

RM | SMART Standards | Company Standards

editorial directives for provisions

RM | SMART Standards | Werknormen

Redaktionsrichtlinien für Festlegungen

tekom Regionalgruppe Berlin & Brandenburg

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- Lead Expert, staff office Strategy & Transformation, **DIN Solutions**
- focus on **SMART Standards** (digital transformation for Industry 4.0)
- representative of the DIN group in the **Initiative for Digital Standards (IDiS)** of DIN and DKE
- member of DSA, iIRDS, prostep ivip, tekomp and other committees and associations
- since 1994 built-up and supported operation of the **media-neutral XML production** and **online portals** for standards and legislative documents at DIN Media (Beuth)
- graduate engineer (FH) in computer engineering, specialized in systems engineering



Task description

- Requirements management (**RM**) is essential for the use of standard content.
- Provisions in **natural language** cannot be easily extracted, interpreted, and processed by machines.
- DIN, DKE, and standard users should develop **editorial guidelines** for the formulation of provisions for SMART Level 3.



Objectives

- develop **editorial guidelines** for provisions
- clearly **demarcate provisions**
- formulate clearly **interpretable provisions**
- define **relationships, contexts** and **conditions** for provisions
- structure data so that it can be **automatically interpreted**



IDiS SMART roadmap references

- **ReqIF™** developments
- national test profile for **NISO STS contents**
- SMART Information Model (**IEC SG 12 SIM**)



Data

Project manager	Dirk Buchholz (DKE) Andreas Wernicke (DIN Solutions)
Runtime	2023-11-29 to 2026-06-30
Workload (h)	288 h or 32 h per participant
Participants	see stakeholder

Why participate actively?

- **understanding** problems
- **influence** drafting of editorial directives
- Improve **quality of provisions** for SMART Level 3
- **exchange experiences** with other companies
- **improve interoperability** with external partners



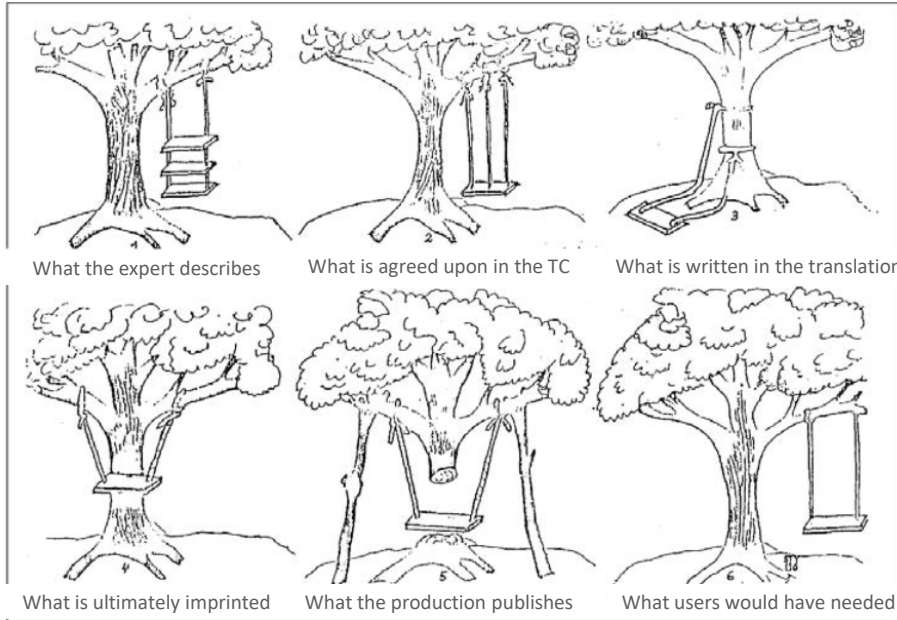
Dependence on other IDiS activities

- economic efficiency of SMART standards (**IDiS Whitepaper 3**)
- Requirements Interchange Format (**DIN DKE SPEC ReqIF**)



SMART Standards: examples and exercises on the “is” and “should”

Ahead: what standardization work and project management have in common...



