System Requirements Specification

Customer

Project

**Revision History**

| **Version** | **Date** | **Change Description / Reason** | **Author** |
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# Project

## System description

Short description of the system.

What is it? For which market and kind of vehicle?

What is it not intended for.

# Definitions and general assignments

## Assumption and deviations

Attribute H\_ObjectStatus must be marked as "Point to clarify" if there are assumptions and deviations from customer requirements.

For Word document :Assumption and deviations from customer requirements must be marked **in *italics*** in the following document.

## *Assumptions about the typical user in case of a user interface*

Example: Nationality, Language

## List of mutually applicable documents

Complete list of all referenced or affected documents, standards etc. including the relevant index marking. this includes

- Legal requirements resulting from laws and regulations (mandatory)

- Common standards (mandatory)

- Specific MHE standards (mandatory)

- Additional standards and regulations (recommended)

Note: All documents that are listed are binding.

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| ***Design regulations / Design specifications / Functional regulations / Standard*** | ***Version / Status*** | ***Remarks / Contents*** |
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## Abbreviations, definitions

List and explanation of all the abbreviations and specialised terms used in these specifications but not defined in the project glossary.

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| --- | --- | --- | --- |
| ***Abbreviation*** | ***Explanation*** | ***Abbreviation*** | ***Explanation*** |
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# General project data

## Brief description

*Brief description of the project including distinction/interfaces of the components to be developed to the (overall) system.*

## Logistics requirements

Requirements concerning packaging, batch sizes etc.

## Quality and reliability

Specification of Q-targets for line-side failures and field failures

## Documentation

Documents requested by the customer which are not standardised MHE documents

## Additional general project data

# General product data (system / device / module / component)

## General product requirements

### Brief description of product

#### *What is the item? What is the item intended for?* *For which market and kind of vehicle shall the item be designed?*

#### *What is the item not intended for?*

*Boundaries of the item (what is part of the considered item vs. what is part of its environment / other items?)*

### Variants / Versions

List of the product versions and their distinctive features and creation (e.g. by coding)

*Are different variants of the item anticipated?*

*Different states and modes of operation defined or foreseen (operating scenarios)*

### Classification

e.g. depending on the spatial installation location of the product (e.g. in the engine compartment), safety relevance (e.g. worst-case scenario)

### Service life / life cycle

### Maintenance ability

e.g. demands on application software, coding possibilities, SW patch, modification authorization / limitation, in-service monitoring and modification tools and procedures.

### Additional general product requirements

e.g. expansion capability (flexibility) portability, testability etc.

## Product environment

Description of the mechanical and electronic environment of the product

List all systems with which interaction is expected

### Block/basic circuit diagram

Here the block diagram or basic circuit diagram of the product can be documented. Within this chapter the author can describe the basic hardware architecture of the product required.

### Interface specification

All device interfaces (plug-in, screw and solder connections), hydraulic, pneumatic, mechanical, optical or electrical signals with their mechanical, climatic and electrical properties are described here.

#### Specification of connecting elements

Here all types of connecting elements (e.g. a fibreglass cable, electric cable, screw, solder, plug-in or clamp connections) are specified.

#### Communication interface

General requirements, network management, communication matrix etc.

#### Diagnosis interface

General requirements, details to follow later

#### User interface

General description of the "man-machine interface" e.g. for operating elements

More detailed description in the respective chapters (e.g. haptic and optical properties)

### Additional specifications related to the product environment

e.g. Prerequisites, dependencies on other items (products / systems/sub-systems / devices / ...),

Cooperating systems, other adjacent systems to be taken into account (potential influence).

## Climatic properties

*Here, details can be given of temperature ranges, air pressure, humid heat, thermal shock etc..*

### Temperatures

Details of operating temperature, storage temperature etc. can be given here.

### IP protective rating/protection against foreign bodies, touch and water

*Basis: EURONORM 60 529, DIN 40 050*

*The IP protective rating describes the penetration protection against foreign bodies, touch and water and implicitly specifies the tests to be carried out.*

### Additional specifications related to climatic properties

## Chemical properties

### Resistance to reagents

*Resistance to mediums such as acids (e.g. battery acid), lyes, premium petrol, diesel fuel, oils, radiator antifreeze, headlamp/windscreen cleaning fluids, brake fluid, cold cleaner, spirit, beverages etc.*

### Resistance to pollution gases

e.g. sulphur dioxide or (corrosive) gas mixtures (calm or flowing gases)

### Further details of chemical resistance

*e.g. resistance to mould*

## Haptic properties

## Optical properties

## Acoustic properties

## Magnetic properties

## Measures / methods for increasing product safety

*e.g. FMEA, fault tree analysis, MTBF calculation*

## Additional product requirements

Which other limitations are foreseen or acceptable?

