

## 38 Refrigeration and Air Con

### WorldSkills Standards Spec

Section	WSSS Marks
1	Work organization and management
2	Communication and interpersonal skills
3	Design refrigeration and air conditioning systems
4	Installation and maintenance of refrigeration and air conditioning
5	Commission refrigeration and air conditioning systems
6	Fault finding refrigeration and air conditioning systems

### Criteria

ID	Name
A	Component Fabrication
B	Component and System Installation
C	Electrical Installation

D	Commissioning and Adjustment
E	Electrical Fault Find and Repair
F	Refrigeration Fault Find and Repair
G	Refrigerant Recovery and Control
H	Work Practices and Safety
I	

Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
A1	Module A - Ice Tank Coil Fabrication	1	M M M M M M M M M M M M M J	Dimension A Dimension B Dimension C1 Dimension C2 Dimension D Dimension E1 Dimension E2 U-bend diameter U-bend arc Right angle bends Tube straightness Pipe clamps Dry Nitrogen Cross tube brazed joints	0 1 2 3
			J	U-bends	

					0
					1
					2
					3
			J	Right angle bends	
					0
					1
					2
					3
			J	Overall coil	
					0
					1
					2
					3
A2	Module A - Heat Recovery Coil Fabrication	1			
			M	Dimension A	
			M	Dimension B	
			M	Dimension C	
			M	Dimension D	
			M	Dimension E	
			M	Dimension F	
			M	Dimension G	
			M	U-bend diameter	
			M	U-bend arc	
			M	Right angle bends	
			M	Tube straightness	
			M	Dry Nitrogen	
			J	Support tube brazed joints	
					0
					1
					2
					3
			J	U-bends	
					0
					1
					2
					3
			J	Right angle bends	
					0

A3	Module A - Work organisation and management	1	J	Overall coil	1 2 3
			M	Fabrication time	0
			M	Fabrication completion	1
			M	Efficient use of material - sustainability	2 3
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
B1	Module B - Major Component installation	1	M	Compressor installation	
			M	Air cooled condenser installation	
			M	Liquid receiver installation	
			M	Suction accumulator installation	
			M	Electrical control box installation	
			M	Pressure control installation	
B2	Module B - Refrigerant Controls Installation	3	M	Thermostatic expansion valve installation	
			M	Hot gas bypass valve	
			M	Crankcase pressure regulator	
			M	Solenoid valves	
			M	Ball valves	
			M	Check valve	
			M	Pressure relief valve	
			M	Liquid line filter dryer	
			M	Sight glass	
			M	Pressure controls	
			M	Pressure gauges and their hand valves	
B3	Module B - Low Pressure Vapour Lines	3			

B4	Module B - High Pressure Liquid Line	3	M	Horizontal and vertical pipework	0 1 2 3  0 1 2 3  0 1 2 3  0 1 2 3  0 1 2 3  0 1 2 3
			M	Pipework bends	
			M	Pipework installation	
			M	Pipework fastenings	
			M	Pipework brazing procedure	
			M	Pipework insulation	
			J	Brazed joint #1 (copper to copper)	
			J	Brazed joint on compressor's suction service valve	
			J	Right angle bends	
			M	Horizontal and vertical pipework	
			M	Pipework bends	
			M	Pipework layout	
			M	Pipework installation	
			M	Pipework fastenings	
			M	Pipework brazing procedure	
			J	Brazed joint #2 is acceptable (copper to copper)	
			J	Brazed joint on liquid receiver inlet	
			J	Right angle bends	

					0
					1
					2
					3
B5	Module B - High Pressure Discharge Line	3	M	Horizontal and vertical pipework	
			M	Pipework bends	
			M	Pipework installation	
			M	Pipework fastenings	
			M	Pipework brazing procedure	
			J	Brazed joint #3 is acceptable (copper to copper)	
					0
					1
					2
					3
			J	Brazed pipe joint on Pressure relief valve brass union	
					0
					1
					2
					3
			J	Right angle bends	
					0
					1
					2
					3
B6	Module B - Pressure Test	3	M	Test pressure	
			M	System valves	
			M	Gauges fitted	
			M	Dry Nitrogen	
			M	Leak test	
			M	First leak test	
			M	Final leak test	
			M	Pressure release	
B7	Module B - Evacuation	3	M	System valves	
			M	Vacuum pump	
			M	Vacuum gauge	
			M	Vacuum pressure reached	

