ABSTRACT

This document is the Section C to NSQ-100 Guidelines.

Its objective is to help to the understanding of NSQ-100 requirements through some examples or recommendations and descriptions of industrial good practices.

The Guidelines Section C is related to the classification and grading approach of NSQ100 (Chapters 4.1.2 & 4.1.3).

Summary

- Chapter 1: Purpose of this section
- Chapter 2 : Guidelines

  The following questions are addressed :

  - *What does the wording "nuclear safety" and "classification" mean?*
  - *What does the wording "classification of items or activities" mean?*
  - *How to allocate the product safety classification to its constituents?*
  - *How to understand "consequences of their potential failure or malfunction"?*
  - *How to grade the quality requirements?*
  - *How to pass on the quality requirements along the supply chain?*
  - *How to deal with "commercial grade items"?*

- Annex 1: Example of classification

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CHAPTER 1: PURPOSE OF THIS SECTION

The present section refers to NSQ-100 following chapters:

4.1 General requirements ➲ 4.1.2 & 4.1.3 only

CHAPTER 2: GUIDELINES

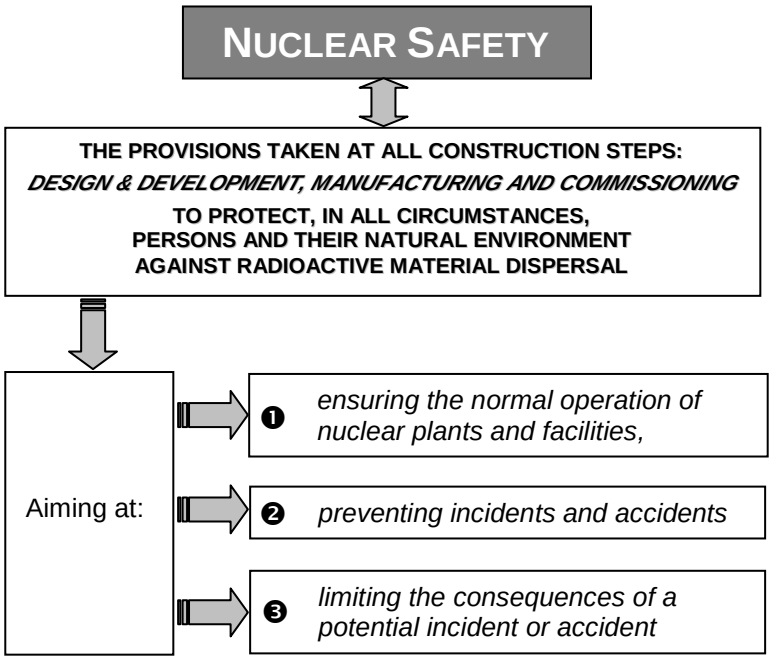
4. QUALITY MANAGEMENT SYSTEM

4.1 General

4.1.2 Classification of product

➲ What does the wording "nuclear safety" and "classification" mean?

Further to the general definition given at the chapter 3.9 of NSQ-100 and, having regard to practical considerations limited to the scope of this document, the **nuclear safety** must be considered as being:

