

# ITQAN Institute

Diploma in Inspection Fundamentals:  
Electrical Systems

**Qualification Handbook:  
City & Guilds Framework**



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## Introduction to the Qualification

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### Who is the qualification for?

This qualification is for learners who wish to become a trainee technical inspector in the Kingdom of Saudi Arabia. Learners select one pathway from five options: mechanical inspection, electrical inspection, welding inspection, civil inspection, and NDT inspection. The qualification covers a wide range of inspection topics within each pathway, allowing you to develop your knowledge and skills and providing a solid foundation for subsequent on the job training as a trainee inspector within KSA

### What does the qualification cover?

This qualification covers basic theoretical aspects of engineering and their application to inspection. It also provides ample opportunity for practical application of the knowledge and skills acquired. All areas are compulsory. Delivery of the qualification includes site visits where learners can enhance their understanding of specific inspection processes in industrial settings.

### What opportunities for progression are there?

Progression from these qualifications is into the workplace as trainee inspectors.

### Who did we develop the qualification with?

This qualification has been developed by City & Guilds in conjunction with The Inspection Technology and Quality Assurance National Institute of Saudi Arabia

## Structure

The Diploma is split into two (2) x 22- week sessions. Trainee are expected to attend all sessions and complete all activities and examinations.

To achieve the Diploma in Inspection Fundamentals (Electrical Systems)), learners must mandatory units 101-110 plus optional units 139-148.

City & Guilds Unit Number	Unit title	GLH	Credit
101	Principles of Inspection	66	6
102	Principles of Quality Management	66	6
103	Engineering inspection	66	6
104	Use of IT in a work setting	44	6
105	Health and safety for the inspector	66	6
106	Technical English for inspectors	44	6
107	Technical documentation	66	6
108	Technical drawings	66	6
109	Complete inspection documentation	66	6
110	Visual inspection	66	6

City & Guilds Unit Number	Unit title	GLH	Credit
139	Fundamentals of electrical systems	88	9
140	Electrical area classifications	22	2
141	Introduction to electrical equipment	88	9
142	Electrical Safety for inspectors	44	4
143	Wiring methods	44	4
144	Electrical standards and procedures	22	2
145	The care and use of electrical inspection tools	88	9
146	Grounding	88	9
147	Cathodic protection systems	44	4
148	Inspection of electrical systems	88	8

