مجلس أبـــوظبـي للـجـودة والـمـطابـــقـة
ABU DHABI QUALITY & CONFORMITY COUNCIL

ABU DHABI OCCUPATIONAL TERMS

Chiller Mechanic – Level 3

22 NOVEMBER 2018
FIRST EDITION

Table of contents

Amendment Page 2
Abu Dhabi Quality & Conformity Council……...……..……3
Foreword 3
Acknowledgments 4
Introduction 5
Occupational Terms 6
Key terms 8
Performance Criteria 11
Technical Knowledge 14
Knowledge and understanding 15
Softskills 16
References 17

Amendment Page

This Amendment Page is updated and issued with each set of revised and/or new pages of the document to help ensure that each copy of this Abu Dhabi Occupation Term (ADOT) contains a complete record of amendments.

This Occupational Term is a live document, which can be amended when necessary. QCC can review stakeholder comments in order to review and amend this document; ultimately resulting in an issuance of an updated version, if necessary.

Log of Amendments						
Amendment			Discard		Insert	
No.	Date	*Sections Changed	Page(s)	Issue No.	Page(s)	Issue No.

About the Abu Dhabi Quality & Conformity Council

The Abu Dhabi Quality and Conformity Council (QCC) were established by law No. 3 of 2009, issued by His Highness Sheikh Khalifa Bin Zayed Al Nahyan, President of the UAE. QCC is responsible for the development of Abu Dhabi Emirate's Quality Infrastructure, which enables industry and regulators to ensure that products, systems and personnel can be tested and certified to UAE and International Standards.

Products and services certified by QCC receive the Abu Dhabi Trustmark. The Trustmark is designed to communicate that a product or system conforms to various safety and performance standards that are set by Abu Dhabi regulators.

Foreword

The QCC, along with relative stakeholders, had developed occupational terms for 21 unique occupations in the construction sector. This was required because of a high dependence on migrant labour to fill key technical roles in the skilled trades and concerns about the productivity of the industry where skills investment is inconsistent.

The occupational terms are professional standards that personnel must meet in order to perform the jobs they are assigned to produce quality outcomes. The Government of Abu Dhabi, under the leadership of His Highness Sheikh Khalifa bin Zayed Al Nahyan, President of the UAE and Ruler of Abu Dhabi, and His Highness Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi, Deputy Supreme Commander of the UAE Armed Forces and Chairman of the Abu Dhabi Executive Council, has invested heavily, and at high levels of professionalism and safety, in the Infrastructure of Abu Dhabi. Therefore, it is crucial and obligatory to encourage the presence of skilled workmanship to maintain the quality infrastructure value in the Emirate of Abu Dhabi in particular and the United Arab Emirates in general.

Acknowledgments

The QCC would like to thank the members of the working group listed below:

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Introduction

- Qualification Pack - Chiller Mechanic

Brief description of Job – A Chiller Mechanic is an important job role in HVACR who is specialized in maintenance of all types of chiller's, it's dismantling, removing, replacing faulty or damaged components including but not limited to motors, fans, pumps, valves, couplings, Compressors of various type… and chiller's testing & commissioning. He/ She will be expected to apply a range of dismantling and assembly methods and techniques, such as proof marking/labeling of components to aid the reassembly, dismantling components requiring pressure techniques, torque loading and setting, aligning and adjusting components.

Personal attributes – A Chiller Mechanic should comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with the maintenance activities, or the tools and equipment used that he/she cannot personally resolve, or that are outside his/her permitted authority, to the relevant people. She/he must ensure that all tools, equipment and materials used in the maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly, in line with environment, health and safety (EHS) best practices. He/she is being expected to work with minimal supervision, taking personal responsibility for his/her own actions, and for the quality and accuracy of the work that he/she carries out.

Duties and responsibilities	To do the maintenance, overhauling, testing & commissioning works for all types of chillers including but not limited to water cooled chillers, air cooled chillers and its components like Compressors, condensers, Evaporators, driers etc…
Min. qualification	General High School Education with an Industrial Training Institute certification (ITI) or who has 3 years of work experience as level 2 HVACR mechanic with chiller working background from recognized certification authority.
Training **(Suggested but not mandatory)**	On the job training for 6 months.
Work Experience	In line with min qualification, he/she should have a total of 5 years of HVAC work experience among 3 years should be as level 2 Chiller mechanic.
Performance criteria	As described in relevant chapters