Additional performance range (overall, details if required for understanding) and robustness criteria

### Functionality required from other systems

# Functional description

***Preface:***

*In this chapter the system to build is specified from functional point of view.*

*The pre-defined sub-chapter structure is based on the following aspects:*

* *Standardization of specification style (to enhance completeness and navigation)*
* *Structured decomposition of the system (to ease system analysis and specification)*

*To utilize this structure a simple workflow has to be applied, which is described in the following:*

***Workflow:***

*1. The decomposition starts from top-level (i.e. system context and boundaries).*

*2. Then the system is decomposed in functional subsystems (which represent the main different functionalities of the system).*

*3. Then there are two ways to proceed which depends on the actual sub-system:*

*3a. A sub-system can be decomposed in further sub-systems to reduce its complexity.*

*In this case the template-structure for a "sub-system" is used again, i.e. in an iterative manner.*

*Then step 3. is applied again.*

*OR*

*3b. If a sub-system is not decomposed in further subsystems the "function"-Template-structure is used to specify its functional behaviour. The "lowest" sub-system consists of functions.*

***Summary:***

*This means that this chapter is composed of two basic structures (sub-system, function) which are repeated on different levels to decompose the system.*

*The depth of the decomposition depends mainly on the complexity of the actual system.*

*Therefore no standardized level can be given but the following aspects should be considered to find a suitable and reasonable decomposition level:*

* *Familarity with the system (e.g. re-use from former projects)*
* *Complexity ot the system (e.g. usage as guidance for decomposition)*
* *Type, structure and quality of customer specifications (e.g. alignment similar to customer specifications)*

*Acceptance (approval) criteria must be clearly recognisable, either through exact definition in the requirements, specification of a (tolerance) range or reference to an applicable value*.

## Overview

*A Context Diagram of the system should be given to define the system boundaries, i.e. it should be clearly visualized and explained here what is outside and what is inside the system to build from functional point of view.*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

## Functionality

*In this chapter a more detailed overview of the functionality of the system should be given. Regular and exceptional cases, different states and modes of operation should be considered.*

*The description should at least comprise a list of the subsystems with a basic description of their functionality.*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

*If it is explicitly defined that a function is OUT OF SCOPE it should also be mentioned here.*

*In the case of Word document, insert a table with overwiew of the functionality with the following information*

*ID*

*short Name*

*Description*

*ASIL level*

*Scope*

*Comment(relevance for functional safety concept if possible)*

## System interfaces

### Input

*The input of the system should be described according to the context diagram.*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

***Tailoring Rule:***

*The required depth and completeness of specification depends on the information model.*

*If a separate "System interfaces"-Module is used it is sufficient to give an overview and insert mainly references here.*

### Output

*The output of the system should be described according to the context diagram.*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

***Tailoring Rule:***

*The required depth and completeness of specification depends on the information model.*

*If a separate "System interfaces"-Module is used it is sufficient to give an overview and insert mainly references here.*

## Configuration

*The configuration possibilities on system level should be described. Consider environment.*

***Tailoring Rule:***

*The required depth and completeness of specification depends on the information model.*

*If a separate "System interfaces"-Module is used it is sufficient to give an overview and insert mainly references here.*

## System control

### Operating conditions

*Operating conditions on system level should be specified here:*

*e.g. dependence on vehicle electric system (clamp states, power supply ranges, ...), environmental conditions, ...*

### System modes transitions

*Transitions between the operation conditions on system level should be specified here.*

### Function control

*Here it should be defined if some functionalities of the system are controlled on system level e.g. functionalities are only available in special system states or on special operating conditions.*

## Subsystems

### Subsystem <Subsystem 1> "System-Template with Subsystems"

#### Functionality

*In this chapter a more detailed overview of the functionality of the system should be given.*

*The description should at least comprise a list of the subsystems with a basic description of their functionality.*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

#### System interfaces

##### Input

*The input of the system should be described according to the context diagram.*

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***Tailoring Rule:***

*The required depth and completeness of specification depends on the information model.*

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##### Output

*The output of the system should be described according to the context diagram.*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

***Tailoring Rule:***

*The required depth and completeness of specification depends on the information model.*

*If a separate "System interfaces"-Module is used it is sufficient to give an overview and insert mainly references here.*

#### Configuration

*The configuration possibilities on system level should be described.*

***Tailoring Rule:***

*The required depth and completeness of specification depends on the information model.*

*If a separate "System interfaces"-Module is used it is sufficient to give an overview and insert mainly references here.*

#### System control

##### Operating conditions

*Operating conditions on system level should be specified here:*

*e.g. dependence on vehicle electric system (clamp states, power supply ranges, ...), environmental conditions, ...*

##### System modes transitions

*Transitions between the operation conditions on system level should be specified here.*

##### Function control

*Here it should be defined if some functionalities of the system are controlled on system level e.g. functionalities are only available in special system states or on special operating conditions.*

#### Subsystems

##### Subsystem <Subsystem 1>

##### Subsystem <Subsystem N>

### Subsystem <Subsystem N> "System-Template with Functions"

#### Functionality

*In this chapter a more detailed overview of the functionality of the system should be given.*

*The description should at least comprise a list of the subsystems with a basic description of their functionality.*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

