Deliverable 9.1

Inventory of norms and standards relevant for Messib

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Summary

This report is a restricted document delivered in the context of WP9, Task 9.1: "Inventory of norms and standards relevant for Messib".

It analyses existing standards and blank spots in normalisation related to Messib technologies.

The analysis is carried out for the following technologies:
- *Geothermal conductive fluid matrix (CFM)*
- *Improved geothermal heat exchanger (coaxial)*
- *Phase change materials in the envelope (PCM)*
- *Phase change slurries (PCS)*
- *Redox Flow batteries (Redox)*
- *Flywheel*

The approach has been as follows:
- *Inventory of existing standards*
- *Establishment of a list with aspects that standards should cover, for each technology*
- *Identification of output from Messib*
- *Missing input for standardisation that has to be developed in future work*

This document deals with the first part, the inventory of standards and guidelines.

Contents

Abbreviations

ESS	Energy Storage System
MESSIB	Multy-Source Energy Storage Systems integrated in Buildings
PCM	Phase change material
PCS	Phase change slurries
REDOX	Reduction-oxidation flow battery
Flywheel	rotating mechanical device used to store rotational energy
CFM	Conductive fluid material

1. Introduction

This WP deals with the inventory of existing references related to Messib technologies. The results will be the basis for the identification of blank spots in national and European standardisation.

2. Improved geothermal borehole

2.1 Coaxial borehole tube System Standards

Standard Title	Product Code	Date	Issue Committee	Scope
NF X10-970: Water drilling and geothermal energy		2010-08	AFNOR	Vertical geothermal borehole (U-tube heat exchanger with heat transfer fluid in a closed loop) - realization, implementation, maintenance, relinquishment. The standard covers all types of building or construction (for example: individual, grouped, residential building etc...) and for service or tertiary activity (for example: hospitals, schools etc...) purposes. The minimal recommended depth of the work individually-orientated or for a domestic use is 50 m; the depth in the case of borehole fields will be defined by the engineering consulting company.

Standard Title	Product Code	Date	Issue Committee	Scope
NF X10-960 water drilling and geothermal energy			AFNOR	This document specifies the criteria for the design and the characteristics of vertical boreholes. It refers to borehole circuits, devices inserted into vertical geothermal boreholes referring to NF X 10 970, realized by oblique or vertical drilling and in which the heat transport is insured in a closed circuit by a coolant liquid. It does not apply to horizontal heat exchangers, to geothermal baskets or to compact heat exchangers, to sensors with direct expansion, to energy structures, as well as any mechanical assembly. This document covers single or multiple U configurations, coaxial and multi-pipes with common room. It can also apply to innovative devices. It applies to borehole loops constituted by single-wall in polyethylene tubes PE 100, in polyethylene (PE X) or in polyethylene with better temperature resistance (PE RT) and also in PB. Borehole loops intended for deep works superior to 350 m are not covered by the present document. The present document defines two classes of application: the class S (standard) and the class T (thermal).

Standard Title	Product Code	Date	Issue Committee	Scope
EN 378-1:2008+A1:2012			CEN	Refrigerating systems and heat pumps-Safety and environmental requirements-Part1: Basic requirements, definitions, classification and selection criteria.

Standard Title	Product Code	Date	Issue Committee	Scope
EN 378-2:2008+A1:2012			CEN	Refrigerating systems and heat pumps-Safety and environmental requirements-Part2: Design, construction, testing, marking and documentation.

Standard Title	Product Code	Date	Issue Committee	Scope
EN 378-4:2008+A1:2012			CEN	Refrigerating systems and heat pumps-Safety and environmental requirements-Part4: operation, maintenance, repair and recovery.

Standard Title	Product Code	Date	Issue Committee	Scope
EN 14276-2:2007+A1:2011			CEN	Pressure equipment for refrigerating systems and heat pumps-Part2:Piping - general requirements

Standard Title	Product Code	Date	Issue Committee	Scope
CEN/TS 15223:2008			CEN	Plastics piping systems- Validated design parameters of buried thermoplastics piping systems.

Standard Title	Product Code	Date	Issue Committee	Scope
VDI 4640-1-4		2010-06 2001-09 2001-06	VDI	Part 1: Thermal use of the underground - Fundamentals, approvals, environmental aspects Part 2: Thermal use of the underground - Ground source heat pump systems Part 3: Utilization of the subsurface for thermal purposes - Underground thermal energy storage Part 4: Thermal use of the underground - Direct uses

Standard Title	Product Code	Date	Issue Committee	Scope
DIN 8901		2002-12	DIN	Refrigerating systems and heat pumps - Protection of soil, ground and surface water - Safety and environmental requirements and testing

Standard Title	Product Code	Date	Issue Committee	Scope
DVGW 120-2		2010-12	DVGW	Qualifikationsanforderungen für die Bereiche Bohrtechnik und oberflächennahe Geothermie (Erdwärmesonden) Qualification requirements for the following areas: drilling engineering and near-surface geothermal energy (borehole heat exchanger)