Example from actual DIN EN 12201-2:2013-09

exercise: which types of pipes shall be marked using which colors?

5.2 Colors

Pipes intended for the conveyance of water for human consumption shall be black or blue. In addition, black pipes may be identified by blue stripes, according to national preference.

Blue pipes or black pipes with blue stripes are intended for the conveyance of water for human consumption only.

Pipes intended for other purposes, drainage and sewerage shall be black or black with brown stripes or according to national preference.

The outer coextruded layer of coextruded pipes (see Annex B) or the outer peelable layer of peelable layer pipes (see Annex C) for pipe intended for the conveyance of water for human consumption shall be either black or blue. In addition identification stripes may be used according to national preference for the application.

The outer coextruded layer of coextruded pipes (see Annex B) or the outer peelable layer of peelable layer pipes (see Annex C) for pipe intended for other purposes shall be either black or black with brown stripes or brown or according to national preference. In addition identification stripes of a different colour may be used according to national preference for the application.

...

NOTE 3 The national preference for colour should be stated in the National Foreword.

machine interpretable?

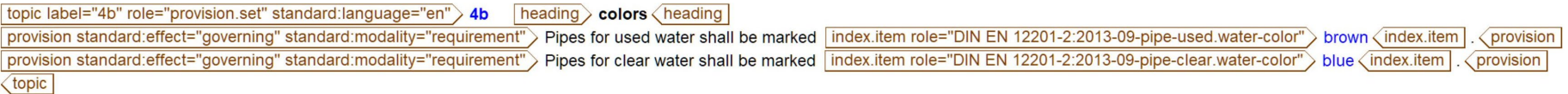
for humans unambiguously interpretable?



what?

Example for SMART structured DIN EN 12201-2:2013-09

SMART structuring enables readability and interpretation for humans as well as machines:



Example from actual DIN EN standard about plastics piping systems
exercise: identify singular provisions and formulate them separately:

“If the temperature is above 50 °C or the pressure exceeds 50 MPa the pipe and the connection elements shall be made from material according to EN 1234 or have an elastic modulus between 15.000 and 18.000 N/mm².”



Example for SMART structured DIN EN standards about plastics piping systems

subject	modal verb	main verb	object	relation
The temperature	is	above	50 °C	if ... or ...
The pressure	is	exceeds	50 MPa	if ... then ...
The pipe	shall	be made	from material	and
The connection elements	shall	be made	from material	and
The material	shall	be according	to EN 1234	or
The pipe	shall	have	an elastic modulus	and
The connection elements	shall	have	an elastic modulus	and
The elastic modulus	shall	measure	$\geq 15.000 \text{ N/mm}^2$	and
The elastic modulus	shall	measure	$\leq 18.000 \text{ N/mm}^2$	~

What are the challenges und chances for improvement?

- Standards and requirements are predominantly formulated in **natural language**.
- Content is marked with **ambiguous presentation structures**.
- Provisions in natural language are often neither **singular, unambiguous, measurable**, nor **testable**.
- Provisions in natural language can only be machine-processed with a **risk of error** if provisions are not reformulated with **additional manual effort** and risk of error.
- Content for **SMART standards** has **not yet** been developed **productively**.
- Consolidate **specifications** for this in a **more sustainable** manner than before.

Objectives

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- define **relationships, contexts** and **conditions** for provisions
- structure data so that it can be **automatically interpreted**
- realize **first edition**

Scope

- We focus primarily on provisions for **requirements management (RM)**.
- We also consider potential improvements to **public standards, customer standards, and company standards**.
- We take into account **existing** recommendations and guidelines.