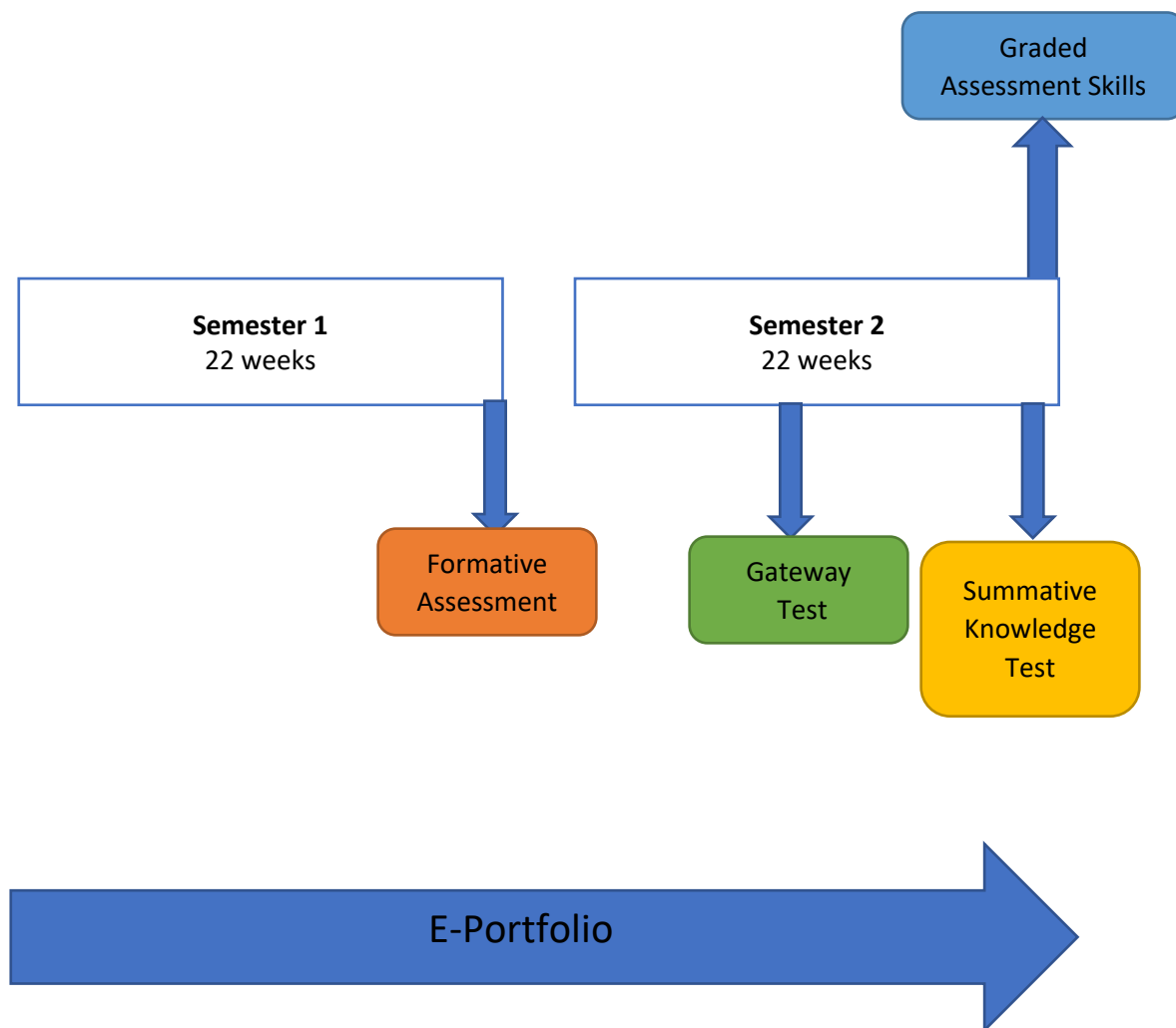
## Assessment Types

Within the Diploma there are multiple assessment types:

- Formative assessment
- Knowledge assessment
- Portfolio assessment
- Gateway assessment
- Skills assessment

## Assessment strategy

The proposed assessment arrangements are illustrated in diagram below:



The approach is summarised as follows:

**Semester 1:**

There will be one formative knowledge test at the end of trimester 1. This assessment will not contribute towards qualification grading and will not act as a gateway assessment (although ITQAN may choose to use it to assess the need for additional learner support).

**Semester 2:**

There will be one “gateway” skills assessment in week 11 or 12. This will be a pass/fail assessment of practical competency

There will be a summative test of underpinning knowledge (a “knowledge test”) at the end of semester 2. This test will be scored and will contribute 20% towards qualification grading. There will be a graded skills assessment at the end of semester 2. This assessment will be graded and will contribute 50% towards qualification grading.

**All trimesters:**

Learners will be required to maintain a cumulative portfolio of evidence to supplement their knowledge tests and skills assessments. This assessment will contribute 30% towards qualification grading, 10% from each trimester.

## Grading

The key features of grading are:

1. The qualification will have four grades: x Distinction x Merit x Pass x Fail/Not Passed Yet
2. Summative knowledge tests will have scored outcomes.
3. Graded skills assessments will have graded outcomes.
4. Portfolio will have graded outcomes.
5. A Grade Point Average or GPA will be used to show learners’ overall level of achievement and to calculate the qualification outcome for each learner. The GPA is calculated from the learner’s attainment over the three scored/graded assessments (the portfolio, the summative knowledge test and the skills assessment).
6. Individual units are not graded.
7. Gateway skills assessment are pass/fail but do not otherwise contribute to the overall qualification grade.

## The Grade Point Average

A Grade Point Average or GPA will be used to show learners' overall level of achievement and to calculate their qualification grade. The GPA is calculated as the learner's average attainment over the three scored/graded assessments (the summative knowledge test, the skills assessment and the graded portfolio). The cut score boundaries (measured on the GPA) for the four qualification outcomes are shown in the following table (for completeness, the table also includes the percentage score equivalents to GPA for each cut score):

Classification	Percentage score		GPA	
	Low	High	Low	High
Distinction	80%	100%	3.2	4
Merit	70%	79%	2.8	3.16
Pass	50%	69%	2	2.76
Fail	0%	49%		1.96

## Recording Evidence

Trainees are able to submit paper-based or electronic method of recording evidence. This must be agreed with the trainer/ Vice Dean. Trainees and Trainers must ensure all documentation is submitted on time.

