




ERJU SYSTEM PILLAR

Requirements Management Plan - Annex R1 Requirements Rules



Requirements Management Plan - Annex R1

Requirements Rules

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Table of contents

1	Preamble	6
1.1	Purpose	6
1.2	Intended Audience	6
1.3	Document Context	6
1.4	Glossary	6
2	Introduction	6
2.1	Instructions for readers	6
2.2	Overview of rules	6
3	Generic rules	10
3.1	Structure and style	10
3.2	Wording and punctuation	18
3.3	Terms and abbreviations	25
3.4	Conditions	27
3.5	Values	29
3.6	References	33
4	Specific rules	34
4.1	Functional requirements	34
4.2	Non-functional requirements	38
4.3	Application conditions	40


1 Preamble

1.1 Purpose

Purpose of the requirements rules

The purpose of this document is to provide detailed rules for writing good textual requirements in structured natural language. It provides a ruleset to the language to manage the expressiveness of requirements based on the aspects and criteria defined in  SPPR-10493 - ISO/IEC/IEEE 29148:2018 and  SPPR-4100 - INCOSE Guide to Writing Requirements. [SPPR-11230]


1.2 Intended Audience

This document describes generic and specific rules for writing requirements as part of the  Requirements Management Plan. It is valid for all the System Pillar tasks and domains.

1.3 Document Context

This document is an annex of the  Requirements Management Plan.

1.4 Glossary

This document primarily outlines the rules, while the definitions can be found in the  Requirements Management Plan.

2 Introduction

2.1 Instructions for readers

Usage of requirements rules

Each rule in this document has a property called "Compliance" which defines whether a rule is mandatory or optional in the context of writing requirements. The following compliance levels are used:


Compliance level	Explanation
Required	This rule is mandatory to ensure that the quality characteristics of good requirements are fulfilled.
Recommended	This rule is optional, but provides recommended best practices.
Suggested	This rule is optional, but gives suggested hints and ideas.

[SPPR-11566]

2.2 Overview of rules

























Overview of the requirements rules

This chapter provides an overview of the required rules to be applied per each requirement work item type.

Note: There are no rules defined for common business objectives, railway requirements and operational requirements. This distinction is made because these three work item types are needs and not direct requirements to the overall system levels 3 to 5 in context of the System Pillar. See the  Systems Engineering Management Plan - 01 Main for more information. [SPPR-11712]








Each **stakeholder requirement** must satisfy the following rules.

Stakeholder Requirement

Linked Work Items	<p>has parent :  SPPR-11564 - Overview of rules</p> <p>_ is ruled by :  SPPR-3519 - Functional requirement pattern is used for system behaviour</p> <p>_ is ruled by :  SPPR-3824 - Requirement is written as a well-formed sentence</p> <p>_ is ruled by :  SPPR-3941 - Superfluous infinitives using are avoided</p> <p>_ is ruled by :  SPPR-3942 - Universal quantifier is used</p> <p>_ is ruled by :  SPPR-3945 - British English is used with correct grammar and spelling</p> <p>_ is ruled by :  SPPR-3946 - Values are expressed precisely</p> <p>_ is ruled by :  SPPR-3948 - Vague phrases are avoided</p> <p>_ is ruled by :  SPPR-3949 - Requirement is written as solution-free as possible</p> <p>_ is ruled by :  SPPR-3950 - Requirement is expressed once</p> <p>_ is ruled by :  SPPR-3952 - Conditions are written as logical expressions</p> <p>_ is ruled by :  SPPR-3953 - Acronyms are defined and used consistently</p> <p>_ is ruled by :  SPPR-3954 - Punctuation is used correctly and appropriately</p> <p>_ is ruled by :  SPPR-3955 - Terms are defined and used consistently</p> <p>_ is ruled by :  SPPR-3957 - Negative phrases are avoided</p> <p>_ is ruled by :  SPPR-3958 - Abbreviations are avoided</p> <p>_ is ruled by :  SPPR-3961 - Vague words are avoided</p> <p>_ is ruled by :  SPPR-3966 - Requirement is separated from its rationale</p> <p>_ is ruled by :  SPPR-3972 - Values use correct units</p> <p>_ is ruled by :  SPPR-3973 - Definite article is used</p> <p>_ is ruled by :  SPPR-3977 - Requirement does not rely on document or chapter headings</p> <p>_ is ruled by :  SPPR-3979 - Requirement is atomic</p> <p>_ is ruled by :  SPPR-4332 - Non-functional requirement pattern is used for system characteristics</p> <p>_ is ruled by :  SPPR-10311 - Requirement has a good readability</p> <p>_ is ruled by :  SPPR-10366 - Values use consistent decimal format</p> <p>_ is ruled by :  SPPR-11195 - Conditions are reusable</p> <p>_ is ruled by :  SPPR-11354 - Functional requirement mentions actors or interfaces explicitly</p>
Type	 Stakeholder Requirement


















Each **system requirement** must satisfy the following rules.

System Requirement

Linked Work Items	<p>has parent :  SPPR-11564 - Overview of rules</p> <p>_ is ruled by :  SPPR-3519 - Functional requirement pattern is used for system behaviour</p> <p>_ is ruled by :  SPPR-3824 - Requirement is written as a well-formed sentence</p> <p>_ is ruled by :  SPPR-3941 - Superfluous infinitives using are are avoided</p> <p>_ is ruled by :  SPPR-3942 - Universal quantifier is used</p> <p>_ is ruled by :  SPPR-3945 - British English is used with correct grammar and spelling</p> <p>_ is ruled by :  SPPR-3946 - Values are expressed precisely</p> <p>_ is ruled by :  SPPR-3948 - Vague phrases are avoided</p> <p>_ is ruled by :  SPPR-3949 - Requirement is written as solution-free as possible</p> <p>_ is ruled by :  SPPR-3950 - Requirement is expressed once</p> <p>_ is ruled by :  SPPR-3952 - Conditions are written as logical expressions</p> <p>_ is ruled by :  SPPR-3953 - Acronyms are defined and used consistently</p> <p>_ is ruled by :  SPPR-3954 - Punctuation is used correctly and appropriately</p> <p>_ is ruled by :  SPPR-3955 - Terms are defined and used consistently</p> <p>_ is ruled by :  SPPR-3957 - Negative phrases are avoided</p> <p>_ is ruled by :  SPPR-3958 - Abbreviations are avoided</p> <p>_ is ruled by :  SPPR-3961 - Vague words are avoided</p> <p>_ is ruled by :  SPPR-3966 - Requirement is separated from its rationale</p> <p>_ is ruled by :  SPPR-3972 - Values use correct units</p> <p>_ is ruled by :  SPPR-3973 - Definite article is used</p> <p>_ is ruled by :  SPPR-3977 - Requirement does not rely on document or chapter headings</p> <p>_ is ruled by :  SPPR-3979 - Requirement is atomic</p> <p>_ is ruled by :  SPPR-4332 - Non-functional requirement pattern is used for system characteristics</p> <p>_ is ruled by :  SPPR-10311 - Requirement has a good readability</p> <p>_ is ruled by :  SPPR-10366 - Values use consistent decimal format</p> <p>_ is ruled by :  SPPR-11195 - Conditions are reusable</p> <p>_ is ruled by :  SPPR-11354 - Functional requirement mentions actors or interfaces explicitly</p>
Type	 System Requirement
















Each **application condition** must satisfy the following rules.

Application Condition

Linked Work Items	<p>has parent :  SPPR-11564 - Overview of rules</p> <p>_ is ruled by :  SPPR-3824 - Requirement is written as a well-formed sentence</p> <p>_ is ruled by :  SPPR-3941 - Superfluous infinitives using are avoided</p> <p>_ is ruled by :  SPPR-3942 - Universal quantifier is used</p> <p>_ is ruled by :  SPPR-3945 - British English is used with correct grammar and spelling</p> <p>_ is ruled by :  SPPR-3946 - Values are expressed precisely</p> <p>_ is ruled by :  SPPR-3948 - Vague phrases are avoided</p> <p>_ is ruled by :  SPPR-3949 - Requirement is written as solution-free as possible</p> <p>_ is ruled by :  SPPR-3950 - Requirement is expressed once</p> <p>_ is ruled by :  SPPR-3952 - Conditions are written as logical expressions</p> <p>_ is ruled by :  SPPR-3953 - Acronyms are defined and used consistently</p> <p>_ is ruled by :  SPPR-3954 - Punctuation is used correctly and appropriately</p> <p>_ is ruled by :  SPPR-3955 - Terms are defined and used consistently</p> <p>_ is ruled by :  SPPR-3957 - Negative phrases are avoided</p> <p>_ is ruled by :  SPPR-3958 - Abbreviations are avoided</p> <p>_ is ruled by :  SPPR-3961 - Vague words are avoided</p> <p>_ is ruled by :  SPPR-3966 - Requirement is separated from its rationale</p> <p>_ is ruled by :  SPPR-3972 - Values use correct units</p> <p>_ is ruled by :  SPPR-3973 - Definite article is used</p> <p>_ is ruled by :  SPPR-3977 - Requirement does not rely on document or chapter headings</p> <p>_ is ruled by :  SPPR-3979 - Requirement is atomic</p> <p>_ is ruled by :  SPPR-10311 - Requirement has a good readability</p> <p>_ is ruled by :  SPPR-10366 - Values use consistent decimal format</p> <p>_ is ruled by :  SPPR-10572 - Functional requirement patterns are used for application conditions</p> <p>_ is ruled by :  SPPR-11195 - Conditions are reusable</p> <p>_ is ruled by :  SPPR-11354 - Functional requirement mentions actors or interfaces explicitly</p>
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Each **condition** (represented by work item type "Constraint") must satisfy the following rules.

