

Level 3 Refrigeration and Air Conditioning CPD Pathways (6187- 31)



Candidate performance evidence logbook

www.cityandguilds.com
February 2012
Version 1.0

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Qualification title	Number	QAN
Level 3 Certificate in Carbon Dioxide (CO ₂) Air Conditioning and Heat Pump Systems Installation and Commissioning	6187-31	600/3027/6
Level 3 Certificate in Carbon Dioxide (CO ₂) Air Conditioning and Heat Pump Systems Service and Maintenance	6187-31	600/3025/2
Level 3 Certificate in Ammonia Refrigeration Systems Installation and Commissioning	6187-31	600/3024/0
Level 3 Certificate in Ammonia Refrigeration Systems Service and Maintenance	6187-31	600/3043/4
Level 3 Certificate in Carbon Dioxide (CO ₂) Refrigeration Systems Installation and Commissioning	6187-31	600/3044/6
Level 3 Certificate in Carbon Dioxide (CO ₂) Refrigeration Systems Service and Maintenance	6187-31	600/3026/4

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Contents

1	About your candidate logbook	5
1.1	Contact details	5
1.2	Introduction to the logbook	6
2	The assessment process	7
3	Using your logbook	8
4	Qualification structures	9
5	Overall Unit Sign-off	11
Unit 314	Install and commission CO₂ air conditioning systems	12
Unit 315	Service and maintain CO₂ air conditioning systems	17
Unit 322	Install and commission ammonia refrigeration systems	21
Unit 323	Install and Commission CO₂ Refrigeration Systems	28
Unit 324	Service and maintain ammonia refrigeration systems	33
Unit 325	Service and maintain CO₂ refrigeration systems	40
	On Site Assessment Plan / Feedback	44
	On Site Observation Report	45
	Supplementary Evidence Sheet	46
	Oral Questioning Supplementary Evidence Sheet	47
	Photographic Supplementary Evidence	48
	Workplace Recorder Details	49
	Assessor Continuation Sheet	50
	Signature Sheet	51
Appendix 1	Summary of City & Guilds assessment policies	52

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1 About your candidate logbook

1.1 Contact details

Candidate name	
Candidate enrolment no	
Centre name	
Centre number	
Programme start date	
Date of registration with City & Guilds	

Keep a record of relevant contact details in the space provided below. You may find it helpful to make a note of phone numbers and e-mail addresses here.

Your Assessor(s)	
Your Internal Verifier	
Quality Assurance Contact	

1 About your candidate logbook

1.2 Introduction to the logbook

This logbook will help you complete the units in City & Guilds' **Level 3 Refrigeration and Air Conditioning CPD Pathways (6187-31)**. It contains forms you can use to record the evidence of what you have done.

About City & Guilds

City & Guilds is your awarding body for this qualification. City & Guilds is the UK's leading awarding body for vocational qualifications.

Information about City & Guilds and our qualifications is available on our website **www.cityandguilds.com**.

2 The assessment process

The following people at your centre will explain the assessment process and help you achieve your unit(s).

The assessor/tutor

The assessor/tutor is the person you will have the most contact with as you work towards your unit(s). You may have more than one assessor/tutor depending on which unit(s) you take or you may be assessed by a person who is not your tutor.

The internal verifier

The internal verifier maintains the quality of assessment within the centre.

The external verifier

The external verifier works for City & Guilds and helps to ensure that your centre meets the required standards for quality and assessment.

3 Using your logbook

Recording forms

This logbook contains all of the forms you and your assessor will need to plan, review and organise your evidence. Your assessor will be able to help you decide which forms you need to complete and help you fill them in.

Please photocopy these forms as required.

4 Qualification structures

To achieve the **Level 3 Certificate in Carbon Dioxide (CO₂) Air Conditioning and Heat Pump Systems Installation and Commissioning**, learners must achieve **14** credits from the mandatory units.

Unit accreditation number	City & Guilds unit	Unit title	Credit value
T/602/4549	312	Understand CO ₂ air conditioning and heat pump system installation and commissioning techniques	11
Y/602/6097	*314	Install and commission CO ₂ air conditioning and heat pump systems	3

This Logbook includes only those units assessed by performance in the workplace (marked with an *).

To achieve the **Level 3 Certificate in Carbon Dioxide (CO₂) Air Conditioning and Heat Pump Systems Service and Maintenance**, learners must achieve **13** credits from the mandatory units.

Unit accreditation number	City & Guilds unit	Unit title	Credit value
Y/602/4558	313	Understand CO ₂ air conditioning system service and maintenance techniques	10
R/602/4591	*315	Service and maintain CO ₂ air conditioning systems	3

This Logbook includes only those units assessed by performance in the workplace (marked with an *).

To achieve the **Level 3 Certificate in Ammonia Refrigeration Systems Installation and Commissioning**, learners must achieve **14** credits from the mandatory units.

Unit accreditation number	City & Guilds unit	Unit title	Credit value
D/502/9301	318	Understand ammonia refrigeration system installation and commissioning techniques	11
A/502/9306	*322	Install and commission ammonia refrigeration systems	3

This Logbook includes only those units assessed by performance in the workplace (marked with an *).

To achieve the **Level 3 Certificate in Carbon Dioxide (CO2) Refrigeration Systems Installation and Commissioning**, learners must achieve **14** credits from the mandatory unit.

Unit accreditation number	City & Guilds unit number	Unit title	Credit value
Y/602/4561	319	Understand CO2 refrigeration system installation and commissioning techniques	11
H/602/4594	*323	Install and commission CO2 refrigeration systems	3

This Logbook includes only those units assessed by performance in the workplace (marked with an *).

To achieve the **Level 3 Certificate in Ammonia Refrigeration Systems Service and Maintenance**, learners must achieve **13** credits from the mandatory units.