Completed work will be graded, feedback will then be given to the trainee for future development. Then, the work will go through the ITQAN internal verification (IV) process to ensure the required standards have been met. Also, some work will be sent to an external examiner (EE).

## Understanding Delivery

The Learning Outcomes for the unit should be delivered in sequence as presented as they represent escalating complexity and interdependence. The unit may be delivered by a combination of lectures, tutorial work and practical laboratory work and refer as often as possible to the engineering inspection context.

Learners should be made aware that they will spend a lot of their working life applying Visual Inspection techniques and that a sound knowledge of their background, principles, limitations, codes and standards will be very useful.

## Appendix A: Programme Descriptor

<b>ITQAN Curriculum Learning Outcomes</b>			
<b>#</b>	<b>Unit Code</b>	<b>Learning Outcome</b>	<b>Topics</b>
<b>A- Mandatory Units</b>			
1	101	<ol style="list-style-type: none"> <li>1. Understand the roles and the responsibilities of the inspector</li> <li>2. Understand types of inspection</li> <li>3. Know types of non-conformities</li> </ol>	<ol style="list-style-type: none"> <li>1.1 attributes of the inspector</li> <li>1.2 safety aspects of inspection                             <ol style="list-style-type: none"> <li>2.1 phases of inspection</li> </ol> </li> <li>2.2 inward / outward inspection                             <ol style="list-style-type: none"> <li>2.3 test plans and sampling</li> </ol> </li> <li>3.1 deterioration                             <ol style="list-style-type: none"> <li>3.2 manufacture</li> </ol> </li> </ol>
2	102	<ol style="list-style-type: none"> <li>1. Understand the differences between quality assurance and quality control</li> <li>2. Understand the principles and application of quality assurance</li> <li>3. Understand the principles and application of quality control</li> </ol>	<ol style="list-style-type: none"> <li>1.1 quality assurance and quality control                             <ol style="list-style-type: none"> <li>2.1 quality assurance</li> <li>3.1 quality control</li> </ol> </li> </ol>
3	103	<ol style="list-style-type: none"> <li>1. Understand the ITQAN seven basic skills of inspection</li> <li>2. Understand the personal and professional skills required to work as an Inspector</li> <li>3. Understand the role of individual departments and how these relate to the work of an Inspector</li> <li>4. Apply the seven basic skills, professional skills and technical knowledge to inspection work</li> </ol>	<ol style="list-style-type: none"> <li>1.1 ITQAN seven basic skills                             <ol style="list-style-type: none"> <li>2.1 personal skills</li> <li>2.2 professional skills</li> </ol> </li> <li>3.1 the relationship between other departments and the role of the Inspector                             <ol style="list-style-type: none"> <li>4.1 inspection activities</li> </ol> </li> </ol>



4	104	<ol style="list-style-type: none"> <li>1. Understand the principles and concepts of computer applications in a work setting</li> <li>2. Understand the use of a range of storage devices in a work setting</li> <li>3. Understand how to input and extract information, produce and store documents</li> <li>4. Use email and internet to search, download and send information</li> <li>5. Understand how to use IT safely in a work setting</li> </ol>	<ol style="list-style-type: none"> <li>1.1 principles and concepts of computer applications</li> <li>1.2 correct operation of computer systems in a work setting</li> <li>1.3 carrying out, recording and reporting upon inspection activities using IT</li> <li>2.1 technical storage devices</li> <li>2.2 transfer of information between applications using storage media</li> <li>1.1 inputting and extracting information</li> <li>1.2 producing documents</li> <li>1.3 storing documents</li> <li>1.1 use of email and the internet</li> <li>1.1 workstation height and layout</li> <li>5.2 occupational Health and Safety (OHS) guidelines related to the use of computing equipment</li> </ol>
5	105	<ol style="list-style-type: none"> <li>1. Understand health and safety for inspectors</li> <li>2. Carry out simple risk assessments</li> </ol>	<ol style="list-style-type: none"> <li>1.1 principles of health and safety</li> <li>2.1 carry out simple risk assessments</li> </ol>
6	106	<ol style="list-style-type: none"> <li>1. Understand and interpret technical information</li> <li>2. Communicate technical information with others</li> </ol>	<ol style="list-style-type: none"> <li>1.1 understand and use common inspection terminology</li> <li>1.2 understand readings from equipment</li> <li>2.1 communicating technical information with colleagues</li> <li>2.2 communicating in writing and verbally with others using established inspection vocabulary</li> </ol>