Condition

Linked Work Items	has parent :  SPPR-11564 - Overview of rules
	_ is ruled by :  SPPR-3942 - Universal quantifier is used
	_ is ruled by :  SPPR-3945 - British English is used with correct grammar and spelling
	_ is ruled by :  SPPR-3946 - Values are expressed precisely
	_ is ruled by :  SPPR-3948 - Vague phrases are avoided
	_ is ruled by :  SPPR-3953 - Acronyms are defined and used consistently
	_ is ruled by :  SPPR-3954 - Punctuation is used correctly and appropriately
	_ is ruled by :  SPPR-3955 - Terms are defined and used consistently
	_ is ruled by :  SPPR-3957 - Negative phrases are avoided
	_ is ruled by :  SPPR-3958 - Abbreviations are avoided
	_ is ruled by :  SPPR-3961 - Vague words are avoided
	_ is ruled by :  SPPR-3972 - Values use correct units
	_ is ruled by :  SPPR-3973 - Definite article is used
	_ is ruled by :  SPPR-10366 - Values use consistent decimal format
	_ is ruled by :  SPPR-11195 - Conditions are reusable

3 Generic rules

This chapter provides the generic rules which are applicable to all requirement work item types.

3.1 Structure and style

Requirement is written as a well-formed sentence

A requirement consists of a single sentence following the subject-verb-object structure.

General structure of a requirement sentence

A requirement sentence consists of the following parts in this specific order and is written as follows:

<condition (optional)> <subject> shall <verb> <object> <extension (optional)>.

This requirement sentence structure is tailored further for specific cases of functional and non-functional system requirements as well as application conditions and stakeholder requirements. This is done to provide derived patterns which are more easy and practical to apply.

















Explanation of the requirement sentence parts

Part	Explanation
condition	The <condition> is a clause which describes the circumstances under which the requirement is valid. It <u>must be fulfilled beforehand</u> otherwise the requirement cannot be achieved. Conditions consist of preconditions (i.e. periods of time, states or generalisation of multiple past events) or triggers (i.e. events). Conditions are optional and the usage depends on the particular requirement.
subject	The <subject> represents the subject of the sentence. It is the entity <u>required to achieve the action, function or characteristic</u> which is described by the verb.
shall	The keyword " shall " indicates that what is being communicated by the requirement <u>is an obligation, means formal and legally binding</u> . The entity has to be verified against the requirement.
verb	The <verb> represents what the entity does or is the specific verb "be" for characteristics of the entity. It <u>belongs to the subject</u> and is written in <u>present tense with active voice</u> only. What is described by the verb is achieved if and only condition is satisfied.

Part	Explanation
object	The < object > represents the thing which is being acted upon by the entity through the verb.
extension	The < extension > is a clause which adds further detailed information to the requirement (like limits, characteristics or references) and qualifies the verb and object of the sentence. It is optional and the usage depends on the particular requirement.


Compliance	❗ Required
ID	SPPR-3824
Rationale	This structure forces the requirement author to separate the different parts of the sentence. The order of the parts in this sentence is also significant, since it follows temporal logic.

Example	<p>Unacceptable: "The function shall ..." {unverifiable, because ambiguous as each actor has to be uniquely identifiable) "There shall be ..." {always start with the entity who has to do something} "The supplier shall design the perception system that detects objects of size x in a distance of y." {Wrong actor. Always distinguish between technical system requirements and statement of work type requirements to be concise and clear. Do not mix them.}</p> <p>Unacceptable: The Audio shall be recorded by the System. {The entity is responsible for recording the audio.} The Audio shall be recorded. {The entity performing the action is missing.}</p> <p>Acceptable: The System shall record the Audio_Feed.</p> <p>Unacceptable: The Life Support System may provide oxygen to the SystemUser. {There are no optional requirements. Goals can be captured separately in the specification.}</p> <p>Unacceptable: The <entity> shall <precondition> <entity response>. {The precondition belongs at the start of the sentence, not the middle or end of it.}</p> <p>Unacceptable: While Harbor_Harbor_Approach_Maneuvering, the Navigation_Beacon shall provide Augmentation_Data at an accuracy of less than or equal to 20 meters to each Maritime_User. {This is unacceptable because it inserts a phrase in such a way that the object of the sentence is separated from the verb.}</p> <p>Acceptable: The Navigation_Beacon shall provide Augmentation_Data to each Maritime_User engaged in Harbor_Harbor_Approach_Maneuvering, at an accuracy of less than or equal to 20 meters. {This rewrite places the basic function in an unbroken clause followed by the sub-clause describing the performance value.}</p> <p>Unacceptable: The user shall perform <system function>. {This is unacceptable because the requirement should be on the system, not the user or operator of the system. This wording is often the result of writing requirements directly from user stories or resulting need statements, without doing the transformation of the use case or user need into a system requirement. This means what the system have to do so that the user need can be achieved.}</p> <p>Acceptable: The <system> shall <system action/function> ... The <actor> shall <actor action/function> ...</p>
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Linked Work Items	<p>refers to :  SPPR-3813 - Unambiguous (C3)</p> <p>refers to :  SPPR-3814 - Complete (C4)</p> <p>refers to :  SPPR-3817 - Verifiable (C7)</p> <p>refers to :  SPPR-3818 - Correct (C8)</p> <p>refers to :  SPPR-3819 - Conforming (C9)</p> <p>refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements</p> <p>refers to :  SPPR-3815 - Singular (C5)</p> <p>refers to :  SPPR-3821 - Comprehensible (C13)</p> <p>refers to :  SPPR-3812 - Appropriate (C2)</p> <p>refers to :  SPPR-3823 - Able to be validated (C14)</p> <p>refers to :  SPPR-10493 - ISO/IEC/IEEE 29148:2018</p> <p>rules :  SPPR-10324 - Application Condition</p> <p>rules :  SPPR-10323 - System Requirement</p> <p>rules :  SPPR-10359 - Stakeholder Requirement</p> <p>refers to :  SPPR-3822 - Consistent (C11)</p> <p>has parent :  SPPR-10773 - Structure and style</p>
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Requirement is atomic

Each requirement sentence does not contain multiple requirements at once.











Compliance	 Required
ID	SPPR-3979
Rationale	Write separate requirements to enable verification and reduce ambiguity, because a requirement has to be clear by its own. Think ahead of issues with allocation, traceability, verification, and validation. Each individual requirement will most certainly be differently allocated, have different child requirements and has to be individually verified and validated.

Example	<p>Unacceptable (trigger is stated following a list of actions): When the fire is detected:</p> <ul style="list-style-type: none"> • Power to electromagnetic fire door catches shall be turned off. • Security entrances shall be set to Free_Access_Mode. • Fire escape doors shall be unlocked. <p>Acceptable (separate requirements): When the fire is detected, the Security_System shall turn off power to electromagnetic fire door catches. When the fire is detected, the Security_System shall set security entrances to the Free_Access_Mode. When the fire is detected, the Security_System shall unlock fire escape doors.</p> <p>Unacceptable (ambiguous function "manage"): The thermal control system shall manage temperature-related functions.</p> <p>Acceptable (three separate requirements): The Thermal_Control_System shall update the display of Current_System_Temperature every 10 ± 1s. The Thermal_Control_System shall maintain the Current_System_Temperature between 95°C and 98°C. The Thermal_Control_System shall store the history of Current_System_Temperature.</p> <p>Unacceptable (two requirements and the qualifier only applies to the first requirement): When in the Active_State, the Record_Subsystem shall display the Name of each Line_Item and shall record the Location of each Line_Item, without obscuring the User_ID.</p> <p>Acceptable (two separate requirements): When in the Active_State, the Record_Subsystem shall display the Name of each Line_Item, without obscuring the User_ID. When in the Active_State, the Record_Subsystem shall record the Location of each Line_Item.</p> <p>Unacceptable (forward slash "/" is used to enumerate actions/functions): The User_Management_System shall open/close the User_Account in less than 1 second. {This is unacceptable because it is unclear as to what is meant: open, close, or both.}</p> <p>Acceptable (two separate requirements): The User_Management_System shall open the User_Account in less than 1 second. The User_Management_System shall close the User_Account in less than 1 second.</p> <p>Unacceptable (passive requirement written on the user rather than on the system): The user shall either be trusted or not trusted. {Note: The intention is that a user should be classified in one of two ways and it is ambiguous: the requirement would still be met if the system took the option of treating all users as trusted.}</p> <p>Acceptable (use of logical expressions): The Security_System shall categorise each User as [Trusted XOR Not_Trusted].</p>
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Linked Work Items	refers to :  SPPR-3814 - Complete (C4) refers to :  SPPR-3817 - Verifiable (C7) refers to :  SPPR-3818 - Correct (C8) refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements refers to :  SPPR-3813 - Unambiguous (C3) refers to :  SPPR-3815 - Singular (C5) rules :  SPPR-10324 - Application Condition rules :  SPPR-10359 - Stakeholder Requirement rules :  SPPR-10323 - System Requirement refers to :  SPPR-3819 - Conforming (C9) has parent :  SPPR-10773 - Structure and style
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Requirement is expressed once


Avoid to write the same or equivalent requirement more than once, either as a duplicate or in similar form.








Compliance	 Required
ID	SPPR-3950
Rationale	Exact duplicates are relatively straightforward to identify; Finding similar need or requirement statements with slightly different wording is much more difficult but is aided by the consistent use of defined terms and by classification.
Example	<p>Unacceptable: The following requirements are overlapping because the first is a subset of the second:</p> <ul style="list-style-type: none"> • The system shall generate the report of financial transactions containing the information defined in <some standard or contract deliverable listing>. • The system shall generate the financial report containing the information defined in <some standard or contract deliverable listing>.
Linked Work Items	refers to :  SPPR-3805 - Necessary (C1) refers to :  SPPR-3819 - Conforming (C9) refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements rules :  SPPR-10323 - System Requirement rules :  SPPR-10324 - Application Condition rules :  SPPR-10359 - Stakeholder Requirement refers to :  SPPR-3820 - Complete (C10) refers to :  SPPR-3822 - Consistent (C11) has parent :  SPPR-10773 - Structure and style

Requirement is separated from its rationale

Avoid to write the purpose of the requirement in the requirement sentence. In addition, avoid terms like "purpose of", "intent of", "so that" or "reason for" inside the requirement. Instead, use separate rationales instead to describe the requirement's purpose. The rationale of a  SPPR-10323 - System Requirement,  SPPR-10359 - Stakeholder Requirement and  SPPR-10324 - Application Condition is placed in the "Rationale" custom field.