Occupational Terms

<table>
<tr><th>No.</th><th>Field</th><th>Details</th></tr>
<tr><td>1.</td><td>Occupation (Standard Unit)</td><td>Chiller Mechanic – Level 3</td></tr>
<tr><td>2.</td><td>Description</td><td>This occupational term specifies the outcome required to perform as a Chiller Mechanic to do the maintenance and troubleshooting works of equipment/accessories related to all types of chillers.</td></tr>
<tr><td>3.</td><td>Unit type</td><td>☐ Knowledge and Skills OR ■ Application</td></tr>
<tr><td>4.</td><td>Elements</td><td>
<table>
<tr><th>No.</th><th>Element</th></tr>
<tr><td>E1</td><td>Identify and handle materials, tools, tackles and consumables used for Chiller maintenance and its working knowledge</td></tr>
<tr><td>E2</td><td>Procedures for maintenance works and related activitieS</td></tr>
<tr><td>E3</td><td>Follow healthy, safe and secure working environment</td></tr>
</table>
</td></tr>
<tr><td>5.</td><td>QF Emirates level</td><td>☐ 1 ☐ 2 ■ 3 ☐ 4 ☐ 5
☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10</td></tr>
<tr><td>6.</td><td>Function</td><td>☐ Policy and strategy QF 9-10
☐ Managing QF 7-8
☐ Specifying QF 6-7
☐ Controlling QF 6
☐ Maintaining capability QF 4-6
■ Performing/carry out QF 1-4</td></tr>
<tr><td>7.</td><td>Entry information and prerequisites</td><td>General High School Education with an Industrial Training Institute certification (ITI) or who has 3 years of work experience as level 2 HVACR mechanic with chiller working background from recognized certification authority.</td></tr>
<tr><td>8.</td><td>Grading</td><td>Application unit:
Competent/Not Yet Competent</td></tr>
<tr><td>9.</td><td>Industry sector</td><td>Construction & Maintenance</td></tr>
</table>

No.	Field	Details		
10.	Developed by	Know How	Government Entities	Abu Dhabi Quality & Conformity Council
11.	Endorsement date	TBD		
12.	Frequency of review	2 Years		
13.	Version No.	0		
14.	ISCO-08	7127 Air Conditioning & Refrigeration Mechanics		

Key terms

Term	Description
Personal Protective Equipment (PPE)	Items that construction workers can use to protect themselves against hazards. PPE includes but not limited to gloves, safety helmet, eye protection, face protection, foot protection and appropriate clothing.
Risk	Risk is the product of the measure of the likelihood of occurrence of an undesired event and the potential adverse consequences which this event may have upon: · People – injury or harm to physical or psychological health · Environment – water, air, soil, animals, plants and social Risk = frequency x consequences
Hazard	Any substance, physical effect, or condition with potential to harm people, property or the environment.
OSHA	Occupational Safety & Health Administration.
OSHAD	Abu Dhabi occupational safety and health center.
Building diagram	A technical drawing of a structure or building that is drawn in a scale that is proportionate to its real-world dimensions. Building drawings include site plans, floor plans, elevations and sections. Drawings that provide additional specific/specialist details are known as Coordination Drawings.
Cross Section	A section is a type of building drawing. It represents a vertical plane cut through the structure.
Elevation	An elevation is a type of building drawing. It is a drawing of the exterior or interior of a building or structure as seen from a horizontal position - without dimensional perspective.
Floor plan	A floor plan is a building drawing. It is a drawing to scale showing a view from above, of the relationships between rooms, spaces and other physical features at one level of a structure.
Layout drawing	An approved design or plans to show the way things are arranged.
Site Plan	A site plan is a type of building drawing that shows a new or existing building's position in relation to the boundaries of the block of land.
Work instructions	Written or verbal description of the work to be undertaken by an individual or work team.
HVAC	Heating, Ventilation, & Air Conditioning here refers to "Self-Contained Equipment" i.e. Complete, factory-assembled and tested, heating, air-conditioning equipment installed as a single unit, and having all working parts, complete with motive power, in an enclosed unit of said machinery and/or Split System/DX Split System consisting of indoor unit housing evaporator & fan and outdoor unit housing compressor, condenser and heat rejection fan.
Chiller	A Chiller is a machine that removes heat from a liquid via a vapor compression or absorption refrigeration cycle. This liquid can then be circulated through a heat exchanger to cool equipment, or another process stream (such as air or process water).