7	107	<ol style="list-style-type: none"> <li>1. Understand technical documentation</li> <li>2. Work with technical documents</li> </ol>	<ol style="list-style-type: none"> <li>1.1 understand technical documentation</li> <li>2.2 work with technical documents</li> </ol>
8	108	<ol style="list-style-type: none"> <li>1. Understand the different types of drawings</li> <li>2. Understand the different uses of technical drawings</li> </ol>	<ol style="list-style-type: none"> <li>1.1 international standards</li> <li>1.2 principles of technical drawings</li> <li>1.3 types of technical drawings <ol style="list-style-type: none"> <li>2.1 design</li> <li>2.2 installation</li> <li>2.3 commissioning</li> <li>2.4 inspection</li> </ol> </li> </ol>
9	109	<ol style="list-style-type: none"> <li>1. Identify technical documentation</li> <li>2. Complete technical documentation</li> </ol>	<ol style="list-style-type: none"> <li>1.1 types of inspection documentation</li> <li>2.1 complete technical documentation</li> </ol>
10	110	<ol style="list-style-type: none"> <li>1. Understand the development of visual inspection</li> <li>2. Understand the principles of vision</li> <li>3. Understand the purpose of visual inspection</li> <li>4. Carry out and report visual inspection</li> <li>5.</li> </ol>	<ol style="list-style-type: none"> <li>1.1 overview of visual inspection</li> <li>2. 1the mechanics of vision <ol style="list-style-type: none"> <li>2.2issues affecting vision</li> </ol> </li> <li>3.1types of visual inspection</li> <li>3.2non-conformities identified through visual inspection</li> <li>4.1carry out visual inspection</li> <li>4.2report on visual inspection</li> </ol>

<b>B- Specialty Units</b>			
<b>11</b>	<b>139</b>	<p><b>1 Understand the principles of electricity, magnetism and electrical power</b></p> <p><b>2 Understand Direct Current (DC) sources of electricity and methods of generation</b></p> <p><b>3 Understand Alternating Current (AC) sources of electricity and methods of generation</b></p> <p><b>4 Understand electrical symbols, diagrams and labels</b></p> <p><b>5 Apply technical knowledge to inspection work</b></p>	<p><b>1.1 electron theory</b></p> <p><b>1.2 static electricity/conduction</b></p> <p><b>1.3 electrical terminology</b></p> <p><b>1.4 electricity generation</b></p> <p><b>1.5 magnets and electromagnets</b></p> <p><b>1.6 principles of electrical power</b></p> <p><b>2.1 DC sources of electricity</b></p> <p><b>2.2 DC circuits</b></p> <p><b>2.3 resistance/resistor</b></p> <p><b>2.4 capacitance/capacitor</b></p> <p><b>2.5 inductance/inductor</b></p> <p><b>2.6 DC motor/generator theory</b></p> <p><b>3.1 AC sources of electricity</b></p> <p><b>3.2 transformers</b></p> <p><b>3.3 filters</b></p> <p><b>3.4 AC generators</b></p> <p><b>3.5 AC motors</b></p> <p><b>3.6 safety devices</b></p> <p><b>4.1 electrical symbols, diagrams and labels</b></p> <p><b>4.2 use of electrical symbols</b></p> <p><b>5.1 safety precautions</b></p> <p><b>5.2 settings for inspection work</b></p>
<b>12</b>	<b>140</b>	<p><b>1 Understand the hazards associated with classifications and zones</b></p> <p><b>2 Understand the electrical coding of building specification</b></p> <p><b>3 Understand the types of electrical area classifications</b></p> <p><b>4 Understand the use of zones for storage</b></p>	<p><b>1.1 inappropriately installed equipment</b></p> <p><b>1.2 certification and labelling</b></p> <p><b>2.1 the purpose of the codes of access</b></p> <p><b>2.2 the National Electrical Code (NEC), or National Fire Protection Association NFPA 70</b></p> <p><b>3.1 the 3 classes</b></p> <p><b>3.2 the 5 zones</b></p> <p><b>4.1 use of zones for storage</b></p>
<b>13</b>	<b>141</b>	<p><b>1 Understand the purpose and safe operation of electrical equipment</b></p> <p><b>2 Understand the purpose and safe operation of electrical equipment that controls power</b></p> <p><b>3 Understand the purpose and safe operation of electrical equipment that carries power</b></p>	<p><b>1.1 AC equipment and systems</b></p> <p><b>1.2 DC equipment and systems</b></p> <p><b>2.1 equipment that controls power</b></p> <p><b>3.1 equipment that carries power</b></p>

