

ELICIT

Environmentally
Low Impact
Cooling
Technology



REGULATORY CONTEXT ANALYSIS OF
MAGNETIC REFRIGERATOR
THERMAG VI,
VICTORIA B.C., CANADA

CEMAFROID
TUESDAY, SEPTEMBER 9, 2014

CONTENT

- 1) Cemafruid, a leading independent expertise center for cold chain and refrigeration
- 2) Regulatory Context : Regulation & Standards
- 3) Impacts of the regulatory framework on design & development of magnetic cooling refrigerator
- 4) Further works to be achieved



CEMAFROID, INDEPENDENT EXPERTS



- **Cold Chain** is indispensable for safeguarding quality and safety of food, health and Wellbeing of people...
- **Provide** our independent expertise to professionals and stakeholders
- **Contribute** to improving the economic and environmental performance of companies and reduce risks.
- Independence, impartiality, quality, responsiveness, reliability, trust and teamwork



Certification of companies, services and products



Testing, calibration, verification



Expertise



Public Service



Formation

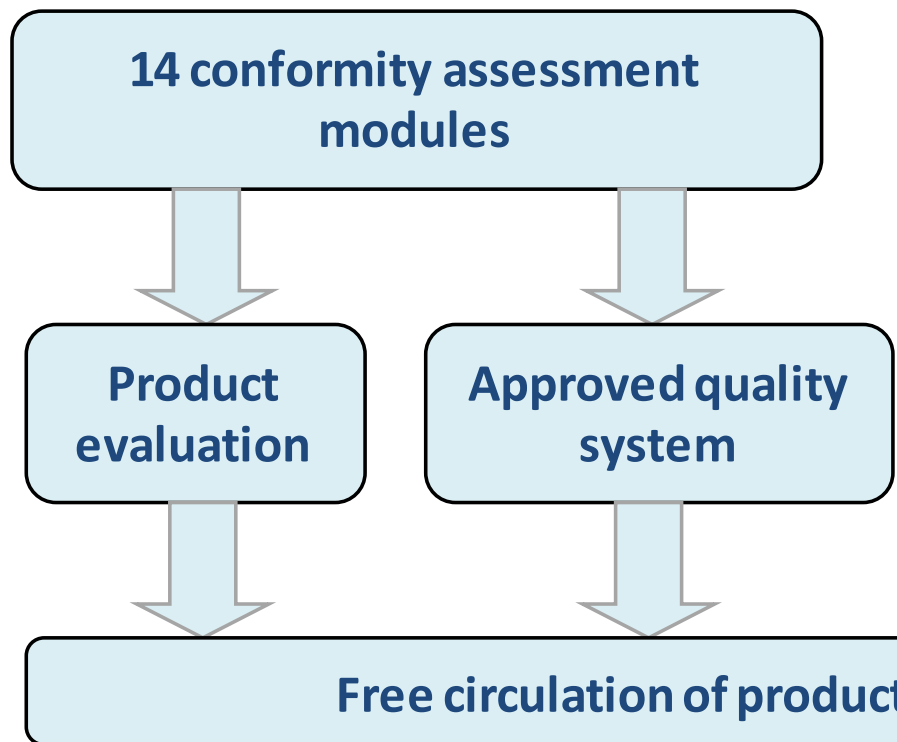


REGULATORY CONTEXT : SUBSIDIARITY PRINCIPLE

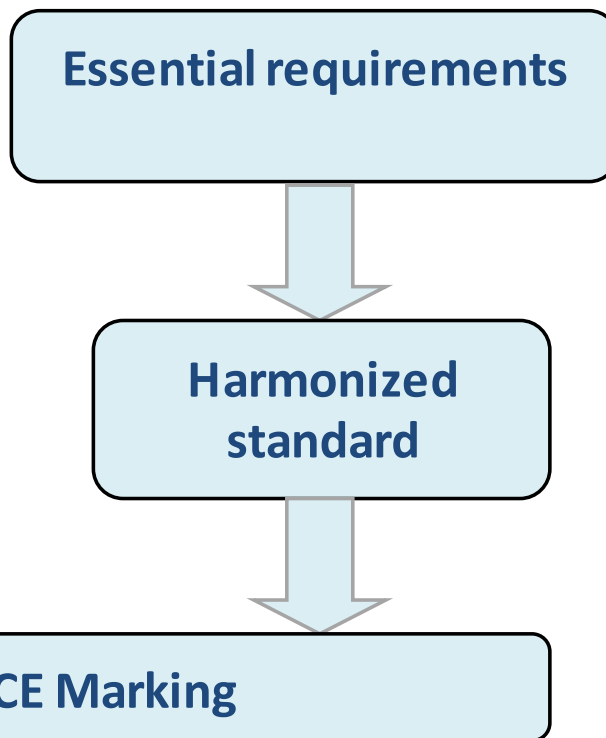


EU REGULATORY CONTEXT

Global approach



New approach (1985)



Essential requirements



Safety



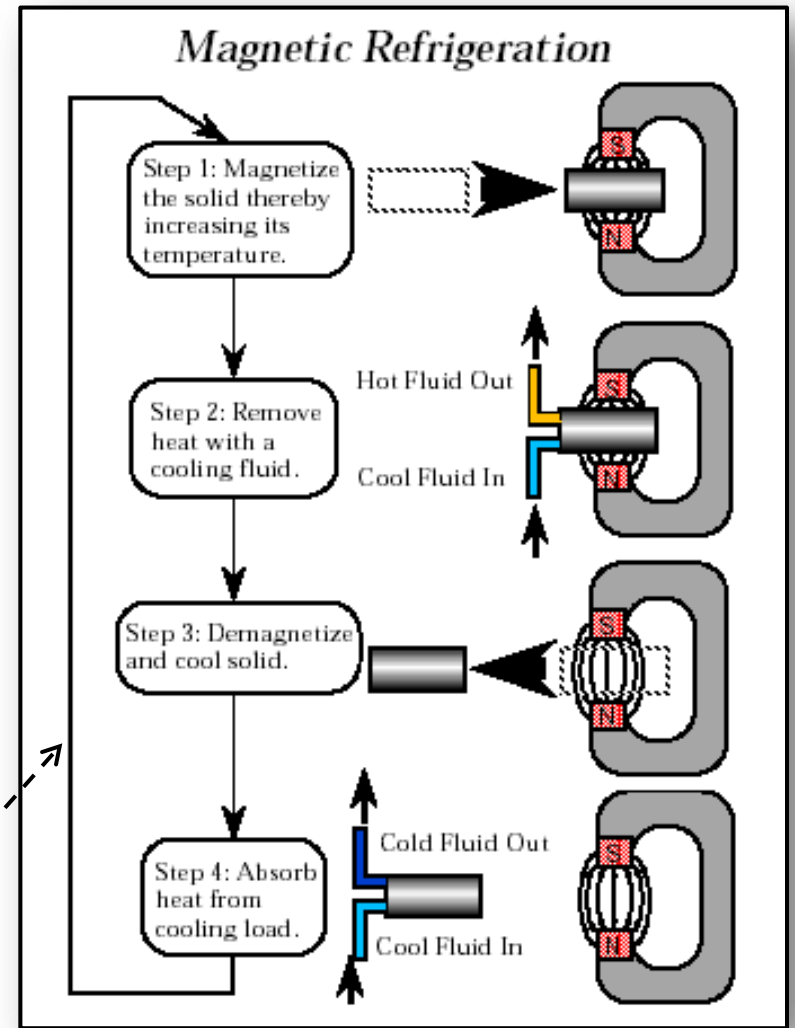
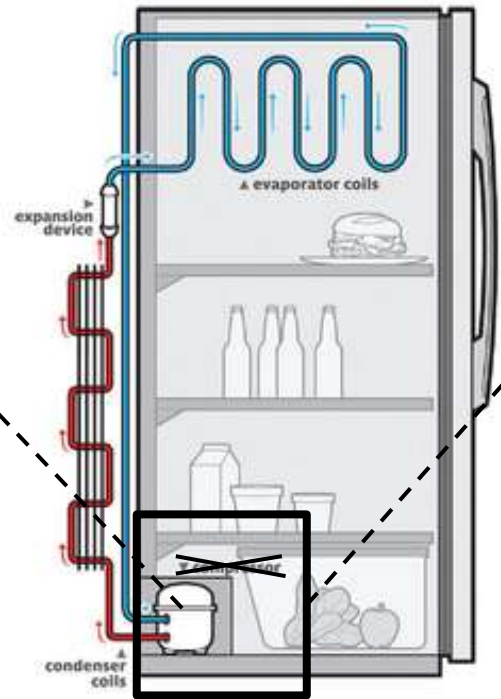
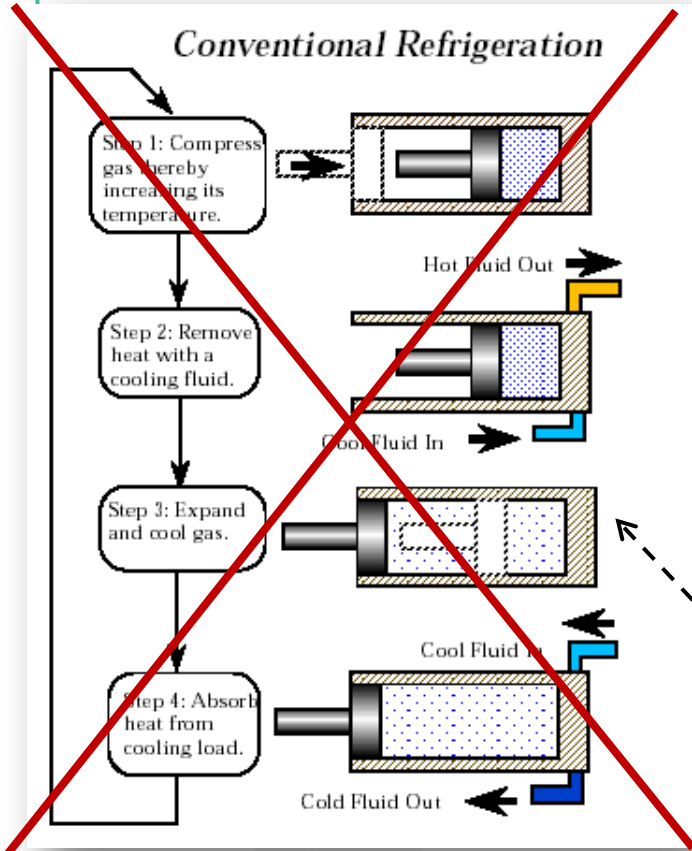
Security