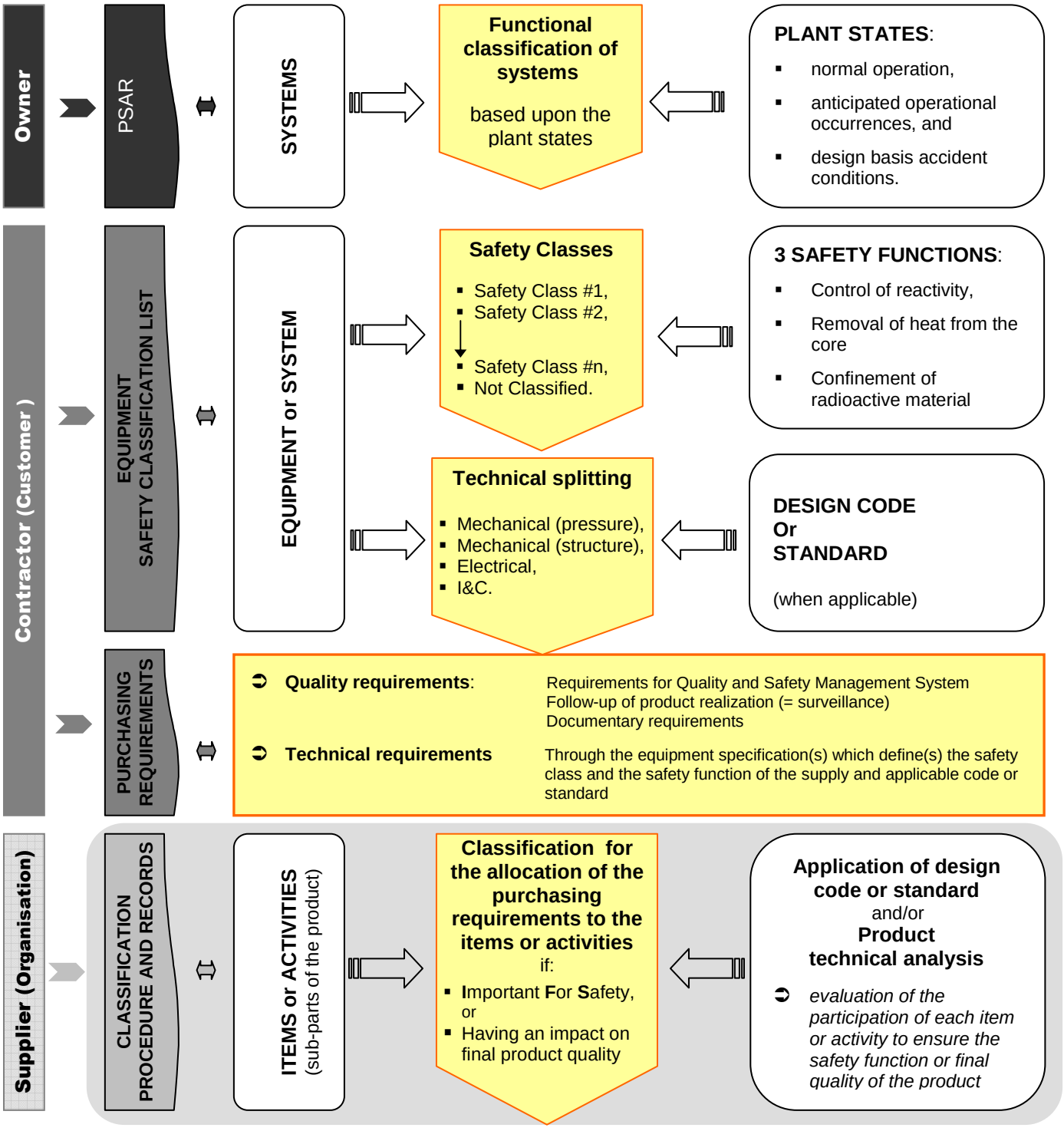


The wording **classification of product** must be understood as the categorization of products (items and activities) with regard to their contribution to **nuclear safety** of an assembly or system.

➲ What does the wording "classification of items or activities" mean?

These 3 above objectives (❶❷❸) are examined by the Owner in the Preliminary Safety Analysis Report (PSAR) as per the following scheme:

- All Systems Structures and Components (SSC) of a nuclear plant shall be identified and classified on the basis of their importance for safety.
- The classification of SSC shall be primarily based on deterministic methods, complemented where appropriate by probabilistic methods and engineering judgment.



➲ How to allocate the product safety classification to its constituents?

The "PRODUCT" has to be the object of a technical analysis by the organization (its manufacturer) in order to:

- ➲ **determine the participation** (impact) **o**f each **item** (*sub-component*) of the product to the product safety function, the product key operating function or the product operating performance,
- ➲ **identify** each **activity** (*task*) which contributes (impacts) during: design, development, manufacturing, erection, commissioning and related services, to the product safety function, the product key operating function or the product operating performance.

To perform this analysis, it may be useful to refer to one or more of the different type of methods as listed in EN 31010 standard (Risk management – Risk assessment techniques).

The output of the analysis could be formalized according to the following table:

Item or Activity	Direct or Indirect participation of the item or activity to the safety function of the product	Contribution of the item or activity to the key operating function or the operating performance of the product
#1	YES / NO	YES / NO
#2	YES / NO	YES / NO
#3	YES / NO	YES / NO
…	…	…
#n	YES / NO	YES / NO

- ➲ If one answer is YES for an item or activity, purchasing requirements have to be cascaded to the sub-supplier.

Note: Refer to annex 1 for a practical example of classification.

➲ How to understand "consequences of their potential failure or malfunction"?