Air cooled chiller	Air-cooled chillers actively absorb heat from process water to refrigerant; they then transfer this heat into the air around the chiller unit using fans.
Water cooled Chiller	Water-cooled chillers actively absorb heat from process water to primary refrigerant (water); they then transfer this heat into the air through cooling tower were direct heat exchange will take place.
Cassette unit	HVAC equipment installed in false ceiling which recirculates & provides cool air and is part of DX and chilled water equipment.
Airside Chilled Water Equipment	HVAC equipment dealing with recirculate, outdoor, or mixed air for purpose of cooling & ventilation.
Compressor	A compressor is a mechanical device that increases the pressure of a gas by reducing its volume. It's the main component in the refrigerant cycle of air conditions and refrigerators. Different types of compressors are Reciprocating compressors, Screw Compressors, Scroll compressors, Centrifugal compressors…
Air Handling Unit	A series of components joined in section that provide cool air and/or treated ventilation air to space directly or indirectly.
Ceiling Suspended Ducted Unit	HVAC equipment hung or installed above false ceiling suspended from slab of floor above.
Duct	A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air ducts.
Duct Accessories	Fire Dampers, Motorized Fire Dampers, Motorized Smoke Dampers, Motorized Combined Fire & Smoke Dampers and Volume Control Dampers installed in duct system to serve designed purpose.
VAVs-By pass	In this type VAV the required quantity of air to each zone is pumped in to the serving area based on the load requirement and the balance air bypassed through the bypass section of the VAV unit above false ceiling or to return air ducts.
VAVs-Pressure independent	This unit modulates the amount of 'primary' cooling air to the space between a minimum set point and the design airflow.
Duct Fittings	A piece of duct in a standard form or shape to connect two pieces of ducts.
DX Equipment	Abbreviation of Direct Expansion; of refrigerant that takes advantage of latent heat of the refrigerant fluid, and cools it by expansion.
Equipment	All piping, ducts, vents, control devices and other components of systems other than appliances which are permanently installed and integrated to provide control of environmental conditions for buildings or to serve a design purpose.
Fabricate	Construct or manufacture.
Fan Coil Unit	A simple device consisting of cooling coil, fan, motor, & filter used for providing cool air to space.
Install	Place or fix equipment or an item in position ready for use.
Insulate	The act of protecting something by surrounding it with material that reduces or prevents the transmission of heat.
Piping	**Pipe:** A rigid conduit of iron, steel, copper, brass or plastic & **Tube:** Semi rigid conduit of iron, steel, copper, brass or plastic.
Pressure Test	A test following the installation of new equipment/piping system or modification

	of existing equipment/piping system where the equipment/piping system is place under pressure to ensure that it will not leak.
Refrigerant	A Refrigerant is a chemical compound that is used as a heat carrier within a Refrigeration cycle which undergoes a phase change from gaseous to liquid state and back in order to transfer heat within a refrigeration cycle.
Rooftop Package Unit	Self-contained HVAC equipment installed on roof that provide cool and/or treated air directly or indirectly to space.
Valve Package	Chilled water valves & accessories including strainers installed to operate, test, commission, & maintain equipment such as Fan Coil Unit, Air Handling Unit etc.
Wall Mounted Unit	A part of split system, installed in a space, where it provides recirculates & provides conditioned air.
WMS	Work Method Statement.
SOP	Standard operating Procedure.
GMP	Good Manufacturing Practices.

Performance Criteria

Element1: Identify and handle materials, tools, tackles and consumables used for Chiller maintenance and its working knowledge

Scope	• Identify and differentiate materials, tools and consumables • Handle tools, tackles consumables and materials • Know how's of chiller
Performance Criteria (PC) w.r.t. the Scope	
Element	**Performance Criteria**
Identify and differentiate materials, tools and consumables	To be competent, the user / individual on the job must be able to: PC1. identify and differentiate between different types of tools and tool kits PC2. identify the various gas cylinders and refrigerant. PC3. identify and differentiate between gases based on their uses and applications PC4. identify and differentiate between different types of Chillers, Compressors, Pumps, chiller accessories and their cycles and functions
Handle tools, tackles, consumables and materials	PC5. handle and stack different tools that are required for each operations PC6. identify different types of coils, cables and pipes and shift them as per instructions PC7. stack the wire/ cables as per manufactures guidelines as per standard safety norms and instruction PC8. knowledge of shifting gas cylinders as per manufacturer recommendation PC9. knowledge of stacking gas cylinders separately as per instructions or standard practice
Know how's of chiller	PC10. the chiller mechanic shall have sufficient knowledge, experience and capability to check, troubleshoot and maintain chiller's Control Panels, its software and chiller supervisor /Manger with sufficient training and experience for different make of chiller's. PC11. Chiller mechanic shall have capabilities, knowhow to interface chiller's control Panel with BMs gateways and directly with BMS system as well. PC12. Chiller's mechanic shall be capable of monitoring and management of Refrigerants in order to prevent their leaks and consequential damages to environment and humans. PC13.Chiller Mechanic shall have the capabilities, knowhow and complete working knowledge of Chiller's Electrical Supply systems, Breakers, Motor Control Centers, Electrical distribution Boards, cabling, protection etc. including all trouble shooting, Preventive maintenance, overhaul etc.