Environmental issues

MAGNETIC COOLING REFRIGERATOR : PRINCIPLE

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Conventional Gas compressor



Magnetocaloric material regenerators



MAIN EU REGULATIONS APPLICABLE TO MAGNETIC REFRIGERATOR

e l i c i t - p r o j e c t - e u

<u>Type of requirement</u>	<u>EU Directive</u>							<u>EU & USA Regulation</u>			
	<u>Energy Labeling</u>	<u>Eco-Design</u>	<u>Machinery</u>	<u>Low Voltage</u>	<u>EMC</u>	<u>WEEE</u>	<u>RoHS</u>	<u>REACH</u>	<u>The Food Law</u>	<u>Delegated act for Energy labelling</u>	<u>Delegated act for Eco Design</u>
/	2010/30/EU	2009/125/EC	2006/42/EC	2014/35/EU	2014/30/EU	2012/19/EU	2011/65/EU	1907/2006	178/2002 - 852/2004 - 853/2004	1060/2010	643/2009
Safety			+	+							
Health									+		
Performance		++	+	+	+				+		+
Environment	+					++	++	++		+	



MAIN STANDARDS APPLICABLE TO MAGNETIC REFRIGERATOR

<u>Type of requirement</u>	<u>Main Standards</u>					
	<i>International</i>	<i>Regional</i>				<i>National</i>
/	<u>Characteristics & test methods</u> ISO - EN 15502	<u>Environmental testing</u> EN 60068	<u>EMC of Household Appliance</u> EN 55014	<u>Airbourne Acoustical Noise</u> EN 60704-2-14	<u>Measurement methods for electromagnetic fields of household appliances</u> EN 62233	Nothing to report
Safety	+	+	+		+	
Health	+					
Performance	+		+	+		
Environment						