Standard Title	Product Code	Date	Issue Committee	Scope
DIN EN 805			DIN	Water supply - Requirements for systems and components outside buildings

Standard Title	Product Code	Date	Issue Committee	Scope
DIN EN 917		1997-03	DIN	Kunststoff-Rohrleitungssysteme - Armaturen aus Thermoplasten - Prüfverfahren für die Widerstandsfähigkeit gegen Innendruck und die Dichtheit; Plastics piping systems - Thermoplastics valves - Test methods for resistance to internal pressure and leaktightness

2.2 Coaxial borehole tube System Guidelines

Guidelines title	Guidelines number	Date	Issue Committee	Scope
Guide for soil thermal resistivity measurements	IEEE 442-1981		IEEE	This guide covers the measurement of soil thermal resistivity. A thorough knowledge of the thermal properties of a soil will enable the user to properly install and load underground cables. The method used is based on the theory that the rate of temperature rise of a line heat source is dependent upon the thermal constants of the medium in which it is placed. The designs for both laboratory and field thermal needles are also described. The main purpose of this guide is to provide sufficient information to enable the user to select useful commercial test equipment, or to manufacture equipment which is not readily available on the market, and to make meaningful resistivity measurements with this equipment. Measurements may be made in the field or in the laboratory on soil samples or both.

Guidelines title	Guidelines number	Date	Issue Committee	Scope
Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe Procedure	ASTM D5334 - 08		ASTM	This test method presents a procedure for determining the thermal conductivity of soil and soft rock using a transient heat method. This test method is applicable for both undisturbed and remolded soil specimens and soft rock specimens. This test method is suitable only for isotropic materials.

Guidelines title	Guidelines number	Date	Issue Committee	Scope
Greenhouse gases	ISO 16064-1	2006	ISO	Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.

Guidelines title	Guidelines number	Date	Issue Committee	Scope
Greenhouse gases	ISO 16064-2	2006	ISO	Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removals enhancements

Guidelines title	Guidelines number	Date	Issue Committee	Scope
Greenhouse gases	ISO 16064-3	2006	ISO	Specification with guidance for the validation and verification of greenhouse assertions

2.3 Coaxial borehole tube System Testing Procedures/Methods

Testing procedure title (book)	Editor	Date	Issue Committee	Scope
NF EN ISO 2505 Thermoplastic tubes-hot longitudinal withdrawal - Trial methods and parameters		2005-09	AFNOR, ISO	The Standard specifies a method of determination of the longitudinal hot withdrawal of thermoplastic tubes, realized either in a liquid, or in the air. In case of contention, the determination by means of the warmed liquid is the reference. The Standard is applicable to all thermoplastic tubes with smooth external and internal walls of constant section. It is not applicable to thermoplastic tubes without smooth structured wall. The Appendix A gives the appropriate parameters for the tubes and recommendations relative to maximal values of withdrawal according to the essential materials of the tubes.

Testing procedure title (book)	Editor	Date	Issue Committee	Scope
NF EN ISO 6259 Thermoplastic tubes-Determination of the characteristics under tensile stress		2002-04	AFNOR,ISO	Part 1: General method for trial. It prescribes a method to determinate the characteristics under tensile stress. It is applicable to all types of thermoplastic tubes

Testing procedure title (book)	Editor	Date	Issue Committee	Scope
NF EN 921 Plastic pipes systems-thermoplastic tubes		1995-03	AFNOR	Determination of the resistance under internal pressure with a constant temperature.

Testing procedure title (book)	Editor	Date	Issue Committee	Scope
ISO 13490:1997 Polyethylene pipes		1997	ISO	Resistance to slow crack growth- Cone test method

Testing procedure title (book)	Editor	Date	Issue Committee	Scope
NF EN ISO 1133-1 Plastics		2012-02	ISO, AFNOR	Determination of the fluidity rating under heat for thermoplastics, in terms of mass and volume- Part 1 normal method

Testing procedure title (book)	Editor	Date	Issue Committee	Scope
EN 13136:2001 Refrigerating systems and heat pumps		2001	CEN	Pressure relief devices and their associated piping- Methods for calculation. Modification of the requirements regarding external heat sources, calculation of backpressure compensating valves with respect to reduced stroke depending on pressure ratio and the design of upstream and downstream lines.

Testing procedure title (book)	Editor	Date	Issue Committee	Scope
EN 12061:1999 Plastics piping systems-Thermoplastics fitting-test method for impact resistance.		1999	CEN	This standard specifies a method for testing the impact resistance of fittings by dropping them onto a rigid surface. For a fitting with seal retaining components, such as seal retaining caps or rings, the method includes assessment of the water tightness of the fittings when the fixing elements show disturbance as a result of the test. This standard is applicable to fittings made from thermoplastics materials intended to be used for buried and above ground applications.

Testing procedure title (book)	Editor	Date	Issue Committee	Scope
EN 12106:1997 Plastics piping systems-Polyethylene pipes-		1997	CEN	Test method for the resistance to internal pressure after application of squeeze-off.

