ISO 19372 - Microturbines applications – Safety: topics for a revision proposal

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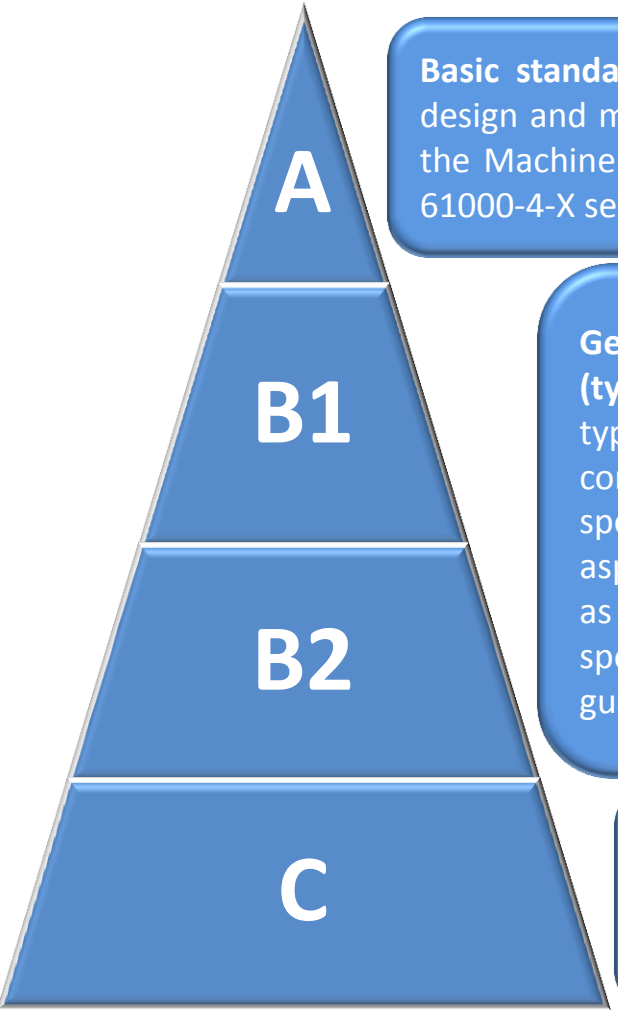
Levels of standards



Basic standards (type A). These fundamental standards contain general principles for safe design and may be applied to products when appropriate. The main harmonized Standard for the Machinery Directive is the EN ISO 12100. Design Concepts and Risk Assessment. The EN 61000-4-X series for immunity levels is an example of basic standards for EMC.

Generic standards (type B). For safety, the type B standards concern specific technical aspects and are applied as needed, such as for specific components or guarding.

B1 Standards. These apply to particular aspects, such as surface temperatures and safety distances. Some B1 examples are EN 13849-1 (Safety Related Control Systems), and EN 60204-1 (Electrical Requirements of Machinery).

B2 Standards. These apply to particular safety devices or components such as EN 13850 (Emergency Stop Systems). For EMC, the generic standards are grouped by function and environment, such as products for use in heavy industrial areas.

Product standards (type C). Type C standards address a specific product or related group or range of equipment. The type C standards take precedence over the basics and generics and call up the appropriate A and B standards, when necessary.

ISO 19372 is a type C standard.

Harmonized standards

Harmonised standards are drawn up by the European standards organisations: **CENELEC** for electrical/electronic industry products, **ETSI** for products in the telecommunications sector, **CEN** for the products of other sectors.