#### System interfaces

##### Input

*The input of the system should be described according to the context diagram.*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

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*If a separate "System interfaces"-Module is used it is sufficient to give an overview and insert mainly references here.*

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*The configuration possibilities on system level should be described.*

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#### System control

##### Operating conditions

*Operating conditions on system level should be specified here:*

*e.g. dependence on vehicle electric system (clamp states, power supply ranges, ...), environmental conditions, ...*

##### System modes transitions

*Transitions between the operation conditions on system level should be specified here.*

##### Function control

*Here it should be defined if some functionalities of the system are controlled on system level e.g. functionalities are only available in special system states or on special operating conditions.*

#### Functions

##### <Function 1> "Function-Template"

*"Functions" represent the lowest level of decomposition and are not further decomposed by means of the pre-defined structure.*

*On "Function"-Level the real behaviour of the functionality is specified i.e. how are the inputs transformed into outputs.*

###### Abstract

*The functionality should be summarized here.*

###### Function interfaces

Input

*The input of the function should be described here.*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

***Tailoring Rule:***

*The required depth and completeness of specification depends on the information model.*

*If a separate "System interfaces"-Module is used it is sufficient to give an overview and insert mainly references here.*

Output

*The input of the function should be described here.*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

***Tailoring Rule:***

*The required depth and completeness of specification depends on the information model.*

*If a separate "System interfaces"-Module is used it is sufficient to give an overview and insert mainly references here.*

###### Configuration

*The configuration possibilities on function level should be described.*

***Tailoring Rule:***

*The required depth and completeness of specification depends on the information model.*

*If a separate "System interfaces"-Module is used it is sufficient to give an overview and insert mainly references here.*

###### Operation modes

*Here it should be defined if there are special operation modes where the functionality depends on:*

*e.g. diagnostic mode, sleep mode, ...*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

###### Processing

*Detailed specification of how input signals are transformed into output signals.*

*Means:*

* *decision tables*
* *state charts*
* *...*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

##### <Function N> "Function-Template"

*"Functions" represent the lowest level of decomposition and are not further decomposed by means of the pre-defined structure.*

*On "Function"-Level the real behaviour of the functionality is specified i.e. how are the inputs transformed into outputs.*

###### Abstract

*The functionality should be summarized here.*

###### Function interfaces

Input

*The input of the function should be described here.*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

***Tailoring Rule:***

*The required depth and completeness of specification depends on the information model.*

*If a separate "System interfaces"-Module is used it is sufficient to give an overview and insert mainly references here.*

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*The input of the function should be described here.*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

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*The configuration possibilities on function level should be described.*

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*Here it should be defined if there are special operation modes where the functionality depends on:*

*e.g. diagnostic mode, sleep mode, ...*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

###### Processing

*Detailed specification of how input signals are transformed into output signals.*

*Means:*

* *decision tables*
* *state charts*
* *...*

*If a model-based method for system-analysis is used also the appropriate diagrams can be inserted here.*

### <Model based feature> "Template"

This template should be used to specify a model based feature from customer, i.e. the customer provides a model which has to be integrated and contains the main functionality but addtional parts have to be developed by MHE.

In this chapter essential requirements are extracted from the model specification as well as the additional extensions to be developed are specified.

#### Introduction

A short overview of the functionality should be given here.

As base in put for the following requirements the <...> FuVo is used.

#### Model covered essence

For customer requirements which are **fully** covered by the function model the **essence** shall be transferred to the system requirement specification in this chapter.

As a rule of thumb the follwing numbers of extracted requirements are recommended:

* For small features 20
* For medium features 40
* For big features 60
* FuSi relevant also 60

1 ... The BCM\_x ICF shall ... if... AND ...

20 ... The BCM\_x ICF shall ... if... AND ...

#### Non model covered requirements

**All** customer requirements which are **not** (or only partly) covered by the function model are specified, especially:

* All related additional functional requirements (e.g. to be implemented in the framework in which the model is integrated).

.... Requirements related the system ...

.... Reaction time / performance related requirements ....

The BCM\_R shall provide XXX Byte of ROM for the model based application.

The BCM\_R shall provide XXX Byte of RAM for the model based application.

The BCM\_R shall provide XXX Byte of NVRAM for the model based application.

The BCM\_R shall provide XXX µs runtime for the model based application.

The BCM\_x ICF shall ... if... AND ...

#### Diagnosis

**All** customer requirements which are **not** (or only partly) covered by the function model are specified, especially:

* All customer diagnosis related issues (measurement blocks, IO ctrl,…).

The BCM\_x ICF shall able to be activated by <IO-CTRL>

#### Non functional requirements

**All** customer requirements which are **not** (or only partly) covered by the function model are specified, especially:

* All HW and basic software related (performance, special know how, point of attention)

#### Interfaces

Interfaces of this feature should be specified here (mainly model based).

The BCM\_x ICF shall use "ICF.arxml" as model interface description.