Testing procedure title (book)	Editor	Date	Issue Committee	Scope
EN 1411:1996		1996	CEN	Plastics piping systems-Thermoplastic pipes-Determination of resistance to external blows by the stair case method

2.4 Coaxial borehole tube System Certifications

Certifications title	Editor	Date	Issue Committee	Scope
ISO9000: Quality management systems — Fundamentals and vocabulary	ISO	2005/02	ISO	This International Standard describes fundamentals of quality management systems, which form the subject of the ISO 9000 family, and defines related terms. This International Standard is applicable to the following: a) organizations seeking advantage through the implementation of a quality management system; b) organizations seeking confidence from their suppliers that their product requirements will be satisfied; c) users of the products; d) those concerned with a mutual understanding of the terminology used in quality management (e.g. suppliers, customers, regulators); e) those internal or external to the organization who assess the quality management system or audit it for conformity with the requirements of ISO 9001 (e.g. auditors, regulators, certification/registration bodies); f) those internal or external to the organization who give advice or training on the quality management system appropriate to that organization; g) Developers of related standards.

3. Injection of fluid conductive material in the ground (CFM)

3.1 Injection of fluid conductive material standards

Standard Title	Product Code	Date	Issue Committee	Scope
PR NF X10-950		draft	AFNOR	The present document specifies the criteria of performance, characterization's essays, the requirements and the prescriptions of preparation and implementation of the geothermal grout for low energy heat exchangers with a closed circuit implemented by drilling. It concerns grout specially designed for geothermal heat exchangers in particular to vertical geothermal probes and making reference to the NF X 10-970. This document does not concern flat heat exchangers with closed circuit (horizontal sensors) as well as in the drillings of water used for the geothermal energy. It does not handle aspects of composition of the grout but defines objectives of performance and durability.

Standard Title	Product Code	Date	Issue Committee	Scope
VDI 4640-1-4		2010-06 2001-09 2001-06	VDI	Part 1: Thermal use of the underground - Fundamentals, approvals, environmental aspects Part 2: Thermal use of the underground - Ground source heat pump systems Part 3: Utilization of the subsurface for thermal purposes - Underground thermal energy storage Part 4: Thermal use of the underground - Direct uses

Standard Title	Product Code	Date	Issue Committee	Scope
DIN 8901		2002-12	DIN	Refrigerating systems and heat pumps - Protection of soil, ground and surface water - Safety and environmental requirements and testing

3.2 Injection of fluid conductive material guidelines

No references have been found.

3.3 Injection of fluid conductive material testing procedure

No references have been found.

3.4 Injection of fluid conductive material certifications

No references have been found.

4. Phase change materials in the building envelope

4.1 PCS Standards

Standard Title	Product Code	Date	Issue Committee	Scope
RAL-GZ 896		2006	GERMAN INSTITUTE FOR QUALITY ASSURANCE AND CERTIFICATION E.V	These quality and testing regulations define the general principles for PCM including PCM composites, particularly concerning definitive properties and requirements, and the content and extent of control measures.

4.2 PCS Guidelines

Guidelinestitle	Guidelines number	Date	Issue Committee	Scope
Greenhouse gases	ISO 16064-1	2006	ISO	Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.

Guidelinestitle	Guidelines number	Date	Issue Committee	Scope
Greenhouse gases	ISO 16064-2	2006	ISO	Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removals enhancements

Guidelinestitle	Guidelines number	Date	Issue Committee	Scope
Greenhouse gases	ISO 16064-3	2006	ISO	Specification with guidance for the validation and verification of greenhouse assertions

4.3 PCS Procedures/Methods

No references have been found.

4.4 PCS Certifications

Certifications title	Editor	Date	Issue Committee	Scope
ISO9000: Quality management systems — Fundamentals and vocabulary	ISO	2005/02	ISO	This International Standard describes fundamentals of quality management systems, which form the subject of the ISO 9000 family, and defines related terms. This International Standard is applicable to the following: a) organizations seeking advantage through the implementation of a quality management system; b) organizations seeking confidence from their suppliers that their product requirements will be satisfied; c) users of the products; d) those concerned with a mutual understanding of the terminology used in quality management (e.g. suppliers, customers, regulators); e) those internal or external to the organization who assess the quality management system or audit it for conformity with the requirements of ISO 9001 (e.g. auditors, regulators, certification/registration bodies); f) those internal or external to the organization who give advice or training on the quality management system appropriate to that organization; g) Developers of related standards.

4.5 PCM in passive components standards

Standard Title	Product Code	Date	Issue Committee	Scope
EN ISO 13786		2007	ISO	ISO 13786:2007 specifies the characteristics related to the dynamic thermal behaviour of a complete building component and provides methods for their calculation. It also specifies the information on building materials required for the use of the building component. Since the characteristics depend on the way materials are combined to form building components, ISO 13786:2007 is not applicable to building materials or to unfinished building components. The definitions given in ISO 13786:2007 are applicable to any building component. A simplified calculation method is provided for plane components consisting of plane layers of substantially homogeneous building materials. Annex A specifies simpler methods for the estimation of the heat capacities in some limited cases. These methods are suitable for the determination of dynamic thermal properties required for the estimation of energy use. These approximations are not appropriate, however, for product characterization. Annex B gives the basic principle and examples of applications of the dynamic thermal characteristics defined in ISO 13786:2007. Annex C provides information for programming the calculation method. Annex D gives an example of calculation for a building component.
Standard Title	**Product Code**	**Date**	**Issue Committee**	**Scope**
EN 12667		2001	CEN	Determination of thermal resistance by means of guarded hort plate and heat flow meter methods. Products of high and medium thermal resistance.