Unit accreditation number	City & Guilds unit	Unit title	Credit value
K/502/9303	320	Understand ammonia refrigeration system service and maintenance techniques	10
J/502/9308	*324	Service and maintain ammonia refrigeration systems	3

This Logbook includes only those units assessed by performance in the workplace (marked with an *).

To achieve the **Level 3 Certificate in Carbon Dioxide (CO2) Refrigeration Systems Service and Maintenance**, learners must achieve **13** credits from the mandatory units.

Unit accreditation number	City & Guilds unit number	Unit title	Credit value
H/602/4563	321	Understand CO2 refrigeration system service and maintenance techniques	10
K/602/4595	325	Service and maintain CO2 refrigeration systems	3

This Logbook includes only those units assessed by performance in the workplace (marked with an *).

5 Overall Unit Sign-off

The following units are included in the rules of combination for the **Level 3 Refrigeration and Air Conditioning CPD Pathways (6187-31)**. Learners must achieve these portfolio units to contribute towards achievement of the overall qualification.

City & Guilds unit	Unit title	Unit Achieved Yes/No	Assessor Initials	Date
314	Install and commission CO ₂ air conditioning systems			
315	Service and maintain CO ₂ air conditioning systems			
322	Install and commission ammonia refrigeration systems			
323	Install and Commission CO ₂ Refrigeration Systems			
324	Service and maintain ammonia refrigeration systems			
325	Service and maintain CO ₂ refrigeration systems			

Declaration

I confirm that the evidence supplied for the above selected unit is authentic and a true representation of my own work. The work logged is my own work carried out during my normal work duties.

The answers in the question bank are my own work and discussed with my assessor on completion. I have been observed in my workplace by my assessor on several occasions.

Candidate Name:	
Candidate Signature:	
Date:	

I confirm that this candidate has achieved all the requirements of the selected unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor Name:	
Assessor Signature:	
Date:	

IV Name:	
IV Signature:	
Date:	

Level: 3

Credit value: 3

UAN: Y/602/6097

Outcome 1	Be able to plan and prepare for the installation and commissioning of CO₂ air conditioning systems			
Criteria		Candidate initials	Assessor initials	Evidence reference
1	conduct a review of the work location to identify any factors which may impact upon the work			
2	confirm that relevant people have been provided with job information (as appropriate) and identify points within the work process when liaison with identified relevant persons may be necessary			
3	identify manufacturers' instructions, regulations and industry standards to determine installation and commissioning requirements for systems and components			
4	use manufacturer's instructions, regulations and industry standards to determine requirements for systems and components, including procedures to:			
	<ul style="list-style-type: none"> confirm that components have suitable pressure ratings for Carbon Dioxide Systems and are suitable for use 			
	<ul style="list-style-type: none"> confirm that fittings have suitable pressure ratings for Carbon Dioxide Systems and are suitable for use 			
	<ul style="list-style-type: none"> determine Strength Test Pressure(s) from the system Maximum Allowable Pressure(s) 			
	<ul style="list-style-type: none"> determine Tightness Test Pressure(s) from the system Maximum Allowable Pressure(s) 			
5	produce a risk assessment and method statement for the charging and venting of Carbon Dioxide			
6	confirm that authorisation has been provided by relevant persons prior to the completion of work activity			
7	select appropriate PPE for the completion of work activities.			

Outcome 2		Be able to carry out the installation of CO₂ air conditioning systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	identify and interpret appropriate sources of information which impact upon the installation of CO ₂ air conditioning pipework, systems and components, including:			
	<ul style="list-style-type: none"> regulatory documents 			
	<ul style="list-style-type: none"> industry codes of practice 			
	<ul style="list-style-type: none"> manufacturer's instructions 			
2	assemble and join CO ₂ air conditioning system components to meet the requirements of the installation specification			
	<ul style="list-style-type: none"> spacing intervals 			
	<ul style="list-style-type: none"> expansion and contraction methods 			
	<ul style="list-style-type: none"> insulation and vapour seals 			
3	confirm that installed system components and pipework are correctly installed in accordance with the installation specification			
4	adjust and set safety and control features as appropriate			
5	complete procedures to remove and refit components to CO ₂ air conditioning systems.			

Outcome 3		Be able to carry out the commissioning of CO₂ air conditioning systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	use manufacturer's instructions, regulations and industry standards to prepare a pre-commissioning checklist for one of the following types of system:			
	<ul style="list-style-type: none"> direct expansion 			
	<ul style="list-style-type: none"> heat pump 			
	<ul style="list-style-type: none"> trans-critical 			
	<ul style="list-style-type: none"> VRV 			
2	conduct the following checks on Carbon Dioxide equipment and systems:			
	<ul style="list-style-type: none"> visual inspection of pipework for leakage 			
	<ul style="list-style-type: none"> visual inspection of pipework for adequate support 			
	<ul style="list-style-type: none"> visual inspection of insulation and vapour seals 			
	<ul style="list-style-type: none"> visual check for high moisture levels 			

	<ul style="list-style-type: none"> • visual check of pressure relief valves and relief piping 			
3	demonstrate procedures for testing CO ₂ air conditioning systems, including:			
	<ul style="list-style-type: none"> • establishing system allowable pressure(s) 			
	<ul style="list-style-type: none"> • conducting a strength pressure test 			
	<ul style="list-style-type: none"> • conducting a tightness pressure test 			
4	demonstrate procedures for charging CO ₂ air conditioning systems, including:			
	<ul style="list-style-type: none"> • evacuating a system 			
	<ul style="list-style-type: none"> • breaking a vacuum with Carbon Dioxide vapour 			
	<ul style="list-style-type: none"> • charging a system with oil 			
5	demonstrate CO ₂ air conditioning system operation to confirm that system and equipment is functioning correctly			
	<ul style="list-style-type: none"> • charging a system with Carbon Dioxide 			
6	demonstrate procedures for adjusting system operating parameters through:			
	<ul style="list-style-type: none"> • adjusting safety and system controls 			
	<ul style="list-style-type: none"> • topping up refrigerant levels as required 			
	<ul style="list-style-type: none"> • topping up oil levels as required 			
7	demonstrate procedures for safely venting CO ₂ , including:			
	<ul style="list-style-type: none"> • safely vent CO₂, avoiding “dry ice” 			
	produce documentary records to provide system users with information necessary for continuing operation of CO ₂ air conditioning systems, including:			
	<ul style="list-style-type: none"> • record of refrigerant operating levels 			
	<ul style="list-style-type: none"> • record of oil operating levels 			
	<ul style="list-style-type: none"> • records of : <ul style="list-style-type: none"> – refrigerant quantity added 			
	<ul style="list-style-type: none"> – refrigerant quantity removed 			
	<ul style="list-style-type: none"> – oil quantity added 			
<ul style="list-style-type: none"> – oil quantity removed 				
<ul style="list-style-type: none"> • log of system in operation. 				

