

ITQAN Institute

Diploma in Inspection Fundamentals:
Mechanical Systems

**Qualification Handbook:
City & Guilds Framework**



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Introduction to the Qualification

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 (Mechanical Systems), learners must mandatory units 101-110 plus optional units 111-118.

| 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 |
|---------------------------|---|-----|--------|
| 111 | Materials Science | 88 | 9 |
| 112 | Basic Engineering Science | 44 | 4 |
| 113 | Basic Mechanical Inspection | 110 | 11 |
| 114 | Manufacturing Processes and Material Testing | 88 | 9 |
| 115 | Inspection Tools, Equipment and Calibration | 88 | 9 |
| 116 | Inspection Types | 110 | 10 |
| 117 | Introduction to Non Destructive Testing (NDT) | 44 | 4 |
| 118 | Read Technical Drawings for Mechanical Inspectors | 44 | 4 |

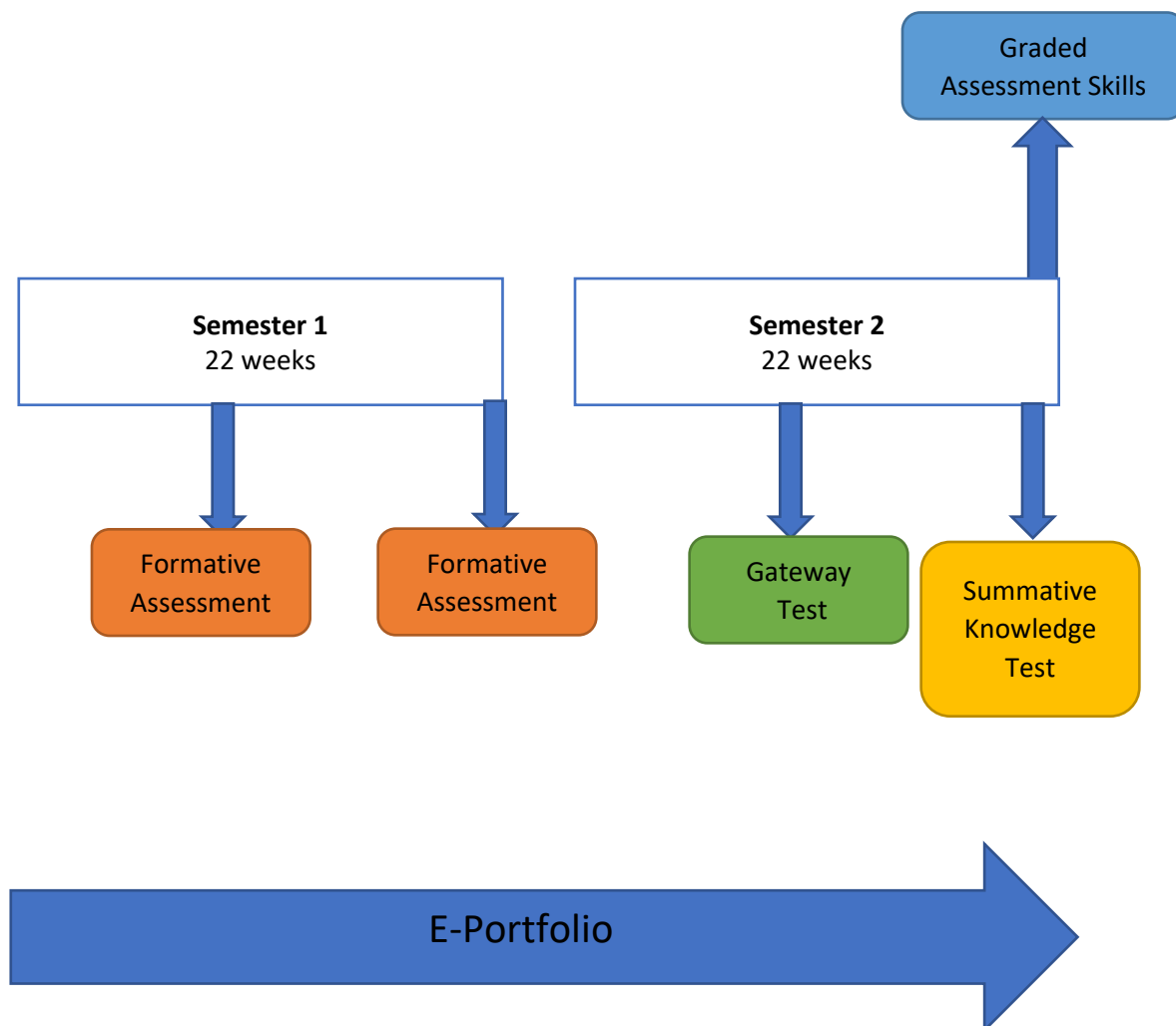
Assessment Types

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 semesters:

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.

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

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

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| 4 | 104 | <ol style="list-style-type: none"> 1. Understand the principles and concepts of computer applications in a work setting 2. Understand the use of a range of storage devices in a work setting 3. Understand how to input and extract information, produce and store documents 4. Use email and internet to search, download and send information 5. Understand how to use IT safely in a work setting | <ol style="list-style-type: none"> 1.1 principles and concepts of computer applications 1.2 correct operation of computer systems in a work setting 1.3 carrying out, recording and reporting upon inspection activities using IT <ol style="list-style-type: none"> 2.1 technical storage devices 2.2 transfer of information between applications using storage media <ol style="list-style-type: none"> 1.1 inputting and extracting information 1.2 producing documents 1.3 storing documents 1.1 use of email and the internet <ol style="list-style-type: none"> 1.1 workstation height and layout 5.2 occupational Health and Safety (OHS) guidelines related to the use of computing equipment |
| 5 | 105 | <ol style="list-style-type: none"> 1. Understand health and safety for inspectors 2. Carry out simple risk assessments | <ol style="list-style-type: none"> 1.1 principles of health and safety 2.1 carry out simple risk assessments |