			M M	Vacuum holding pressure Final vacuum pressures	
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
C1	Module B - Connect the Electrical Circuit	4	M M M M M M M M M M M M M M M	All electrical wiring Electrical supply plug Control board electrical supply Compressor wiring Condenser fan motor Solenoid valve - normally open Solenoid valve - normally closed Dual pressure control High pressure control Cable duct (channel) Flexible cables secured Flexible cable condition Flexible cable protection Cable and duct locations	
C2	Module B - Connect the Electronic Controls (The	4	M M M M	Ice temperature probe wiring Ice temperature probe installation Heat recovery temperature probe wiring Heat recovery temperature probe installation	
C3	Module B - Electrical Testing	4	M M M M M M M M M M	Supply voltage to earth Supply voltage to neutral Earth continuity to control board Earth continuity to compressor, fan motor and solenoid valves Supply continuity to control board Earth leakage Short circuits Electrical testing faults Energising circuit	

			M M	Circuit's first operation Circuit's final operation	
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
D1	Module B - Charge with Refrigerant	4	M M M M M M M M M M	Refrigerant service manifold Refrigeration system's valves Liquid refrigerant Adding liquid refrigerant Liquid refrigerant quantity Adding vapour refrigerant Final refrigerant quantity Service gauge removal Leak test	
D2	Module B - Commissioning Report	4	M M	Ambient temperature Ice tank temperature Heat recovery water tank temperature Refrigerant type Refrigerant charge Suction pressure Evaporation temperature Discharge pressure Condensing temperature Liquid line subcooling Thermostatic expansion valve superheat Total suction superheat Hot gas by-pass valve setting Compressor operating current Ice tank thermostat Heat recovery thermostat Dual pressure control's LP settings Dual pressure control's HP settings High pressure control's settings	



D3	Module B - Commissioning - Complete the Insta	4	M M M M	Additional materials Component covers Damage to equipment System operational	
D4	Module E - Commissioning Report	3	M M M M M M M M	Ambient dry bulb temperature Return air dry bulb temperature Supply air dry bulb temperature Indoor fan speed and mode of operation Refrigerant type and charge Suction gauge pressure Total suction superheat Outdoor unit's current draw	
D5	Module E - Commissioning - Complete the Insta	3	M M M M	Project completed Unit covers Damage to equipment System operation	
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
E1	Module C - Electrical Fault Finding	2	M M M M M M M M M M M M	Supply voltage to earth Supply voltage to neutral Earth continuity to outdoor unit's metal frame Active and Neutral continuity to the outdoor unit Earth continuity to indoor unit's metal frame Earth continuity to the compressor Active earth leakage Neutral earth leakage Unit electrical fault Compressor winding resistance testing Compressor winding insulation testing Compressor electrical fault	

			M M M M M M	Compressor reconnection Unit operation Unit's electrical fault found with in 60 minutes Unit's electrical fault found with in 45 minutes Unit's electrical fault found with in 30 minutes Units returned to original condition	
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
F1	Module D - Refrigeration Fault Finding	2	M M M M M M M M M M M M M M M	Ambient dry bulb temperature Return air dry bulb temperature Supply air dry bulb temperature Indoor fan speed and mode of operation Refrigerant type Suction pressure Saturated suction temperature Discharge pressure Total suction superheat Compressor current draw Unit's refrigeration fault found in 60 minutes or less Unit's refrigeration fault found in 45 minutes or less Unit's refrigeration found in 30 minutes or less Units returned to original condition	
F2	Module E - Refrigeration Fault Repair	3	M	Refrigeration Fault Repair	
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
G1	Module E - Reclaim Refrigerant	3	M	Electrical supply isolation	