Outcome 4		Be able to carry out the de-commissioning of CO₂ air conditioning systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	produce appropriate risk assessments and method statements to ensure decommissioning activities can be completed safely			
2	demonstrate work sequences for permanently decommissioning:			
	• a complete CO ₂ air conditioning system			
	• part of a CO ₂ air conditioning system			
3	demonstrate how oil and refrigerant could be safely removed from a system and disposed of.			

Unit 314 Install and commission CO2 air conditioning systems

Declaration

I confirm that the evidence supplied for this unit is authentic and a true representation of my own work. The work logged is my own work carried out during my normal work duties.

The answers in the question bank are my own work and discussed with my assessor on completion. I have been observed in my workplace by my assessor on several occasions.

Candidate Name:	
Candidate Signature:	
Date:	

I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor Name:	
Assessor Signature:	
Date:	

IV Name:	
IV Signature:	
Date:	

Level: 3

Credit value: 3

UAN: R/602/4591

Outcome 1	Be able to plan and prepare for the servicing and maintenance of CO ₂ air conditioning systems			
Criteria		Candidate initials	Assessor initials	Evidence reference
1	conduct a review of the work location to identify any factors which may impact upon the work			
2	confirm that relevant people have been provided with job information (as appropriate) and identify points within the work process when liaison with identified relevant persons may be necessary			
3	identify manufacturers' instructions, regulations, industry standards and maintenance schedules to determine planned periodic maintenance schedules and servicing requirements for systems and components			
4	use manufacturers' instructions, regulations and industry standards and maintenance schedules to determine planned servicing requirements for three of the following components:			
	• compressor			
	• expansion valve			
	• gas cooler			
	• heat exchanger			
5	use manufacturers' instructions, regulations and industry standards and maintenance schedules to determine planned periodic maintenance schedules for any of the following system types:			
	• direct expansion			
	• heat pump			
	• trans-critical			
	• volatile secondary			
• VRV				
6	produce a risk assessment and method statement for the charging and venting of Carbon Dioxide			

7	confirm that authorisation has been provided by relevant persons prior to the completion of work activity			
8	select appropriate PPE for the completion of work activities.			

Outcome 2	Be able to carry out the servicing and maintenance of CO₂ air conditioning systems			
Criteria		Candidate initials	Assessor initials	Evidence reference
1	conduct the following checks on Carbon Dioxide equipment and systems:			
	• visual inspection of pipework for leakage			
	• visual inspection of pipework for adequate support			
	• visual inspection of insulation and vapour seals			
	• visual check for high moisture levels			
	• visual check of pressure relief valves and relief piping			
2	demonstrate CO ₂ air conditioning system operation to confirm that system and equipment is functioning correctly			
3	demonstrate the procedures for:			
	• safe removal of oil from a compressor			
	• completion of waste transfer paperwork for removed oil			
4	produce documentary records to provide system users with information necessary for continuing operation of CO ₂ air conditioning systems, including:			
	• record of refrigerant operating levels			
	• record of oil operating levels			
	• records of:			
	– refrigerant quantity added			
	– refrigerant quantity removed			
	– oil quantity added			
	– oil quantity removed			
	• log of system in operation.			

Outcome 3		Be able to identify and rectify faults in CO₂ air conditioning systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	demonstrate procedures for adjusting system operating parameters through:			
	<ul style="list-style-type: none"> adjusting and setting safety and system controls 			
	<ul style="list-style-type: none"> topping up refrigerant levels as required 			
	<ul style="list-style-type: none"> topping up oil levels as required safely venting CO₂, avoiding “dry ice” 			
2	apply logical fault diagnosis procedures for CO ₂ air conditioning systems			
3	complete procedures to remove and refit components in order to rectify faults in CO ₂ air conditioning systems			
4	confirm system is functioning in accordance with the performance specification after completion of repairs through completion of appropriate checks, including:			
	<ul style="list-style-type: none"> checking refrigerant charge checking oil charge. 			

Outcome 4		Be able to carry out the de-commissioning of CO₂ air conditioning systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	produce appropriate risk assessments and method statements to ensure decommissioning activities can be completed safely			
2	demonstrate work sequences for permanently decommissioning:			
	<ul style="list-style-type: none"> a complete CO₂ air conditioning system part of a CO₂ air conditioning system 			
3	demonstrate how oil and refrigerant could be safely removed from a system and disposed of.			

Unit 315 Service and maintain CO2 air conditioning systems

Declaration

I confirm that the evidence supplied for this unit is authentic and a true representation of my own work. The work logged is my own work carried out during my normal work duties.

The answers in the question bank are my own work and discussed with my assessor on completion. I have been observed in my workplace by my assessor on several occasions.