In order to determine if the item or activity ~~is~~ must be classified as IFS, the analysis must take into account their level of participation (impact) on the safety function of the product:

Level #1: Direct participation (impact)

Potential failure or malfunction of the item or activity have systematically an impact on the safety function of the product.

Example: *Rupture of pressure vessel walls which have a direct impact on containment function.*

Level #2: Indirect participation (impact)

Potential failure or malfunction of the item or activity may have an impact on the safety function of the product.

Example: *Internal part of a pressure vessel which detachment can induce an indirect impact on safety as a blocking of safety valve.*

4.1.3 Grading the application of Quality requirements

➲ How to grade the quality requirements?

Having regard to the results of the above allocation, the organization must determine the level of **quality requirements** applicable to each item or activity.

The requirements may be as follows (non exhaustive list which must be adapted to the item or activity):

ITEM or ACTIVITY			REQUIREMENTS								
			Organization	Documentation						Inspection	Surveillance
Status	Level of requirements	Impact	QMS	Document(s)		Record(s)		End Of Manufacturing Report	Certificate of compliance to the order	performed by	
				to be issued by the organization before sub-contracting	to be issued by the organization before manufacturing	to be issued by the organization	surveillance Records to be issued by the organization			the organization on its own activities	the organization on its supplier(s) activities
Important For SAFETY (IFS)	1	**Direct impact on Safety**	NSQ100	Technical specification(s)	Preparatory documents for the Order + individual QC plan (*)	All manufacturing & inspection records	Surveillance report for the supplier(s) records	Issued by the organization manufacturing the product or item	Issued by the supplier of the product, item or activity	Intervention for all points of the QC plan	Intervention for specific points specified by the organization on it's supplier's QC plan
Impact on final product QUALITY	2	**Indirect impact on Safety** No impact on safety but **impact on key operating function** defined in the Technical Specification issued by the Customer			Preparatory documents for the Order + individual or batch QC plan (*)						
Impact on final product QUALITY	3	No impact on safety but **impact on operating performance(s)** defined by the technical specification(s) issued by the Organization	Similar to ISO9001		Preparatory documents if required by the technical specification(s)	Only manufacturing & inspection records required by the technical specification(s)	/			Intervention only for points defined in the technical specification(s)	Final reception only if required by the technical specification(s)
OTHERS	4	**No impact** on the safety nor on the product quality	/	/	/	Manufacturing & inspection records if required by the Order	/	/		/	/

(*) : Refer to Guidelines Section G [Production & Inspection] for more detailed information about QC plan.

➲ How to pass on the quality requirements along the supply chain?

The organization has to pass on the NSQ100 requirements until the level of supply of raw materials, and in this last case, eventually with additional technical requirements to the commercial standard.

Examples:

- *Steel plate ordered according EN 10028-3 without additional technical requirements. The steel manufacturer has not to be NSQ100 compliant.*
- *Steel plate ordered according EN 10028-3 with additional technical requirements (e.g. Technical Specification of Reference from RCC-M). The steel manufacturer has to be NSQ100 compliant and this requirement shall have been included in the purchasing order issued by the organization.*

Note: Refer also to Guidelines Section F [Purchasing].

➲ How to deal with “commercial grade items”?

Example to understand definition of **Commercial grade item** given in chapter 3.3 of NSQ-100.

Case #1: Welded steel pressure tank

If the welds of the tank need to be inspected during manufacturing, the tank cannot be considered as a commercial-grade item and, therefore, shall be manufactured by an organization compliant with NSQ-100.

Case #2: Bolting

If the bolt specification doesn't require any verification during manufacturing, therefore the bolt may be considered as a Commercial-grade item.

Dedication of a commercial grade item to be used as an IFS item is an acceptance process undertaken to provide reasonable assurance that the item to be used will perform its intended safety function and, in this respect, is deemed equivalent to an item specifically designed and manufactured as being an IFS item.

This assurance is achieved by:

❶ identification of the critical characteristics of the item, including the corresponding acceptance criteria,

❷ the selection and documentation of the dedication method(s) for determining compliance with acceptance criteria, and

❸ verification of commercial grade item acceptability by one or more of the following:

- product inspections or witness at hold-points at the manufacturer's facility,
- analysis of manufacturer’s historical records for acceptable performance,
- tests or analyses performed by the purchaser or third-party dedicating entity after delivery,
- commercial grade surveys : technical evaluations or audits of the manufacturing facility.