| 6 | 106 | <ol style="list-style-type: none"> 1. Understand and interpret technical information 2. Communicate technical information with others | <ol style="list-style-type: none"> 1.1 understand and use common inspection terminology 1.2 understand readings from equipment <ol style="list-style-type: none"> 2.1 communicating technical information with colleagues 2.2 communicating in writing and verbally with others using established inspection vocabulary |
| 7 | 107 | <ol style="list-style-type: none"> 1. Understand technical documentation 2. Work with technical documents | <ol style="list-style-type: none"> 1.1 understand technical documentation 2.2 work with technical documents |

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| 8 | 108 | <ol style="list-style-type: none"> 1. Understand the different types of drawings 2. Understand the different uses of technical drawings | <ol style="list-style-type: none"> 1.1 international standards 1.2 principles of technical drawings 1.3 types of technical drawings <ol style="list-style-type: none"> 2.1 design 2.2 installation 2.3 commissioning 2.4 inspection |
| 9 | 109 | <ol style="list-style-type: none"> 1. Identify technical documentation 2. Complete technical documentation | <ol style="list-style-type: none"> 1.1 types of inspection documentation 2.1 complete technical documentation |
| 10 | 110 | <ol style="list-style-type: none"> 1. Understand the development of visual inspection 2. Understand the principles of vision 3. Understand the purpose of visual inspection 4. Carry out and report visual inspection 5. | <ol style="list-style-type: none"> 1.1 overview of visual inspection 2. 1the mechanics of vision <ol style="list-style-type: none"> 2.2 issues affecting vision 3.1 types of visual inspection 3.2 non-conformities identified through visual inspection <ol style="list-style-type: none"> 4.1 carry out visual inspection 4.2 report on visual inspection |
| B- Specialty Units | | | |
| 11 | 111 | <ol style="list-style-type: none"> 1 Understand the basic atomic model 2 Understand material types and their properties 3 Understand corrosion and how it can be prevented | <ol style="list-style-type: none"> 1.1 atomic structure 1.2 phases of matter <ol style="list-style-type: none"> 2.1 metals 2.2 non-metals 2.3 properties of materials <ol style="list-style-type: none"> 3.1 corrosion 3.2 corrosion prevention |
| 12 | 112 | <ol style="list-style-type: none"> 1 Understand statics 2 Understand dynamics 3 Understand heat | <ol style="list-style-type: none"> 1.1 statics <ol style="list-style-type: none"> 2.1 dynamics 3.1 heat |