G2	Module E - Pressure Test	3	M	Manifold gauge fitting	
			M	Refrigerant cylinder selection	
			M	Refrigerant cylinder weight	
			M	Recovery system connections	
			M	Refrigerant recovery	
			M	Refrigerant leak test	
			M	System pressure	
			M	Disconnection of recovery equipment	
			M	Recovered refrigerant quantity	
			M	Test pressure	
G3	Module E - Evacuation	3	M	System valves	
			M	Gauges fitted	
			M	Dry Nitrogen	
			M	Leak test	
			M	First leak test	
			M	Final leak test	
			M	Pressure release	
			M	System valves	
G4	Module E - Charge with Refrigerant	3	M	Vacuum pump	
			M	Vacuum gauge	
			M	Vacuum pressure reached	
			M	Vacuum holding pressure	
			M	Final vacuum pressures	
			M	Refrigerant service manifold	
			M	Refrigeration system's valves	
			M	Liquid refrigerant	
			M	Adding liquid refrigerant	
			M	Liquid refrigerant quantity	
			M	Service gauge removal	
			M	Leak test	

Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
H1	Module A - Work Practices and Safety	1	M	Protective gloves	
			M	Protective eye wear	
			M	Tools and safe work practices	
			M	Brazing torches and regulators	
H2	Module B - Work Practices and Safety	4	M	Protective gloves	
			M	Protective eye wear	
			M	Tools and safe work practices	
			M	Brazing torches and regulators	
H3	Module C - Work Practices and Safety	2	M	Protective gloves	
			M	Protective eye wear	
			M	Tool and safe work practices	
			M	Tool and equipment safety	
H4	Module D - Work Practices and Safety	2	M	Protective gloves	
			M	Protective eye wear	
			M	Tool and safe work practices	
			M	Tool and equipment safety	
H5	Module E - Work Practices and Safety	3	M	Protective gloves	
			M	Protective eye wear	
			M	Tool and safe work practices	
			M	Tool and equipment safety	
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score



# Conditioning

Classification			
	WSSS Marks	Aspect Marks	Variation
	10.00	9.90	0.10
	5.00	5.75	0.75
	15.00	15.00	0.00
	30.00	29.55	0.45
	20.00	20.00	0.00
	20.00	19.80	0.20
Total Variation			1.50

	Mark
	12.50
	20.60
	14.10

	17.10
	10.50
	9.80
	8.50
	6.90

Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Does it meet the drawing specification?	240mm +/- 2mm	2		0.40
Does it meet the drawing specification?	352mm +/- 2mm	2		0.25
Does it meet the drawing specification?	40mm +/- 2mm	2		0.35
Does it meet the drawing specification?	40mm +/- 2mm	4		0.25
Does it meet the drawing specification?	200mm +/- 2mm	2		0.25
Does it meet the drawing specification?	50mm +/- 2mm	4		0.25
Does it meet the drawing specification?	50mm +/- 2mm	4		0.25
Are they the correct diameter?	88mm +/-2mm	4		0.25
Are the bent tubes parallel?	Tubes parallel +/- 2	4		0.30
Are they at correct angle?	90 Deg +/- 2 Deg	4		0.30
Are the required straight tubes straight when put against a	Straight +/- 2mm o	4		0.30
Are they securely fastened to the coil?	Yes	4		0.30
Was Dry Nitrogen correctly used during brazing of the sup	Yes	4		0.40
		3		0.30
Performance is below industry standard:- Dry nitrogen not				
Performance meets industry standards – Dry nitrogen use				
Performance meets industry standards and surpasses tha				
Excellent or outstanding performance relative to industry e				
		4		0.25