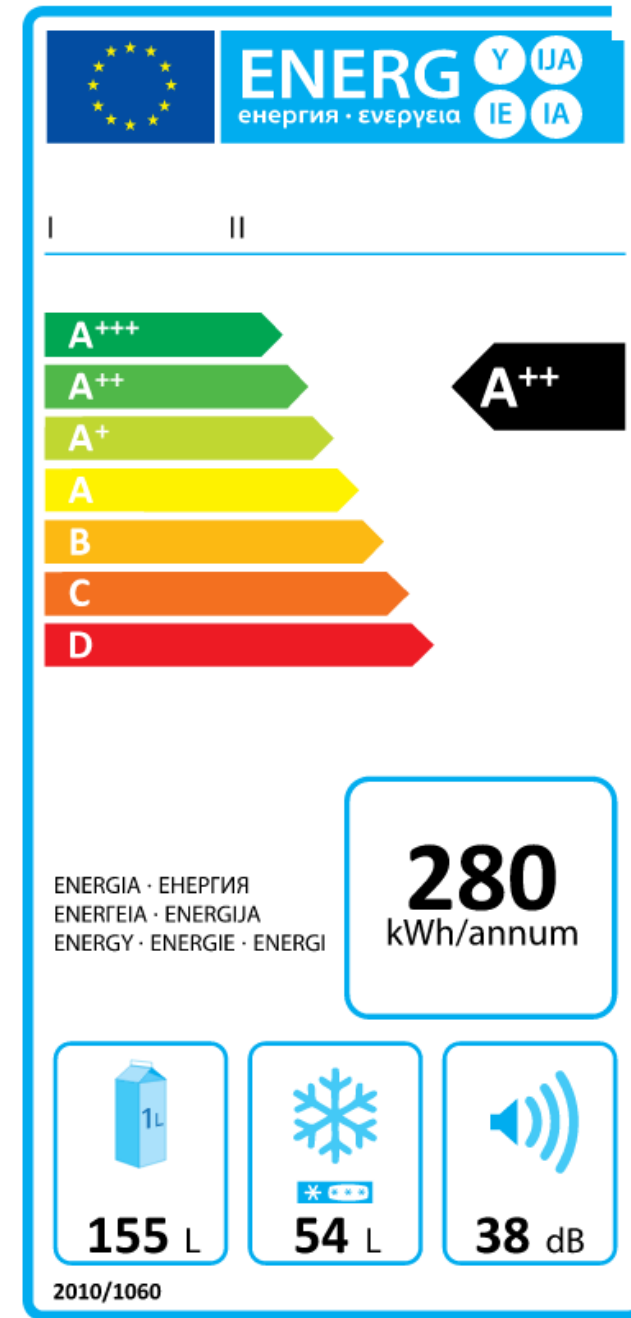
N.B.: For W.P 4.2 : EN 60730-2-9, EN 60335 will be also developed...

EU ENERGY LABELING

- Influence end-user's choice
- Delegated Regulation 2010/1060/EU
- Introduce Energy classification

$$EEI = \frac{AE_c}{SAE_c} \times 100$$

Energy efficiency Class	Energy efficiency Index
A+++ (best efficiency)	EEI < 22
A++	22 < EEI < 33
A+	33 < EEI < 44
A	44 < EEI < 55
B	55 < EEI < 75
C	75 < EEI < 95
D	95 < EEI < 110
E	110 < EEI < 125
F	125 < EEI < 150
G (poor efficiency)	150 < EEI



EU ECO DESIGN/ENERGY RELATED PRODUCT

- Minimum requirements
- Fixed by implementing Regulation 643/2009

Application Date	Compression Type	Absorption Type
01/07/2010	EEI < 55	EEI < 150
01/07/2012	EEI < 44	EEI < 125
01/07/2014	EEI < 42	---
10/07/2015	---	EEI < 110