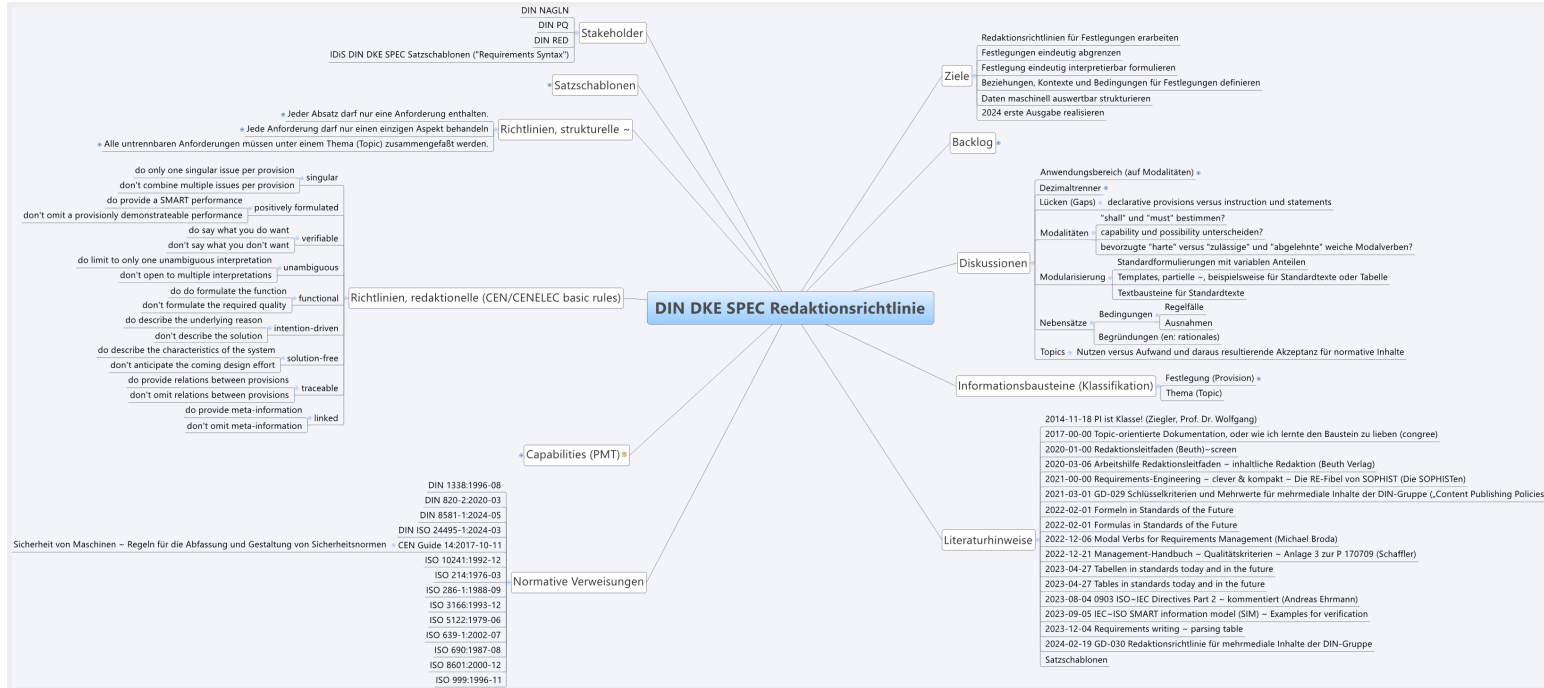
Stakeholder, external ~

- Dokoza, Leo (VDMA)
- Ehrmann, Andreas (Schaeffler)
- Franke, Markus (Schaeffler)
- Raith, Dr. Burkhard (thyssenkrupp)
- Urban, Johannes (Audi)

Stakeholder, internal ~

- Bergander, Sven (DIN Solutions)
- Buchholz, Dirk (DKE)
- Reimann, Silvia (DIN)
- Schnäpp, Dieter (DKE)
- Wernicke, Andreas (DIN Solutions)
- Wiedmann, Birgit (DIN Solutions)

Overview of topics (mind map)



Sources selected (Bibliography)

- PI ist Klasse! (Ziegler, Prof. Dr. Wolfgang)
- Topic-orientierte Dokumentation, oder wie ich lernte den Baustein zu lieben (congree)
- Redaktionsleitfaden (DIN Media, ehem. Beuth Verlag)
- Requirements-Engineering — clever & kompakt — Die RE-Fibel von SOPHIST (Die SOPHISTen)
- Formulas in standards today and in the future
- Modal Verbs for Requirements Management (Michael Broda)
- Management-Handbuch — Qualitätskriterien — Anlage 3 zur P 170709 (Schaeffler)
- Tables in standards today and in the future
- ISO/IEC Directives Part 2 — kommentiert (Andreas Ehrmann)
- IEC/ISO SMART information model (SIM) — Examples for verification
- Requirements writing — parsing table
- Satzschablonen und kontrollierte Sprachen