Criterion A      Total Mark      12.50

Performance below industry standards - Large kinks, grooves				
Performance meets industry standards - Small kinks, grooves				
Performance meets industry standards and surpasses that of industry				
Excellent or outstanding performance relative to industry				
		4		0.25
Performance below industry standards - Large kinks, grooves				
Performance meets industry standards - Small kinks, grooves				
Performance meets industry standards and surpasses that of industry				
Excellent or outstanding performance relative to industry				
		4		0.25
Performance below industry standards - Coil not complete				
Performance meets industry standards - Coil complete, but				
Performance meets industry standards and surpasses that of industry				
Excellent or outstanding performance relative to industry				
Does it meet the drawing specification?	250mm +/- 2mm	2		0.40
Does it meet the drawing specification?	352mm +/- 2mm	2		0.40
Does it meet the drawing specification?	40mm +/- 2mm	2		0.40
Does it meet the drawing specification?	300mm +/- 2mm	2		0.40
Does it meet the drawing specification?	88mm +/- 2mm	4		0.40
Does it meet the drawing specification?	90mm +/- 2mm	2		0.60
Does it meet the drawing specification?	175mm +/- 2mm	4		0.30
Are they the correct diameter?	88mm +/-2mm	4		0.40
Are the bent tubes parallel?	Tubes parallel +/- 2	4		0.40
Are they at correct angle?	90 Deg +/- 2 Deg	4		0.40
Are the required straight tubes straight when put against a	Straight +/- 2mm or	4		0.40
Was Dry Nitrogen correctly used during brazing of the supply	Yes	4		0.40
		3		0.30
Performance is below industry standard:- Dry nitrogen not				
Performance meets industry standards – Dry nitrogen used				
Performance meets industry standards and surpasses that of industry				
Excellent or outstanding performance relative to industry				
		4		0.40
Performance below industry standards - Large kinks, grooves				
Performance meets industry standards - Small kinks, grooves				
Performance meets industry standards and surpasses that of industry				
Excellent or outstanding performance relative to industry				
		4		0.40
Performance below industry standards - Large kinks, grooves				



Performance meets industry standards - Small kinks, good				
Performance meets industry standards and surpasses the				
Excellent or outstanding performance relative to industry e		4		0.40
Performance below industry standards - Coil not complete				
Performance meets industry standards - Coil complete, bu				
Performance meets industry standards and surpasses the				
Excellent or outstanding performance relative to industry e				
Were both coils completed in 150 minutes?	Yes/No	1		0.40
Were both coils completed in 180 minutes?	Yes/No	1		0.40
Was NO additional copper tube given to the competitor?	Yes/No	1		0.40
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Is it installed in specified location using mounting kit and s	Refer drawing 38.0	4		0.20
Is it installed in specified location and securely fixed?	Refer drawing 38.0	4		0.20
Is it installed in specified location and securely fixed?	Refer drawing 38.0	4		0.20
Is it installed in specified location and securely fixed?	Refer drawing 38.0	4		0.20
Is it installed in specified location and securely fixed?	Refer drawing 38.0	4		0.20
Are they installed in specified location, level and securely f	Refer drawing 38.0	4		0.20
Is it installed in the correct location in system, with correct	Refer drawing 38.0	3		0.20
Is it installed in the correct location in system, with correct	Refer drawing 38.0	3		0.20
Is it installed in the correct location in system, with correct	Refer drawing 38.0	3		0.20
Are they installed in the correct location in system, with co	Refer drawing 38.0	3		0.20
Are they installed in the correct location in system, with co	Are they installed in	3		0.20
Is it installed in the correct location in system, with correct	Refer drawing 38.0	3		0.20
Is it installed in the correct location in system, with correct	Refer drawing 38.0	3		0.20
Is it installed in the correct location in system, with correct	Refer drawing 38.0	3		0.20
Is it installed in the correct location in system, with correct	Refer drawing 38.0	3		0.20
Are the pressure controls piped as per specifications?	Refer drawing 38.0	3		0.20
Are they installed in the correct location, secure and with d	Refer drawing 38.0	3		0.20

Criterion B      Total Mark      20.60

Are all the pipes installed in vertical and horizontal planes	Within deviation line	3	0.40
Are all the bends an appropriate radius and angle with no	Yes/No	3	0.40
Is the pipework installed so that it does not rub on any con	Yes/No	3	0.40
Is the pipework securely fastened using provided pipe clamps	Yes/No	4	0.40
Was dry Nitrogen used correctly during all pipework brazing	Yes/No	4	0.50
Is all of the relevant pipework insulated appropriately?	Yes/No	4	0.40
		3	0.30
Performance below industry standards - Joint leaks under			
Performance meets industry standards – Does not leak, d			
Performance meets industry standards and surpasses tha			
Excellent or outstanding performance relative to industry e		3	0.30
Performance below industry standards - Joint leaks under			
Performance meets industry standards – Does not leak, d			
Performance meets industry standards and surpasses tha			
Excellent or outstanding performance relative to industry e		4	0.40
Performance below industry standards - Large kinks, groo			
Performance meets industry standards - Small kinks, groo			
Performance meets industry standards and surpasses tha			
Excellent or outstanding performance relative to industry e			
Are all the pipes installed in vertical and horizontal planes	Within deviation line	3	0.40
Are all the bends an appropriate radius and angle with no	Yes/No	3	0.30
Are the pipes set out so that they don't cross each other?	Yes/No	3	0.30
Is the pipework installed so that it does not rub on any con	Yes/No	3	0.30
Is the pipework securely fastened using provided pipe clamps	Yes/No	4	0.30
Was dry Nitrogen used correctly during all pipework brazing	Yes/No	4	0.50
		3	0.30
Performance below industry standards - Joint leaks under			
Performance meets industry standards – Does not leak, d			
Performance meets industry standards and surpasses tha			
Excellent or outstanding performance relative to industry e		3	0.30
Performance below industry standards - Joint leaks under			
Performance meets industry standards – Does not leak, d			
Performance meets industry standards and surpasses tha			
Excellent or outstanding performance relative to industry e		4	0.40

