WORLDSKILLS STANDARD SPECIFICATION

Skill 38

Refrigeration and Air Conditioning

THE WORLDSKILLS STANDARDS SPECIFICATION (WSSS)

GENERAL NOTES ON THE WSSS

The WSSS specifies the knowledge, understanding and specific skills that underpin international best practice in technical and vocational performance. It should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSSS).

The skill competition is intended to reflect international best practice as described by the WSSS, and to the extent that it is able to. The Standards Specification is therefore a guide to the required training and preparation for the skill competition.

In the skill competition the assessment of knowledge and understanding will take place through the assessment of performance. There will not be separate tests of knowledge and understanding.

The Standards Specification is divided into distinct sections with headings and reference numbers added.

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards Specification. The sum of all the percentage marks is 100.

The Marking Scheme and Test Project will assess only those skills that are set out in the Standards Specification. They will reflect the Standards Specification as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme and Test Project will follow the allocation of marks within the Standards Specification to the extent practically possible. A variation of five percent is allowed, provided that this does not distort the weightings assigned by the Standards Specification.

WORLDSKILLS STANDARDS SPECIFICATION

SECTION		RELATIVE IMPORTANCE (%)
1	Work organization and management	10
	The individual needs to know and understand: • The health and safety standards that apply to the RAC industry • How to recognize and respond to hazardous situations while working in the RAC industry • The safe personal protection measures while working in the RAC industry • How to apply manual handling techniques • How to respond to accidents that occur while working in the RAC industry • The procedures for electrical safety when working in the RAC industry • How to apply basic electrical safety measures in the RAC industry • The methods of working safely with heat producing equipment (heat pumps) in the RAC industry • How to safely work with refrigerant hot gas heating equipment • The methods of safely using access equipment • The methods of working safely in excavations and confined spaces • The purposes, uses, maintenance, and care of all equipment, together with their safety implications • The purposes, uses, care, and potential risks associated with materials and chemicals • The first aid requirements and actions required when both minor and major injury • The use of new technologies as a work aid • The working time associated with each activity • The parameters within which work needs to be scheduled • Principles and their application to good housekeeping within the work environment • How to apply environmental protection measures within the RAC industry • The applications of energy sources used in the RAC industry • The importance of energy conservation when commissioning RAC systems • The methods of reducing waste, and safe disposal of materials in the RAC industry	

	The individual shall be able to: • Produce risk assessments and method statements • Apply the respective health and safety legislation for the RAC industry • Take responsibility for those working in the RAC industry • Identify hazards and dangers to the workforce and members of public where RAC work is carried out • Identify and implement methods to control common hazardous substances and prevent accidents or dangerous situations occurring in the RAC industry • Plan and perform safe manual handling of heavy and bulky items including mechanical lifting aids • Prepare and maintain a safe and tidy work area at all times • Select and use appropriate personal protective equipment in all RAC activities • Select and use appropriate hand tools to complete RAC tasks safely and efficiently • Apply first aid procedures for dealing with minor and major injuries in the RAC industry record near misses and accidents at work • Safely use access equipment such as step ladders, extension ladders, and mobile towers • Identify common electrical hazards encountered during RAC activities • Demonstrate safe working practice for working with electrically powered tools • Identify how bottled gases and equipment should be transported in the RAC industry • Identify types of energy sources and uses in RAC • Identify and apply basic operating principles • Plan work within time limits to maximize work efficiency and minimize disruption • Restore the work area to an appropriate condition	
2	Communication and interpersonal skills	5
	The individual needs to know and understand: • The identities and roles of the members of the construction team and the building services industry • How to apply information sources • How to communicate the technical language associated with the skill with others in the building services industry • The dynamics of working in a team and collaboration with other related skill groups and teams to achieve task completion • The working requirements of other trades either operating in the immediate area or affected by the installation works • The range and purposes of documentation, including text, graphical, paper based, and electronic • The standards required for routine and exceptional reporting in oral, handwritten and electronic form • The nature of the reports provided by measuring equipment, together with their interpretation • The required standards for health, safety, and environment, customer service and care	

	The individual shall be able to: • Read, interpret and extract technical data and instructions from manuals and other documentation • Communicate in the workshop by oral, written, and electronic means using standard formats with clarity, effectiveness, and efficiency • Use a standard range of communications technology • Respond to legislative requirements, customers' needs face to face and indirectly • Use search methods to obtain specific and non-specific information, specifications, and guidance	
3	Design refrigeration and air conditioning systems	15
	The individual needs to know and understand: • The standard units of measurement used in the RAC industry • The detailed properties of used materials and fluids in the RAC industry • Relevant Directives applicable to RAC industry • The relationship and interactions of energy, heat, and power • Principles of force and pressure and their application to RAC industry • Principles of electricity and control circuits as related to RAC industry • The detailed properties of fluids used in RAC industry • The refrigeration and heat pump cycle • Condensate drainage and secondary refrigerant circuits • The information requirements for the design of a refrigeration or air conditioning system • The principles and conventions used in specifications and drawings • The range of specifications and drawings in use, and their purposes • The uses and limitations of the generally available drawing tools • The types and use of electrical cables and devices for different applications	