Element2: Procedures for maintenance works and related activities

Scope	• Maintenance Schedules • Operations
Performance Criteria (PC) w.r.t. the Scope	
Element	**Performance Criteria**
Maintenance Schedules	To be competent, the user/individual on the job must be able to: PC1. inspect the manpower requirement based on chiller maintenance required PC2. identify the material requirements for carrying chiller maintenance PC3. follow schedule for maintenance activities (including preventive maintenance) while ensuring that equipment operation is not hindered and should inform about this to the HVAC team leader for implementation of work. PC4. select the suitable alternatives in case the appropriate equipment and materials are not available for maintenance and inform the appropriate person PC5. understanding the instructions of team leaders and updating work status PC6. display the appropriate signage for the work being conducted
Operations	PC7. Knowledge of executing works as per schedule, method statement, job briefing and scope PC8. provide technical assistance when requested to colleagues PC9. ability to report to the appropriate person any disturbances in material flow or equipment and any additional works required PC10. Should have first-hand knowledge of chiller maintenance practices and all standard HVAC equipment maintenance practices like… 1. Ability to plan- maintenance activities, follow procedure or systems and relevant safety regulation and requirement related to chiller maintenance 2. importance of keeping latest version of drawings and operational manuals and relevant documents 3. knowledge of assembling and dismantling chillers and related accessories and components with accuracy 4. knowledge of proper waste disposal 5. maintenance knowledge of remote air-conditioning generation-district cooling, local air conditioning distribution, air conditioning control 6. knowledge and execution of various maintenance techniques like 6.1 testing the system for leaks 6.2 marking/labeling of components 6.3 dismantling equipment to unit/sub-assembly level 6.4 tightening fasteners to the required torque 6.5 setting, aligning and adjusting replaced components 6.6 making `off-line' checks before starting up 6.7 checking components for serviceability 6.8 functionally testing the completed system 6.9 replacing all `lifed' items (such as batteries, lamps etc..) 6.10 replacing damaged/defective components like expansion valves,

compressors, motors and other chiller component parts.
6.11 Cleans refrigerant systems.

7. knowledge of various air conditioning components like…
   7.1 motors
   7.2 Compressors
   7.3 manifolds/flanges
   7.4 thermostats
   7.5 chiller batteries
   7.6 dampers
   7.7 silencers/attenuators
   7.8 insulation
   7.9 pumps
   7.10 vents/diffusers
   7.11 gaskets and sealants
   7.12 electrical connectors
   7.13 humidifiers
   7.14 valves
   7.15 gauges/indicators
   7.16 electrical components
   7.17 chilled beams
   7.18 filters
   7.19 sensors
   7.20 wiring safety devices
   7.21 condensers
   7.22 pipework
   7.23 switches
   7.24 evaporators
   7.25 couplings
   7.26 local air conditioning system
   7.27 fans (supply and extraction)
   7.28 battery heaters (generation/local controlled)
8. Knowledge of maintaining air conditioning systems as per standards, guide line and codes of practices like ASHRAE …

   8.1 BS7671/IEE wiring regulations
   8.2 equipment manufacturer's operation range
   8.3 BS, ISO and/or BSEN standards

9. Knowledge, procedure and importance of
   9.1 Monitoring
   9.2 Preventive, corrective and breakdown maintenance
   9.3 Repairing and shut down
   9.4 HSE
10. Ability to prepare , job cards, permits to work/formal risk assessment and/or

	sign-on/off procedures , maintenance log or report , company-specific documentation PC11. Responds to emergency service requests. PC12. Provide service-related information to Service Managers regarding estimates, problems etc PC13. Provides technical assistance with installations and modifications to existing systems.