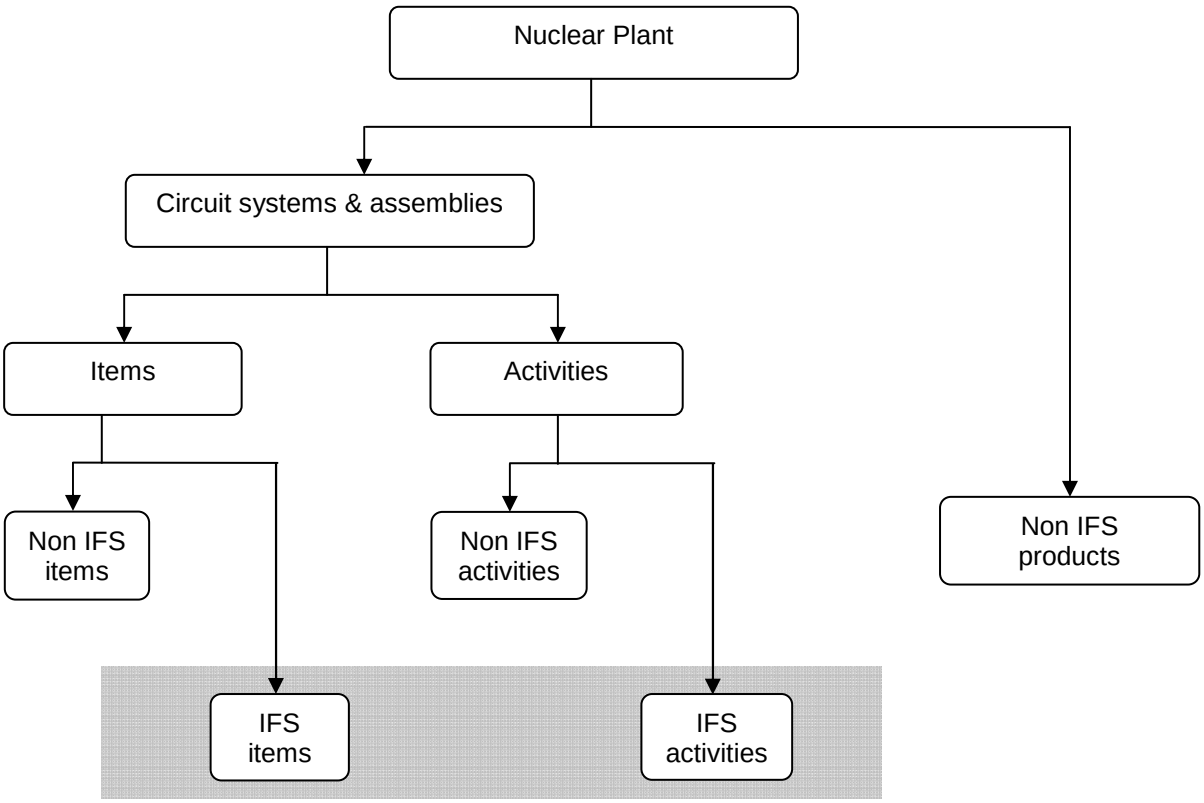
The dedication method will be made available to the customer and will be subject to customer approval in case manufacturing process of the item is contractually subject to customer surveillance.

HOW TO PROCEED PRACTICALLY TO A CLASSIFICATION OF ITEMS OR ACTIVITIES ?

Preamble

The following guidelines only apply to the case identified in the grey area of the hereunder sketch.

In case of complex products (e.g. systems or assemblies), a more detailed approach and analysis shall be implemented.



Note : Disregarding the classification analysis which might be performed by the organization, when the product has been considered as important for plant operation (then the Technical Specification issued by the Contractor formally identifies for the product the key operating functions), the Contractor may also require that some items or activities shall be classified as IFS or being submitted to a similar level of requirements.

CLASSIFICATION METHODOLOGY

The following steps should be respected to proceed to the classification of items or activities.

❶ **Analysis of the Technical specification** defining the product requirements in order to identify:

a) the safety function(s) associated to the product. The safety function is determined by the Contractor and associated to the product through the attribution of a safety class to the product by the Contractor, the safety class level representing the criticality of the product having regard to safety considerations,

and/or

b) the product key operating function or operating performances (these operating performances may be quantified by numerical requirements, e.g. : flow for a pump, allowable pressure for a tank, ambient conditions as temperature or humidity ….),

❷ Then, the product will be subject to **identification of the constitutive items and activities** used or implemented for its production (production must be understood here as meaning manufacturing that can include the fabrication of the material for the concerned items and/or assembling activities).