Candidate Name:	
Candidate Signature:	
Date:	

I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor Name:	
Assessor Signature:	
Date:	

IV Name:	
IV Signature:	
Date:	

Level: 3

Credit value: 3

UAN: A/502/9306

Outcome 1	Be able to plan and prepare for the installation and commissioning of ammonia refrigeration systems			
Criteria		Candidate initials	Assessor initials	Evidence reference
1	confirm that all information is available prior to planning installation or commissioning activities			
2	confirm that all tools, equipment and materials are available and fit for use prior to commencement of the work			
3	confirm that all persons relevant to the installation or commissioning activity are identified and that lines of communication are established			
4	carry out site survey to identify any variations or deviations to planned work or any structural or access issues which need to be resolved prior to work commencement			
5	identify safe storage arrangements for tools, equipment and materials prior to commencement of installation or commissioning activity			
6	plan safe access to work areas and confirm with responsible person on site			
7	ensure that all necessary risk assessment and safe working procedure development has been undertaken prior to work commencement			
8	confirm the site arrangements for:			
	• security			
	• fire precaution and control			
9	complete preparatory work as necessary in relation to location, siting and fixing of cold stores, including:			
	• insulated panels			
	• steel framework – internal or external arrangements			
	• piping			
	• jointing by brazing or flaring			
	confirming requirements for:			

	<ul style="list-style-type: none"> • cleanliness inside pipes by purging with OFN 			
	<ul style="list-style-type: none"> • insulation 			
	<ul style="list-style-type: none"> • electrical supply 			
	<ul style="list-style-type: none"> • condensate disposal 			
	<ul style="list-style-type: none"> • positioning of evaporative condensers 			
	<ul style="list-style-type: none"> • control arrangements. 			

Outcome 2		Be able to carry out the installation of ammonia refrigeration systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	identify and interpret appropriate sources of information which impact upon the installation of refrigeration pipework, systems and components, including:			
	<ul style="list-style-type: none"> • regulatory documents 			
	<ul style="list-style-type: none"> • industry codes of practice 			
	<ul style="list-style-type: none"> • manufacturer's instructions 			
2	demonstrate appropriate methods for positioning and fixing:			
	<ul style="list-style-type: none"> • cold store arrangements, including: 			
	<ul style="list-style-type: none"> – underfloor heating arrangements, to include the laying of glycol heating pipe circuit or electric heater mats, insulation floor slabs and vapour barriers 			
	<ul style="list-style-type: none"> – door furniture 			
	<ul style="list-style-type: none"> – lighting 			
	<ul style="list-style-type: none"> – condensate drains 			
	<ul style="list-style-type: none"> – pipework and pipe insulation 			
	<ul style="list-style-type: none"> – internal racking 			
	<ul style="list-style-type: none"> • pressure, temperature and flow controls 			
	<ul style="list-style-type: none"> • insulation floor slabs 			
	<ul style="list-style-type: none"> • vapour barriers 			
<ul style="list-style-type: none"> • leak detection and ventilation systems 				
3	confirm that contraction joints are fixed correctly in position within the floor slab as required			
4	erect steel frameworks required for refrigeration systems			
5	position and fix slip sheet and supervise the laying of the appropriate floor slab			
6	complete the sealing junction locations, including:			
	<ul style="list-style-type: none"> • roof and wall 			
	<ul style="list-style-type: none"> • floor and wall 			

7	complete the interconnection and fixing of electrical power and communication components			
8	confirm that installed system components and pipework are correctly installed in accordance with the installation specification			
9	confirm that the worksite has been cleared in preparation for system testing.			

Outcome 3	Be able to carry out the pre-commissioning of ammonia refrigeration systems			
Criteria		Candidate initials	Assessor initials	Evidence reference
1	revisit risk assessment and safe working procedure to confirm currency and validity prior to commencement of pre-commissioning			
2	identify placement of components to design drawings			
3	carry out the following pre-commissioning checks and tests in accordance with industry and safety requirements:			
	• preliminary checks, including:			
	– unit inspection			
	– confirmation of: plant details, unit nameplate detail and compressor details			
	• pre-start check list, consisting of:			
	– heat exchanger checks			
	– mechanical check list			
	– electrical check list			
	– user connections			
	– power supply tests			
	– crankcase heaters			
	– pressure regulators			
	– oil heater options			
	– transformer voltage checks			
	– electronic controller, software, configuration etc			
	• visual inspection of installation; checking:			
– component serial numbers				
– piping circuits				
– controls to design specifications				
– refrigerant distributors				
– oil levels				
– pumps				
4	demonstrate procedures for removing and replacing the refrigerant			
5	carry out the following tests in accordance with appropriate legislation:			

	<ul style="list-style-type: none"> • strength integrity test 			
	<ul style="list-style-type: none"> • pressure tightness test 			
	<ul style="list-style-type: none"> • evacuation and dehydration methods 			
6	charge plant with correct refrigerant			
7	carry out electrical tests to confirm that system is safe to switch on:			
	<ul style="list-style-type: none"> • visual integrity check 			
	<ul style="list-style-type: none"> • continuity 			
	<ul style="list-style-type: none"> • insulation resistance 			
	<ul style="list-style-type: none"> • polarity 			
	<ul style="list-style-type: none"> • resistance to earth 			
8	open service valves, run plant and:			
	<ul style="list-style-type: none"> • check for correct rotation of all fans 			
	<ul style="list-style-type: none"> • check control operation and adjust as necessary to required design settings 			
	<ul style="list-style-type: none"> • check defrost system 			
	<ul style="list-style-type: none"> • leak test system 			
	<ul style="list-style-type: none"> • check air circulation in storage areas. 			