Principles (structural directives)

- Each provision must be clearly separated in the text content by a presentation element (*form follows function*), for example, by presenting each requirement in a separate paragraph element, or by formulating only one requirement per paragraph element.
- Each provision should be **singular**, id est, it should deal with only one aspect, contain only one full verb per sentence, and should not contain long-winded sentences or nested sentences with many “or” or “and” linking alternatives or further requirements.
- Divisions should be used selectively in line with the **topics concept** in order to **embrace provisions** that **form a meaningful unit** and cannot be interpreted individually without the context.

Basic rules (CEN/CENELEC basic rules)

- **singular:** do only one singular issue per provision
- **positively formulated:** do provide a SMART performance
- **verifiable:** do say what you do want
- **unambiguous:** do limit to only one unambiguous interpretation
- **functional:** do formulate the function
- **intention-driven:** do describe the underlying reason
- **solution-free:** do describe the characteristics of the system
- **traceable:** do provide relations between provisions
- **linked:** do provide meta-information

Scope (for editorial directives)

- all provisions
- selected modalities like recommendations and provisions
- requirements only

Information components (classification)

- provision (“requirement”)
- topic (subject)

Topic (subject)

in the broader sense of the technical communication

- Topics *in the broader sense of the technical communication* are containers for a set of information that:
 - are focused on **one subject**,
 - have a **clear purpose**,
 - do not require **external context for understanding**.
- considered **semantically the successors** of clauses, annexes, concepts, or other divisions types within the modular concept of the technical communication.
- To enable generating documents, topics are unlike conventional divisions not ordered or nested statically but assembled using so-called **topic maps**.
- Because both the structure as well as the order of topics do not affect their interpretation, different **variants** and **versions** of topics can be dynamically included in different documents as well as multiple target formats.
- Topics are **building blocks** for **dynamically generated documents**.

Topic (subject)

in the sense of SMART Standards

- Topics *in the sense of the SMART standards* are the containers for a **set of provisions** in order to summarize them under a term or heading for the **subject**.
- Topics are for a set of provisions of a context,
 - within which certain provisions together form a **meaningful unit**,
 - without which the individual provisions lack the **necessary context** to interpret the provisions.
- Ideally, a topic contains the **minimum intrinsic set** of information or provisions on the respective topic.

example for a topic with provisions

set view and structure

Screw M4 x 16

The thread outer diameter shall be $d_1 = 4$ mm.

The shaft length shall be $L = 16$ mm.

The thread shall be metric fine.

▪ topic

▪ heading

▪ provision

▪ provision

▪ provision

example for a topic with provisions markup with attributes

topic label="none" role="provision.set" style="border: 1px solid black; padding: 2px;">none
heading style="border: 1px solid black; padding: 2px;">Screw M4 x 16
heading style="border: 1px solid black; padding: 2px;">

provision standard:effect="governing" standard:modality="requirement" style="border: 1px solid black; padding: 2px;">The thread outer diameter shall be
formula style="border: 1px solid black; padding: 2px;"> d
inf style="border: 1px solid black; padding: 2px;">1
inf style="border: 1px solid black; padding: 2px;">= 4
roman style="border: 1px solid black; padding: 2px;">mm
roman style="border: 1px solid black; padding: 2px;">

formula style="border: 1px solid black; padding: 2px;">.
provision style="border: 1px solid black; padding: 2px;">

provision standard:effect="governing" standard:modality="requirement" style="border: 1px solid black; padding: 2px;">The shaft length shall be
formula style="border: 1px solid black; padding: 2px;"> $L = 16$
roman style="border: 1px solid black; padding: 2px;">mm
roman style="border: 1px solid black; padding: 2px;">
formula style="border: 1px solid black; padding: 2px;">.
provision style="border: 1px solid black; padding: 2px;">

provision standard:effect="governing" standard:modality="requirement" style="border: 1px solid black; padding: 2px;">The thread shall be metric fine.
provision style="border: 1px solid black; padding: 2px;">

topic style="border: 1px solid black; padding: 2px;">

Topic (subject)

not a self-purpose when it comes to variants and versions...

without topic-based *Content Creation*:

- no efficient management of **variants** and **versions**,
- is the fragmentation of documents less useful.