Standard Title	Product Code	Date	Issue Committee	Scope
EN 12114		2000	CEN	This standard defines a general laboratory test method for determining the air permeability of building components or building elements, when subjected to positive or negative air pressure differences. It specifies the definitions, the test equipment and procedure, and provides directions for the interpretation of results. Annexes give indications on test conditions and a method for expressing results using a regressions technique. This standard is not applicable to whole buildings or on site measurements.

Standard Title	Product Code	Date	Issue Committee	Scope
EN 1946-1		1999	CEN	Thermal performance of building products and components-Specific criteria for the assessment of laboratories measuring heat transfer properties-Part1 common criteria

Standard Title	Product Code	Date	Issue Committee	Scope
EN 1946-2		1999	CEN	Thermal performance of building products and components-Specific criteria for the assessment of laboratories measuring heat transfer properties-Part2 Measurements by guarded hot plate method

Standard Title	Product Code	Date	Issue Committee	Scope
EN 1946-3		1999	CEN	Thermal performance of building products and components-Specific criteria for the assessment of laboratories measuring heat transfer properties-Part3 Measurements by heat flow meter method

Standard Title	Product Code	Date	Issue Committee	Scope
EN 1946-4		2000	CEN	Thermal performance of building products and components-Specific criteria for the assessment of laboratories measuring heat transfer properties-Part4 Measurements by hot box method

Standard Title	Product Code	Date	Issue Committee	Scope
EN 1946-5		2000	CEN	Thermal performance of building products and components-Specific criteria for the assessment of laboratories measuring heat transfer properties-Part5 Measurements by pipe test method

Standard Title	Product Code	Date	Issue Committee	Scope
DIN 18168-1		2007	DIN	Ceiling linings and suspended ceilings with gypsum plasterboards – Part 1 Requirements for construction

Standard Title	Product Code	Date	Issue Committee	Scope
DIN 18182-1		2007	DIN	Accessories for use with gypsum plasterboards – Part 1 Steel plate sections

Standard Title	Product Code	Date	Issue Committee	Scope
EN 13009		2000	CEN	The document specifies a procedure for determination the hygric expansion or contraction behaviour of building materials as a property of moisture content. It is applicable for mineral, porous hygroscopic materials. For other materials showing moisture deformations, the procedure specified can be adapted in a suitable way taking into account their specific moisture behaviour. This document is relevant to material states when practically reversible expansion/contraction processes may be assumed but excluding initial shrinkage tests after material production. This procedure does not take precedence over material specific test methods.

Standard Title	Product Code	Date	Issue Committee	Scope
EN 15026		2007	CEN	This standard defines the practical application of hygrothermal simulation software used to predict onedimensional transient heat and moisture transfer in multi-layer building envelope components subjected to non steady climate conditions on either side. In contrast to the steady-state assessment of interstitial condensation by the Glaser method (as described in EN ISO 13788), transient hygrothermal simulation provides more detailed and accurate information on the risk of moisture problems within building components and on the design of remedial treatment. While the Glaser method considers only steady-state conduction of heat and vapour diffusion, the transient models covered in this standard take account of heat and moisture storage, latent heat effects, and liquid and convective transport under realistic boundary and initial conditions. The application of such models has become widely used in building practice in recent years, resulting in a significant improvement in the accuracy and reproducibility of hygrothermal simulation.

Standard Title	Product Code	Date	Issue Committee	Scope
EN ISO 12571		2000	CEN	Hygrothermal performance of building materials and products -- Determination of hygroscopic sorption properties

Standard Title	Product Code	Date	Issue Committee	Scope
EN ISO 12570		2000	CEN	Hygrothermal performance of building materials and products -- Determination of moisture content by drying at elevated temperature

Standard Title	Product Code	Date	Issue Committee	Scope
EN ISO 12572		2001	CEN	This standard specifies a method based on cup tests for determining the water vapour permeance of building products and the water vapour permeability of building materials under isothermal conditions. Different sets of test conditions are specified. The general principles are applicable to all hygroscopic and non hygroscopic building materials and products, including those with facings and integral skins. Annexes give details of test methods suitable for different material types. This standard is not applicable in the case of test specimens with water vapour diffusion-equivalent air layer thickness values less than 0.1m, as a result of increasing uncertainty in the measurements results. If the measured water vapour diffusion-equivalent air layer thickness is greater than 1500m the material can be considered impermeable. The results obtained by this method are suitable for design purposes, production control and for inclusion in product specifications.