Performance below industry standards - Large kinks, grooves				
Performance meets industry standards - Small kinks, grooves				
Performance meets industry standards and surpasses that of industry				
Excellent or outstanding performance relative to industry				
Are all the pipes installed in vertical and horizontal planes	Within deviation limits	3		0.40
Are all the bends an appropriate radius and angle with no kinks	Yes/No	3		0.40
Is the pipework installed so that it does not rub on any components	Yes/No	3		0.40
Is the pipework securely fastened using provided pipe clamps	Yes/No	4		0.40
Was dry Nitrogen used correctly during all pipework brazing	Yes/No	4		0.50
		3		0.30
Performance below industry standards - Joint leaks under test pressure				
Performance meets industry standards – Does not leak, dry				
Performance meets industry standards and surpasses that of industry				
Excellent or outstanding performance relative to industry				
		3		0.30
Performance below industry standards - Joint leaks under test pressure				
Performance meets industry standards – Does not leak, dry				
Performance meets industry standards and surpasses that of industry				
Excellent or outstanding performance relative to industry				
		4		0.40
Performance below industry standards - Large kinks, grooves				
Performance meets industry standards - Small kinks, grooves				
Performance meets industry standards and surpasses that of industry				
Excellent or outstanding performance relative to industry				
Did the test pressure during all attempts meet required standards	Refer standards set	4		0.50
Were all the appropriate valves opened to ensure pressure	Check all valves in	4		0.30
Were the gauges and gauge lines correctly fitted to the system	Refer standards set	4		0.30
Was dry Nitrogen safely added to the system to the required level	Refer standards set	4		0.30
Was the system leak tested while under pressure?	Soapy water solution	4		0.50
Were no leaks detected on FIRST pressure test attempt?	Test project instructions	4		1.00
Did the system hold the test pressure for required standing time	Refer standards set	4		1.00
Was the dry Nitrogen safely released from system at completion	Refer standards set	4		0.30
Were the appropriate valves opened to ensure evacuation		4		0.30
Was the vacuum pump connected to the system correctly	Yes/No	4		0.30
Was the vacuum gauge installed so it could be isolated from system	Yes/No	4		0.30
Did the system reach the required vacuum level on the first attempt	At least 1000 microns	4		0.40