				Content-Variante #4:2021.de	Content-Variante #4:2021.en	Content-Variante #4:2021.fr
		z	Content-Variante #3:2021.de	Content-Variante #3:2021.en	Content-Variante #3:2021.fr	...
Content x		Content-Variante #2:2021.de	Content-Variante #2:2021.en	Content-Variante #2:2021.fr
y	Sprach-Variante #1:2021.de	Sprach-Variante #1:2021.en	Sprach-Variante #1:2021.en	Version #4:1994.fr
	Version #1:2020.de	Version #1:2020.en	Version #1:2020.fr	...	Version #3:1994.fr	
	Version #1:2019.de	Version #1:2019.en	Version #1:2019.fr	Version #2:1994.fr		
	Version #1:1994.de	Version #1:1994.en	Version #1:1994.fr			

Provision (de: Festlegung)

- **elementary information units** of legal standards, technical rules, and **company standards**
- To enable customers to identify and process the required provisions more efficiently, the content shall be structured in accordance with the **SMART Information model** and enriched with attributes (**metadata**).
- **provisions** can have different content forms, such as text in **natural language**, text in **controlled language**, **formulas**, and increasingly also **machine-interpretable instructions and data**.
- **provisions** shall be created to be **human-readable** as well as increasingly **machine-processable**. This means:
 - Textual content shall be clearly delimited as information elements within the standard, for example **per paragraph only one provision for one aspect**.
 - Textual content should increasingly be formulated in **controlled language**; id est, provisions should progressively avoid natural language with chained long sentence structures that are only interpretable by humans.
 - Textual content should increasingly be created using a **controlled character set**.

Provision (de: Festlegung)

according to ISO/IEC Directives — Part 2 (DIN 820-2)

expression in the content of a **normative document** (3.1.9) that takes the form of a **statement** (3.3.2), an **instruction**, a **recommendation** (3.3.4) or a **requirement** (3.3.3)

Note: These types of provision are distinguished by the form of wording they employ; e. g. instructions are expressed in the imperative mood, recommendations by the use of the auxiliary “should” and requirements by the use of the auxiliary “shall”.

[SOURCE: ISO/IEC Guide 2:2004, 7.1]

SMART Standards

declarative provisions versus governing provisions**declarative provision**

defining provision

definition or fact as premise without a scope of action

NOTE 1: A declarative provision is usually expressed without a modality using “is”, “has to”, “can be able to”, bool’s or mathematical expressions.

NOTE 2: A declarative provision refers to a **status in the past or presence**.

NOTE 3: Users have to take into account declarative provisions as premises for implementing governing provisions.

EXAMPLE:

- formula, physical quantity and units
- terminological definition

see also:

- governing provision
- information provision

SMART Standards

declarative provisions versus governing provisions**governing provision**

provision regulating or steering to achieve something with a scope of action

NOTE 1: A governing provision is usually expressed using a modality or modal verb in accordance with ISO/IEC Directives Part 2.

NOTE 2: A governing provision refers to a **status to be achieved in the future**.