Outcome 4 Be able to carry out the commissioning of ammonia refrigeration systems				
Criteria		Candidate initials	Assessor initials	Evidence reference
1	confirm that the system provides refrigeration			
2	complete compressor start and safety device tests			
3	check and confirm the starting procedures for:			
	<ul style="list-style-type: none"> • controls 			
	<ul style="list-style-type: none"> • fan and compressor motors 			
	<ul style="list-style-type: none"> • defrosting 			
4	check capacity control operation for :			
	<ul style="list-style-type: none"> • screw compressors 			
	<ul style="list-style-type: none"> • reciprocating compressors 			
	and confirm that all machinery guards and warning notices are in place			
5	demonstrate commissioning methods for cold stores, including requirements for:			
	<ul style="list-style-type: none"> • under floor heating arrangements 			
	<ul style="list-style-type: none"> • jointing and sealing 			
	<ul style="list-style-type: none"> • door furniture 			
	<ul style="list-style-type: none"> • drains 			
	<ul style="list-style-type: none"> • bringing store floor down to operating temperature 			
	<ul style="list-style-type: none"> • lighting 			
	<ul style="list-style-type: none"> • defrost 			

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6	record operating conditions on the appropriate log sheet for:			
	• compressors			
	• evaporators			
	• condensers			
	• liquid refrigerant pumps			
	• auxiliary components as required by specialist refrigeration systems such as:			
	– compound inter-cooling arrangements			
	– secondary fluid chillers, (brine etc)			
7	remove analysers/gauges from systems ensuring:			
	• minimal vapour refrigerant loss			
	• no liquid refrigerant loss			
8	replace valve caps and confirm valves are leak free.			

Outcome 5 Be able to handover ammonia refrigeration systems				
Criteria		Candidate initials	Assessor initials	Evidence reference
1	complete system records for hand over documentation, including those which detail:			
	• strength integrity test			
	• pressure tightness test			
	• evacuation and dehydration			
	• compressor starter tests			
	• safety device tests			
	• system refrigerant charge and type			
	• performance testing			
	• control settings			
2	complete refrigeration system records including:			
	• operational log sheet			
	• running current log sheet			
3	demonstrate system operation and operating controls to customer			
4	pass over system documentation and records to customer			
5	report to line manager that installation is complete and fill in appropriate company documentation.			

Outcome 6	Be able to carry out the de-commissioning of ammonia refrigeration systems			
Criteria		Candidate initials	Assessor initials	Evidence reference
1	produce appropriate risk assessments and method statements to ensure decommissioning activities can be completed safely			
2	demonstrate work sequences for decommissioning and making safe:			
	<ul style="list-style-type: none"> • a complete Ammonia refrigeration system 			
	<ul style="list-style-type: none"> • part of an Ammonia system 			
3	demonstrate how oil and refrigerant could be safely recovered from a system and disposed of.			

Unit 322

Install and commission ammonia refrigeration systems

Declaration

I confirm that the evidence supplied for this unit is authentic and a true representation of my own work. The work logged is my own work carried out during my normal work duties.

The answers in the question bank are my own work and discussed with my assessor on completion. I have been observed in my workplace by my assessor on several occasions.

Candidate Name:	
Candidate Signature:	
Date:	

I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor Name:	
Assessor Signature:	
Date:	

IV Name:	
IV Signature:	
Date:	

Level: 3
 Credit value: 3
 UAN: H/602/4594

Outcome 1	Be able to plan and prepare for the installation and commissioning of CO ₂ refrigeration systems			
Criteria		Candidate initials	Assessor initials	Evidence reference
1	Conduct a review of the work location to identify any factors which may impact upon the work			
2	Confirm that relevant people have been provided with job information (as appropriate) and identify points within the work process when liaison with identified relevant persons may be necessary			
3	Identify manufacturers' instructions, regulations and industry standards to determine installation and commissioning requirements for systems and components			
4	Use manufacturer's instructions, regulations and industry standards to determine requirements for systems and components, including procedures to: <ul style="list-style-type: none"> • Confirm that components have suitable pressure ratings for Carbon Dioxide Systems and are suitable for use • Confirm that fittings have suitable pressure ratings for Carbon Dioxide Systems and are suitable for use • Determine Strength Test Pressure(s) from the system Maximum Allowable Pressure(s) • Determine Tightness Test Pressure(s) from the system Maximum Allowable Pressure(s) 			
5	Produce a risk assessment and method statement for the Charging and venting of Carbon Dioxide			
6	Confirm that authorisation has been provided by relevant persons prior to the completion of work activity			
7	Select appropriate PPE for the completion of work activities			

Outcome 2		Be able to carry out the installation and commissioning of CO₂ refrigeration systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	Identify and interpret appropriate sources of information which impact upon the installation of CO ₂ refrigeration pipework, systems and components, including: <ul style="list-style-type: none"> Regulatory documents Industry Codes of Practice Manufacturer's instructions Installation specification 			
2	Assemble and join CO ₂ refrigeration system components to meet the requirements of the installation specification			
3	Position and fix CO ₂ refrigeration system components and pipework correctly, in respect of: <ul style="list-style-type: none"> Spacing intervals Expansion and contraction methods Insulation and vapour seals 			
4	Confirm that installed system components and pipework are correctly installed in accordance with the installation specification			
5	Adjust and set safety and control features as appropriate			
6	Complete procedures to remove and refit components to CO ₂ refrigeration systems			

Outcome 3		Be able to carry out the commissioning of CO₂ refrigeration systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	Use manufacturer's instructions, regulations and industry standards to prepare a pre-commissioning checklist for one of the following types of system: <ul style="list-style-type: none"> Direct Expansion Trans-critical Volatile Secondary Cascade 			
2	Conduct the following checks on Carbon Dioxide equipment and systems: <ul style="list-style-type: none"> Visual inspection of pipework for leakage Visual inspection of pipework for adequate support Visual inspection of insulation and vapour seals Visual check for high moisture levels 			