Note: In case of difficulties to distinguish rationale and requirements start to formulate the rationale with "The requirement purpose is to ..." and then write the separate requirement sentences.


Compliance	 Required
ID	SPPR-3966
Rationale	Do not combine the requirement sentence and the rationale sentence in a single one.


Example	<p>Unacceptable: The Record_Subsystem shall display the Name of each Line_Item so that the Operator can confirm that it is the correct Item. {This is unacceptable because the text “so that the Operator can confirm that it is the correct Item” is a rationale.}</p> <p>Acceptable: The Record_Subsystem shall display the Name of each Line_Item.</p> <p>Rationale: Display the name of each Line_Item is needed so that the Operator can confirm correct selection of items”.</p>
Linked Work Items	<p>refers to :  SPPR-3805 - Necessary (C1)</p> <p>refers to :  SPPR-3815 - Singular (C5)</p> <p>refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements</p> <p>rules :  SPPR-10359 - Stakeholder Requirement</p> <p>rules :  SPPR-10323 - System Requirement</p> <p>rules :  SPPR-10324 - Application Condition</p> <p>has parent :  SPPR-10773 - Structure and style</p>








Requirement has a good readability

A more complex requirement is formatted using the following rules:

- separate the **<verb>** clause into a dedicated line via line break
- separate each **<precondition>** or **<trigger>** clause into a dedicated line via line break if it encompasses more than 2 preconditions or triggers connected by a logical operator (each line starts then with the next logical operator)

Note: Requirements which do not have any preconditions or triggers are usually quite short. Therefore, do not put a line break for such ones. When a requirement is related to complex behaviour or which is complex to express, use references directly in the requirement text (see  SPPR-10738 - References are written consistently).











Compliance	 Required
ID	SPPR-10311
Rationale	For some complex requirements, the actual complexity cannot be reduced, or the texts are simply long. However, formatting and separating their particular parts strongly improves the readability without changing their syntax or semantics. Follow formatting proposals across the whole project also for non-complex requirements improves the homogeneity.
Example	<p>While [... , <line break with Shift+Enter> OR ...] <line break with Shift+Enter> when [... <line break with Shift+Enter> AND ... <line break with Shift+Enter> AND ...], <line break with Shift+Enter> the system shall</p> <p>For better readability it is allowed to put a blank line between the condition clause and the main clause.</p> <p>While [... , <line break with Shift+Enter> OR ...] <line break with Shift+Enter> when [... <line break with Shift+Enter> AND ... <line break with Shift+Enter> AND ...], <line break with Shift+Enter> <line break with Shift+Enter> the system shall ...</p>

Linked Work Items	rules :  SPPR-10323 - System Requirement rules :  SPPR-10359 - Stakeholder Requirement rules :  SPPR-10324 - Application Condition refers to :  SPPR-3813 - Unambiguous (C3) refers to :  SPPR-3817 - Verifiable (C7) refers to :  SPPR-3819 - Conforming (C9) has parent :  SPPR-10773 - Structure and style
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Requirement does not rely on document or chapter headings


Do not use document and chapter headings within or as part of a requirement sentence.







Exception: Use headings to indicate groupings of related requirements or types of requirements.

Compliance	 Required
ID	SPPR-3977
Rationale	Avoid relying on headings to support explanation or understanding of the requirement (mainly applicable when documenting requirements).
Example	<p>Unacceptable: Heading: Alert Buzzer Requirements The system shall sound it for greater than 20 minutes. {This is unacceptable because the requirement uses the pronoun "it", which requires the heading to understand what "it" means. In addition, the word "sound" could be ambiguous as it can be a noun, a verb, adverb, or adjective. It is not known whether Alert_Buzzer is a subsystem that controls the noise or the thing that makes the noise.}</p> <p>Acceptable: The system shall activate the Alert_Buzzer for greater than 20 minutes.</p>
Linked Work Items	refers to :  SPPR-3814 - Complete (C4) refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements rules :  SPPR-10359 - Stakeholder Requirement rules :  SPPR-10323 - System Requirement rules :  SPPR-10324 - Application Condition refers to :  SPPR-3819 - Conforming (C9) refers to :  SPPR-3821 - Comprehensible (C13) refers to :  SPPR-10223 - Correct (C15) has parent :  SPPR-10773 - Structure and style

Requirement is written as solution-free as possible

Write requirements as solution-free or technology-agnostic as possible to avoid unintentional solution constraints at the given level of abstraction.

Compliance	 Recommended
ID	SPPR-3949
Rationale	<p>What vs. how Requirements have to describe the problem "what" ("what is needed from the system" i.e. design input) rather the solution "how" (how the solution is going to achieve it, i.e. design output).</p> <p>Abstraction vs. solution The system requirements specification has to define the system in the most solution-neutral way possible. This principle of black-box thinking applies at lower levels as well. The goal is to provide solution neutral design input requirements into the architecture and design process thereby ensuring that the designers have the widest possible design space to develop an optimal solution.</p>

Example	<p>Unacceptable: When the pedestrian signals their presence by pressing a button on the traffic-light pillar, the traffic light shall turn red for the traffic to stop. {This is unacceptable because this requirement contains solution-biased detail – design output. In addition, the requirement is unacceptable because the subject is the user over which we have no control - that is, we cannot tell the user what to do in a requirement.}</p> <p>Acceptable: While Day_Light_Hours is detected, when the presence of the Pedestrian that needs to cross the street at the Intersection is detected, the Traffic_Control_System shall issue the Traffic_Stop_Signal for Average_Pedestrian_Crossing_Time. {This requirement allows freedom in determining the best solution (design input), which may be a means of automatic detection rather than button pushing.}</p>
Linked Work Items	<p>refers to :  SPPR-3812 - Appropriate (C2)</p> <p>refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements</p> <p>rules :  SPPR-10359 - Stakeholder Requirement</p> <p>rules :  SPPR-10323 - System Requirement</p> <p>rules :  SPPR-10324 - Application Condition</p> <p>has parent :  SPPR-10773 - Structure and style</p>

3.2 Wording and punctuation












British English is used with correct grammar and spelling

Refer to the Cambridge Dictionary or the Oxford Dictionary or further information.

<https://dictionary.cambridge.org/>

<https://www.oed.com/>

<https://www.oxfordlearnersdictionaries.com/>








Compliance	 Required
ID	SPPR-3945
Rationale	British English should be used at all times, in order to use correct grammar and ensure consistency within the project.
Example	"Generalisation" is used instead of "generalization".
Linked Work Items	<p>refers to :  SPPR-3813 - Unambiguous (C3)</p> <p>refers to :  SPPR-3817 - Verifiable (C7)</p> <p>refers to :  SPPR-3818 - Correct (C8)</p> <p>refers to :  SPPR-3819 - Conforming (C9)</p> <p>refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements</p> <p>rules :  SPPR-10359 - Stakeholder Requirement</p> <p>rules :  SPPR-10323 - System Requirement</p> <p>rules :  SPPR-10324 - Application Condition</p> <p>rules :  SPPR-11193 - Condition</p> <p>has parent :  SPPR-11196 - Wording and punctuation</p>

Definite article is used


Use the definite article "the" instead of the indefinite articles "a" or "an" for the <subject> and the <object>.

Note: "the" can be omitted in <precondition> and <trigger> to shorten the requirement sentence.


Compliance	 Required
ID	SPPR-3973









Rationale	Use of "a or an" turns the subject or object into an indefinite element that cannot be verified.
Example	<p>Unacceptable: A user shall ... , A system shall ... , A train shall ... , The perception system shall detect a cat. {Unverifiable examples: It is not clear what "user" or "cat" means exactly (i.e. certain type, a large or small, a black or white cat)}.</p> <p>Acceptable: The subsystem shall display the Current_Time. (Whereby Current_Time (as the object) is a defined term in a glossary and used consistently throughout the project.)</p>
Linked Work Items	<p>refers to :  SPPR-3813 - Unambiguous (C3)</p> <p>refers to :  SPPR-3817 - Verifiable (C7)</p> <p>refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements</p> <p>rules :  SPPR-10359 - Stakeholder Requirement</p> <p>rules :  SPPR-10323 - System Requirement</p> <p>rules :  SPPR-10324 - Application Condition</p> <p>rules : {C} SPPR-11193 - Condition</p> <p>has parent :  SPPR-11196 - Wording and punctuation</p>

Negative phrases are avoided

The words "not" and "no" are avoided in requirements. Only use "NOT" as a logical operator inside conditions as described in  SPPR-3952 - Conditions are written as logical expressions.


Note: Safety conditions may be written from a safety perspective and focus on what should "not" happen e.g. "system harming humans". But there is no 100% certainty. Therefore, in such cases "not" has to be avoided and translated into achievable and allowable constraints that are often defined by standards and regulations.