## Robustness

### Loss strategy - mechanics

#### Behaviour when not used properly

*Following the analysis of faulty operation possibilities, these will be listed here alongside the required behaviour*

#### Recognising and eliminating faults

*Detailed description of fault recognition and emergency running properties, e.g. limitations in functions*

### Loss strategy - electronics

*e.g. definition of time-out times and actions to be taken when application messages do not appear*

#### Behaviour when not used properly

*Following the analysis of faulty operation possibilities, these will be listed here alongside the required behaviour.*

#### Error recognition and handling

*Detailed description of fault recognition (e.g. watchdog, automatic switch-off in case of undervoltage or excess voltage), and emergency running properties (e.g. limitations in functions, default values when fault or invalid values are received)*

*Refer also to the chapter Diagnosis*

### Influence on other components

What is the relationship between the components and the overall system?

e.g.: can missing "predetermined breaking points" lead to other components being destroyed (mechanics, wire harness), what effect does the transmission of certain signals have on the receiver, is this known?. If appropriate - is this influence critical for safety-related issues?

### Additional specifications related to robustness

## Determination of impact on the operating environment

Identify and document all interfaces between the system to build and the operating environment. If a separate System Interface Module is describe interfaces between system and operating environment there.

# Design

## Mechanical properties

### Static resistance

#### Torsion resistance

*e.g. torque of screw connections, torsional load on the ignition key*

#### Resistance to compression and extension

*e.g. firm fit of housing parts, pressure load on key-type switches*

#### Additional specifications related to static resistance

### Dynamic resistance

#### Sinusoidal oscillation

*Basis: DIN IEC 68 Part 2-6*

#### Broadband random vibration

*Basis: DIN IEC 68 Part 2-34 - 37, DIN 40 046 Part 22 - 25*

#### Semi-sinusoidal shocks

*Basis: DIN IEC 68 Part 2-27*

*Usually used to test components which are installed in flaps, doors, steering knuckles or next to locks in general.*

#### Permanent shocks

*Basis: DIN IEC 68 Part 2-29*

*Usually used to test components which are installed in flaps, doors, steering knuckles or next to locks in general.*

#### Torsion fatigue limit

#### Additional specifications related to dynamic resistance

### Free fall

*Basis: DIN IEC 68 Part 2-32*

*The "free fall" test is the simple method of copying the effect of a crash happening during careless handling.*

### Surface resistance

#### Scratch resistance

#### Abrasion resistance

*The test is used to prove the abrasion resistance of adhesive stickers and general surfaces. The test can be carried out according to DIN 54 021 using a crockmeter.*

##### Adhesive stickers, general surfaces

##### Keys, resistance to synthetic sweat solution with abrasion

*The test is used to prove the abrasion resistance of manually operated keys, switches, touch displays and bodywork fittings with lettering. The test can be carried out using a test device following DIN 40 046 Part 59.*

#### Additional specifications related to surface resistance

### Tightness of connections

*Plug cut-through resistance, plug-in forces, extraction forces*

### Additional specifications related to mech. properties

## Technical design

### Housing

#### Material

#### Pressure compensation

#### Labelling

#### Dimensions and weights

#### Additional specifications related to the housing

### Optical design

#### Shapes

#### Colours

#### Additional specifications related to the optical design

### Ergonomics

### Assembly conditions

### Emissions

### Additional specifications related to technical design

# Electronics

## Hardware

### Switch requirements

e.g. requirement of semi-conductor switches instead of relays

### Component requirements

e.g. exclusion of certain component suppliers and/or certain component shapes or sizes, prescribed uses for components, component burn-in etc.

### Additional hardware specifications

## Software

### Development tools

e.g. simulation requirements (Matlab, Simulink,..), compilers to be used, application and visualisation tools etc.

### Software structure

Specifications related to SW design, forbidden application of certain constructs, prescription of programming language, special treatment of important data (e.g. plausibility tests) etc.

### EMC software measures

Prescribed cycle frequencies, PWM control of loads etc.

### Operating system

e.g. required use of a standard operating system (e.g. OSEK). Instructions about special settings, standard modules etc.

### Device capacity

any max. memory reserves (RAM, ROM, EEPROM) that may be required

### Time requirements

Load on operating system,, calculating or processing speed

### Additional software specifications

## Diagnosis

### Self-diagnosis

All the required diagnosis possibilities (def. sensors/actuators, switch parts, wire interruptions and short-circuits, RAM, ROM, EEPROM tests) including a description of the recognition method, the implementation times and the reaction in the event of a fault

#### Additional specifications related to error recognition and handling

*Additional details (if not already described in Chapter 4.2, Sturdiness. E.g. CAN short-circuit, open-load, power drop, short-circuits at plugs …*

## Application instructions/Adjustability

## EMC design

Design requirements and constructional measures for the early guarantee of the electromagnetic compatibility of electric/electronic assemblies are described in the chapter on EMC design.