	<ul style="list-style-type: none"> • Visual check of pressure relief valves and relief piping 	
3	<p>Demonstrate procedures for testing CO₂ refrigeration systems, including:</p> <ul style="list-style-type: none"> • Establishing system allowable pressure(s) • Conducting a strength pressure test • Conducting a tightness pressure test 	
4	<p>Demonstrate procedures for charging CO₂ refrigeration systems, including:</p> <ul style="list-style-type: none"> • Evacuating a system • Breaking a vacuum with Carbon Dioxide Vapour • Charging a system with Oil • Charging a system with Carbon Dioxide 	
5	<p>Demonstrate CO₂ refrigeration system operation to confirm that system and equipment is functioning correctly</p>	
6	<p>Demonstrate procedures for adjusting system operating parameters through:</p> <ul style="list-style-type: none"> • Adjusting safety and system controls • Topping up refrigerant levels as required • Topping up oil levels as required • Safely venting CO₂, avoiding “dry ice” 	
7	<p>Produce documentary records to provide system users with information necessary for continuing operation of CO₂ refrigeration systems, including:</p> <ul style="list-style-type: none"> • Record of refrigerant operating levels • Record of oil operating levels • Records of <ul style="list-style-type: none"> - Refrigerant quantity added - Refrigerant quantity removed - Oil quantity added - Oil quantity removed • Log of system in operation 	

Outcome 4		Be able to carry out the de-commissioning of CO₂ refrigeration systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	Produce appropriate risk assessments and method statements to ensure decommissioning activities can be completed safely			
2	Demonstrate work sequences for permanently decommissioning: <ul style="list-style-type: none"> • A complete CO₂ refrigeration system • Part of a CO₂ refrigeration system 			
3	Demonstrate how oil and refrigerant could be safely removed from a system and disposed of			

Unit 323

Install and Commission CO₂ Refrigeration Systems

Declaration

I confirm that the evidence supplied for this unit is authentic and a true representation of my own work. The work logged is my own work carried out during my normal work duties.

The answers in the question bank are my own work and discussed with my assessor on completion. I have been observed in my workplace by my assessor on several occasions.

Candidate Name:	
Candidate Signature:	
Date:	

I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor Name:	
Assessor Signature:	
Date:	

IV Name:	
IV Signature:	
Date:	

Level: 3

Credit value: 3

UAN: J/502/9308

Outcome 1	Be able to plan and prepare for the servicing and maintenance of ammonia refrigeration systems			
Criteria		Candidate initials	Assessor initials	Evidence reference
1	confirm that all information is available prior to planning service or maintenance activities			
2	confirm that all tools, equipment and materials are available and fit for use prior to commencement of the work			
3	confirm that all persons relevant to the service or maintenance activity are identified and that lines of communication are established			
4	carry out site survey to identify any variations or deviations to planned work or any structural or access issues which need to be resolved prior to work commencement			
5	identify safe storage arrangements for tools, equipment and materials prior to commencement of service or maintenance activity			
6	plan safe access to work areas and confirm with responsible person on site			
7	ensure that all necessary risk assessment and safe working procedure development has been undertaken prior to work commencement			
8	complete preparatory work as necessary for system service and maintenance activities, to include consideration of :			
	• location			
	• function			
	• cooling loads served			
	• records			
	• labelling.			

Outcome 2	Be able to carry out the servicing and maintenance of ammonia refrigeration systems				
Criteria		Candidate initials	Assessor initials	Evidence reference	
1	identify appropriate sources of information which impact upon the servicing and maintenance of ammonia refrigeration systems, including:				
	• regulatory documents				
	• industry codes of practice				
	• manufacturer's instructions				
1	• maintenance and service schedules				
	2	interpret maintenance schedules to identify required work activities			
	3	perform the following service and maintenance tasks safely and efficiently:			
		• cleaning and checking the condition of:			
– condensers (including fans)					
– filters					
– indoor units					
– evaporators (including fans)					
• checking the condition of:					
– pipework and its insulation					
– electrical wiring, fuses and connections					
• checking:					
– water cooled condenser flow rate					
– air flow rate through condenser and evaporator					
– oil compressor charge					
– operation of all safety devices					
– condition and operation of all compression drives					
4	check system operating conditions against control settings				
5	measure humidity and temperature in the controlled space				
6	reconnect or re-install system components after maintenance and then carry out the following checks and tests before running the system:				
	• tightness testing				
	• evacuation and dehydration				
6	• electrical testing				
	7	demonstrate procedures for replacing the refrigerant type in refrigeration systems, including:			

	<ul style="list-style-type: none"> selecting suitable replacement refrigerant types for different systems 			
	<ul style="list-style-type: none"> safely disposing of refrigerant that is to be replaced 			
	<ul style="list-style-type: none"> re-commissioning the system on completion of refrigerant replacement 			
8	re-charge refrigerant to correct quantity and check for leakage			
9	complete system performance test			
10	complete appropriate maintenance documentation and records.			

Outcome 3		Be able to identify and rectify faults in ammonia refrigeration systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	diagnose common faults associated with:			
	<ul style="list-style-type: none"> compressors 			
	<ul style="list-style-type: none"> condensers 			
	<ul style="list-style-type: none"> suction and discharge 			
	<ul style="list-style-type: none"> compressor oil supply 			
	<ul style="list-style-type: none"> refrigerant supply 			
	<ul style="list-style-type: none"> metering 			
2	rectify common faults associated with:			
	<ul style="list-style-type: none"> compressors 			
	<ul style="list-style-type: none"> condensers 			
	<ul style="list-style-type: none"> suction and discharge 			
	<ul style="list-style-type: none"> compressor oil supply 			
	<ul style="list-style-type: none"> refrigerant supply 			
	<ul style="list-style-type: none"> metering 			
	<ul style="list-style-type: none"> electrical connections/supply. 			