Element3: Follow healthy, safe and secure working environment

Scope	**Ensuring healthy, safe and secure working environment** **Following emergency procedures**:
Performance Criteria (PC) w.r.t. the Scope	
Element	**Performance Criteria**
Ensuring healthy, safe and secure working environment	To be competent, the user/individual on the job must be able to: PC1. observe and comply with the company's current health, safety and security policies and procedures PC2. identify and correct any hazards that the individual can deal with safely, competently and within the limits of their authority PC3. identify and recommend opportunities for improving health, safety, and security to the designated person PC4. complete any health, safety and security activities like safety drills and prepare records legibly and accurately PC5. hazards associated with carrying out maintenance activities on air conditioning equipment (such as handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how to minimize them to reduce any risks PC6. procedures for working in hot summer season and heat stress knowledge
Following emergency procedures	PC7. report any hazards that the individual is not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected PC8. follow the company's emergency procedures promptly, calmly, and efficiently

Technical Knowledge

Relevant work Context	The user/individual on the job needs to know and exhibit: TK1. how to obtain and interpret drawings, specifications, manufacturers' manuals and other documents needed in the maintenance process TK2. the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance TK3. company policy on the repair/replacement of components during the maintenance process TK4. the sequence to be adopted for the dismantling/reassembly of various types of

	assemblies TK5. the methods and techniques used to dismantle/assemble air conditioning equipment (such as release of pressures/force, proof marking, extraction, pressing, alignment) TK6. methods of checking components are fit for purpose, how to identify defects and wear characteristics, and the need to replace `lifed' items (such as seals and gaskets) TK7. the basic principles of how the equipment functions, its operation sequence, the working purpose of individual units/components and how they interact TK8. the typical building design temperatures, such as for offices, factories (light and heavy work) warehouses and canteens TK9. how to check that tools and equipment are free from damage or defects, are in a safe and usable condition, and are configured correctly for their intended purpose TK10. the problems associated with the maintenance activity, and how they can be overcome TK11. the extent of your own authority and to whom you should report if you have problems that you cannot resolve TK12. Ability to access the required tools & Tackles

Knowledge and Understanding

General & organizational Context	The user/individual on the job needs to know and exhibit: KA1. standard practices of maintenance works KA2. rules and regulation for handling and storing required tools, equipment and materials KA3. procedure for issue of tools and materials KA4. material and equipment used in the maintenance process and their function KA5. importance of identifying non-conforming products and dealing of the same KA6. use of monitoring and measuring devices KA7. the reason and impact of the occurrence of problems in chillers and coolers KA8. measures, steps and possible solutions that have been taken/identified to address the previous problems KA9. the correct method for carrying out corrective actions outlined for each problem KA10. Basic understanding of computer technology

Soft Skills

A. Core Skills/ Generic Skills	**Reading Skills**
	SA1. read and understand manuals, SOPs, health and safety instructions, memos, Reports, job cards etc.
	Writing skills
	SA2. do legible entries with permanent ink SA3. Assist supervisor for preparing maintenance schedules SA4. pay attention to detail while recording maintenance parameters
	Oral Communication (Listening and Speaking skills)
	SA5. communicate with upstream and downstream teams SA6. communicate with people in a proper form and manner and use language that is open and respectful
B. Professional Skills	**Plan & Organize**
	SB1. multi-task and adapt to meet work timelines SB2. study past data to identify resource needs for maintenance activities SB3. Do the work with proper order SB4. plan and organize work to meet health, safety and security requirements
	Decision Making
	SB5. collaborate within the team and with other maintenance teams for identifying appropriate maintenance requirements SB6. make decisions on suitable courses of action
	Critical Thinking
	SB8. apply balanced judgment to different situations SB9. apply basic mathematical and statistical knowledge
	Analytical Thinking
	SB7. analyze operations data and information to identify assembly, installation and maintenance needs SB8. pay attention to detail for identifying faults and anomalies SB9. spot process disruptions and delays and report and communicate these to the Immediate supervisor with solutions SB10. analyze data and activities
	Problem solving
	SB11. solve conflicts and negotiate within the team on work schedules and adherence SB12. explore the correct ways of doing things SB13. identify and objectively evaluate both temporary/short-term and permanent/long-term solutions SB14. identify alternate approaches/resource deployment/equipment utilization to ensure schedule adherence
	Customer Centricity
	SB15. Should be able to in cooperate the customer requirements while doing the shut-down works SB16. follow the preplanned maintenance requirements to avoid delays in customer occupancy

References

http://www.ukstandards.org.uk

http://www.nsdcindia.org/nos

http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_172572.pdf

https://www.oshad.ae/en/Pages/OSHTopicInnerViewPage.aspx?topicID=15

https://dmat.abudhabi.ae/_data/ADC2014/AD_Property_Maintenance_Code/index.html#p=40

https://www.nqa.gov.ae/en/Documents/QF_Handbook_FINAL.pdf

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