Minimum requirements as to the skills and knowledge to be covered by the evaluation bodies

		CATEGORIES						
		FG I	FG II	FG III	FG IV	FLAM II smal	FLAM I big	CO2
	SKILLS AND KNOWLEDGE							
1.00	**Basic thermodynamics**							
1.01	Know the basic ISO standard units as for temperature, pressure, mass, density, energy	T	T					
1.02	Understand basic theory of refrigeration systems: basic thermodynamics (key terms, parameters and processes such as Superheat, High Side, Heat of Compression, Enthalpy, Refrigeration Effect, Low Side, Sub-cooling), properties and thermodynamic transformations of refrigerants including identification of zeotropic blends and fluid states	T	T					
1.03	Use relevant tables and diagrams and interpret them in the context of indirect leakage checking (including checking of the good operation of the system): log p/h diagram, saturation tables of a refrigerant, diagram of a single compression refrigeration cycle	T	T					
1.04	Describe the function of the main components in the system (compressor, evaporator, condenser, thermostatic expansion valves) and the thermodynamic transformations of the refrigerant	T	T					
1.05	Know the basic operation of the following components used in a refrigeration system and their role and importance for refrigerant leakage prevention and identification: (a) valves (ball valves, diaphragms, globe valves, relief valves), (b) temperature and pressure controls, (c) sight glasses and moisture indicators, (d) defrost controls, (e) system protectors, (f) measuring devices as manifold thermometer, (g) oil control systems, (h) receivers, (i) liquid and oil separators	T						
1.06	Know about the specific behaviour, physical parameters, solutions, systems, deviances of alternative refrigerants in the refrigeration cycle and components for their use	T	T	T				
1.07	Know the differences between low GWP refrigerants and HFCs	T	T	T				
1.08	Know the toxicity characteristics, grades and limits of CO2 for the human body							T
1.09	Know the characteristic of flammability of refrigerants, velocity of flame propagation, LFL, UFL, occupancy limits					T	T	
2.00	**Environmental impact of refrigerants and corresponding environmental regulations**							

legend

T = theoretical assesment

P = practical assesment

2.01	Have a basic knowledge of the EU and international climate change policy, including the United Nations Framework Convention on Climate Change	T	T	T				
2.02	Have a basic knowledge of the concept of Global Warming Potential (GWP), the use of fluorinated greenhouse gases and other substances as refrigerants, the impact of the emissions of fluorinated greenhouse gases on the climate (order of magnitude of their GWP) and relevant provisions of Regulation (EU) No 517/2014 and of the relevant implementing acts	T	T	T				
3	**Checks before putting in operation, after a long period of non-use, after maintenance or repair intervention, or during operation**							
3.01	Carry out a pressure test to check the strength of the systém	P	P					
3.02	Carry out a pressure test to check the tightness of the systém	P	P					
3.03	Use a vacuum pump	P	P					
3.04	Evacuate the system to remove air and moisture according to standard practice	P	P					
3.05	Fill in the data in the equipment records and fill in a report about one or more tests and checks carried out during the examination	T	T					
4	**Checks for leakage**							
4.01	Know potential leakage points of refrigeration, air conditioning and heat pump equipment	T	T					
4.02	Check equipment records prior to a check for leakage and identify the relevant information on any repeating issues or problem areas to pay special attention to	T	T					
4.03	Make a visual and manual inspection of the whole system in accordance with Commission Regulation (EC) No 1516/2007	P	P					
4.04	Carry out a check for leakage of the system using an indirect method in accordance with Regulation (EC) No 1516/2007 and the instruction manual of the system	P	P					
4.05	Use portable measuring devices such as manometer sets, thermometers and multimeters for measuring Volt/Amp/Ohm in the context of indirect methods for leakage checking, and interpret the measured parameters	P	P					
4.06	Carry out a check for leakage of the system using one of the direct methods referred to in Regulation (EC) No 1516/2007	P						