Outcome 4	Be able to carry out the commissioning of ammonia refrigeration systems			
Criteria		Candidate initials	Assessor initials	Evidence reference
1	revisit risk assessment and safe working procedure to confirm currency and validity prior to commencement of testing			
2	<p>carry out the checks and tests in accordance with industry and safety requirements, including:</p> <ul style="list-style-type: none"> • checking: <ul style="list-style-type: none"> – safety mechanisms – emergency procedures – insulated structure for heat leakage (use of thermographic testing techniques) – the performance of the refrigeration system – the electrical energy consumption of the plant – defrost system controls and operation – sediment levels in brine tanks – filters (and cleaning) – pumping arrangements for noise, vibration, rotary shaft seals, stuffing boxes • inspecting: <ul style="list-style-type: none"> – condenser coils and fans – evaporators and fans – pressure relief valves – condensate drains • testing specific gravity of secondary refrigerant 			
3	<p>carry out the following tests in accordance with appropriate legislation:</p> <ul style="list-style-type: none"> • strength integrity test • pressure tightness test • evacuation and dehydration methods 			
4	compare pipework length with system factory charge and determine whether extra refrigerant charge is required			
5	add additional refrigerant charge by weight in accordance with manufacturer's instructions			

6	carry out basic electrical tests to confirm that system is safe to switch on:			
	• visual integrity check			
	• continuity			
	• insulation resistance			
	• polarity			
7	open system valves and run system			
8	complete checks to confirm system is leak free			
9	confirm that the system provides cooling and/or heating by measuring air flow temperature difference across indoor and outdoor unit heat exchangers			
10	record temperature differences			
11	remove analysers/gauges from systems ensuring:			
	• minimal vapour refrigerant loss			
	• no liquid refrigerant loss			
12	replace valve caps and confirm valves are leak free.			

Outcome 5		Be able to handover ammonia refrigeration systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	complete system records for hand over documentation, including those which detail:			
	• strength integrity test			
	• pressure tightness test			
	• evacuation and dehydration			
	• system refrigerant charge and type			
	• performance testing			
2	demonstrate system operation and operating controls to customer			
3	pass over system documentation and records to customer			
4	report to line manager that servicing or maintenance work is complete and fill in appropriate company documentation.			

Outcome 6		Be able to carry out the de-commissioning of ammonia refrigeration systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	follow appropriate risk assessments and method statements to ensure decommissioning activities are completed safely			
2	demonstrate work sequences for decommissioning and making safe:			
	<ul style="list-style-type: none"> • a complete ammonia refrigeration system 			
	<ul style="list-style-type: none"> • part of an ammonia refrigeration system 			
3	demonstrate how oil, refrigerant and cleaning solvents can be safely recovered from a system and disposed of in accordance with appropriate regulations.			

Unit 324 Service and maintain ammonia refrigeration systems

Declaration

I confirm that the evidence supplied for this unit is authentic and a true representation of my own work. The work logged is my own work carried out during my normal work duties.

The answers in the question bank are my own work and discussed with my assessor on completion. I have been observed in my workplace by my assessor on several occasions.

Candidate Name:	
Candidate Signature:	
Date:	

I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor Name:	
Assessor Signature:	
Date:	

IV Name:	
IV Signature:	
Date:	

Level: 3
 Credit value: 3
 UAN: K/602/4595

Outcome 1		Be able to plan and prepare for the servicing and maintenance of CO ₂ refrigeration systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	Conduct a review of the work location to identify any factors which may impact upon the work			
2	Confirm that relevant people have been provided with job information (as appropriate) identify points within the work process when liaison with identified relevant persons may be necessary			
3	Identify manufacturer's instructions, regulations, industry standards and maintenance schedules to determine planned periodic components			
4	Use manufacturer's instructions, regulations and industry standards and maintenance schedules to determine planned servicing requirements for three of the following components <ul style="list-style-type: none"> • Compressor • Expansion valve • Gas cooler • Heat exchanger • Refrigerant pump 			
5	Use manufacturer's instructions, regulations and industry standards and maintenance schedules to determine planned periodic maintenance schedules for one of the following system types: <ul style="list-style-type: none"> • Direct expansion • Cascade • Trans-critical • Volatile secondary 			
6	Produce a risk assessment and method statement for the charging and venting of Carbon Dioxide			
7	Confirm that authorisation has been provided by relevant persons prior to the completion of work activity			

8	Select appropriate PPE for the completion of work activities			
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Outcome 2	Be able to carry out the servicing and maintenance of CO₂ refrigeration systems			
Criteria		Candidate initials	Assessor initials	Evidence reference
1	Conduct the following checks on Carbon Dioxide equipment and systems: <ul style="list-style-type: none"> • Visual inspection of pipework for leakage • Visual inspection of pipework for adequate support • Visual inspection of insulation and vapour seals • Visual checks for high moisture levels • Visual checks of pressure relief valves and relief piping 			
2	Demonstrate CO ₂ refrigeration system operation to confirm that system and equipment is functioning correctly			
3	Demonstrate the procedures for: <ul style="list-style-type: none"> • Safe removal of oil from a compressor • Completion of waste transfer paperwork for removed oil 			
4	Produce documentary records to provide system users with information necessary for continuing operation of CO ₂ refrigeration systems, including: <ul style="list-style-type: none"> • Record of refrigerant operating levels • Record of oil operating levels • Records of – <ul style="list-style-type: none"> - Refrigerant quantity added - Refrigerant quantity removed - Oil quantity added - Oil quantity removed • Log of system in operation 			

Outcome 3		Be able to identify and rectify faults in CO₂ refrigeration systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	Demonstrate procedures for adjusting system operating parameters through: <ul style="list-style-type: none"> • Adjusting safety and system controls • Topping up refrigerant levels as required • Topping up oil levels as required • Safely venting CO₂, avoiding “dry ice” 			
2	Apply logical fault diagnosis procedures for CO ₂ refrigeration systems			
3	Complete procedures to remove and refit components in order to rectify faults in CO ₂ refrigeration systems			
4	Confirm system is functioning in accordance with the performance specification after completion of repairs through completion of appropriate checks, including: <ul style="list-style-type: none"> • Checking refrigerant charge • Checking oil charge 			

Outcome 4		Be able to carry out the de-commissioning of CO₂ refrigeration systems		
Criteria		Candidate initials	Assessor initials	Evidence reference
1	Produce appropriate risk assessments and method statements to ensure decommissioning activities can be completed safely			
2	Demonstrate work sequences for permanently decommissioning: <ul style="list-style-type: none"> • A complete CO₂ refrigeration system • Part of a CO₂ refrigeration system 			
3	Demonstrate how oil and refrigerant could be safely removed from a system and disposed of			

Unit 325

Service and maintain CO₂ refrigeration systems

Declaration

I confirm that the evidence supplied for this unit is authentic and a true representation of my own work. The work logged is my own work carried out during my normal work duties.