Compliance	 Required
ID	SPPR-3957
Rationale	Requirements that contain "not" or "no" are impossible to verify.
Example	<p>Unacceptable: The <system> shall not fail. {This is impossible as verification of the requirement would require infinite time.}</p> <p>Acceptable: The <system> shall have an Availability of greater than or equal to 95%.</p> <p>The <system> Mean_Time_Between_Failures shall be of 6 months.</p> <p>Unacceptable: The <system> shall not contain mercury. {The real concern may be the use of toxic materials, not just mercury. If that is the case, it may be best to reference a standard for allowable exposures to a list of common toxic materials.}</p> <p>Acceptable: The <system> shall limit metallic mercury exposures to less than or equal 0.025 mg/m₃ over an 8-hour workday.</p> <p>Unacceptable: The system shall not allow unauthorized access.</p> <p>Acceptable: The system shall provide access only to authorized users.</p>

Linked Work Items	refers to :  SPPR-3813 - Unambiguous (C3) refers to :  SPPR-3817 - Verifiable (C7) refers to :  SPPR-3818 - Correct (C8) refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements rules :  SPPR-10359 - Stakeholder Requirement rules :  SPPR-10323 - System Requirement rules :  SPPR-10324 - Application Condition rules : {c} SPPR-11193 - Condition has parent :  SPPR-11196 - Wording and punctuation
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Universal quantifier is used

Use "each" as quantifier for nouns instead of "all", "any", "every" or "both" for universal quantification.



Note: "All" can be used if "all" can be clearly defined as a closed set. Otherwise it is hard to verify. See also  SPPR-3955 - Terms are defined and used consistently to support the usage of the quantifiers with clearly defined nouns.















Compliance	 Required
ID	SPPR-3942
Rationale	Use only "each" when universal quantification of nouns is intended.
Example	<p>Unacceptable: The Operation_Logger shall record any (or all) warning messages. {This is unacceptable because of the use of the word "any", which is then made worse by the addition of "(or all)".}</p> <p>Acceptable: The Operation_Logger shall record each Warning_Message. {Note that Warning_Message must be defined so that it is clear that the system only will record each defined Warning Message.}</p> <p>Unacceptable: The Record_Subsystem shall display the Names of both of the Line_Items. {This is unacceptable because of the use of the word "both".}</p> <p>Acceptable: The Record_Subsystem shall display the name of each Line_Item.</p> <p>Acceptable: The Record_Subsystem shall display each Line_Item_Name.</p>
Linked Work Items	refers to :  SPPR-3813 - Unambiguous (C3) refers to :  SPPR-3817 - Verifiable (C7) refers to :  SPPR-3818 - Correct (C8) refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements rules :  SPPR-10323 - System Requirement rules :  SPPR-10324 - Application Condition rules :  SPPR-10359 - Stakeholder Requirement rules : {c} SPPR-11193 - Condition has parent :  SPPR-11196 - Wording and punctuation

Vague words are avoided

The following words shall be avoided to ensure measurable quantification.

Word category	Forbidden words
Personal pronouns	such as: "it", "this", "that", "he", "she", "they", "them", "his", "her"
Indefinite pronouns	such as: "all", "another", "any", "anybody", "anything", "both", "each", "either", "every", "everybody", "everyone", "everything", "few", "many", "most", "much", "neither", "no one", "nobody", "none", "one", "several", "some", "somebody", "someone", "something", "such"
Adjectives	such as: "relevant", "routine", "common", "generic", "significant", "flexible", "expandable", "typical", "sufficient", "adequate", "appropriate", "efficient", "effective", "proficient", "reasonable", "easy", "high", "low", "user-friendly", "fast", "prompt", "medium-sized", "maximum", "minimum", "optimum", "nominal", "best", "routine", "until", "before", "after",














Word category	Forbidden words
	<p>“as”, “once”, “earliest”, “latest”, “instantaneous”, “simultaneous”, “at last”, “allowable”</p> <p><u>Note:</u> For a  SPPR-10359 - Stakeholder Requirement it might be difficult to avoid such vague adjectives generally because a more detailed requirement is not yet available. Use then such adjectives in specific stakeholder requirements, but carefully chosen.</p>
Adverbs	such as: “usual(ly)”, “approximate(ly)”, “sufficient(ly)”, “typical(ly)”, “constantly”, “eventually”, “nearly”, “always”, “almost”, “never”
Combinators	such as: “and”, “or”, “then”, “unless”, “but”, “as well as”, “but also”, “however”, “whether”, “meanwhile”, “whereas”, “on the other hand”, and “otherwise”
Indefinite quantifiers	such as: “a lot of”, “a few”, “about”, “close to”
Compliance	 Required
ID	SPPR-3961
Rationale	Words which lead to ambiguous and unverifiable requirements are hard to verify. Therefore, it is important to avoid such unachievable or unmeasurable characteristics and quantifications or values. Thus, it must be checked whether it is possible to define such words more precisely with a quantitative measure. If this requires further design decisions, state this also e.g. in the rationale.

Example	<p>Unacceptable: The controller shall send the driver his itinerary for the day. It shall be delivered at least 8 hours prior to his Shift. {This is unacceptable because the requirement is expressed as two sentences and the second sentence uses the pronouns "it" and "his."}</p> <p>Acceptable: The Controller shall send the Driver_Itinerary for the day to the Driver in less than 8 hours prior to the Driver_Shift. {Use a glossary to define terms and to be explicit about the relationship between the driver, shift, and the itinerary for that particular driver.}</p> <p>Unacceptable: The Flight_Information_System shall usually be on line. {This is unacceptable because "usually" is ambiguous - is it the availability what is meant?}</p> <p>Acceptable: The Flight_Information_System shall have an Availability of greater than 99.99966% over a period of equal or greater than 365 days. {Note that "Availability" must be defined in the glossary since there are a number of possible ways of calculating that measure.}</p> <p>Unacceptable: The Life Support System shall maximise system availability. {Firstly, using unmeasurable quantifiers like "maximise" and secondly, goals cannot be mixed with requirements therefore avoid use of "shall" keywords.}</p> <p>Acceptable: The Life Support System shall have an Availability greater than 99.99966% over a period of equal or greater than 365 days.</p> <p>Alternative: The Life Support System Availability shall be greater than 99.99966% over a period of equal or greater than 365 days. {This has a stronger focus on the availability attribute.}</p> <p>Unacceptable: The system shall use minimum power. {This is unacceptable because "minimum" is ambiguous.}</p> <p>Acceptable: The system shall use less than or equal to 50W of main power. {This considers the underlying goal to minimise power consumption and provides a measurable target.}</p> <p>Unacceptable: The System shall limit arsenic contamination in the drinking water to allowable levels. Rationale: Arsenic contamination in drinking water can cause health problems. {While "allowable" is acceptable in a need statement, it is unacceptable in a requirement statement because allowable is ambiguous. It is not clear which specific concentration is allowable or to which market it is applicable.}</p> <p>Acceptable: The system shall limit arsenic contamination in the drinking water to less than 10 parts per billion. Rationale: EPA set the arsenic standard for drinking water at 10 ppb (or 0.010 parts per million. {The EPA has determined that concentrations of this level or less will protect consumers from the effects of long-term, chronic exposure to arsenic.}</p>
Linked Work Items	<p>refers to :  SPPR-3813 - Unambiguous (C3)</p> <p>refers to :  SPPR-3814 - Complete (C4)</p> <p>refers to :  SPPR-3817 - Verifiable (C7)</p> <p>refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements</p> <p>rules :  SPPR-10359 - Stakeholder Requirement</p> <p>rules :  SPPR-10323 - System Requirement</p> <p>rules :  SPPR-10324 - Application Condition</p> <p>rules :  SPPR-11193 - Condition</p> <p>refers to :  SPPR-3816 - Feasible (C6)</p> <p>refers to :  SPPR-3818 - Correct (C8)</p> <p>refers to :  SPPR-3822 - Consistent (C11)</p> <p>refers to :  SPPR-3821 - Comprehensible (C13)</p> <p>refers to :  SPPR-3823 - Able to be validated (C14)</p> <p>has parent :  SPPR-11196 - Wording and punctuation</p>

Vague phrases are avoided


The following phrases shall be avoided to ensure measurable quantification.











Phrase category	Forbidden phrases
Open-ended	such as: “including but not limited to”, “etc.” and “and so on.”, “so far as possible”, “as little as possible”, “if possible”
Unprecise	such as: “if necessary”, “as appropriate”, “as required”, “if practicable”, or “there is”, “bug free”

Compliance	 Required
ID	SPPR-3948
Rationale	Vague phrases imply that there is more required without stating exactly what is needed. Also do not use escape clauses where the reader may interpret the requirement or parts of it as optional.
Example	<p>Unacceptable: The ATM shall display the Customer Account_Number, Account_Balance, and so on. {This is unacceptable because it contains an opened list of what is to be displayed. Split therefore into as many requirements as necessary to be complete.}</p> <p>Acceptable: The ATM shall display the Customer Account_Number. The ATM shall display the Customer Account_Balance. The ATM shall display the Customer Account_Type.</p> <p>Unacceptable: The GPS system shall, where there is sufficient space, display the User_Location. {This is vague, ambiguous and unverifiable.}</p> <p>Acceptable: The GPS system shall display the User_Location. {Note that “GPS” and “User_Location” must be defined in the glossary.}</p>
Linked Work Items	refers to :  SPPR-3813 - Unambiguous (C3) refers to :  SPPR-3814 - Complete (C4) refers to :  SPPR-3815 - Singular (C5) refers to :  SPPR-3817 - Verifiable (C7) refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements rules :  SPPR-10359 - Stakeholder Requirement rules :  SPPR-10323 - System Requirement rules :  SPPR-10324 - Application Condition rules : {c} SPPR-11193 - Condition refers to :  SPPR-3821 - Comprehensible (C13) refers to :  SPPR-3822 - Consistent (C11) refers to :  SPPR-3823 - Able to be validated (C14) has parent :  SPPR-11196 - Wording and punctuation

Superfluous infinitives using are avoided

Such as: “...shall be designed to ...” or “...shall be able to ...” or “...shall be designed to be capable of ...”










Compliance	 Required
ID	SPPR-3941
Rationale	Avoid superfluous infinitives to be precise for verification.