- Scales are different for Compression type & Absorption type
- Magnetic refrigerator type can follow the same restriction that compression type



EU MACHINERY & LOW VOLTAGE DIRECTIVES

- Risks assessment due to moving components
- Risks assessment due to electric components

- Applicable to Magnetic refrigerator:
Magnetocaloric material Motion system

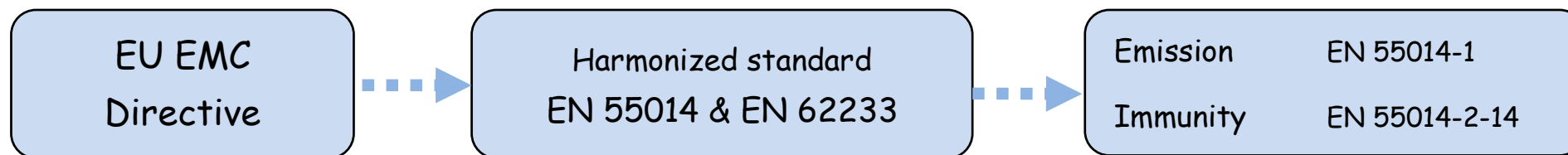


EU EMC DIRECTIVE

- Compliant electromagnetic disturbance
 - Emission : Do not disturb other appliances
 - Immunity : Is not disturb by other appliances



- Applicable to Magnetic Cooling System



EU WEEE

- Producer responsibilities
- Prevention of WEEE by re-use, recovery...
- Compliance ensured by EEE Symbol

Minimum recovery target
recovered 80%
recycled 75%
<i>Starting from 15/08/2015</i>
recovered 85%
recycled 80%



All materials can be re-use and/or recover

OTHER EU DIRECTIVES : ROHS & REACH

➤ Rohs ✓

- Prototype not include Rohs restricted materials (Lead, Mercury, Cadmium, ...)

➤ Reach regulation ✓

- All materials out of Reach restriction



Further studies have to be performed concerning toxicity of the magnetocaloric material which is made of $\text{LaFe}_{13}\text{Si}_{1-x}\text{Co}_x$.

OTHER REQUIREMENTS

➤ Storage Temperature

- Respect general storage temperature required in the Food Law
- Evaluate conformity by initiating a cartography procedure

➤ Coolant toxicity

- The coolant (non-drinkable water) may contain adjuvant – Contact with foodstuffs in case of knife defrosting ?



Maximum temperatures for frozen foodstuffs	
<u>Type of food</u>	<u>Food storage temperature</u>
Ice and ice-cream	-18 °C
Minced meat	-18 °C
Seafood	-18 °C
Brine frozen fish	-9 °C
Others frozen foodstuffs	-12 °C

Nota: The maximum temperature indicated is without an inferior limit

Maximum temperatures for non-frozen foodstuffs	
<u>Type of food</u>	<u>Food storage temperature</u>
Meat	+7°C
Giblet	+3 °C
Minced meat	+2 °C
Meat mixture	+4 °C
Poultry	+4 °C
Fresh fishery	0 to 2 °C
Milk	+4 °C
Cheese	Defined by the producer or packager
Meal components	+3 °C
Others perishable foodstuffs	Defined by the producer or packager

Nota: The inferior temperature limit of a foodstuff must be the same as the proper frozen temperature.

FURTHER WORK TO BE ACHIEVED

- Draft testing protocol in order to evaluate the following characteristics

<i>Mechanical test</i>	Opening Resistance & Endurance
	Shock Response
	Tightness
<i>Performance test</i>	Storage Temperature
	Energy Consumption
	Rising Temperature Time
	Cold Ambient Temperature
	Airbourne Acoustical Noise
<i>Components conformity</i>	Disturbance generated
	Immunity of appliance
	Density Flux Measurement
	Heating of electrical components



FURTHER WORK TO BE ACHIEVED

➤ Magnetic field

- Evaluate Magnetic flux density/comparison with exposure limit (Magnetic engine provider)

➤ WEEE

- Use an efficient recovery system, think about a re-use policy (Household refrigerator manufacturer).

THANK YOU!

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