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| 13 | 114 | 1 Understand manufacturing processes 2 Test materials | 1.1 statics 2.1 dynamics 3.1 heat 1.1 manufacturing processes 2.1 materials testing |
| 14 | 117 | 1 Understand the principles of NDT 2 Perform basic conventional NDT | 1.1 NDT and quality assurance 1.2 how NDT works 2.1 prepare for NDT tests 2.2 carry out simple NDT tests 1.1 engineering equipment 1.2 inspection of welds |
| 15 | 125 | 1 Understand the development of VT 2 Understand principles of vision 3 Understand principles of light 4 Understand principles of optics 5 Understand factors which impact on VT inspection 6 Use, maintain and calibrate VT equipment 7 Understand formal requirements for VT 8 Apply VT Techniques 9 Manage documentation and storage requirements | 1.1 overview of VT 2.1 the mechanics of vision 2.2 issues affecting vision 3.1 the fundamental principles of light 3.2 measurement of light 4.1 types of optics 5.1 material factors 5.2 environmental factors 5.3 personal factors 6.1 use VT equipment 6.2 maintain and calibrate VT equipment 7.1 formal VT requirements 8.1 types of materials to be inspected 8.2 plan, carry out and complete VT 9.1 key documentation 9.2 record and store images |

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| 16 | 126 | <p>1 Understand the development of DPT</p> <p>2 Understand factors which impact on DPT</p> <p>3 Use, maintain and calibrate DPT equipment</p> <p>4 Understand formal requirements for DPT inspection</p> <p>5 Understand material types</p> <p>6 Use penetrants, emulsifiers and developers</p> <p>7 Apply DPT methods</p> <p>8 Inspect and evaluate indications</p> <p>9 Manage documentation and storage requirements</p> | <p>1.1 overview of DPT</p> <p>2.1 material factors</p> <p>2.2 environmental factors</p> <p>2.3 personal factors</p> <p>3.1 DPT equipment</p> <p>3.2 DPT equipment calibration and maintenance</p> <p>4.1 formal requirements for DPT inspection</p> <p>5.1 types of materials to be inspected</p> <p>6.1 use penetrants</p> <p>6.2 use emulsifiers</p> <p>6.3 use developers</p> <p>7.1 DPT methods</p> <p>7.2 selection of DPT methods</p> <p>7.3 application of DPT methods</p> <p>8.1 inspection of indications</p> <p>8.2 evaluation of indications</p> <p>9.1 key documentation</p> <p>9.2 record and store images</p> |
| 17 | 127 | <p>1 Understand the development of UT</p> <p>2 Understand the principles of sound</p> <p>3 Understand UT methods</p> <p>4 Use, maintain and calibrate UT equipment and consumables</p> <p>5 Understand the factors which impact on UT</p> <p>6 Understand formal requirements for UT</p> <p>7 Understand material types</p> <p>8 Apply UT methods</p> <p>9 Inspect and evaluate indications</p> <p>10 Manage documentation and storage requirements</p> | <p>1.1 overview of UT</p> <p>2.1 the mechanics of sound</p> <p>2.2 the properties of sound</p> <p>3.1 UT scan types</p> <p>3.2 UT contact methods</p> <p>3.3 UT immersion methods</p> <p>4.1 UT equipment and consumables</p> <p>4.2 calibration of UT equipment</p> <p>5.1 material factors</p> <p>5.2 environmental factors</p> <p>5.3 personal factors</p> <p>6.1 understand formal requirements of UT</p> <p>7.1 types of materials to be inspected</p> <p>8.1 select UT methods</p> |