Did the vacuum hold when isolated from the vacuum pump?	Refer standards section 38.02	4		0.50
Did the system reach and hold the required vacuum on the vacuum pump?	Refer standards section 38.02	4		1.50
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Is all wiring installed and connected per supplied wiring diagram?	Refer 38.02, 38.03	2		0.50
Is the electrical supply wired correctly on supplied plug?	Yes/no	4		0.50
Is the 220V supply wired to correct terminals and correctly terminated?	Refer 38.02, 38.03	4		0.50
Is the compressor wired to correct terminals in control board?	Refer 38.02, 38.03	4		0.50
Is the wiring connected and terminated correctly at the motor terminals?	Refer 38.02, 38.03	4		0.50
Is the wiring connected and terminated correctly at the valve terminals?	Refer 38.02, 38.03	4		0.50
Is the wiring connected and terminated correctly at the valve terminals?	Refer 38.02, 38.03	4		0.50
Is the wiring connected and terminated correctly at the DPST terminals?	Refer 38.02, 38.03	4		0.50
Is the wiring connected and terminated correctly at the HP terminals?	Refer 38.02, 38.03	4		0.50
Is it vertically and horizontally levelled and securely fastened?	Within deviation limits	3		0.50
Are all flexible cables not in duct saddled (fixed) and secured?	Secured at least every 1m	4		0.30
Are the installed cables not be crushed or damaged by pipes?	Yes/No	3		0.30
Are all installed cables and wires adequately protected?	Conduit or double cable	3		0.30
Are all cables and duct installed within the boundaries of the unit?	Front or rear of frame	3		0.50
Is the temperature probe wired and terminated correctly?	Refer 38.02, 38.03	4		0.20
Is the temperature probe securely installed in suitable location?	Refer 38.02, 38.03	3		0.20
Is the temperature probe wired and terminated correctly?	Refer 38.02, 38.03	4		0.20
Is the temperature probe securely installed in suitable location?	Refer 38.02, 38.03	3		0.20
Was the supply voltage measured and confirmed correct?	220v a.c +/- 10v	5		0.20
Was the supply voltage measured and confirmed correct?	220v a.c +/- 10v	5		0.20
Was the earth continuity of the power supply to the control board tested?	Less than 1ohm	5		0.20
Was the earth continuity of the power supply to the compressor tested?	Less than 1ohm	5		0.20
Was the earth continuity of the power supply to the compressor tested?	Less than 1ohm	5		0.50
Was the installation tested for earth leakage using a Megohmmeter?	Infinity	6		0.60
Was the installation tested for shorts between active and neutral?	Greater than 100ohm	6		0.60
Were No electrical faults found during circuit testing?	Yes/No	6		1.20
Was the circuit energised safely the first time without blowing the fuse?	Yes/No	5		1.20

Criterion C      Total Mark      14.10

Did the circuit work safely and correctly the first time it was	Refer 38.02, 38.03	5		1.00
Did the circuit work safely and correctly after any necessary	Refer 38.02, 38.03	5		1.00
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Was the refrigerant service manifold correctly connected to	Yes/No	5		0.40
Were all the refrigeration system's valves in correct position	Yes/No	5		0.40
Was liquid refrigerant added to the liquid line only (not suction)	Yes/No	5		0.50
Was liquid refrigerant added to the system using correct method	R134a liquid charge	5		0.50
Was the initial quantity of refrigerant added to the system	1/5kg +/- 100g	5		0.50
Was vapour refrigerant added to the system using correct method	R134a vapour charge	5		0.50
Was adequate refrigerant added to the system to ensure it	Yes/No	5		1.00
Were the service gauges removed from the system and stored	Yes/No	5		0.30
Was an electronic leak test carried out during or after the	Refer standards section	5		0.50
Is the ambient dry bulb temperature measured and recorded		5		0.20
Is the Ice tank temperature measured and recorded correctly	Less than -5 DegC	5		0.20
Is the Heat recovery water tank temperature measured and recorded	35 DegC to 45 DegC	5		0.20
Is the refrigerant type recorded correctly on the commissioning	R134a	5		0.20
Is the refrigerant charge measured and recorded correctly	2.5-3.5 kg	5		0.50
Is the suction pressure measured and recorded correctly	5-20 psi / 35-140kPa	5		0.20
Is the evaporation temperature determined and recorded correctly	Based on suction pressure	3		0.30
Is the discharge pressure measured and recorded correctly	111 - 152psi / 770	5		0.20
Is the condensing temperature determined and recorded correctly	Based on discharge pressure	3		0.30
Is the liquid line subcooling determined and recorded correctly	Condensing temperature	3		0.30
Is the Thermostatic expansion valve superheat determined	5k +/- 2K	3		0.30
Is the total suction superheat determined and recorded correctly	7k +/- 2K	3		0.30
Is the Hot gas by-pass valve correctly set and recorded on	9 psi / 60kPa +/- 10	5		0.50
Is the Compressor operating current measured and recorded	Max 10 amps	5		0.50
Was the ice tank thermostat was correctly programmed?	Cut out -17 DegC, Cut	5		0.50
Was the heat recovery thermostat was correctly programmed	Cut in 35 DegC, Cut	5		0.50
Are the dual pressure control's LP cut in and cut-out set and	Cut out 4.6psi/ 46k	5		0.50
Is the dual pressure control's HP cut out and cut in set and	Cut out 200psi/ 138	5		0.50
Are the high pressure control's cut in and cut out set and	Cut out 114psi / 78	5		0.50