Standard Title	Product Code	Date	Issue Committee	Scope
EN ISO 13788		2001	CEN	This standard describes calculation methods to avoid the occurrence of eventual moulds or problems due to condensation and to determine the interstitial condensation because of water vapour diffusion. The following main problems of the building physics are dealt with: 1. The internal surface temperature of a building component below which a mould can take place. The method designs the building envelope (k-value, insulation thickness) to prevent the effects of the critical surface humidity (e.g. mould growth). 2. The interstitial condensation due to the water vapour diffusion by comparing the condensation rate in winter to the evaporation rate in summer. The method establishes the annual moisture balance and calculates the maximum amount of the accumulated moisture due to the interstitial condensation

Standard Title	Product Code	Date	Issue Committee	Scope
EN ISO 15148		2002	CEN	This European Standard specifies a method for determining, by partial immersion with no temperature gradient, the short-term liquid water absorption coefficient. It is intended to assess the rate of absorption of water, by capillary action from continuous or driving rain during on site storage or construction, by insulating and other materials, which are normally protected. The method is suitable for renders or coatings tested in conjunction with the substrate on which they are normally mounted. It is not intended to assess the absorption of water by materials used under water or in overall contact with saturated ground, where a total immersion test is more appropriate. This title may contain less than 24 pages of technical content.

4.6 PCM in passive components guidelines

Standard Title	Product Code	Date	Issue Committee	Scope
EN ISO 10456		2007	CEN	The standard specifies methods for the determination of declared and design thermal values for thermally homogeneous building materials and products, together with procedures to convert values obtained under one set of conditions to those valid for another set of conditions. These procedures are valid for design ambient temperatures between -30 °C and +60 °C. It provides conversion coefficients for temperature and for moisture. These coefficients are valid for mean temperatures between 0 °C and 30 °C. It also provides design data in tabular form for use in heat and moisture transfer calculations, for thermally homogeneous materials and products commonly used in building construction.

4.7 PCM in passive components testing procedure

No references have been found.

4.8 PCM in passive components certifications

No references have been found.

5. Flywheel

5.1 Flywheel Standards

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Flywheel Spin Test Procedure	J1240	1991-12-01	Sae Ic Powertrain Steering Committee	This SAE Recommended Practice applies to flywheels and flywheel-starter ring gear assemblies used with internal combustion engines of spark ignition and diesel type. Engine sizes are those capable of using SAE No. 6 through SAE No. 00 size flywheel housings. This document is intended to provide a uniform test procedure for flywheel assemblies to determine the rotative speeds at which they will either burst or withstand a specified limiting speed	http://standards.sae.org/j1240_199112

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Procedure for Measuring Bore and Face Runout of Flywheels, Flywheel Housings, and Flywheel Housing Adapters	J1033	2012-06-01	Sae Ic Powertrain Steering Committee	This SAE Recommended Practice applies to any internal combustion engine which can utilize SAE No. 6 thru SAE No. 00 size flywheel housing. It provides instructions for correcting flywheel housing bore runout readings which are influenced by crankshaft bearing clearance. Limits for bore and face runout are specified in the various SAE Standards and Recommended Practices covering flywheels and flywheel housings.	http://standards.sae.org/j1033_201206

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Flywheels for Engine-Mounted Torque Converters	J927	2012-06-11	Sae Ic Powertrain Steering Committee	This SAE Recommended Practice defines flywheel configuration to promote standardization of flywheels for engine flywheel mounted torque converters.	http://standards.sae.org/j927_201206

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Engine Flywheel Housings With Sealed Flanges	J1172	1993-05-01	Sae Ic Powertrain Steering Committee	This SAE Recommended Practice defines flywheel housing flange configurations for applications requiring 'O' ring sealing of the flange pilot bore. Table 1 and Figure 1 show dimensions that are different from those in SAE J617. All other dimensions and tolerances of SAE J617 apply.	http://standards.sae.org/j1172_199305

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Flywheels for Two-Plate Spring-Loaded Clutches	J619	2012-05-31	Sae Ic Powertrain Steering Committee	This SAE Recommended Practice defines flywheel configuration to promote standardization of flywheels for dry spring-loaded clutches. Clutches to fit flywheels with configurations per this recommended practice may not be commercially available. Availability should be ascertained prior to flywheel design (see Figure 1 and Table 1).	http://standards.sae.org/j619_201205

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Maximum Allowable Rotational Speed for Internal Combustion Engine Flywheels	J1456	1995-07-01	Sae Ic Powertrain Steering Committee	This SAE Recommended Practice applies to flywheels and flywheel-starter ring gear assemblies used with internal combustion engines of the spark ignition and diesel type equipped with a governor or speed limiting device. Engine sizes are those capable of using SAE No. 6 through SAE No. 00 flywheel housings. This document applies to methods used to determine the rotational speed capability of flywheels for stresses imposed by centrifugal forces only. This document is intended to establish maximum allowable rotational speeds for flywheels under centrifugally imposed stresses.	http://standards.sae.org/j1456_199507