### Types of wire and wire routing

### Signal forms from the vehicle wiring system

During the transmission of data and loads via the vehicle wiring system, the signals involved are often in cyclic, periodic form. In order to reduce the radiation caused by these signals, general basic conditions concerning the speed of rise and fall of the signal curve can be defined.

### Ground concept

The ground concept describes the EMC measures required related to the ground wires, the ground routing, the ground points in the system and in the vehicle.

### Vehicle antennas

### Additional specifications related to EMC design

## Additional specifications related to components

## Electrical properties

### Electrical supply

*Details of voltages, currents and power values for the whole system.*

#### Voltages

Range of supply voltage, drops in voltage on current paths in the device, switching thresholds, "soiling resistance"

#### Currents

*Current consumption (requirements for operational and quiescent current), input and output currents at the connections*

#### Power values

#### Additional specifications related to the electrical supply

### Electrical resistance

*Inverse polarity protection requirements, resistance to excess voltage, short-circuits and overload, leak resistance, dielectric strength and voltage displacement can be specified here.*

#### Inverse polarity protection

*The term inverse polarity protection describes the behaviour (functional status and permissible fault descriptions) of the system when the battery is permanently connected incorrectly. Inverse polarity is defined through inverse polarity voltage, time and test temperature.*

#### Resistance to over voltage

*Resistance to excess voltage describes the behaviour of the system when excess voltage is applied to the supply connections.*

#### Resistance to short-circuit

*Resistance to short-circuit describes the functional status of the system when a terminal is short-circuited against ground or supply voltage (inputs and outputs).*

#### Resistance to overload

*Resistance to overload describes an overload of the outputs (consumers use more than the rated current, short-term and permanent load resistance).*

#### Leak resistance

*Leak resistance is determined between two DC insulated connections or between the housing and the DC insulated connections.*

#### Dielectric strength

*Dielectric strength is determined between two DC insulated connections or between the housing and the DC insulated connections by applying an AC voltage.*

#### Voltage displacement

*Voltage displacement describes the ability of the system or the component to fulfil a specified function in the case of voltage displacement in the ground or supply cable.*

#### Additional specifications related to electrical resistance

### Electromagnetic compatibility (EMC)

*The basis of EMC is the standard DIN 40 839 Part 1- 3 (with the exception of ripple in the vehicle wiring system)*

#### Interference immunity

*Specification of all the interference variables which can affect the component from outside*

##### Conducted interference variables

##### Conducted interference variables in supply cables

##### Coupled-in interference variables in transducer and sensor cables

##### Ripple in the vehicle wiring system

*Requirements concerning ripple in the vehicle wiring system define the sturdiness of a test sample to ripples in the voltage of the vehicle wiring system caused by a generator.*

###### ESD

###### Additional specifications related to conducted interference variables

##### Radiated interference variables

*The description of the requirements related to radiated interference variables is based on DIN 40839 Part 4.*

###### Degree of interference immunity

###### Frequency bands

###### Modulations

###### Measuring methods

###### Additional specifications related to radiated interference variables

##### Additional specifications related to interference immunity

#### Radiated interference

*Specification of all the permissible interference variables produced by the component*

##### Conducted interference

*The basis for radiated interference on supply lines leaving the device is the standard DIN 40 839 Part 1.*

##### Interference emission (radio interference suppression)

*Radio interference suppression requirements are described according to VDE 0879 Part 1 - 3 and DIN 57 879, Part 1 - 3.*

###### Close-range radio interference suppression

###### Long-range radio interference suppression

##### Additional specifications related to radiated interference

#### Additional specifications related to electromagnetic compatibility

### Additional specifications related to electrical properties

# Tests

## General test conditions

### General test parameters

### Classification according to degrees of strictness

The degrees of strictness of the test requirements are a result of the installation-specific environment, functional ability and classification according to functionality (refer to the section "Classification" in Chapter 3 here, too)

#### Installation-specific environment

*A wide range of different environmental requirements are possible depending on the installation location.*

#### Functional ability

*The functional ability specifies the permissible reduction of function of the component during an electrical fault (EMC/ESD, vehicle wiring system etc.) as well as the requirement of functionality after it has been influenced by such a fault (fall back behaviour). The functional ability requirements are defined in "Functional states A to E".*

#### Classification according to functionality

The requirement of functionality in the vehicle results from the condition of use (e.g. related to safety or operation), the voltage of the vehicle wiring system (e.g. start-related consumers, date reception) and the operating temperature for the permissible operating area (e.g. engine compartment) of the component.