	The individual shall be able to: • Appraise the purposes of the required systems • Appraise the feasibility of locating the system within designated areas • Calculate relative density of refrigerants to air and water • Apply specialist knowledge of the principal applications and detailed properties of solid materials • Apply the principal applications and basic properties of fluids used in the RAC industry • Use the terminology associated with latent, sensible heat and fluid change of state • Carry out simple heat energy and power, force, and pressure calculations • Carry out simple electrical calculations i.e. ohms law, power consumption, voltage, current, and resistance circuits • Design an efficient refrigeration system that includes a range of heat exchangers and refrigerant types; HFC, HC and those with low or zero ODP and GWP • Choose components and joining methods that ensure leak-tight installation • Design an air conditioning system that would serve a comfort cooling application and also a full building application • Produce simple drawings and specifications, using standard conventions and symbols • Estimate the cost/budget requirement for equipment and materials • Select the required equipment and materials according to given criteria, including price and environmental considerations • Check the price and either order the equipment and materials or amend the design of the system to maintain the budget	
4	Installation and maintenance of refrigeration and air conditioning	30
	The individual needs to know and understand: • Specific health and safety requirements that apply to fitting and fixing, servicing, maintaining, and decommissioning RAC systems • The working principles and layouts of RAC and heat pump systems • The procedure for fitting, fixing and testing materials, equipment, and components in RAC systems • The service and maintenance procedures for RAC systems, equipment, and components	

	The individual shall be able to: • Interpret diagrams, plans, and specifications for piping and electricity routes • Work safely with hot gas heating equipment in the RAC industry • Prepare and, if need be, improve the area and surfaces which the installation depends upon • Itemize the required tools, components, and materials required for installation • Take and transfer measurements and angles from given drawings to surfaces and piping materials • Identify, check, and use various types of gases and equipment used for joining materials in the RAC industry • Safely drain oil and recover refrigerant • Join similar and dissimilar materials commonly found in refrigeration and air conditioning systems using a range of permanent and accessible jointing methods (brazing) • Fabricate and install mechanical materials and components according to drawings and specifications • Install electrical materials components and control devices according to drawings and specifications • Install ancillary components and systems found in refrigeration and air conditioning systems such as condensate drainage, and leak detection systems • Use tools and equipment to apply pressure to test the strength of a refrigeration system or any part of it (see e.g. EN 378:2015) • Use tools and equipment to apply pressure to test the tightness of a refrigeration system or any part of it (see e.g. EN378:2015) • Use tools and equipment to evacuate moisture and non-condensable gases from inside a refrigeration system, and ensuring that the system is dry and free of leakage	
5	Commission refrigeration and air conditioning systems	20
	The individual needs to know and understand: • How to interpret the design parameters of the given systems • Safety standards relating to the handling and application of refrigerants • Safe procedures for applying electrical supply to RAC systems • How to set up safety controls and devices to satisfy design requirements • How to ensure the integrity of RAC systems • How to ensure efficient operation of a system	

	The individual shall be able to: • Charge the system with the correct type and quantity of refrigerant for efficient operation without leaking refrigerant to the environment • Examine the system for leakage after commissioning, using direct or indirect measuring methods (see EG 1516/2007) • Assess the refrigeration system for correct operation • Assess the air conditioning system for correct operation • Assess any secondary refrigerant or cooling system for correct operation • Assess the refrigeration or air conditioning system electrical installation for correct operation • Adjust refrigerant controls and flow devices for optimal system performance • Adjust electrical and electronic controls for optimal system performance • Balance the air distribution systems • Measure and record the RAC system operating parameters • Ensure the availability of essential client documentation • Provide training for the client operators • Demonstrate the safe functioning and care of the system to the client • Hand over the system to the client, while responding to all relevant queries	
6	Fault finding refrigeration and air conditioning systems	20
	The individual needs to know and understand: • The electrical standards that apply to the RAC industry • The inspection and testing requirements of electrically operated RAC services and components • The procedures for safely diagnosing and rectifying faults in electrically operated RAC services and components • The layout and features of electrical circuits in RAC systems • The procedure for safe isolation of the specific systems • The procedure for carrying out a risk assessment prior to investigating RAC systems • The importance of the original design and operational parameters • The impact of system isolation on client operations	

	The individual shall be able to: • Inspect and test electrically operated RAC system components • Safely diagnose and rectify faults in electrically operated RAC services and components • Prepare and safeguard the area of work and its surroundings • Carry out safe isolation of electrical systems • Assess the refrigerant system for integrity and correct operation • Replace faulty refrigerant system components • Evaluate and test electrical wiring integrity prior to energizing • Assess the electrical installation for correct operation • Examine the whole system for leakage using direct and indirect methods, knowing the parts most likely to leak • Reclaim HFC and HFO refrigerant from systems without leakage to the environment • Safely purge natural refrigerants, like Ammonia or Carbon Dioxide • Drain and refill compressor lubricant • Restore the work area and its surroundings to its prior state • Explain, advise, and report on findings, actions, and matters requiring further attention	
	Total	100