Example	<p>Unacceptable: The xyz_subsystem shall be able to store the location of each Ordnance. {This is unacceptable because it contains the superfluous infinitive "be able to".}</p> <p>Acceptable: The xyz_subsystem shall store the location of each Ordnance.</p>
Linked Work Items	<p>refers to :  SPPR-3813 - Unambiguous (C3)</p> <p>refers to :  SPPR-3817 - Verifiable (C7)</p> <p>refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements</p> <p>rules :  SPPR-10359 - Stakeholder Requirement</p> <p>rules :  SPPR-10323 - System Requirement</p> <p>rules :  SPPR-10324 - Application Condition</p> <p>refers to :  SPPR-3822 - Consistent (C11)</p> <p>refers to :  SPPR-3821 - Comprehensible (C13)</p> <p>refers to :  SPPR-3823 - Able to be validated (C14)</p> <p>has parent :  SPPR-11196 - Wording and punctuation</p>

Punctuation is used correctly and appropriately

Use punctuation symbols in a consistent way. See [Punctuation - Cambridge Dictionary](#) for further background information.

Category	Explanation
Allowed symbols	<p>The following punctuation symbols are used:</p> <ul style="list-style-type: none"> • full stop " . " • comma " , " • dash / hyphen " - " • underscore " _ " • percent " % " • degree " ° " <p><u>Note:</u> Place commas correctly "," inside the requirement sentence and use full stops "." at the end of the requirement sentence.</p>
Not allowed symbols	<p>The following punctuation symbols must be avoided:</p> <ul style="list-style-type: none"> • semi-colon " ; " • question mark " ? " • exclamation mark " ! " • forward slash " / " • back slash " \ " • parentheses "(...)" • curly brackets "{ ... }" • asterisk " * " • multiplied by " × " • divided by " ÷ " • less than " < ", greater than " > " • less than or equal to " <= ", greater than or equal to " >= " • and " & " • or " " • equals " = " <p><u>Exception 1:</u> The forward slash is allowed for units (e.g. "m/s").</p> <p><u>Exception 2:</u> Square brackets are used for conditions. See  SPPR-3952 - Conditions are written as logical expressions for the details.</p>













Compliance	❗ Required
ID	SPPR-3954
Rationale	The requirement sentence follows correct grammar and is written consistently without spelling errors. Parentheses or brackets usually contain superfluous information or worse and introduce ambiguity. See https://dictionary.cambridge.org/grammar/british-grammar/punctuation as a reference.
Example	<p>Unacceptable: The Navigation_Beacon shall provide Augmentation_Data to each Maritime_User, engaged in Harbor_Approach_Maneuvering at an accuracy of 20 meters or less at least 99.7% of the time. {This is unacceptable because the incorrectly placed comma in this sentence confuses the meaning, leading the reader to believe that the accuracy is related to the maneuver rather than to the augmentation data.}</p> <p>Acceptable: The Navigation_Beacon shall provide Augmentation_Data to each Maritime_User engaged in Harbor_Approach_Maneuvering, at an accuracy of less than or equal to 20 meters greater than 99.7% of the time. {The positioning of the comma now makes it clear that the accuracy and availability relate to the data.}</p> <p>Unacceptable: The Control_Unit shall disconnect power from the Boiler when the water temperature exceeds 85 °C (usually towards the end of the boiling cycle). {This is unacceptable because of the parenthetical phrase as well as the ambiguous word "usually".}</p> <p>Acceptable: When the water temperature is greater than 85 °C, the Control_Unit shall disconnect power from the Boiler.</p>
Linked Work Items	<p>refers to :  SPPR-3813 - Unambiguous (C3)</p> <p>refers to :  SPPR-3818 - Correct (C8)</p> <p>refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements</p> <p>refers to :  SPPR-3815 - Singular (C5)</p> <p>rules :  SPPR-10359 - Stakeholder Requirement</p> <p>rules :  SPPR-10323 - System Requirement</p> <p>rules :  SPPR-10324 - Application Condition</p> <p>rules : {c} SPPR-11193 - Condition</p> <p>refers to :  SPPR-3817 - Verifiable (C7)</p> <p>has parent :  SPPR-11196 - Wording and punctuation</p>

3.3 Terms and abbreviations

Terms are defined and used consistently

Define relevant terms in the glossary and use them consistently inside the requirements. Please consider the *SPPROCESS/30 SP Metadata Management/Glossary Usage Guidelines : 722327* for the details.











Compliance	❗ Required
ID	SPPR-3955
Rationale	Terms and must be used consistently throughout the project, i.e. in the sets of requirements and also between all artefacts developed across all life cycle stages.

Example	<p>Unacceptable: When the Input_Valve is connected to the Water_Source, the Control_Subsystem shall open the Inlet_Valve. {Two terms are used for the same thing "Input_Valve" and "Inlet_Valve".}</p> <p>Acceptable: When the Inlet_Valve is connected to the Water_Source, the Control_Subsystem shall open the Inlet_Valve.</p> <p>Unacceptable: The system shall display current time. {Unverifiable: Current time where, in which time zone, to what degree of accuracy, in what format?}</p> <p>Acceptable: "The <subsystem> shall display the Current_Time in "DD/MM/YYYY-hh:mm:ss" format. {Note that "Current_Time" must then be defined in the glossary in terms of accuracy, format, time zone, and unit.}</p>
Linked Work Items	<p>refers to :  SPPR-3813 - Unambiguous (C3)</p> <p>refers to :  SPPR-3818 - Correct (C8)</p> <p>refers to :  SPPR-3819 - Conforming (C9)</p> <p>refers to :  SPPR-3822 - Consistent (C11)</p> <p>refers to :  SPPR-3821 - Comprehensible (C13)</p> <p>refers to :  SPPR-3823 - Able to be validated (C14)</p> <p>refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements</p> <p>refers to :  SPPR-3817 - Verifiable (C7)</p> <p>rules :  SPPR-10359 - Stakeholder Requirement</p> <p>rules :  SPPR-10323 - System Requirement</p> <p>rules :  SPPR-10324 - Application Condition</p> <p>rules : {c} SPPR-11193 - Condition</p> <p>has parent :  SPPR-10253 - Terms and abbreviations</p>

Abbreviations are avoided

If there is special need to use an abbreviation in a requirement though, then a link or glossary reference to its definition must be provided. Please consider the *SPPROCESS/30 SP Metadata Management/Glossary Usage Guidelines : 722327* for the details.

Note: When there are abbreviations which have different or multiple meanings, it is a best practice to avoid ambiguity by spelling out the abbreviation.

Compliance	 Recommended
ID	SPPR-3958
Rationale	Abbreviations should be avoided because of unambiguity in elements used in requirements.
Example	<p>Unacceptable: It would not be acceptable for one requirement to refer to the abbreviation "op" meaning operation and another to refer to the "op" meaning the operator.</p> <p>Acceptable: Avoid the abbreviation and use the full term every time.</p>
Linked Work Items	<p>refers to :  SPPR-3819 - Conforming (C9)</p> <p>refers to :  SPPR-3822 - Consistent (C11)</p> <p>refers to :  SPPR-3821 - Comprehensible (C13)</p> <p>refers to :  SPPR-3823 - Able to be validated (C14)</p> <p>refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements</p> <p>rules :  SPPR-10359 - Stakeholder Requirement</p> <p>rules :  SPPR-10323 - System Requirement</p> <p>rules :  SPPR-10324 - Application Condition</p> <p>rules : {c} SPPR-11193 - Condition</p> <p>has parent :  SPPR-10253 - Terms and abbreviations</p>

Acronyms are defined and used consistently

Define relevant acronyms in the glossary and use them consistently inside the requirements. Please consider the *SPPROCESS/30 SP Metadata Management/Glossary Usage Guidelines : 722327* for the

details.

Note: Acronyms are types of abbreviations means that the difference between an abbreviation and an acronym is that an abbreviation is the articulated form of the original word whereas the acronym is a form of a new word.

Compliance	❗ Required
ID	SPPR-3953
Rationale	Acronyms are consistently used and defined throughout the project.
Example	<p>Unacceptable: It would not be acceptable for one requirement to refer to the “Global Positioning System” and the remaining requirements refer just to “GPS”.</p> <p>Acceptable: Use the full term every time or, perhaps more usefully, define the acronym in the project acronym list or glossary and use it every time.</p> <ul style="list-style-type: none"> • Radar: Radio detection and ranging • Laser: light amplification by the stimulated emission of radiation • OLED: organic light emitting diode
Linked Work Items	<p>refers to : ❗ SPPR-3813 - Unambiguous (C3)</p> <p>refers to : ❗ SPPR-3819 - Conforming (C9)</p> <p>refers to : ❗ SPPR-3822 - Consistent (C11)</p> <p>refers to : ❗ SPPR-3821 - Comprehensible (C13)</p> <p>refers to : ❗ SPPR-3823 - Able to be validated (C14)</p> <p>refers to : 📄 SPPR-4100 - INCOSE Guide to Writing Requirements</p> <p>rules : 🧩 SPPR-10359 - Stakeholder Requirement</p> <p>rules : 📁 SPPR-10323 - System Requirement</p> <p>rules : 📁 SPPR-10324 - Application Condition</p> <p>rules : {c} SPPR-11193 - Condition</p> <p>has parent : 📁 SPPR-10253 - Terms and abbreviations</p>

3.4 Conditions

Conditions are written as logical expressions

Conditions are represented consistently by logical expressions which have the following conventions:











- consists of single expression or multiple expressions **separated by logical operators**
- uses the logical operators **NOT, AND, OR, XOR** written in upper case
- are used explicitly in preconditions and triggers for ❗ SPPR-3519 - Functional requirement pattern is used for system behaviour and ❗ SPPR-4332 - Non-functional requirement pattern is used for system characteristics

There are three different cases how to write conditions:

Detailed case	Specific rule
single expression with no logical operator	<p>Do not use square brackets for the expression.</p> <p><expressionA></p> <p>A single expression is written as following ❗ SPPR-3946 - Values are expressed precisely .</p>
multiple expressions with the same logical operator	<p>Put square brackets around the whole expression including all logical operators. Do not put every condition part in a particular square bracket pair connected by the logical operators. This is for the situations where i.e., only AND or only OR is used.</p> <p>[<expressionA> <logical operator 1> <expressionB> <logical operator 1> ...]</p>


Detailed case	Specific rule
	Exception: When the condition is written inside a <u>Capella2Polarion</u> work item, the outer square brackets can be omitted for the whole condition.
multiple expressions with different logical operators	<p>Put square brackets around every expression part that you want to connect with the logical operator. Furthermore, put a blank between subsequent nested square brackets for readability. This is for the situations where i.e., combinations of AND, OR are used.</p> <p>[[<expressionA>] <logical operator 1> <expressionB>] <logical operator 2> <expressionC> ...]</p> <p>Note: Please do not rely on the logical operator precedence known from first-order logic (e.g., a OR b AND c = [a OR [b AND c]]), because other people have to understand the requirements and might have other interpretations. Therefore, place the brackets in the way the conditions within brackets shall be evaluated. This means that the most inner brackets are evaluated first.</p> <p>Exception: When the condition is written inside a <u>Capella2Polarion</u> work item, the outer square brackets can be omitted for the whole condition.</p>






Compliance	🚫 Required
ID	SPPR-3952
Rationale	Conditions are described in a consistent way to control the scope using brackets and logical operators.
Example	<p>Acceptable: Single expression: valueX is greater than 5 Multiple expressions with the same logical operator: [a AND b AND c AND d] Multiple expressions with the different logical operators: [[a AND b] OR [c AND d]]</p> <p>Unacceptable: When the Cruise_Control is engaged, and the Driver applies the Accelerator, the Engine_Management_System shall disengage the Speed_Control_Subsystem. {This is unacceptable because of the ambiguity of “and” could be confused.}</p> <p>Acceptable (square brackets with conjunction): When [the Cruise_Control is engaged AND the Driver applies the Accelerator], the Engine_Management_System shall disengage the Speed_Control_Subsystem.</p> <p>Acceptable (square brackets with disjunction): When [the Audit_Clerk originated the item OR the Audit_Clerk is the actionee OR the Audit_Clerk is the reviewer], the Audit_System shall allow the Audit_Clerk to change the status of the action item.</p> <p>Acceptable (nested square brackets): When [[the SUC executes one GoA4 Task]] OR [[the SUC executes one GoA1 OR GoA2 Task] AND [the SUC simultaneously executes the Mission Task that comprises recording of data]], the SUC shall ...</p> <p>Acceptable (short-hand notation): When [European Trackside Protection System receives point_position_request AND each GroupState of DriveProtectionSectionGroup equals [Ready OR Processing OR Trailed] ...] ...</p>

Linked Work Items	refers to :  SPPR-3813 - Unambiguous (C3) refers to :  SPPR-3817 - Verifiable (C7) refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements rules :  SPPR-10359 - Stakeholder Requirement rules :  SPPR-10323 - System Requirement rules :  SPPR-10324 - Application Condition refers to :  SPPR-3814 - Complete (C4) refers to :  SPPR-3818 - Correct (C8) refers to :  SPPR-3819 - Conforming (C9) has parent :  SPPR-10258 - Conditions
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Conditions are reusable

Use work items of type {c} SPPR-11193 - Condition to write reusable conditions.

Insert the {c} SPPR-11193 - Condition work item as an active link in the requirement sentence. See  SPPR-3952 - Conditions are written as logical expressions for the details how to write conditions (i.e. for preconditions, triggers).

Compliance	 Recommended
ID	SPPR-11195
Rationale	Conditions can be written and managed separately using Constraint work items for the purpose of reusability in multiple requirements.
Example	When [MessageA is received AND {c} SPPR-11193 - Condition is fulfilled], the system shall perform <system function>.
Linked Work Items	rules : {c} SPPR-11193 - Condition rules :  SPPR-10323 - System Requirement rules :  SPPR-10324 - Application Condition rules :  SPPR-10359 - Stakeholder Requirement has parent :  SPPR-10258 - Conditions

3.5 Values



Values are expressed precisely

State values clear and precise in the requirements using tolerances and ranges for the purpose of measurable quantification.

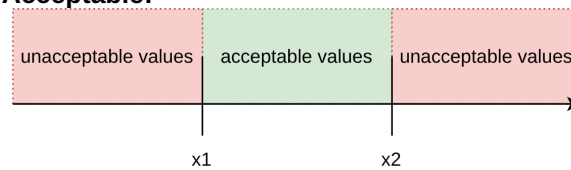
Note: In case of more complex cases the statement can be also written as a logical expression.

Use the following detailed notations to write values:

Content	Notation
Comparison operators	Comparison operators are written as follows: <ul style="list-style-type: none"> • equals, is equal to • is not equal to • greater than • greater than or equal to • less than • less than or equal to
Ranges	Ranges are written as follows: <ul style="list-style-type: none"> • in intervals of <upper bound> to <lower bound> • over a period of ..., in periodic intervals of ... • from ... to, between ... and ..., within ...

Content	Notation
	<ul style="list-style-type: none">• <condition> (see  SPPR-3952 - Conditions are written as logical expressions)
Quantities	<p>Quantities are written as follows:</p> <ul style="list-style-type: none">• a total of• at most, at least• above, below, up to
Compliance	 Required
ID	SPPR-3946
Rationale	<p>Values are expressed sufficiently and precisely using tolerances and ranges. Single-point values are seldom sufficient and are difficult to test. Therefore, provide specific measurable value (e.g. through performance targets and time constraints) appropriate to the entity to which the requirement is stated (e.g. system or component) and against the entity will be verified.</p>

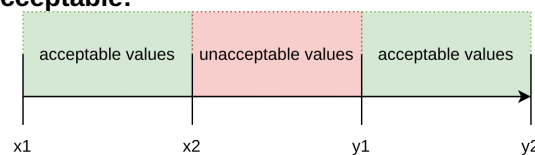
Example

Acceptable:

The System ABC example_value shall be [greater than **x1** AND less than **x2**].
 The System ABC example_value shall be [greater than or equal to **x1** AND less than **x2**].

The System ABC example_value shall be [greater than **x1** AND less than or equal to **x2**].

The System ABC example_value shall be [greater than or equal to **x1** AND less than or equal to **x2**].

Acceptable:

- The System ABC example_value shall be [[greater than **x1** AND less than **x2**] OR [greater than **y1** AND less than **y2**]].
- The System ABC example_value shall be [[greater than or equal to **x1** AND less than **x2**] OR [greater than or equal to **y1** AND less than **y2**]].
- The System ABC example_value shall be [[greater than **x1** AND less than or equal to **x2**] OR [greater than **y1** AND less than or equal to **y2**]].
- The System ABC example_value shall be [[greater than or equal to **x1** AND less than or equal to **x2**] OR [greater than or equal to **y1** AND less than or equal to **y2**]].

Acceptable: While operating hours, the system Availability shall be **greater than or equal to 98%**.

{Use the glossary to define terms e.g. Availability.}

Acceptable: While ..., the SUC shall monitor the external system **<in periodic intervals of [<lower bound> .. <upper bound>]** ... Rationale: The computer hardware is determined in <phase xyz>, so that the periodic interval quantity is specified subsequently.

Acceptable: While the Train Unit velocity **equals** 0 km/h, ...

Acceptable: Tolerances like "**100 ± 5 km/h**" and ranges like "**between 95 and 105 km/h**".

Unacceptable:












While in operation, the Pumping_Station shall maintain the flow of water at **100 liters** per second.

{This is unacceptable because it is not known whether a solution that addresses more or less than the specified quantity is acceptable. As stated, "100" can be interpreted as "100.000". It would be difficult and expensive to design to and verify against this point value.}

Improved (addressing the range defect):










While in operation, the Pumping_Station shall maintain Water_Flow at **100 ±10 liters** per second.

{Now the range of acceptable flow performance is clear. Given that the condition "while in operation", this requirement applies whenever the Pumping_Station is active - no matter how long. Another consideration is whether there is sufficient water at the inlet to the pumping station to establish the required flow rate.}

Linked Work Items	refers to :  SPPR-3813 - Unambiguous (C3) refers to :  SPPR-3814 - Complete (C4) refers to :  SPPR-3817 - Verifiable (C7) refers to :  SPPR-3844 - Feasible (C12) refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements refers to :  SPPR-3816 - Feasible (C6) refers to :  SPPR-3818 - Correct (C8) rules :  SPPR-10359 - Stakeholder Requirement rules :  SPPR-10323 - System Requirement rules :  SPPR-10324 - Application Condition rules : {c} SPPR-11193 - Condition has parent :  SPPR-11303 - Values
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Values use consistent decimal format


Use a consistent format of signification digits (i.e. comma or dot) for decimal numbers.











Compliance	 Required
ID	SPPR-10366
Rationale	Decimal numbers are written in a consistent way for the affected requirements.
Example	<p>Unacceptable: The system MTBF shall be less than or equal to 9.499,99 h. The system power consumption shall be less than or equal to 0.99 W. [These two statements are unacceptable when included in the same set because a different format (<u>one comma and one dot</u>) is used in the two statements.]</p> <p>Acceptable: The system MTBF shall be less than or equal to 9,499.99 h. The system power consumption shall be less than or equal to 0.99 W. The system MTBF shall be less than or equal to 9.499,99 h. The system power consumption shall be less than or equal to 0,99 W.</p>
Linked Work Items	rules :  SPPR-10359 - Stakeholder Requirement rules :  SPPR-10323 - System Requirement rules :  SPPR-10324 - Application Condition rules : {c} SPPR-11193 - Condition refers to :  SPPR-3813 - Unambiguous (C3) refers to :  SPPR-3817 - Verifiable (C7) refers to :  SPPR-3819 - Conforming (C9) refers to :  SPPR-3822 - Consistent (C11) has parent :  SPPR-11303 - Values

Values use correct units

Keep units consistent and apply them accordingly to values in the requirement sentence. Define variables, its numeric values and units of measure in a model or a data dictionary. Apply the SI system and the applicable standards (see the [SI Brochure](#) - bipm.org for detailed information).