### Additional general test conditions

## Summary of trial and qualification tests

### Tests of functional properties

|  |  |  |
| --- | --- | --- |
| **Chapter** | **Name of test** | **Samples** |
| **B...** | **C0** | **C...** | **...** |

### Tests of electrical properties

|  |  |  |
| --- | --- | --- |
| **Chapter** | **Name of test** | **Samples** |
| **B...** | **C0** | **C...** | **...** |

### EMC/ESD requirements

|  |  |  |
| --- | --- | --- |
| **Chapter** | **Name of test** | **Samples** |
| **B...** | **C0** | **C...** | **...** |

### Tests of mechanical properties

|  |  |  |
| --- | --- | --- |
| **Chapter** |  | **Samples** |
| **B...** | **C0** | **C...** | **...** |

### Tests of environment-related properties

|  |  |  |
| --- | --- | --- |
| **Chapter** |  | **Samples** |
| **B...** | **C0** | **C...** | **...** |

### Test of chemical properties

|  |  |  |
| --- | --- | --- |
| **Chapter** |  | **Samples** |
| **B...** | **C0** | **C...** | **...** |

## Specification of the test sequence

Graphical representation: The test sequence a test sample must be put through is given. In addition, the number of respective test samples for the given tests is defined. Depending on the circumstances it can be useful to draw up a flow diagram for each sample phase.

### Initial / final test

#### Visual test

#### Temperature storage / conditioning

#### Functional test

**Test conditions:**

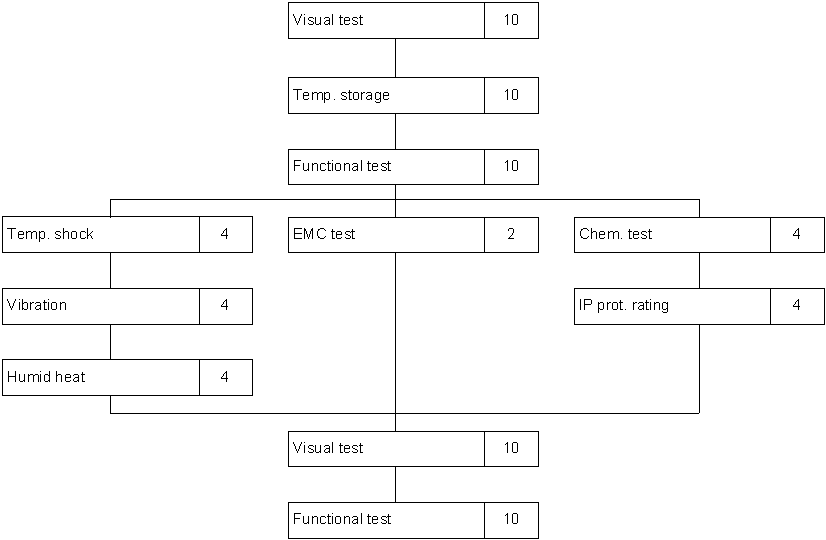
*e.g.: UB = Test voltage, upper and lower operating voltage limits*

*Tu = RT, upper and lower operating temperature limits*

*The functional test using original loads or copies is used both as an initial test and a final test to evaluate the functional ability of the test samples before and after the respective tests.*

### Test flow diagram *Test Number of test samples*

e.g.



## Test equipment

### Test equipment requirements

### Description of the test equipment

*e.g. structure, key data, schematic drawing of the test equipment*

## Tests of electrical properties

*The properties described in the Electronics chapter are tested. Any further tests are listed in the following.*

*Details of the required tests e.g. series investigations, fatigue tests, test drives (e.g. for EKS, RLS, radio signal ranges etc.), EMC*

### Tests of reactions and behaviour in the vehicle wiring system

#### Behaviour in the case of a brief voltage interruption

*e.g. simulation of the engine start-up by applying the start impulse; start impulse during the initialisation phase of the component*

#### Slow increase and drop in supply voltage

#### Behaviour in the case of a sudden increase in voltage

## EMC/ESD requirements (component test)

*The properties described in the Electronics chapter are tested. Any further tests are listed in the following.*

*.*

## Tests of mechanical properties

*The properties described in the Design chapter are tested. Any further tests are listed in the following.*

## Tests of environment-related properties

### Tests of climatic properties

#### Temperature storage

##### Low-temperature storage

##### High-temperature storage

##### Storage at changing temperature

#### Temperature endurance test

##### Low-temperature endurance test

*Basis: EURONORM 60 068-2-1*

*The low-temperature endurance test takes place under climatic conditions described in the above standard.*

##### High-temperature endurance test

*Basis: EURONORM 60 068-2-2*

*The high-temperature endurance test takes place under climatic conditions described in the above standard. This test is equivalent to an accelerated lifetime test.*

##### Changing temperature endurance test

#### Temperature shock test

*Basis: DIN IEC 68 Part 2-14, test Na, defined transition time, splashwater test, submersion test*

#### Cycle temperature

*Basis: DIN IEC 68 Part 2-14, test Nb, specification of the speed at which the temperature changes*

#### Temperature function test

#### Condensation, changing climate

##### Condensation and humidity constant (KK)

##### Condensation with changing temperature; humidity constant (KTW)

##### Condensation with changing humidity and temperature (KFW)

#### Humid heat constant

*Basis: DIN IEC 68 Part 2-3, test Ca*

*The test is used to prove device function under constantly high humidity conditions.*