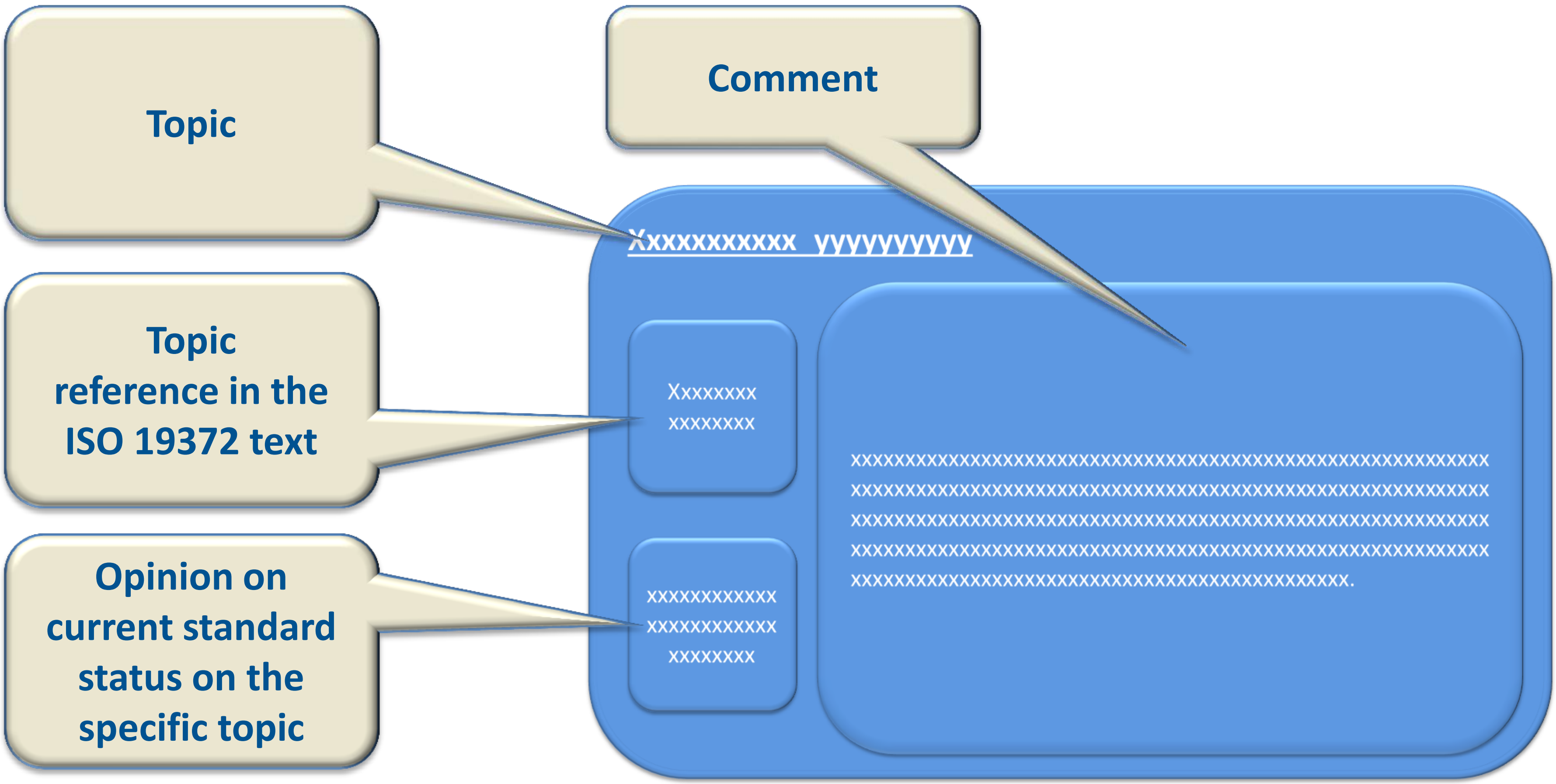
A standard is considered harmonized at the time of announcement which is **published in the Official Journal of the European Communities (OJEC)**.

Compliance with the **harmonized standards** will, in most cases, ensure a product's conformity with the essential requirements of the directives. Adherence to European harmonized standards is the only proven and universally accepted method of showing conformity with the Ers (essential requirements) of the directives. Properly applying standards produces a **"presumption of conformity."**

EC directives do not make it compulsory to adopt harmonized standards, However it is always necessary to demonstrate the conformity of the product to the requirements of the directives applicable to the product. It is in fact possible to choose other technical and procedural solutions to comply with the essential requirements set out in Directives. These solutions typically require more in-depth technical assessments and the involvement of a notified body.

Remarks on ISO 19372

ISO 19372 first edition was issued the 2015-02-15.
The following remarks are to be considered discussion topics for future Standard revision.