4.07	Carry out a check for leakage of the system using one of the direct methods which does not entail breaking into the refrigeration circuit, referred to in Regulation (EC) No 1516/2007		P					
4.08	Use an appropriate electronic leak detection device	P	P					
4.09	Fill in the data in the equipment records	T	T					
5	**Environment-friendly and safe handling of the system and refrigerant during installation, maintenance, servicing or recovery**							
5.01	Connect and disconnect gauges and lines with minimal emissions	P	P					
5.02	Empty and fill a refrigerant cylinder in both liquid and vapour state	P	P	P				
5.03	Use a recovery set to recover refrigerant and connect and disconnect recovery set with minimal emissions	P	P	P				
5.04	Drain F-gas contaminated oil out of a systém	P	P	P				
5.05	Identify refrigerant state (liquid, vapour) and condition (subcooled, saturated or superheated) prior to charging, to ensure correct method and volume of charge. Fill the system with refrigerant (both in the liquid and vapour phase) without loss of refrigerant	P	P					
5.06	Choose the correct type of scales and use them to weigh the refrigerant	P	P	P				
5.07	Fill in the equipment records with all relevant information concerning the refrigerant recovered or added	T	T					
5.08	Know requirements and procedures for handling, reusing, reclaiming, storage and transportation of contaminated refrigerant and oils	T	T	T				
5.09	Know requirements and procedures for safe handling, reusing, reclaiming, storage and transportation of flammable and high pressure refrigerants					T	T	T
6	**Component: installation, putting into operation and maintenance of reciprocating, screw and scroll compressors, single and two-stage**							
6.01	Explain the basic functioning of a compressor (including capacity control and lubricating system) and risks of refrigerant leakage or release associated to it	T	T					
6.02	Install a compressor properly, including control and safety equipment, so that no leak or major release occurs once the system is put into operation	P	P					
6.03	Adjust the safety and control switches	P						
6.04	Adjust the suction and discharge valves	P						
6.05	Check the oil return systém	P						

6.06	Start up and shut down a compressor and check the good working conditions of the compressor, including by making measurements during operation of compressor	P	P					
6.07	Write a report about the condition of the compressor which identifies any problems in the functioning of the compressor that could damage the system and eventually lead to refrigerant leakage or release should no action be taken	T	T					
7	**Component: installation, putting into operation and maintenance of air cooled and water cooled condensers**							
7.01	Explain the basic functioning of a condenser and risks of leakage associated to it	T	T					
7.02	Adjust a discharge pressure control of the condenser	P						
7.03	Install a condenser/outdoor unit properly, including control and safety equipment, so that no leak or major release occurs when the system has been put into operation	P	P					
7.04	Adjust the safety and control switches	P						
7.05	Check the discharge and liquid lines	P						
7.06	Purge non-condensable gases out of the condenser using a refrigeration purging device	P						
7.07	Start up and shut down a condenser and check the good working condition of the condenser including by making measurements during operation	P	P					
7.08	Check the surface of the condenser	P	P					
7.09	Write a report about the condition of the condenser which identifies any problems in the functioning that could damage the system and eventually lead to refrigerant leakage or release should no action be taken	T	T					
8	**Component: installation, putting into operation and maintenance of air cooled and water cooled evaporators**							
8.01	Explain the basic functioning of an evaporator (including defrosting system) and risks of leakage associated to it	T	T					
8.02	Adjust an evaporating pressure control of the evaporator	P						
8.03	Install an evaporator including control and safety equipment, so that no leak or major release occurs when the system has been put into operation	P	P					
8.04	Adjust the safety and control switches	P						
8.05	Check the liquid and suction pipelines in the correct position	P						
8.06	Check the hot gas defrost pipeline	P						