The answers in the question bank are my own work and discussed with my assessor on completion. I have been observed in my workplace by my assessor on several occasions.

Candidate Name:	
Candidate Signature:	
Date:	

I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor Name:	
Assessor Signature:	
Date:	

IV Name:	
IV Signature:	
Date:	

On Site Assessment Plan / Feedback



Evidence Reference:	
---------------------	--

Qualification:
Level:

Qualification number:

Candidate name:
Assessor name:

Date:

Candidate prepared for assessment (Provide details below)	Yes / No	Candidate requires support	Yes / No
Candidate briefed on appeals procedure	Yes / No	Support required	

Assessment Location / Address and postcode:

Type of work to be carried out:

Assessor Feedback:
(Use Assessor continuation sheet if required)

Forward Planning:

Candidate Signature:		
Assessor Signature:		Date:
IV/IQA Name:	IV/IQA Signature:	Date:

Photographic Supplementary Evidence



Evidence Reference:	
---------------------	--

Scheme / Award:

Scheme Number:

Level:

Candidate Name:

Unit Number:

Brief description of task being carried out in the photograph (to be completed by candidate):

(Attach Photo in this Box)

Location of photograph:

Candidate Signature:		
Assessor Signature:		Date:
IV/IQA Name:	IV/IQA Signature:	Date:

Workplace Recorder Details



I confirm I am suitably experienced or qualified in line with the industry requirements to act as a witness for this learner. I acknowledge that I will only counter sign documentation requested by the learner where to my knowledge only the learner has completed the work and on the understanding that the work has been carried out to the acceptable standard.

Workplace Recorder Name:	
Workplace Recorder Signature:	Date:

I confirm I am suitably experienced or qualified in line with the industry requirements to act as a witness for this learner. I acknowledge that I will only counter sign documentation requested by the learner where to my knowledge only the learner has completed the work and on the understanding that the work has been carried out to the acceptable standard.

Workplace Recorder Name:	
Workplace Recorder Signature:	Date:

I confirm I am suitably experienced or qualified in line with the industry requirements to act as a witness for this learner. I acknowledge that I will only counter sign documentation requested by the learner where to my knowledge only the learner has completed the work and on the understanding that the work has been carried out to the acceptable standard.

Workplace Recorder Name:	
Workplace Recorder Signature:	Date:

Appendix 1 Summary of City & Guilds assessment policies

Health and Safety

All centres have to make sure that they provide a safe and healthy environment for learning, including induction and assessment. City & Guilds external verifiers check this when they visit assessment centres.

Equal Opportunities

Your centre will have an equal opportunities policy. Your centre will explain this to you during your induction, and may give you a copy of the policy.

City & Guilds equal opportunities policy is available from our website www.cityandguilds.com, City & Guilds Customer Relations Team or your centre.

Access to assessment

City & Guilds qualifications are open to all candidates, whatever their gender, race, creed, age or special needs. Some candidates may need extra help with their assessment, for example, a person with a visual impairment may need a reader.

If you think you will need alternative assessment arrangements because you have special needs, you should discuss this with your centre during your induction, and record this on your assessment plan. City & Guilds will allow centres to make alternative arrangements for you if you are eligible and if the qualification allows for this. This must be agreed before you start your qualification.

City & Guilds guidance and regulations document *Access to assessment and qualifications* is available on the City & Guilds website www.cityandguilds.com, from the City & Guilds Customer Relations Team or your centre.

Complaints and appeals

Centres must have a policy and procedure to deal with any complaints you may have. You may feel you have not been assessed fairly, or may want to appeal against an assessment decision if you do not agree with your assessor.

These procedures will be explained during induction and you will be provided with information about the Quality Assurance Co-ordinator within your centre who is responsible for this.

Most complaints and appeals can be resolved within the centre, but if you follow the centre procedure and are still not satisfied you can complain to City & Guilds.

Our complaints policy is on our website www.cityandguilds.com or is available from the City & Guilds Customer Relations Team or your centre.

Useful contacts

UK learners

General qualification information

T: +44 (0)844 543 0033

E: learnersupport@cityandguilds.com

International learners

General qualification information

T: +44 (0)844 543 0033

F: +44 (0)20 7294 2413

E: intcg@cityandguilds.com

Centres

Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results

T: +44 (0)844 543 0000

F: +44 (0)20 7294 2413

E: centresupport@cityandguilds.com

Single subject qualifications

Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change

T: +44 (0)844 543 0000

F: +44 (0)20 7294 2413

F: +44 (0)20 7294 2404 (BB forms)

E: singlesubjects@cityandguilds.com

International awards

Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports

T: +44 (0)844 543 0000

F: +44 (0)20 7294 2413

E: intops@cityandguilds.com

Walled Garden

Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems

T: +44 (0)844 543 0000

F: +44 (0)20 7294 2413

E: walledgarden@cityandguilds.com

Employer

Employer solutions, Mapping, Accreditation, Development Skills, Consultancy

T: +44 (0)121 503 8993

E: business@cityandguilds.com

Publications

Logbooks, Centre documents, Forms, Free literature

T: +44 (0)844 543 0000

F: +44 (0)20 7294 2413

If you have a complaint, or any suggestions for improvement about any of the services that City & Guilds provides, email: feedbackandcomplaints@cityandguilds.com

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and training**

LB-07-6187