Remarks on ISO 19372

1- References to Electrical standards and regulations

Introduction page ix

Standard to be updated

The references to the EG/EU-directives must be updated according to http://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/

Directive	Old version	Replace by
ATEX	94/9/EC	2014/68/EU
PED	97/23/EC	2014/68/EU
LVD	2006/95/EC	2014/35/EU
EMC	2004/108/EC	2014/30/EU
Integrated Pollution..	96/61/EC	2010/75/EU
Classification Packaging…	1999/45/EC	1272/2008/EU

Remarks on ISO 19372

2- Safety Requirements

Chapter 5 and Annex C

Weak and unclear

The standard claims that Risk Assessments shall comply with ISO 12100.

The choice between ISO 13849, Safety Parts of Control System (Performance Level) and IEC 61508 Functional safety of electrical/electronic/programmable electronic safety-related systems (Safety Integrated Level) could be clarified.

It could be an idea to mention the different ways to achieve proper safety and even point out the way that is preferred.

Remarks on ISO 19372

3- Reversed rotation

None

Not mentioned

Experience show that it is possible to start a turbine even if the turbine rotation direction is wrong. This is a very dangerous situation and could lead to severe damage.
It can happen as a result of wrongly mounted generator cables.

60204-1, section 7.8 claims:
Where an incorrect phase sequence of the supply voltage can cause a hazardous situation or damage to the machine, protection shall be provided.
NOTE Conditions of use that can lead to an incorrect phase sequence include:

- a machine transferred from one supply to another;
- a mobile machine with a facility for connection to an external power supply.

Makes sense reminding that EN60204-1 is the B-standard that is valid for a microturbine.

Remarks on ISO 19372

4- External combustion and hybrid applications

None

Not mentioned

A microturbine with external combustion or turbine running in hybrid mode needs to be covered in the standard as well. The external equipment and housings will raise a lot of questions regarding PED, fuel safety and so on.
The external housing (connection to energy source) will incorporate hot gases under high pressure and in the case of hybrid mode also fuel lines and combustion chamber.
None of these will be inside an enclosure and requirements for the facility where the system is located needs to be addressed in the standard.

5- Air flow control, combustion air

Chapter 5.12.4

Standard is weak

The standard states that proof of adequate compressor rotation speed shall be used to verify combustion air flow rate.

Tests made clearly shows that rotation speed is NOT an indication of sufficient air flow.
Tests including start attempts with a completely blocked exhaust system shows that it is possible to reach the ignition phase.

The standard should indicate a more reliable system to detect the correct combustion air flow rate.

Remarks on ISO 19372

6- Turbine design issues regarding critical speed

Chapter 5.8.15.3

Standard is unclear

The text clearly states that overhanging rotor parts shall not operate above critical speed related to the first bending mode.

In the next sentence, the text explains what is needed if the operation is above the critical speed.

The text is to be updated.

Remarks on ISO 19372

7- Speed measuring approach, Starting systems

Chapter 5.8.18

Standard is weak

The standard doesn’t provide recommendation of how to detect the turbine speed.
Since the speed is supposed to be a verification of correct air flow, this is a weak point.
The signal from the power electronic (frequently used) is not measuring the speed, it is measuring the sine wave from the generator. During start up, this sine wave is a result of the current pushed to the generator and not an indication of the generator speed.

Recommendation are expected.

Remarks on ISO 19372

8- Inlet air filtering

Chapter 5.9.2

Standard is unclear

This chapter states, among other things, that the air filter for the power electronic should prevent “saliferous atmosphere”.

Assuming that it refers to an atmosphere that can accelerate oxidization, to our knowledge there is no such thing as an air filter that can prevent this. An example would be to have a filter that could prevent traces of sulphur gases to enter the power electronic at a biogas site.

It would be better to give recommendations aiming to protect electronics and other sensitive equipment in this kind of environment, such as air tight connectors or similar protection devices.

Remarks on ISO 19372

9- Icing monitoring, dp measuring

Chapter 5.9.3

Standard is strange and weak

We believe that air filter monitoring would be a better topic.
Clogged air filter due to dust can be a real problem in some environments and a supervision of the filter function is needed.
The standard doesn't provide any recommendations regarding this.
A delta pressure measuring on the air filter allows the supervision of both filter clogging and ice build-up.

The standard should be updated

Remarks on ISO 19372

10- Waste disposal through combustion

Chapter 5.9.6

Standard is weak

Since the waste disposal injection system can create flammable gases and ATEX zones through the turbine path there needs to be a recommendation for this system.