Note: Please consider also *SPPROCESS/10 SEMP V 01_01/System Pillar MBSE Methodology Handbook* : 722327 for further information about units in context of the analysis and architecture model.


Compliance	 Required
ID	SPPR-3972
Rationale	All numeric values shall have a unit of measure explicitly stated which follows common standards. This is especially useful for global numeric values of a variable that have to stay consistent across multiple requirements.




Example	<p>Unacceptable: The Circuit_Board shall ... a temperature less than 30 degrees. {This is unacceptable because the units used are stated without indicating the specific measurement system used.}</p> <p>Acceptable: The Circuit_Board shall ... a temperature of less than 30 degrees Celsius.</p> <p>Unacceptable: The system shall establish communication to at least 4 in less than or equal to 10 seconds. {This is unacceptable because the units used are incomplete. "4" of what?}</p> <p>Acceptable: The system shall establish communications with at least 4 satellites in less than or equal to 10 seconds.</p> <p>Unacceptable: It would not be acceptable for one requirement to use one unit of measure (e.g. US - feet) and another to use another unit of measure (e.g. Metric - meter). Another situation would be usage of both "kph" and "m/s" velocity in the project.</p> <p>Acceptable: Settle on which units of measure will be used and use that unit of measure consistency across all System Engineering artifacts including needs, design input requirements and design output specifications.</p>
Linked Work Items	<p>refers to :  SPPR-3813 - Unambiguous (C3)</p> <p>refers to :  SPPR-3814 - Complete (C4)</p> <p>refers to :  SPPR-3817 - Verifiable (C7)</p> <p>refers to :  SPPR-3818 - Correct (C8)</p> <p>refers to :  SPPR-4100 - INCOSE Guide to Writing Requirements</p> <p>rules :  SPPR-10359 - Stakeholder Requirement</p> <p>rules :  SPPR-10323 - System Requirement</p> <p>rules :  SPPR-10324 - Application Condition</p> <p>rules : {C} SPPR-11193 - Condition</p> <p>refers to :  SPPR-3822 - Consistent (C11)</p> <p>has parent :  SPPR-11303 - Values</p>

3.6 References

References are written consistently

Requirements must use a consistent writing style for the usage of references.

Reference	Notation
Table	<p>Table references are written as follows: ... <as defined in / according to / ...> <table> ... <u>Note:</u> Use another wording before <table> if it is more appropriate.</p> <p><table> provides an active link to the Polarion work item which contains the table.</p>
Diagram	<p>Diagram references are written as follows: ... <as shown in / according to / ...> <diagram> ... <u>Note:</u> Use another wording before <diagram> if it is more appropriate.</p> <p><diagram> provides an active link to the Polarion work item which contains the diagrams.</p>
Polarion document	<p>Polarion document references are written as follows: ... <as described in / in accordance with / ...> <Polarion document> ... <u>Note:</u> Use another wording before <Polarion document> if it is more appropriate.</p> <p><Polarion document> provides an active link to the Polarion LiveDoc which exists internally in the same Polarion repository. Please consider the  References Usage Guidelines for the details on using references to internal Polarion documents.</p>
External source	<p>External source references are written as follows: ... <as specified in / in accordance with / ...> <external source> ... <u>Note:</u> Use another wording before <external source> if it is more appropriate.</p>

Reference	Notation								
	<p><external source> provides an active link to the Polarion work item of type "Reference" which contains the external source. Please consider the  References Usage Guidelines for the details on using references to external sources.</p>								
Compliance	 Required								
ID	SPPR-10738								
Rationale	Reference are used at the end of a requirement sentence to provide extended information for purpose of measurable outcomes.								
Example	<p>Unacceptable: The control system shall close Valves A and B within 5 seconds of the temperature exceeding 95 °C and within 2 seconds of each other. {This is unacceptable because of the confusing set of conditions. In this case what is meant will be clear if expressed in the form of a diagram.}</p> <p>Acceptable (reference to diagram): When the Product temperature exceeds 95 °C, the Control_System shall close Input_Valves as specified in timing diagram xyz. {Note that this assumes, of course, that the timing diagram itself is not ambiguous. If it is not possible to remove the ambiguity through the use of a diagram, it may be better to split the requirement into two.}</p> <p>Acceptable (reference to table): The system shall send move_point_command with the values as defined in Table 1.</p> <table border="1"> <thead> <tr> <th>Property</th><th>Value</th></tr> </thead> <tbody> <tr> <td><property1></td><td><value></td></tr> <tr> <td><property2></td><td><value></td></tr> <tr> <td>...</td><td>...</td></tr> </tbody> </table> <p>Table 1: Property values of move_point_command</p>	Property	Value	<property1>	<value>	<property2>	<value>
Property	Value								
<property1>	<value>								
<property2>	<value>								
...	...								
Linked Work Items	has parent :  SPPR-11337 - References								


4 Specific rules

This chapter provides the specific rules which are applicable to different requirements work items types.

4.1 Functional requirements

Functional requirement pattern is used for system behaviour

Functional requirements for the system of interest are closely following the syntax as defined in






 SPPR-3824 - Requirement is written as a well-formed sentence and are written as follows:

General functional requirements pattern

<precondition (optional)>, <trigger (optional)>, the <system> shall <action / function> <object>
<actor / interface (optional)> <limit (optional)> <reference (optional)>.



The functional requirement pattern is designed to also include non-functional characteristics alongside the system's functional actions or functions to qualify the system's behavior with additional limits (e.g. performance).

Explanation of the requirements parts


















Part	Explanation
precondition	The optional <precondition> is a condition which defines the circumstances under which the <action / function> can be performed. Preconditions are written as follows:  SPPR-3952 - Conditions are written as logical expressions
trigger	The optional <trigger> is a condition which defines the event that activates a desired <action / function> in case the <precondition> is defined and fulfilled. Triggers are written as follows:  SPPR-3952 - Conditions are written as logical expressions
action / function	The <action> or <function> represents the action or function of the system which the system shall perform.
limit	The optional <limit> defines the precise value of the non-functional characteristics for <action / function> . Limits are written as follows:  SPPR-3946 - Values are expressed precisely
actor / interface	<p>The optional <actor> and represents an actor of the <system>. It is used to express that the <system> interacts with the <actor> regarding the <action / function> and the <object>.</p> <p>The optional <interface> represents an interface of the <system>. It is used to express that the <system> interacts via the <interface> regarding the <action / function> and the <object>.</p> <p>See also  SPPR-11354 - Functional requirement mentions actors or interfaces explicitly for further information.</p>
reference	The optional <reference> contains references to documents, tables, diagram or sources. References are written as follows:  SPPR-10738 - References are written consistently

The following five specialised patterns for different system behaviours must be applied:

Behaviour	Pattern
always-active	<p>An always-active behaviour has no preconditions or triggers. It is not invoked by an triggering event detected at the system boundary or in response to a defined system state, but is always active.</p> <p>The <system> shall <action / function> <object> ...</p> <p><u>Note</u>: In most scenarios, always-active requirements are either unnecessary or undesirable. Therefore, it is critical to identify the underlying preconditions and/or triggers to ensure clarity and relevance.</p>
event-driven	<p>An event-driven behaviour is initiated only when a triggering event is detected at the system boundary.</p> <p>When <trigger>, the <system> shall <action / function> <object> ...</p> <p><u>Note</u>: Adding triggers of system event can provide clarity and precision, ensures that the requirement is only relevant under specific scenarios. This makes the requirements more detailed and reduces ambiguity.</p>
state-driven	<p>A state-driven requirement describes the system responses while it is in a defined state, mode or condition. The system response is required at all times while the system is in the defined state.</p> <p>While <precondition>, the <system> shall <action / function> <object> ...</p>
unwanted	

Behaviour	Pattern
	<p>An unwanted behaviour is a general term used to cover all situations that are undesirable. This includes failures, disturbances, deviations from desired user behaviour and any unexpected behaviour of interacting systems. These may be a major source of omissions in early requirements. Consequently, these requirements have been given their own pattern, so that they could be easily identified throughout the lifecycle.</p> <p>If <trigger>, then the <system> shall <action / function> <object> ...</p> <p><trigger> describes a unwanted event or situation of the system or in the system environment which is undesirable or unexpected.</p> <p><u>Note:</u> The pattern is intended primarily to be used by RAMS and security experts to avoid "shall not" requirements because these are not verifiable (see  SPPR-3957 - Negative phrases are avoided). In the particular case of integrating safety conditions into system requirements this pattern can be the most suitable one. In such requirements the system response mitigates the impact of the unwanted situation, or prevents the system from entering an unwanted state.</p>
complex	<p>Complex requirements are expressed as a combination of the aforementioned patterns.</p> <p>While <precondition>, when <trigger>, the <system> shall <action / function> <object>...</p> <p>While <precondition>, if <trigger> then, the <system> shall <action / function> <object> ...</p> <p><u>Note:</u> A specific set of one or more preconditions must exist prior to the system event to trigger the required system action/function.</p>
Compliance	 Required
ID	SPPR-3519
Rationale	<p>This pattern is best suited for higher levels of system abstraction, where requirements are defined broadly and functionally, often as black-box requirements (i.e., design input requirements).</p> <p>This pattern defines the clauses under which circumstances the requirement is invoked (preconditions), the event that initiates the requirement (trigger) and the necessary behaviour (action or function) as well as non-functional characteristics.</p>