NOTE 3: Users have to take action in order to implement governing provisions, taking into account the declarative provisions.

see also:

- declarative provision
- information provision

Modalities (and related properties of provisions)

according to ISO/IEC Directives — Part 2 (DIN 820-2)

modality (property)	explanation
capability	expression that conveys the ability, fitness, or quality necessary to do or achieve a specified thing
constraint, external ~	external constraint or obligation on the user of the document that is not stated as a provision of the document, e. g., laws of nature or particular conditions existing in some countries or regions
instruction	expression in the imperative mood
permission	expression that conveys consent or liberty (or opportunity) to do something
possibility	expression that conveys expected or conceivable material, physical or causal outcome
recommendation	expression that conveys a suggested possible choice or course of action deemed to be particularly suitable without necessarily mentioning or excluding others
requirement	expression that conveys objectively verifiable criteria to be fulfilled and from which no deviation is permitted if conformance with the document is to be claimed
statement	expression in the content of a document conveying information

Modalities

problems and hints for the practical handling

- For the benefit of requirements management, only **capability, permission, possibility, recommendation** and **requirements** should be handled as modality of a provision.

- To maintain managing requirements without gaps,
 - an **external constraint** should be handled as **variant of a requirement** but not as alternative modality.

 - an **instruction** should be handled as **variant of a requirement** but not as alternative modality.

 - a **statement** should be handled as **undefined modality** of a provision.

modal verbs | auxiliary verbs (preferred forms)

according to ISO/IEC Directives — Part 2 (DIN 820-2)

modality (property)	modal verb (English)	modal verb (German)
capability	can	kann
constraint, external ~	must	muss
declarative provision	is are binary operator	ist sind binärer Operator
instruction	(imperative mood)	(imperativer Modus)
permission	can	kann
possibility	may	darf
recommendation	should	sollte (nicht: „soll“)
requirement	shall	muss (nicht: „soll“)
statement	(undefined)	(undefiniert)

modal verb

problems and hints for the practical handling

- Be aware that „**shall**“ and „**must**“ are translated into “muss” so that in German an **external constraint** can not be differentiated from other requirements by the modal verb literally.
- Because the same modal verbs “**can**” or de: “**kann**” be used for **capabilities** and **possibilities**, these are hard to differentiate with a questionable benefit in practice.
- preferred „**hard**“ (“**shall**”) versus „**admitted**“ (“**has to be**”) and „**deprecated**“ (de: “**is to**”) soft modal forms
- Because “**is**” designates **declarative provisions**, do not use “**is to**” as gentle variant for **governing provisions**.
- Do not use de: “**soll**” because it is ambiguous either for “**shall**” (**requirement**) or “**sollte**” (**recommendation**).
- Be aware that conventions for **technical standards** do not match for **legal documents** (de: Norm ≠ Rechtsnorm).

Conditions

- **conditions** regularly **before** the provision, **exceptions** preferably **after** the provision

EXAMPLE:

“If the temperature of the battery exceeds 45 °C, the control unit shall switch off the device.”

“The control unit shall power the device, except the temperature of the battery exceeds 45 °C.”

- use the key words for conditions systematically:
 - „**as soon as**“ (de: “**sobald**”): provision applies triggered at the **point of the time** the condition matches
 - „**so long**“ (de: “**solange**”): provision applies triggered during the **duration over the time** the condition matches
 - „**if**“ (de: “**falls**”): provision applies triggered by one or more **cases** the conditions are matching

controlled language | simplified language

- evaluated but *not* within the scope of this guideline

- actual standards:
 - **DIN 8581-1**, *Einfache Sprache — Anwendung für das Deutsche — Teil 1: Sprachspezifische Festlegungen*

 - **DIN ISO 24495-1**, *Einfache Sprache — Teil 1: Grundsätze und Leitlinien (ISO 24495-1:2023)*

all nice theories — not at all

- **DIN DKE SPEC 99200** has been written according to theses guidelines.
- Ticket RIF-7 with the **programming specification** for the NISO STS XML to ReqIF converter of DIN Solutions has been written according to theses guidelines.
- We do not let innocent users proof our concepts 😊

Next steps

- resolve **open issues** (see discussions)
- submit finalized manuscript in **June 2026**
- **validate practical applicability**
- agree on **improvement process**
- submit results to ISO/IEC

Why actively participate?

- **understanding** problems
- **influence** drafting of editorial directives
- **improve quality** of provisions for SMART Level 3
- **exchange experiences** with other companies
- **improve interoperability** with external partners

Thank you for your cooperation

- Buchholz, Dirk. Offenbach: DKE
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