Criterion D      Total Mark      17.10

Was the project completed without any additional material?	Yes/No	1		0.40
Were all of the components covers installed securely?	Yes/No	1		0.40
Were no burn marks or other damage made to any of the components?	Yes/No	1		0.40
Was the system left operating at completion of module? If Yes = 0.80	Yes/No	2		0.80
Was the ambient dry bulb temperature measured and recorded correctly?	Yes/No	5		0.20
Was the return air dry bulb temperature measured and recorded correctly?	Yes/No	5		0.20
Was the supply air dry bulb temperature measured and recorded correctly?	Yes/No	5		0.20
Was the specified indoor fan speed and mode of operation achieved?	High fan speed and	5		0.20
Was the correct refrigerant type and refrigerant charge added?	R410a and refrigerant	3		0.50
Was the suction pressure measured and recorded correctly?	Yes/No	5		0.20
Was the total suction superheat determined and recorded correctly?	Yes/No	3		0.40
Was the outdoor units current draw measured and recorded correctly?	Yes/No	5		0.30
Was the module completed without requiring additional materials?	Yes/No	1		0.20
Were all of the units covers installed securely?	Yes/No	1		0.20
Was there no damage made to the equipment? If Yes = 0.20	Yes/No	1		0.20
Was the system left in operating correctly and effectively? If Yes = 1.00	Yes/No	2		1.00
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Was the supply voltage measured and confirmed correct?	220v a.c +/- 10v	5		0.50
Was the supply voltage measured and confirmed correct?	220v a.c +/- 10v	6		0.50
Was the earth continuity of the power supply to the outdoor unit tested?	Less than 1 ohm	6		0.50
Was the Active and Neutral continuity to the outdoor unit tested?	Less than 1 ohm	6		0.50
Was the earth continuity of the power supply to the indoor unit tested?	Less than 1 ohm	6		0.50
Was the earth continuity of the power supply to the compressor tested?	Less than 1 ohm	6		0.50
Was the active side of the installation tested for earth leakage?	Infinity	6		0.50
Was the neutral side of the installation tested for earth leakage?	Infinity	6		0.50
Was no electrical fault found during this circuit testing? If Yes = 0.50	Yes/No	6		0.50
Were the resistances of the compressor's winding measured correctly?	3.0 ohm +/- 0.2 ohm	6		0.50
Was the insulation resistance of the compressor's winding measured correctly?	At least 1 megohm	6		0.50
Was the compressor electrically safe to operate?	Yes/No	6		0.50

Criterion E      Total Mark      10.50

Was the electrical wiring corrected re-connect to the comp	Yes/No	6		0.50
Was the operation of the 3 components recorded correctly	Yes/No	6		0.50
Was the unit's electrical fault correctly identified and recor	Yes/No	6		1.00
Was the unit's electrical fault correctly identified and recor	Yes/No	6		1.00
Was the unit's electrical fault correctly identified and recor	Yes/No	6		1.00
Were the units returned to their original condition?	Yes/No	3		0.50

Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
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Criterion F      Total Mark      9.80

Was the ambient dry bulb temperature measured and rec	Yes/No	5		0.50
Was the return air dry bulb temperature measured and rec	Yes/No	5		0.50
Was the supply air dry bulb temperature measured and re	Yes/No	5		0.50
Was the specified indoor fan speed and mode of operation	High fan speed and	5		0.50
Was the correct refrigerant type identified and recorded co	R410a	3		0.50
Was the suction pressure measured and recorded correct	Yes/No	6		0.50
Was the saturated suction temperature determined and re	Yes/No	6		0.50
Was the discharge pressure measured and recorded corr	Yes/No	6		0.50
Was the total suction superheat determined and recorded	Yes/No	3		0.80
Was the compressor current draw measured and recorde	Yes/No	6		0.50
Was the unit's refrigeration fault correctly identified and re	Yes/No	6		1.00
Was the unit's refrigeration fault correctly identified and re	Yes/No	6		1.00
Was the unit's electrical fault correctly identified and recor	Yes/No	6		1.00
Were the units returned to their original condition?	Yes/No	3		0.50
Was the correct fault repaired?	Yes/No	6		1.00

Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
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Criterion G      Total Mark      8.50

Was the power supply to air conditioner isolated before re	Yes/No	6		0.15
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Were the service manifold gauge lines fitted to the system	Yes/No	6	0.15
Was the correct refrigerant recovery cylinder selected and	Yes/No	6	0.20
Was the refrigerant recovery cylinder weighed and recorded	Yes/No	6	0.20
Were the refrigerant recovery cylinder, machine and lines	Yes/No	6	0.20
Was the full refrigerant charge recovered from the system	Yes/No	6	0.40
Was an electronic leak detector used to check for leaks during	Yes/No	6	0.15
Was the system pressure/s at atmospheric pressure or just	Yes/No	6	0.15
Was the recovery equipment disconnected with minimal loss	Yes/No	6	0.15
Was the quantity of refrigerant recovered from the system	Yes/No	6	0.15
Did the test pressure during all attempts meet required standards	Refer standards section	4	0.15
Were all the appropriate valves opened to ensure pressure	Check all valves in	4	0.15
Were the gauges and gauge lines correctly fitted to the system	Refer standards section	4	0.15
Was dry Nitrogen safely added to the system to the required	Refer standards section	4	0.15
Was the system leak tested while under pressure?	Soapy water solution	4	0.30
Were no leaks were detected on FIRST pressure test attempt	Test project instructions	4	0.40
Did the system hold the test pressure for required standing	Refer standards section	4	1.00
Was the dry Nitrogen safely released from system at completion	Refer standards section	4	0.15
Were the appropriate valves opened to ensure evacuation	Yes/No	4	0.15
Was the vacuum pump connected to the system correctly	Yes/No	4	0.15
Was the vacuum gauge installed so it could be isolated from	Yes/No	4	0.15
Did the system reach the required vacuum level on the first	At least 1000 microns	4	0.40
Did the vacuum hold when isolated from the vacuum pump	Refer standards section	4	0.40
Did the system reach and hold the required vacuum on the	Refer standards section	4	1.00
Was the refrigerant service manifold correctly connected to	Yes/No	5	0.15
Were all the refrigeration system's valves in correct position	Yes/No	5	0.15
Was liquid refrigerant added to the liquid line only (not suction)	Yes/No	5	0.15
Was liquid refrigerant added to the system using correct method	R410a liquid charging	5	0.15
Was the correct quantity of refrigerant added to the system	?kg +/- 10g	5	1.00
Were the service gauges removed from the system and stored	Yes/No	5	0.15
Was an electronic leak test carried out after the charging completed	Refer standards section	5	0.15



Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Were Protective gloves were worn at all times when expos	Yes/No	1		0.25
Were protective eye wear was worn at all times while braz	Yes/No	1		0.25
Did the competitor always use the correct tool and safe wo	Yes/No	1		0.25
Were the competitors brazing torches and regulators are l	Yes/No	1		0.25
Were Protective gloves were worn at all times when expos	Yes/No	1		0.50
Were protective eye wear was worn at all times while braz	Yes/No	1		0.50
Did the competitor always use the correct tool and safe wo	Yes/No	1		0.50
Were the competitors brazing torches and regulators are l	Yes/No	1		0.50
Were Protective gloves were worn at all times when expos	Yes/No	1		0.50
Were protective eye wear was worn at all times while braz	Yes/No	1		0.50
Did the competitor always use the correct tool and safe wo	Yes/No	1		0.25
Were the competitors tools and equipment in a safe condi	Yes/No	1		0.25
Were Protective gloves were worn at all times when expos	Yes/No	1		0.35
Were protective eye wear was worn at all times while braz	Yes/No	1		0.35
Did the competitor always use the correct tool and safe wo	Yes/No	1		0.25
Were the competitors tools and equipment in a safe condi	Yes/No	1		0.25
Were Protective gloves were worn at all times when expos	Yes/No	1		0.35
Were protective eye wear was worn at all times while braz	Yes/No	1		0.35
Did the competitor always use the correct tool and safe wo	Yes/No	1		0.25
Were the competitors tools and equipment in a safe condi	Yes/No	1		0.25
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark

Criterion H      Total Mark      6.90

Criterion I      Total Mark      0.00

Competition	Total Mark	100.00
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