❸ For each item or activity identified after the above analysis, the organization will perform a **technical analysis** to determine:

1. whether the failure / malfunction of the item or the activity have, may have or don't have an impact on the:

   - product safety function,

   or

   - product key operating function,

   or

   - product operating performances.

Note: This analysis will be pursued up to the material of above concerned items, in order to identify whether specific characteristics specified by the designer for the material, may have an impact as indicated above

2. the particular requirement linked to the item or activity.

Note: It might be necessary for deciding whether the items or the activity have an "impact" or "not", to perform a risk analysis, combining both probability and consequence considerations. This risk analysis will have to be as simple as possible, considering that the conclusion will have to be formulated in a binary sense (yes or no).

❹ When an item or activity has been considered as impacting the product safety function or the product key operating function or product operating performances, the organization will:

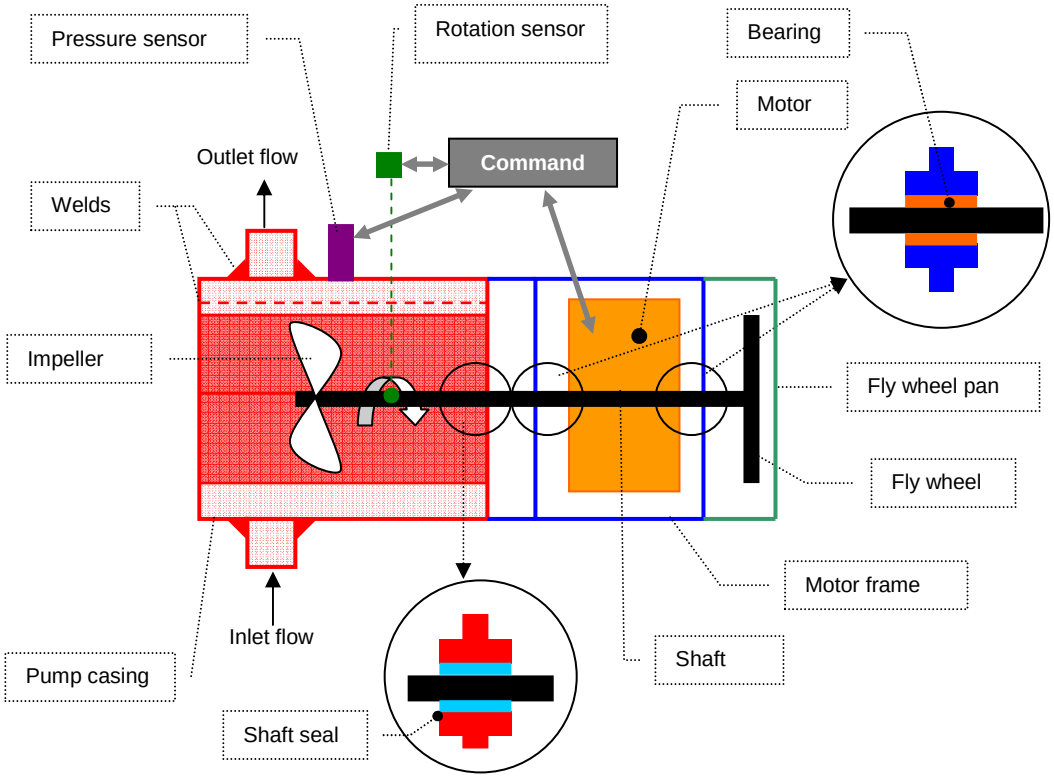
1. whatever the item / activity supplied / performed by the organization or sub-contracted to others, **determine the requirements** (in terms of organization, documentation, inspection and surveillance) which will be applied.

2. in case of purchasing or sub-contracting the item / activity, **pass on the applicable requirements to the selected supplier**, (see the above § 4.1.3 table of the guide – "How to pass on the quality requirements along the supply chain?").

Note: In some cases the item will only be available as a commercial grade item for which the above requirements 1 and 2 will involve a specific purchasing inspection & surveillance process (refer to above § 4.1.3 "How to deal with commercial grade items?"