Example	<p>Always-active behaviour</p> <p>The control system shall indicate the engine oil quantity to the aircraft.</p> <p>The control system shall prevent engine overspeed.</p> <p>The system shall respond to user inputs within 2s.</p> <p>The boiler shall heat water with temperature accuracy of less than $\pm 1^{\circ}\text{C}$.</p> <p>The boiler shall receive power via UK domestic 13 amp plug according to BS 1363.</p> <p>The system element shall accept messageA via SCI-X according to ID 123 of Interface Description ABC.</p> <p>Event-driven behaviour</p> <p>When the driver presses the brake pedal, the vehicle control system shall engage the brake lights within 50 milliseconds.</p> <p>When the Mission_Task_Start_Conditions of the Mission_Task within the Mission are fulfilled, the SUC shall send an Mission_Report to the Operation Centre within less than 2 seconds.</p> <p>State-driven behaviour</p> <p>While [the aircraft is in-flight AND the engine is running], the control system shall maintain engine fuel flow above xyz lbs/sec.</p> <p>While the system operates under normal operating conditions, the database shall store at least 10 million records.</p> <p>While the system operates under normal operating conditions, the database shall maintain read access speeds of less than 100 milliseconds.</p> <p>Unwanted behaviour</p> <p>If the engine temperature sensor indicates an overtemp condition, then the system shall illuminate the engine overtemp symbol within 0.2 seconds. [In this example, the unwanted condition (event that computed air speed fault flag is set) triggers the system response, which allows continued safe operation of the system.]</p> <p>If the engine coolant temperature exceeds the safe threshold, then the vehicle system shall reduce the engine power.</p> <p>If the computed airspeed is unavailable, then the control system shall use modelled airspeed.</p> <p>Complex behaviour</p> <p>While the aircraft is on the ground, when reverse thrust is commanded, the control system shall enable deployment of the thrust reverser.</p>
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Linked Work Items	refers to :  SPPR-3560 - Easy approach to requirements syntax (EARS) rules :  SPPR-10323 - System Requirement rules :  SPPR-10359 - Stakeholder Requirement refers to :  SPPR-3819 - Conforming (C9) refers to :  SPPR-3805 - Necessary (C1) refers to :  SPPR-3812 - Appropriate (C2) refers to :  SPPR-3813 - Unambiguous (C3) refers to :  SPPR-3814 - Complete (C4) refers to :  SPPR-3815 - Singular (C5) refers to :  SPPR-3816 - Feasible (C6) refers to :  SPPR-3817 - Verifiable (C7) refers to :  SPPR-3818 - Correct (C8) refers to :  SPPR-3822 - Consistent (C11) refers to :  SPPR-3821 - Comprehensible (C13) refers to :  SPPR-3823 - Able to be validated (C14) refers to :  SPPR-10223 - Correct (C15) has parent :  SPPR-10305 - Functional requirements
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Functional requirement mentions actors or interfaces explicitly

Mention a system interface and/or system actor explicitly in the **<precondition>**, **<trigger>** or **<actor / interface>** part of the functional requirement. Write these explicit interfaces and actors as follows:


- ... **via <interface>** ...
- ... **from <actor / external system>** ...
- ... **to <actor / external system>** ...
- ... **from <actor / external system> ... via <interface>** ...
- ... **to <actor / external system> ... via <interface>** ...

Note: Depending on the case, the mentioning of an interface and actor can be also combined.

Compliance	 Recommended
ID	SPPR-11354
Rationale	This addition increases the level of detail to describe sources and targets explicitly from a black-box perspective at the system boundary.
Example	<p>While the SubsystemA is operating, when the SubsystemA received ExchangeItemX from the SubsystemB via Interface1, the SubsystemA shall transmit ExchangeItemZ to SubsystemC via Interface2.</p> <p>When [messageA is received via SCI-XY AND element1 of messageA is greater than 5], the system shall send messageB via SCI-Z.</p>
Linked Work Items	rules :  SPPR-10359 - Stakeholder Requirement rules :  SPPR-10323 - System Requirement rules :  SPPR-10324 - Application Condition refers to :  SPPR-3819 - Conforming (C9) refers to :  SPPR-3817 - Verifiable (C7) has parent :  SPPR-10305 - Functional requirements

4.2 Non-functional requirements





Non-functional requirement pattern is used for system characteristics


Non-functional requirements for the system of interest are closely following the syntax as defined in  SPPR-3824 - Requirement is written as a well-formed sentence and are written as follows:

















General non-functional requirements pattern

<precondition (optional)>, <trigger (optional)>, the <system> <characteristic> shall be <limit> <reference (optional)>.

Explanation of the non-functional requirements parts


Part	Explanation
precondition	The optional <precondition> is a condition which defines the circumstances under which the <characteristic> is achieved. Preconditions are written as follows:  SPPR-3952 - Conditions are written as logical expressions
trigger	The optional <trigger> is a condition which defines the event under which the desired <characteristic> is achieved. Triggers are written as follows:  SPPR-3952 - Conditions are written as logical expressions
characteristic	The <characteristic> represents the considered non-functional characteristic for the <system> .
limit	The <limit> defines the precise value of the <characteristic> . Limits are written as follows:  SPPR-3946 - Values are expressed precisely.
reference	The optional <reference> contains references to documents, tables, diagrams or sources. References are written as follows:  SPPR-10738 - References are written consistently

Compliance	 Required
ID	SPPR-4332
Rationale	Each non-functional requirement is formulated in a consistent way using a predefined pattern which focuses on the characteristics of the considered system.
Example	<p>Quality characteristics The system element reliability shall be greater than or equal to <value>. While a 12-month period, the system uptime shall be at least 99.999%. The boiler MTBF shall be greater than 10000 hours. The <system> THR shall be <THR value>. The system interoperability shall be compatible with the existing train control system.</p> <p>Physical characteristics The boiler weight shall be less than or equal to 1.5kg. The system dry_weight shall be less than 500kg. The engine take_off_thrust shall be at least 300kN. The Traffic_Control_Signal_SubSystem signal_button shall be located on the traffic-light pillar. The Traffic_Control_Signal_SubSystem signal_button shall be [located 100 cm above the ground AND opposed to the crossing street]. Rationale: For pedestrian convenience to identify and reach the button easily and quickly.</p> <p>Implementation restrictions The system encryption method shall be AES-256. The system interface connector ETH1 shall be of type M12. The system database_technology shall be PostgreSQL.</p> <p>Compliance to standards and regulations The system element EMC emission shall be compliant with EN 50121-3-2:2016. The Secure Component maturity level shall be 3 according to IEC 62443-4-1.</p>

Linked Work Items	<p>rules :  SPPR-10323 - System Requirement</p> <p>rules :  SPPR-10359 - Stakeholder Requirement</p> <p>refers to :  SPPR-3805 - Necessary (C1)</p> <p>refers to :  SPPR-3812 - Appropriate (C2)</p> <p>refers to :  SPPR-3813 - Unambiguous (C3)</p> <p>refers to :  SPPR-3814 - Complete (C4)</p> <p>refers to :  SPPR-3815 - Singular (C5)</p> <p>refers to :  SPPR-3816 - Feasible (C6)</p> <p>refers to :  SPPR-3817 - Verifiable (C7)</p> <p>refers to :  SPPR-3818 - Correct (C8)</p> <p>refers to :  SPPR-3819 - Conforming (C9)</p> <p>refers to :  SPPR-3822 - Consistent (C11)</p> <p>refers to :  SPPR-3821 - Comprehensible (C13)</p> <p>refers to :  SPPR-3823 - Able to be validated (C14)</p> <p>refers to :  SPPR-10223 - Correct (C15)</p> <p>has parent :  SPPR-10303 - Non-functional requirements</p>
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4.3 Application conditions












Functional requirement patterns are used for application conditions

Application conditions are closely following the  SPPR-3519 - Functional requirement pattern is used for system behaviour. The main distinction lies in two key changes:

- The <subject> shifts from the <system> to the <actor>.
- The <verb> changes from the <system action/function> to the <actor action/function>.

Note: <actor> can be a human actor or an external system.

Compliance	 Required
ID	SPPR-10572
Rationale	This pattern ensures that an  SPPR-3728 - Application Condition is specifically tailored to reflect the responsibilities and actions of human operators or other systems / actors, rather than the system itself.
Example	<p>The following example shows an application condition sentence itself, the corresponding rationale and an additional instruction.</p> <p>Application condition: While the train is in operation under GoA2 mode, when the "braking system anomaly" warning light illuminates, the train operator shall disengage the GoA2 autopilot immediately.</p> <p>Rationale: The braking system anomaly indicates a potential failure that compromises the safe operation of the train under GoA2. Manual intervention by the operator is required to ensure safe train operation.</p> <p>Procedural instructions: The operator have to ensure that the train operations manual and training procedures clearly outline the limitations of GoA2 and the required actions when the "braking system anomaly" warning light is illuminated. Operators have to be trained to recognize and respond appropriately to this condition.</p> <p><u>Note</u>: There are more mandatory attributes for safety-related application conditions (SRAC) that must be explicitly captured e.g. originator, receiver, linked hazard, and so on. Please consult with safety experts and review relevant railway standards (e.g. EN50129:2018 chapter 5.3.13) for more details.</p>

Linked Work Items	<p>rules :  SPPR-10324 - Application Condition</p> <p>refers to :  SPPR-3805 - Necessary (C1)</p> <p>refers to :  SPPR-3812 - Appropriate (C2)</p> <p>refers to :  SPPR-3813 - Unambiguous (C3)</p> <p>refers to :  SPPR-3814 - Complete (C4)</p> <p>refers to :  SPPR-3815 - Singular (C5)</p> <p>refers to :  SPPR-3816 - Feasible (C6)</p> <p>refers to :  SPPR-3817 - Verifiable (C7)</p> <p>refers to :  SPPR-3818 - Correct (C8)</p> <p>refers to :  SPPR-3819 - Conforming (C9)</p> <p>has parent :  SPPR-10479 - Application conditions</p>
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