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| | | | <p>8.2 apply UT methods</p> <p>9.1 discontinuity</p> <p>9.2 interpret inspection of indications</p> <p>9.3 evaluate indications</p> <p>10.1 key documentation</p> <p>10.2 record and store images</p> |
| 18 | 128 | <p>1 Understand the principles of maintenance and on-stream inspection</p> <p>2 Carry out simple inspections</p> | <p>1.1 inspection types</p> <p>1.2 variables associated with inspection types</p> <p>2.1 simple internal inspections using NDT methods</p> <p>2.2 simple external inspections using NDT methods</p> <p>2.3 simple in-service inspections using NDT methods</p> |
| 19 | 129 | <p>1 Understand the development of MPT</p> <p>2 Understand magnets, magnetic fields and flux fields for MPT</p> <p>3 Understand electric current for MPT</p> <p>4 Understand, calibrate and maintain MPT equipment and consumables</p> <p>5 Understand factors which impact on MPT</p> <p>6 Understand formal requirements for MPT</p> <p>7 Apply MPT techniques</p> <p>8 Manage documentation and storage requirements</p> | <p>1.1 overview of MPT</p> <p>2.1 magnets and magnetic fields</p> <p>2.2 flux patterns</p> <p>2.3 principles, units and calculations associated with magnetic flux fields for MPT</p> <p>3.1 electric current and magnetisation</p> <p>3.2 calculations associated with electric current for MPT</p> <p>4.1 MPT equipment</p> <p>4.2 MPT consumables (liquids and powders)</p> <p>4.3 calibrate and maintain MTP equipment and consumables</p> <p>5.1 material factors</p> <p>5.2 environmental factors</p> <p>5.3 personal factors</p> <p>6.1 formal requirements for MPT</p> <p>7.1 select appropriate method and equipment</p> <p>7.2 carry out MPT technique</p> <p>8.1 key documentation</p> <p>8.2 record and store images</p> |

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| 20 | 130 | <p>1 Understand the development and basic safety considerations of RT</p> <p>2 Understand radiation for RT</p> <p>3 Understand radiography for RT</p> <p>4. Understand basic RT darkroom principles and practice</p> <p>5 Understand the factors which impact on RT</p> <p>6 Understand formal requirements for RT</p> <p>7 Evaluate and interpret radiographic images</p> <p>8 Manage documentation and storage requirement</p> | <p>1.1 overview of RT</p> <p>1.2 basic safety considerations of RT</p> <p>2.1 types of radiation</p> <p>2.2 radioactive materials</p> <p>2.3 radiation and matter</p> <p>2.4 exposure devices and radiation sources</p> <p>3.1 radiography</p> <p>3.2 radiographs</p> <p>3.3 film handling, loading, and processing</p> <p>3.4 radiographic exposure techniques and image quality</p> <p>3.5 fluoroscopic techniques</p> <p>4.1 basic RT darkroom principles and practice</p> <p>5.1 material factors</p> <p>5.2 environmental factors</p> <p>5.3 personal factors</p> <p>6.1 formal requirements for RT</p> <p>7.1 typical discontinuities and defects</p> <p>7.2 radiographs</p> <p>7.3 application techniques</p> <p>7.4 evaluation</p> <p>8.1 key documentation</p> <p>8.2 record and store images</p> |
| 21 | 131 | <p>1 Understand personal safety and radiation protection</p> <p>2 Use radiation survey instruments and equipment</p> | <p>1.1 exposure hazards</p> <p>1.2 methods of controlling radiation dose</p> <p>1.3 personal monitoring</p> <p>1.4 biological effects of radiation</p> <p>2.1 survey instruments and equipment</p> <p>2.2 radiation area surveys</p> |