Practical example ⇔ Electro-mechanical pump

Note: this example is not a real example but is just given to illustrate the expected classification activities to be performed by an organization.



For an easy understanding, in the following text, it has been kept the same numbering of steps (❶ to ❹) as previously indicated in the above methodology.

❶ Analysis of the technical specification:

The objective is to identify, within the technical / design specification, all the requirements, technical characteristics or role that the product has to respect or meet, and to define for each of them, which safety or operating category it is linked to.

Hereafter is an example of categorization of the requirements, technical characteristics or role of the product as identified from the technical / design specification:

Safety function of the product	➲ Pressure retaining for pump casing
Key operating function of the product	➲ Pump shall continue running for some time (using a flywheel) after a plant shutdown
Operating performance of the product	➲ Pump nominal flow rate (e.g. 10 m^3/h) to be maintained during operation
Other requirement (not significant)	➲ Standard mechanical protection for fly wheel pan

❷ Identification of the constitutive items and activities:

Items:
- pump casing
- shaft seal
- rotation sensor
- pressure sensor
- command device
- shaft
- impeller
- bearings
- motor
- motor frame
- fly wheel
- fly wheel pan

Activities:
- welding
- pressure test
- functional test

❸ Technical analysis of the product:

The objective is to determine the contribution of each item or activity in fulfilling the requirements (technical characteristics or roles of the product). This will enable to complete the following tables establishing the link between items or activities and their impact on safety functions and/or key operating functions or operating performances of the product:

Item or Activity		*Contribution in fulfilling the requirements*
Items	Pump casing	*Pressure retaining requirement*
	Shaft seal	*Pressure retaining requirement*
	Rotation sensor	Pump flow rate
	Pressure sensor	*Pressure retaining requirement (through action on safety valves)*
	Command Device	Pump flow rate
	Shaft	Pump shall continue running after a plant shutdown
	Impeller	Pump flow rate
	Bearings	Pump shall continue running after a plant shutdown
	Motor	Pump flow rate
	Motor frame	Pump shall continue running after a plant shutdown (through conservation of shaft bearing structure)
	Fly wheel	Pump shall continue running after a plant shutdown
	Fly wheel pan	Standard mechanical protection
Activities	Welding	*Pressure retaining requirement*
	Pressure test	*Pressure retaining requirement*
	Functional test	Pump shall continue running after a plant shutdown

Item or Activity		*Impact on*					*Particular requirement*
		Product Safety function (Direct)	*Product safety function (Indirect)*	*Product Key operating Function*	*Product Operating Performance*	*No impact*	
Items	Pump casing	X					RCC-M
	Shaft seal	X					
	Rotation sensor				X		
	Pressure sensor		X				RCC-E
	Command Device				X		
	Shaft			X			
	Impeller				X		
	Bearings			X			
	Motor				X		RCC-E
	Motor frame			X			
	Fly wheel			X			
	Fly wheel pan					X	
Activities	Welding	X					RCC-M
	Pressure test	X					RCC-M
	Functional test				X		RCC-E

❹ Determination and Grading of requirements (example limited to QMS requirements)

Levels of Requirements and corresponding Management System specifications are defined in line with de definitions given in the table § 4.1.3 of the guide.

Item or Activity	*Level of Requirements*	*Quality Management System specifications*
Pump casing	**1**	**NSQ-100**
Shaft seal	**1**	**NSQ-100**
Rotation sensor	**3**	**ISO 9001**
Pressure sensor	**1**	**NSQ-100**
command device	**3**	**ISO 9001**
Shaft	**2**	**NSQ-100**
Impeller	**3**	**ISO 9001**
Bearings	**2**	**NSQ-100**
Motor	**3**	**ISO 9001**
Motor frame	**2**	**NSQ-100**
Fly wheel	**2**	**NSQ-100**
Fly wheel pan	**4**	***//***
Welding	**1**	**NSQ-100**
Pressure test	**1**	**NSQ-100**
Functional test	**3**	**ISO 9001**

As defined in the table § 4.1.3 of the guide, for each item and activity, in accordance with the level of requirements defined here above, the set of requirements related to the documentation, inspection and surveillance will then be selected.

Finally, in case some items or activities are planned to be sub-contracted, the organization will have to assess the potential sub-suppliers for their capacity to respecting all the requirements here above defined in terms of Quality Management System (QMS), documentation, inspection and surveillance that will be cascaded throughout the supply chain.