Valve proving, placement and response time of shut off valves needs to be considered and tightness control needs to be carried out before start-up.

Remarks on ISO 19372

11- Supervision of ventilation flow

Chapter 5.17.10

Standard is weak

The importance of the ventilation flow is spread over several chapters including topics like Enclosure purging, Dilution ventilation, Ventilation validations and Cooling.
Recommendations regarding flow monitoring (5.17.10) is in our opinion quite weak.
Effectively, this chapter only states that the flow should be monitored and interlocked to the start-up sequence of the turbine. Looks very dangerous to allow the inhibition of the ventilation flow monitoring in case of enclosure doors opening for inspection.

Remarks on ISO 19372

12- Recuperator

Chapter 5.23

Standard is weak

The recuperator is not mentioned at all in the standard.

There must be many suitable topics regarding this component for the micro turbine standard.

Aplicability of PED directive needs to be investigated and overall design needs to be analyzed regarding lifetime fatigue, safety issues and so on.

Remarks on ISO 19372

13- Fuel system

Chapter 5.10

Standard is complex and unclear

5.10.5.1: The schematics describing some arrangements are indicating “14 Typical microturbine enclosure limits” and “13 combustion system” without a clear definition of the meaning.
Additionally, some component are listed several times without explaining the differences (vent valve 5 and 9, shut off valve 3, 4, 8 and 10).

5.10.5.1: Arrangements c) and d) don’t show flow control valve; as 5.10.5.4 states that a shut off valve “can serve as flow control valve” a recommendation on requirements is expected (the note at 5.10.5.1 is very weak)

5.10.5.4: Necessary to foresee a vent system when the gas rate is >1,4MW versus note on “national regulation”.

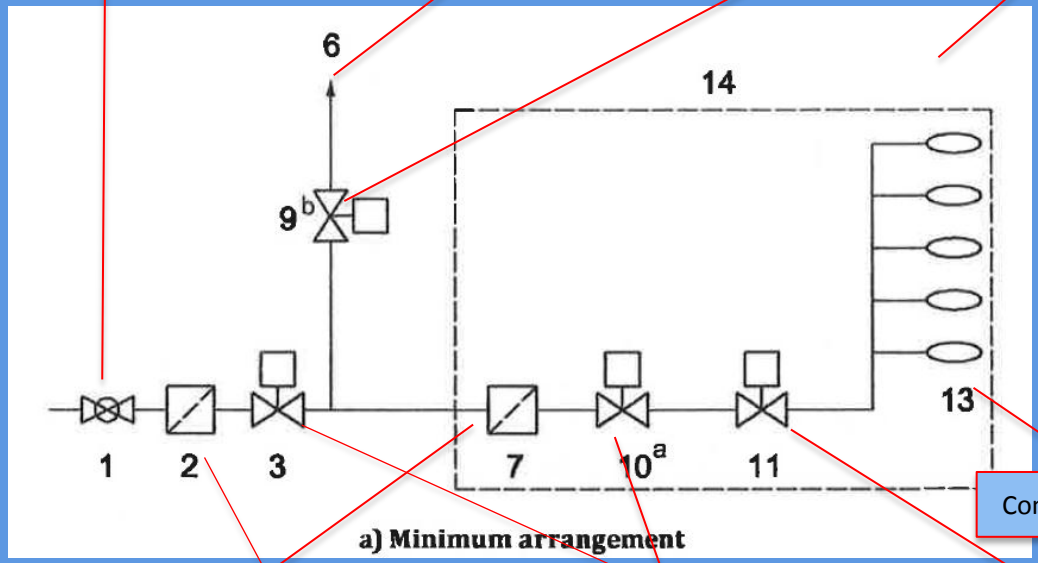
5.10.5.5: “A shut off valve shall be located outside the microturbine enclosure…” is it in addition to what shown in the arrangements?