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Flywheels for Single-Plate Spring-Loaded Clutches	J618	2012-05-31	Sae Ic Powertrain Steering Committee	This SAE Recommended Practice applies to flywheels for dry spring-loaded clutches used on internal combustion engines. Figure 1 and Tables 1, 2, and 3 report information currently used in the industry. Clutches requiring other dimensions are also manufactured. Dimensions given are primarily for single-plate clutches. Flywheels for two plate clutches have the same dimensions if an adaptor for the intermediate plate and second driven disc is supplied with the clutch. If instead the flywheel is to be extended to adapt the intermediate plate and second driven member, consult the clutch manufacturer for the required J dimensions and drive arrangements for the intermediate plate. See SAE J1806 for flywheels for size 14 and 15.5 two plate pull-type clutches.	http://standards.sae.org/j618_201205

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Engine Flywheel Housing and Mating Transmission Housing Flanges	J617	2012-05-31	Sae Ic Powertrain Steering Committee	This SAE Standard specifies the major dimensions and tolerances for Engine Flywheel Housings and the Mating Transmission Housing Flanges. It also locates the crankshaft flange face or the transmission pilot bore (or pilot bearing bore) stop face in relation to housing SAE flange face. This document is not intended to cover the design of the flywheel housing face mating with the engine crankcase rear face of the design of housing walls and ribs. Housing strength analysis and the selection of housing materials are also excluded. This document applies to any internal combustion engine which can utilize SAE No. 6 through SAE No. 00 size flywheel housing for mounting a transmission.	http://standards.sae.org/j617_201205

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Flat Flywheels For Size 13 And 14 Spring Loaded Clutches	J1929	2002-07-23	Truck And Bus Advanced And Hybrid Powertrain Steering Comm	/	http://standards.sae.org/j1929_200207

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Flywheels for Two-Plate Spring-Loaded Clutches	J619	1993-12-01	Sae Ic Powertrain Steering Committee	This SAE Recommended Practice defines flywheel configuration to promote standardization of flywheels for dry spring-loaded clutches. Clutches to fit flywheels with configurations per this recommended practice may not be commercially available. Availability should be ascertained prior to flywheel design (see Figure 1 and Table 1).	http://standards.sae.org/j619_199312

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Flywheels for Single-Plate Spring-Loaded Clutches	J618	1991-01-01	Sae Ic Powertrain Steering Committee	This SAE Recommended Practice applies to flywheels for dry spring-loaded clutches used on internal combustion engines. Figure 1 and Tables 1, 2, and 3 report information currently used in the industry. Clutches requiring other dimensions are also manufactured. Dimensions given are primarily for single-plate clutches. Flywheels for two plate clutches have the same dimensions if an adaptor for the intermediate plate and second driven disc is supplied with the clutch. If instead the flywheel is to be extended to adapt the intermediate plate and second driven member, consult the clutch manufacturer for the required J dimensions and drive arrangements for the intermediate plate. See SAE J1806 for flywheels for size 14 and 15.5 two plate pull-type clutches	http://standards.sae.org/j618_199101

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Engine Flywheel Housing and Mating Transmission Housing Flanges	J617	1992-05-01	Sae Ic Powertrain Steering Committee	Housings and the Mating Transmission Housing Flanges. It also locates the crankshaft flange face or the transmission pilot bore (or pilot bearing bore) stop face in relation to housing SAE flange face. This document is not intended to cover the design of the flywheel housing face mating with the engine crankcase rear face of the design of housing walls and ribs. Housing strength analysis and the selection of housing materials are also excluded. This document applies to any internal combustion engine which can utilize SAE No. 6 through SAE No. 00 size flywheel housing for mounting a transmission	http://standards.sae.org/j617_199205

Standard Title	Product Code	Date	Issue Committee	Scope	Link
Flywheels for Single Bearing Engine Mounted Power Generators	J162	1986-03-01	Sae Ic Powertrain Steering Committee	This SAE Recommended Practice incorporates recommended dimensions for flywheels for use with single bearing power generators in the range of 10-500 kW, operating at speeds of 1000-1800 rpm. Driving torque, fastener strength, and rotative speeds shall be consistent with good design practice.	http://standards.sae.org/j162_198603

5.2 Flywheel Guidelines

Guidelines title	Guidelines number	Date	Issue Committee	Scope	Link
Low Voltage Directive	2006/95/CE	2006-12-12	CEI - Italian Electrotechnical Committee	Approximation of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:374:0010:0019:it:PDF

Guidelines title	Guidelines number	Date	Issue Committee	Scope	Link
Equipment Directive	98/37/CE	1998-06-22	CEI - Italian Electrotechnical Committee	Approximation of the laws of the Member States relating to machinery	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1998L0037:19981207:it:PDF

Guidelines title	Guidelines number	Date	Issue Committee	Scope	Link
Safety Equipment	98/37/CE	2006-09	CEI - Italian Electrotechnical Committee	Safety of machinery - Electrical equipment of machines	http://standards.sae.org/j162_198603