14	142	<p>1 Understand key principles of electrical safety</p> <p>2 Understand the use of electrical protective equipment</p> <p>3 Understand hazard protection methods</p> <p>4 Understand the codes for electrical safety in the workplace</p>	<p>1.1 flash hazards</p> <p>1.2 shock protection boundaries</p> <p>1.3 arc flash energies</p> <p>2.1 electrical protective equipment</p> <p>3.1 working space</p> <p>3.2 safety procedures</p> <p>4.1 National Fire Protection Association Code NFPA-70E</p>
15	143	<p>1 Understand the routing techniques for electrical wiring</p> <p>2 Understand the types, applications and purposes of different wire</p> <p>3 Understand basic wiring methods</p> <p>4 Understand soldering and bonding of electrical wiring</p> <p>5 Understand connection and termination of electrical wiring</p> <p>6 Understand the codes for electrical wiring methods</p>	<p>1.1 routing techniques for electrical wiring</p> <p>1.2 requirements for different locations</p> <p>2.1 types and purposes of wire</p> <p>3.1 properties and applications</p> <p>3.2 inspection and maintenance</p> <p>4.1 bonding</p> <p>5.1 crimping and splicing technology</p> <p>5.2 crimping and splicing methods</p> <p>6.1 codes for electrical wiring methods</p>
16	144	<p>1 Understand and interpret standards and procedures for electrical inspection</p>	<p>1.1 standards and procedures for electrical inspection</p>
17	145	<p>1. Understand health and safety precautions for use of tools and equipment in an electrical inspection environment</p> <p>2 Select and use the correct electrical tools and inspection equipment for given tasks</p>	<p>1.1 health and safety precautions and procedures</p> <p>1.2 reporting faults and calibration of equipment used in electrical inspection</p> <p>2.1 selection and use of hand and power tools</p> <p>2.2 use of electrical test equipment</p>

18	146	<p>1 Understand the principles and safe use of grounding</p> <p>2 Understand the principles and safe use of bonding</p> <p>3 Understand safe working procedures with static electricity</p> <p>4 Understand the reasons for, causes, properties and effects of lightning</p> <p>5 Understand the methods used in lightning protection</p> <p>6 Understand the codes for grounding, bonding and lightning protection systems</p>	<p>1.1 importance of grounding</p> <p>1.2 grounding systems</p> <p>1.3 grounding in corrosive and non-corrosive settings</p> <p>2.1 principles of bonding</p> <p>2.2 bonding specification</p> <p>2.3 shielding</p> <p>3.1 safety procedures for working with Electrostatic Discharge (ESD)</p> <p>4.1 properties of lightning</p> <p>4.2 ground based objects that can emit streamers</p> <p>4.3 effects of lightning</p> <p>5.1 lightning protection</p> <p>5.2 factors to consider in down conductors</p> <p>6.1 codes for grounding, bonding and lightning protection systems</p>
19	147	<p>1 Understand corrosion and how it can be prevented</p> <p>2 Understand galvanic and sacrificial protection systems</p> <p>3 Understand the principles of Cathodic protection systems testing</p> <p>4 Understand how to interpret results</p>	<p>1.1 corrosion</p> <p>1.2 corrosion prevention</p> <p>2.1 galvanic systems</p> <p>2.2 sacrificial systems</p> <p>2.3 impressed current</p> <p>3.1 testing of Cathodic protection systems</p> <p>4.1 interpretation of results</p>
20	148	<p>1 Understand and apply codes required for the inspection of electrical equipment and systems</p> <p>2 Understand and apply technical knowledge to inspect materials used in electrical equipment and systems</p> <p>3 Understand and apply technical knowledge to inspect the operational aspects of installed electrical equipment and systems</p> <p>4 Understand and apply technical</p>	<p>1.1 ISO9001 International Standards Organisation Quality Standards System</p> <p>1.2 IEC documents</p> <p>2.1 verification of vendor documentation</p> <p>2.2 inspection and reporting of equipment and systems</p> <p>2.3 facilities acceptance testing</p> <p>3.1 inspection of installed electrical equipment and systems</p>

		<b>knowledge to inspect electrical systems and installations</b>	<b>4.1 process of inspection 4.2 develop basic inspection and test plans</b>
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