Remarks on ISO 19372

13- Fuel system, flow control valve

Chapter 5.10

Standard is complex and unclear



Remarks on ISO 19372

13- Fuel system, flow control valve

Chapter 5.10

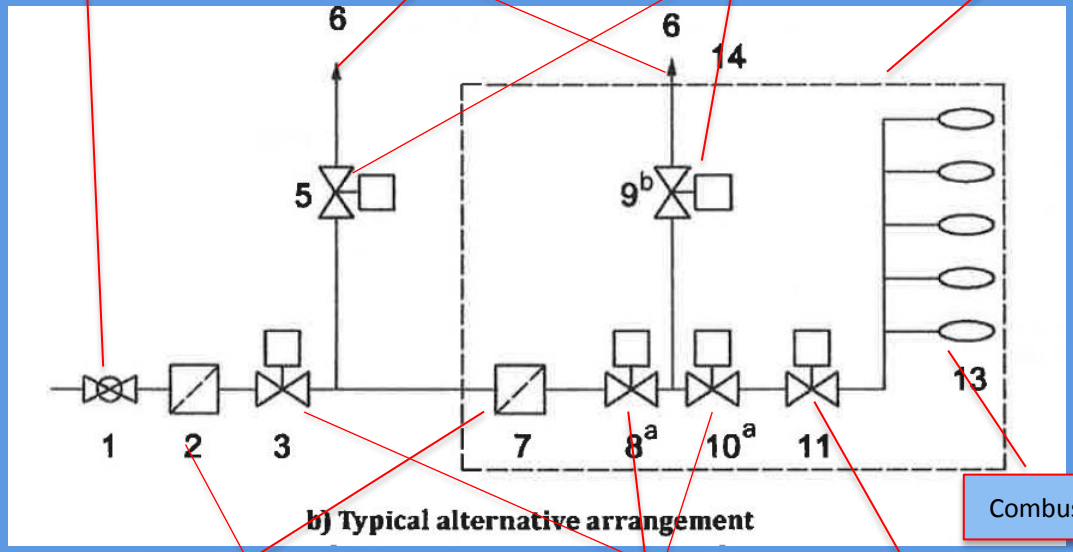
Standard is complex and unclear

Manual Valve

Vent line

Vent valve

Enclosure limits



Combustion system

Strainer

Automatic Shut off valve

Flow control Valve

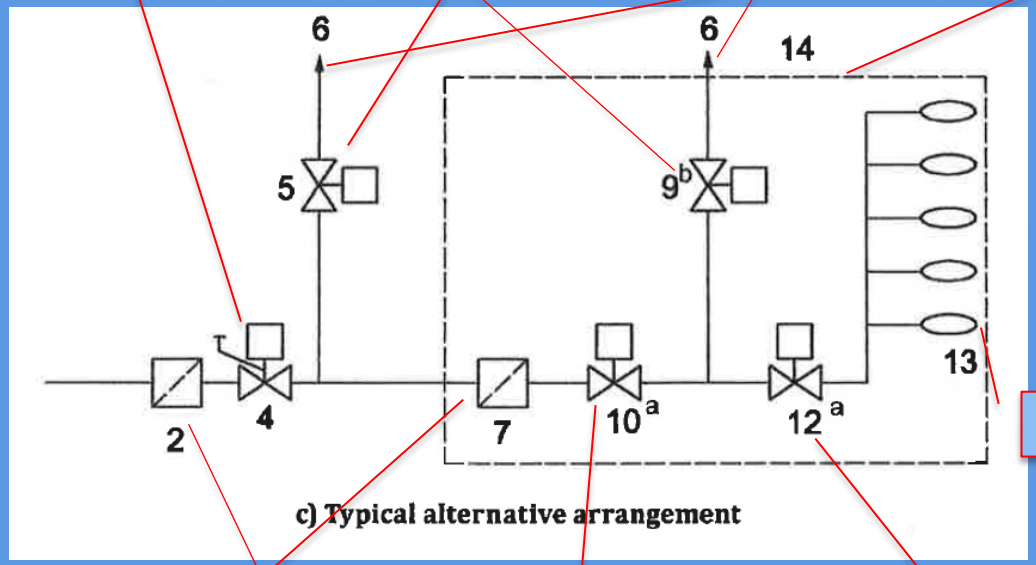
On every shut down : a- Closes and b- vents