Guidelinestitle	Guidelines number	Date	Issue Committee	Scope	Link
Explosive atmospheres	EN 1127-1	2001-02	CEI - Italian Electrotechnical Committee	Explosion prevention and protection. Basic concepts and methodology	http://www.scribd.com/doc/52829610/UNI-EN-1127-1

Guidelines title	Guidelines number	Date	Issue Committee	Scope	Link
UPS Definition of parameters and performance	ENV 50091-3	1998-04	CEI - Italian Electrotechnical Committee	Explosion prevention and protection. Basic concepts and methodology	http://bbs.dianyuan.com/bbs/u/16/1083290169.pdf

Guidelines title	Guidelines number	Date	Issue Committee	Scope	Link
SAE Housing and Flywheel Sizes	/	/	SAE	Flywheel configurations and dimensions	http://www.depco.com/depco/Files/flywheel_70957.pdf

5.3 Flywheel Testing Procedures/Methods

Testing procedure title (book)	Editor	Date	Issue Committee	Scope	Link
Composite materials testing and design	Steven J. Hooper	1997-10 (Thirteenth Volume)	ASTM	Design and Testing of Composite Flywheel Rotors - Page 3	http://books.google.it/books?hl=it&lr=&id=ohLPsdK1nsMC&oi=fnd&pg=PA3&dq=flywheel+testing+procedures&ots=DWuUyIkiwh&sig=-kYvCqmOcEgZhOP7ZO_32bsol3A#v=onepage&q=flywheel%20testing%20procedures&f=false

Testing procedure title (book)	Editor	Date	Issue Committee	Scope	Link
Composite materials testing and design	Steven J. Hooper	1997-10 (Thirteenth Volume)	ASTM	Durability and Damage Tolerance: Testing, Simulation, and Other Virtual Realities- Page 45	http://books.google.it/books?hl=it&lr=&id=ohLPsdK1nsMC&oi=fnd&pg=PA3&dq=flywheel+testing+procedures&ots=DWuUyIkiwh&sig=-kYvCqmOcEgZhOP7ZO_32bsol3A#v=onepage&q=flywheel%20testing%20procedures&f=false

Testing procedure title (book)	Editor	Date	Issue Committee	Scope	Link
Composite materials testing and design	Steven J. Hooper	1997-10 (Thirteenth Volume)	ASTM	Compression Testing- Page 131 to 168	http://books.google.it/books?hl=it&lr=&id=ohLPsdK1nsMC&oi=fnd&pg=PA3&dq=flywheel+testing+procedures&ots=DWuUyIkiwh&sig=-kYvCqmOcEgZhOP7ZO_32bsol3A#v=onepage&q=flywheel%20testing%20procedures&f=false

Testing procedure title (book)	Editor	Date	Issue Committee	Scope	Link
Sizing and Simulation of a Flywheel Energy Storage System for Ramea Hybrid Power System	K. Islam, M.T. Iqbal and R. Ahshan	/	Faculty of Engineering & Applied Science-Canada A1B-3X5	This paper describes the sizing and simulation of a flywheel energy storage system (FESS) for an isolated windhydrogen-diesel hybrid power system in Ramea, Newfoundland. The objective of the proposed flywheel system is to minimize the voltage sag or swelling due to sudden variations of load or windspeed. Currently the hybrid power system in Ramea consists of diesel generators, wind turbines, hydrogen generator and Electrolyzer. Flywheel energy storage system is designed to provide short term energy backup for the hybrid power system in Ramea. HOMER is used for sizing and simulation of the proposed flywheel energy storage system and simulations are also done using Matlab/Simulink. Sizing and simulation results are presented in this paper. Simulation results shows that an addition of a flywheel energy storage system to Ramea hybrid power system will greatly reduce voltage and frequency fluctuations and number of generator switching over a period of time.	http://necec.engr.mun.ca/ocs2010/viewpaper.php?id=18&print=1

5.4 Flywheel Certifications

Certifications title	Editor	Date	Issue Committee	Scope	Link
ISO9000: Quality management systems — Fundamentals and vocabulary	ISO	2005/02	ISO	This International Standard describes fundamentals of quality management systems, which form the subject of the ISO 9000 family, and defines related terms. This International Standard is applicable to the following: a) organizations seeking advantage through the implementation of a quality management system; b) organizations seeking confidence from their suppliers that their product requirements will be satisfied; c) users of the products; d) those concerned with a mutual understanding of the terminology used in quality management (e.g. suppliers, customers, regulators); e) those internal or external to the organization who assess the quality management system or audit it for conformity with the requirements of ISO 9001 (e.g. auditors, regulators, certification/registration bodies); f) those internal or external to the organization who give advice or training on the quality management system appropriate to that organization; g) developers of related standards.	http://www.seatone.cn/news/upfile/2006519845492059.pdf