8.07	Adjust evaporation pressure regulation valve	P						
8.,08	Start up and shut down an evaporator and check the good working condition of the evaporator, including by making measurement during operation	P	P					
8.09	Check the surface of the evaporator	P	P					
8.10	Write a report about the condition of the evaporator which identifies any problems in the functioning that could damage the system and eventually lead to refrigerant leakage or release should no action be taken	T	T					
9	**Component: installation, putting into operation and servicing of Thermostatic Expansion Valves (TEV) and other components**							
9.01	Explain the basic functioning of different kinds of expansion regulators (thermostatic expansion valves, capillary tubes) and risks of leakage associated to it	T	T					
9.02	Install valves in the correct position	P						
9.03	Adjust a mechanical/electronic TEV	P						
9.04	Adjust mechanical and electronic thermostats	P						
9.05	Adjust a pressure-regulated valve	P						
9.06	Adjust mechanical and electronic pressure limiters	P						
9.07	Check the functioning of an oil separator	P						
9.08	Check the condition of a filter dryer	P						
9.09	Write a report about the condition of these components which identifies any problems in the functioning that could damage the system and eventually lead to refrigerant leakage or release should no action be taken	T						
10	Piping: building a leak-tight piping system in a refrigeration installation							
10.01	Weld, braze and/or solder leak-free joints on metallic tubes, pipes and components that can be used in refrigeration, air conditioning or heat pump systems	P	P					
10.02	Make/check pipe and component supports	P	P					
11	**Information on relevant technologies to replace or to reduce the use of fluorinated greenhouse gases and their safe handling**							
11.01	Know the relevant alternative technologies to replace or to reduce the use of fluorinated greenhouse gases and about their safe handling	T	T	T	T			
11.02	Know relevant system designs to reduce the charge size of fluorinated greenhouse gases and to increase energy efficiency	T	T					

11.03	Know relevant safety regulations and standards for the use, storage and transportation of flammable or toxic refrigerants or refrigerants requiring higher operating pressure	T	T					
11.04	Understand the respective advantages and disadvantages, notably in relation to energy efficiency, of alternative refrigerants according to the intended application and to the climate conditions of the different regions	T	T					
11.05	Know differences in component and system design used in systems using flammable refrigerants	T	T	T	T	T	T	
11.06	Know differences in component and system design used in systems using high pressure refrigerants	T	T	T	T			T
11.07	Know differences in components and system design in systems using toxic refrigerants	T	T	T	T	T	T	T
12	**Good practice and safe conduction of service and instalation procedures on systems with flammable refrigerants**							
12.01	Know the requirements for labelling of flammable refrigerants in systems and in pressure vessels					T	T	
12.02	Know the safety requirements for service tools and equipment (recovery stations, vacuum pumps, electronic leak detectors) for working with flammable refrigerants					T	T	
12.03	Prepare working area and select appropriate tools, equipment and personal protection equipment for conducting work on system with flammable refrigerants					P	P	
12.04	Recover or vent flammable refrigerant safely from the system and fill the system with nitrogen					P	P	
12.05	Open the system by brazing (or other appropriate procedure), remove and exchange a component and close the system by brazing (or other appropriate procedure).					P	P	
12.06	Carry out a pressure test to check the tightness of the system					P	P	
12.07	Carry our a vaccum test to remove moisture and check the tightness of the systém					P	P	
12.08	Charge the systém with designed volume of flammable refrigerant					P	P	
12.09	Carry out a check for leakage of the system using one of the direct methods					P	P	
12.10	Write a report about the service work conducted					T	T	
12.11	Calculate allowed flammable refrigerant charge in a system according to applicable safety standards						T	
12.12	Check that Health and Safety rules in the refrigeration system location are respected (emergency exits, fire alarms, leak detectors…)						T	
13	**Good practice and safe conduction of service and instalation procedures on systems with high pressure refrigerants**							
13.01	Know the requirements for labelling of R744 in systems and in pressure vessels							T
13.02	Know the safety requirements for service tools and equipment for working with R744 refrigerant							T

13.03	Prepare working area and select appropriate tools, equipment and personal protection equipment for conducting work on systém with R744 refrigerant							P
13.04	Safely vent R744 refrigerant from the system							P
13.05	Safely charge R744 refrigerant safely into the system							P
13.06	Carry out a check for leakage of the system using one of the direct methods							P
13.07	Write a report about the service work conducted							T
13.08	Check that Health and Safety rules in the refrigeration system location are respected (emergency exits, CO2 alarms, leak detectors…)							T
13.09	Know the safety requirements for operating a system with R744 refrigerant							T