#### Humid heat cyclic

*Basis: DIN IEC 68 Part 2-30, test Db*

*The test is used to prove device function under changing humidity conditions.*

#### Salt spray test

*Basis: DIN IEC 68 Part 2-11, DIN 50 021 - SS*

*The test is used to prove corrosion resistance to salt spray.*

#### Pollutant gas test (multiple component climate)

*This test is not described in any international/national standard, but is required by some vehicle manufacturers and has been detailed in company standards. It is used to test environmental influences which are typically present in road traffic.*

#### Additional tests of climatic properties

### Additional tests of environment-related properties

*Special test specifications for optics, acoustics, magnetism, user interface (haptics), combined tests, chemical properties*

## Functional test

The functional properties listed in the Functional Description chapter and the respective sturdiness specifications are tested. In addition, the properties described in the Diagnosis chapter are tested. Any further tests are described separately in the document "Test Plan System Test".

## Additional tests

# Environmental and recycling conditions

*Do not delete this standard text, please !!!*

The electronic product described above has been developed for original equipment manufacturers and is thus subject to the End of Vehicle Life Law in the version dated 21.6.02. This basically prohibits the use of the heavy metals mercury, cadmium, lead and hexagonal chromium for products which are to be installed in vehicles which will be put into circulation from 01.07.2003 onwards.

These substances can be contained in our electronic products. Permissible use of these substances is regulated by Addendum 2 to the Law in its most recently valid form. The status of calculation and thus the quotation price refer to the status of this law valid at the time the quotation is submitted.

Changes in products which become necessary on the basis of changed legislation have to be recalculated and can result in a change in price, the extent of which can only be determined once the new legislative position is known and the product/production method changes required have been determined and qualified.

Within the context of environmental protection, we are continually working on qualifying new possibilities of avoiding pollution. As far as these can be put into practice from a technological and cost-related point of view for the respective products, they will be.

## Re-use, recycling and disposal concepts

*Basis: VDI 2243, Checklist VDI 2232, DIN ISO 9001, various company and customer standards.*

*Details that are important in terms of the re-use or recycling of component units for the technical design of the components.*

### List of non-approved component materials

*e.g. non-approved chemical constituents*

### Component packaging

*e.g. returnable packaging*

### Additional specifications

## Product design in line with environmental protection and recycling requirements

e.g. design suitable for easy dismantling (connection technology, dismounting technology), choice of materials, material marking

Product design in line with recycling requirements must be carried out whenever the customer explicitly requires a device concept which has been optimised in terms of recycling requirements.

# Functional Safety Requirements

## Overview Safety goals & attributes

**The table below has 12 columns.**

- id SGxx

**Input from H&R (hazard & risk anlysis):**

- Safety Goal

- Hazard

- ASIL

**Attributes to safety goal:**

- FTT (fault tolerant time interval)

- Safestate

- Operating modes

- Warning concept

- necessary driver actions

- Emergency operation interval

- part of PMHF (Probablistic Metric for Hardwar Failure) in %

**Reference**

- referenced system, subsystem

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **id: SGxx** | **Safety Goal** | **Hazard** | **ASIL** | **FTT** | **Safestate** | **Operating modes** | **Warning concept** | **necessary driver actions** | **Emergency operation interval** | **part of PMHF in %** | **referenced system, subsystem** |
| SGx | Turn indicator shall be activated in the direction chosen by the driver and indicated to him. | Turn indicator shows the traffic another direction than chosen by the driver and indicated to him. | B | 500ms | doubleflash to the driver and no flash to traffic | run | doubleflash to the driver if turn indicator is ON | recognize doubleflash and drive to service regarding that turn indicator do not function | n.a. driver warning is sufficient | 100% | vehicle |
|  |  |  |  |  |  |  |  |  |  |  |  |