Certifications title	Editor	Date	Issue Committee	Scope	Link
IEC 61000-4-3Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test	IEC	2006/02	IEC	This part of IEC 61000 is applicable to the immunity requirements of electrical and electronic equipment to radiated electromagnetic energy. It establishes test levels and the required test procedures. The object of this standard is to establish a common reference for evaluating the immunity of electrical and electronic equipment when subjected to radiated, radio-frequency electromagnetic fields. The test method documented in this part of IEC 61000 describes a consistent method to assess the immunity of an equipment or system against a defined phenomenon. NOTE 1 As described in IEC Guide 107, this is a basic EMC publication for use by product committees of the IEC. As also stated in Guide 107, the IEC product committees are responsible for determining whether this immunity test standard should be applied or not, and if applied, they are responsible for determining the appropriate test levels and performance criteria. TC 77 and its sub-committees are prepared to co-operate with product	http://www.sanki-e.com/uploadimg/contents/20100722110540190.pdf

				committees in the evaluation of the value of particular immunity tests for their products. This part deals with immunity tests related to the protection against RF electromagnetic fields from any source. Particular considerations are devoted to the protection against radio-frequency emissions from digital radiotelephones and other RF emitting devices. NOTE 2 Test methods are defined in this part for evaluating the effect that electromagnetic radiation has on the equipment concerned. The simulation and measurement of electromagnetic radiation is not adequately exact for quantitative determination of effects. The test methods defined are structured for the primary objective of establishing adequate repeatability of results at various test facilities for qualitative analysis of effects. This standard is an independent test method. Other test methods may not be used as substitutes for claiming compliance with this standard.	

6. Redox flow battery

6.1 Redox flow battery Standards

Standard Title	Product Code	Date	Issue Committee	Scope
NF EN 50272		2010	AFNOR	Safety requirements for secondary batteries and battery installation Part1: General safety information

Standard Title	Product Code	Date	Issue Committee	Scope
IEEE 1725		2006	IEEE	Standard for rechargeable batteries for cellular phones.

Standard Title	Product Code	Date	Issue Committee	Scope
IEEE 484		2010	IEEE	Recommended practice for installation design and installation of VLAB for stationary applications

Standard Title	Product Code	Date	Issue Committee	Scope
IEEE 1106		2005	IEEE	Recommended practice for installation, maintenance, testing and replacement of Vented Nickel-Cadmium batteries for stationary applications
Standard Title	**Product Code**	**Date**	**Issue Committee**	**Scope**
IEEE 1187		2002	IEEE	Recommended practice for installation design and installation of valve-regulated lead-acid (VRLA) batteries for stationary applications

Standard Title	Product Code	Date	Issue Committee	Scope
IEEE 1257		2009	IEEE	Recommended practice for personnel qualification for installation and maintenance of stationary batteries

Standard Title	Product Code	Date	Issue Committee	Scope
IEEE 450		2010	IEEE	Recommended practice for maintenance, testing and replacement of Vented lead-acid batteries for stationary applications

Standard Title	Product Code	Date	Issue Committee	Scope
IEEE 1188		2005	IEEE	Recommended practice for maintenance, testing and replacement of VLRA batteries for stationary applications

Standard Title	Product Code	Date	Issue Committee	Scope
IEEE 535		2006	IEEE	Standard for qualification of class 1E lead storzge batteries for nuclear power generating stations

Standard Title	Product Code	Date	Issue Committee	Scope
IEEE 946		2004	IEEE	Recommended practice for the design of DC auxiliary power systems for generating systems

Standard Title	Product Code	Date	Issue Committee	Scope
IEEE 1679		2010	IEEE	Recommended practice for the characterization and evaluation of emerging energy storage technologies in stationary applications

6.2 Redox flow battery Guidelines

Guidelines title	Guidelines number	Date	Issue Committee	Scope
IEEE 1375		1998	IEEE	Guide for the protection of stationary battery system

Guidelines title	Guidelines number	Date	Issue Committee	Scope
IEEE 1184		2006	IEEE	Guide for vbatteries for uninterruptible power supply systems

Guidelines title	Guidelines number	Date	Issue Committee	Scope
IEEE 1189		2007	IEEE	Guide for selection of VRLA batteries for stationary applications

Guidelines title	Guidelines number	Date	Issue Committee	Scope
IEEE 1660		2008	IEEE	Guide for application and management of stationary batteries used in cycling service

Guidelines title	Guidelines number	Date	Issue Committee	Scope
IEEE 1491		2005	IEEE	Guide for selection and use of battery monitoring equipment in stationary applications

6.3 Redox flow battery Testing Procedures/Methods

Testing procedure title (book)	Editor	Date	Issue Committee	Scope
NF EN 61056-1		2003	AFNOR	General purpose lead-acid batteries(valve-regulated types)-Part1: General requirements, functional characteristics-Method of test

6.4 Conclusion

This deliverable has allowed an overview on existing standards, certifications, guidelines and testing procedures for each of the main Messib technologies.

These technologies are:

- Geothermal conductive fluid matrix (CFM)
- Improved geothermal heat exchanger (coaxial)
- Phase change materials in the envelope (PCM)
- Phase change slurries (PCS)
- Redox Flow batteries (Redox)
- Flywheel

While some references exist for the more "conventional" technologies, mainly the geothermal heat exchanger, other technologies are less covered by standards or normative references.

Deliverable 9.2 will analyze, for each technology, the missing points in standardization.

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