Remarks on ISO 19372

13- Fuel system

Chapter 5.10

Standard is complex and unclear



Shut off valve and manual valve

Vent Valve

Vent line

Enclosure limits

Combustion system

Strainer

Automatic Shut off valve

Flow control and shut off Valve

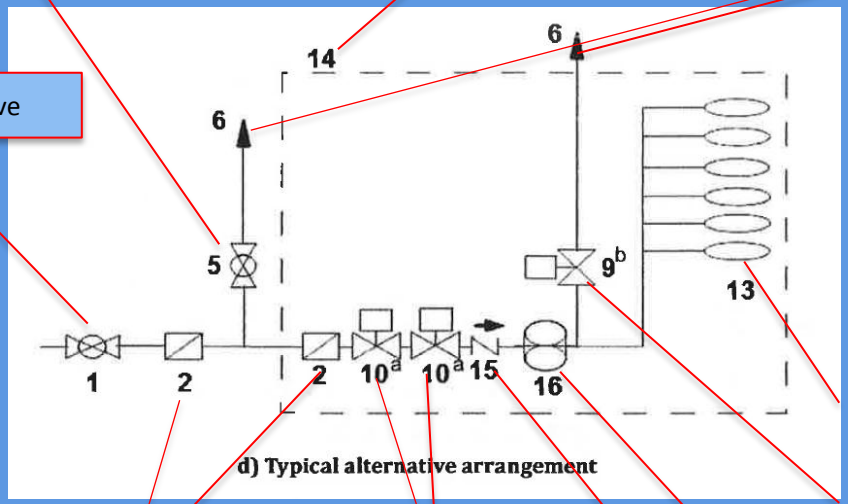
On every shut down : a- Closes and b- vents

Remarks on ISO 19372

13- Fuel system

Chapter 5.10

Standard is complex and unclear



Vent Valve ?!?!

Enclosure limits

Vent line

Manual valve

Combustion system

Vent Valve

Strainer

Automatic Shut off valve

Fuel gas Booster

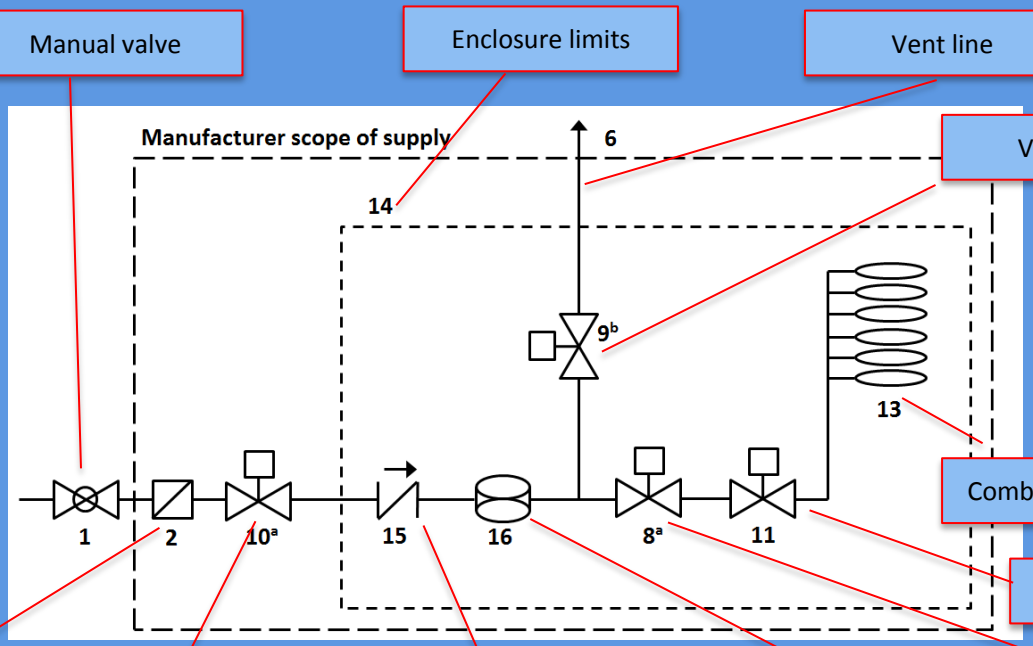
Check Valve

On every shut down : a- Closes and b- vents

Remarks on ISO 19372

13- Fuel system

Ansaldo Energia proposal



Manual valve

Enclosure limits

Vent line

Vent Valve

Combustion system

Flow control valve

Strainer

Fast acting Shut off valve

Check Valve

Fuel gas Booster

Shut off valve

On every shut down : a- Closes and b- vents