## Safety Goals

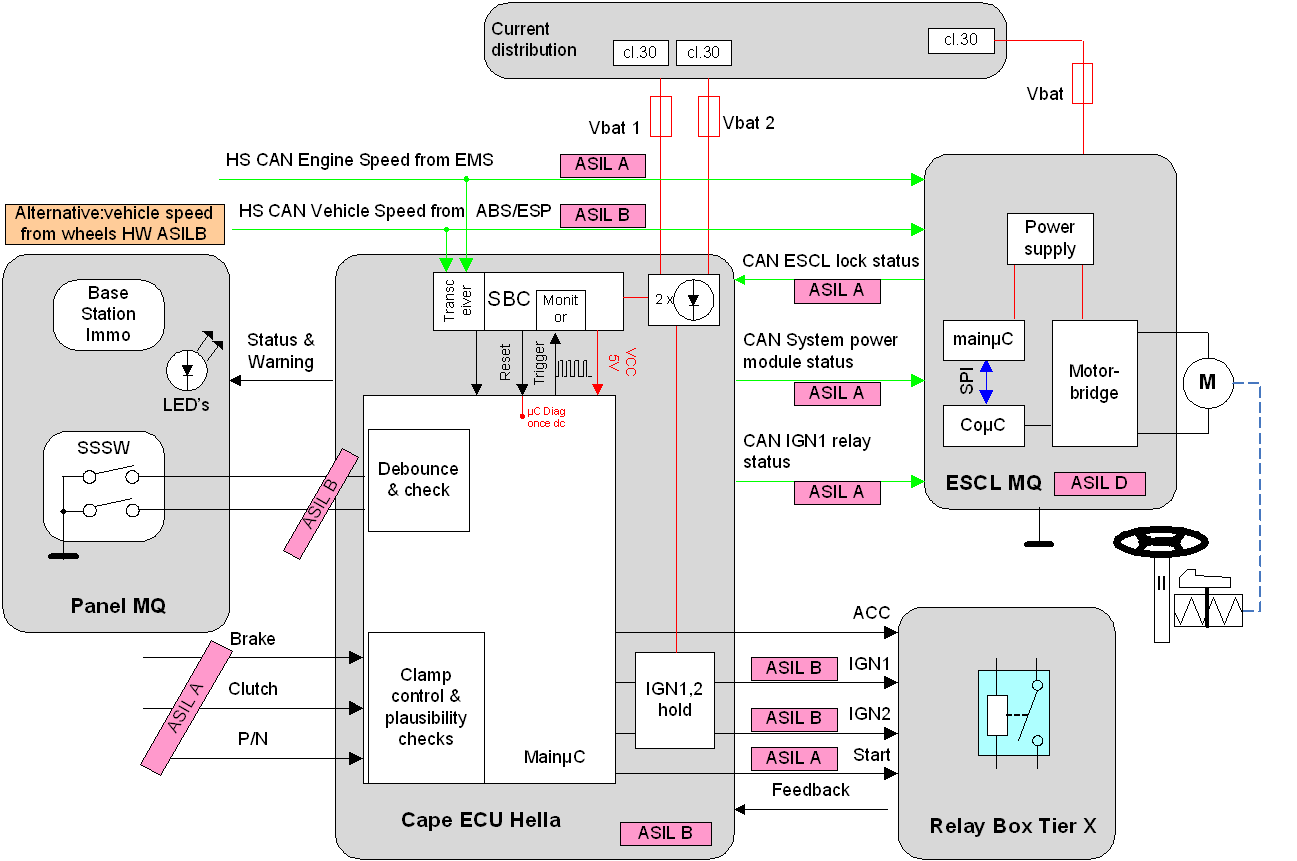
### Safety Goal XX "Template"

#### Block diagram with allocation for Safety Goals

Block diagram with allocation for each safety goal is required.

One block diagram for a function is sufficient, even if several safety goals are related to it.

<Example image>



#### Requirements to Safety Goal and attributes

The safety goal shall be fulfilled:

The hazard shall be avoided:

The compliance to the FTT (fault tolerance time) shall be demonstrated and verified. **FTT is defined as:**

In case of violation of the safety goal the safestate shall be reached in time (< FTT). **Safestate is defined as:**

The validity of the safety goal shall cover the following operating modes:

As required warning concept shall be implemented:

The necessary driver action shall be:

The emergency operation interval shall not be exceeded:

The PMHF metric of the item's function shall not exceed the following fraction of the ASIL:

## Further Requirements

Requirements based on decomposition

Requirements to the interface

Requirements from customer to subsystems (according the allocation of the FSC)

Requirements from subsystem to customer or to other subsystems

## Safety Constraints

This section serves to summarize all aspects relevant to the functional safety assessment which are known before the hazard analysis and risk assessment is performed.

### Known Functional Safety Requirements

Safety requirements raised by the customer

Safety requirements implied by applicable regulations

Safety requirements from other related systems (cooperating systems, environment)

Safety requirements known from similar items or applications (especially: lessons learned)

### External Risk Reduction

Risk reduction features which are available in the item’s environment (vehicle properties, other systems, operating instructions, …), e.g.

functional redundancy,

external monitoring facilities,

driver interface,

application restrictions, emergency/fallback operation, service/maintenance support

## Potentially related Hazards and Risks

Potential sources of hazard which can influence the safety and reliability, e.g. known failure modes and hazards of similar items, suspected risks related to new functionality or new technology.

# MHE Production Mode

The Software solution will be developed specific for each Microcontroller family and will be implemented from the software team.

Reasons of deviations have to be explained and documented.

The projects shall implement MHE Production Mode right from the start of the project.

This test mode shall assure, that Hardware can be tested already within Hardware development phases.

Standardized interfaces to In Circut Test (ICT) and End of Line Test (EOL) have to be provided as well (read and write I/O and data content).

# On board programming

*The system analyst has to document if on board flashing is required or not.*

*The system architect has to ensure that the template (On board programming MHE 8529) including the necessary information for the product facility and the flash equipment manufacturer is filled out.*

# Other / further requirements

*Description of further requirements not taken into account in this template.*

## Post-series strategy

*In order to secure long-term supplies, device structure and device production criteria must be taken into account depending on the post-series strategy. The post-series strategy must be laid down in agreement with PBE-1 S&R.*