



# **Occupational Job Structures for Non Destructive Testing Industrial Sector**



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## **1.0 Executive Summary**

The term Non-destructive testing (NDT) is defined as a technology that tests materials or components without destroying or damaging it. The mostly widely used NDT methods are radiographic testing (RT), ultrasonic testing (UT), magnetic particle testing (MT), liquid penetrant testing (PT), eddy current testing (ET), and visual testing (VT). The importance of NDT as a tool is an undisputed fact, due to its ability to detect, locate and measure defects in specimens. This information would then be used as guidelines in order to evaluate the viability of the part based on specified codes, standards and specifications. However, the final call to be made with regards to the part depends entirely on the integrity and the skill of the personnel conducting the inspection, in which their competency and qualification can be assured via a recognised and structured scheme of qualification and certification.

This study highlights the current status of the NDT workforce in Malaysia in terms of their preliminary status, the lack of qualified and competent personnel, and the shortfall of an existing or planned training agency. These factors necessitated the adoption of foreign based schemes to local practices, but the year 1985 heralded a new era of NDT practices in Malaysia, by the introduction of newly devised locally-developed codes. In order to ensure its implementation and usage among the local industries and companies, regulators and authorisation bodies are compelled to utilise the national certification scheme adopted by the government. This initiative was by and large the result of the combined effort between international experts, the national certifying body i.e. formerly known as NITTCB/MLVK and now JPK, who implement the requirements of the scheme based on an international standard ISO 9712 (1999). The latter has undergone many changes, with its most updated version of 2012 making up the majority of the reference in this review.

This document involves the primary review of the status of occupational analysis for NDT personnel after the national NDT scheme was established in 1985, in conjunction with the creation of the first NOSS in Radiography. After a 10 year period, other NOSS documents have been published for UT, MT, PT and ET. During this period, the practice and implementation of NDT has evolved to levels that makes it necessary for these documents to be reviewed, and if needed, updated. The local

NDT experts who are the products of and benefitted tremendously from the system concluded that there are 124 job titles in NDT, comprising of 110 critical and 14 non-critical job titles, covering a total of 5 job NDT sub-sectors; namely oil and gas, aerospace, transportation, concrete construction and nuclear power. After the occupational analysis of NDT personnel has been produced and finalized, its associated NOSS will be developed, with emphasis firstly on RT and UT methods for the oil and gas industry. The other three methods, namely the MT, PT and ET methods will be analysed after the commencement of the second phase.

## **2.0 Concept and Structure of the Malaysian Occupational Skills Qualification and Certification Framework**

### **2.1 National Occupational Skill Standard (NOSS)**

NOSS is defined as a specification of the competencies expected from a skilled worker gainfully employed in Malaysia for an occupational area and Level, and a path to acquire the competencies.

|   |   |
|---|---|
| <b>Malaysia Skills Certificate<br/>Level 1:</b> | Competent in performing a range of varied work activities, most of which are routine and predictable. |
|---|---|

|   |  |
|---|--|
| <b>Malaysia Skills Certificate<br/>Level 2:</b> | Competent in performing a significant range of varied work activities, performed in a variety of contexts. Some of the activities are non-routine and required individual responsibility and autonomy. |
|---|--|

|   |   |
|---|---|
| <b>Malaysia Skills Certificate<br/>Level 3:</b> | Competent in performing a broad range of varied work activities, performed in a variety of contexts, most of which are complex and non-routine. There is considerable responsibility and autonomy |
|---|---|

and control or guidance of others is often required.

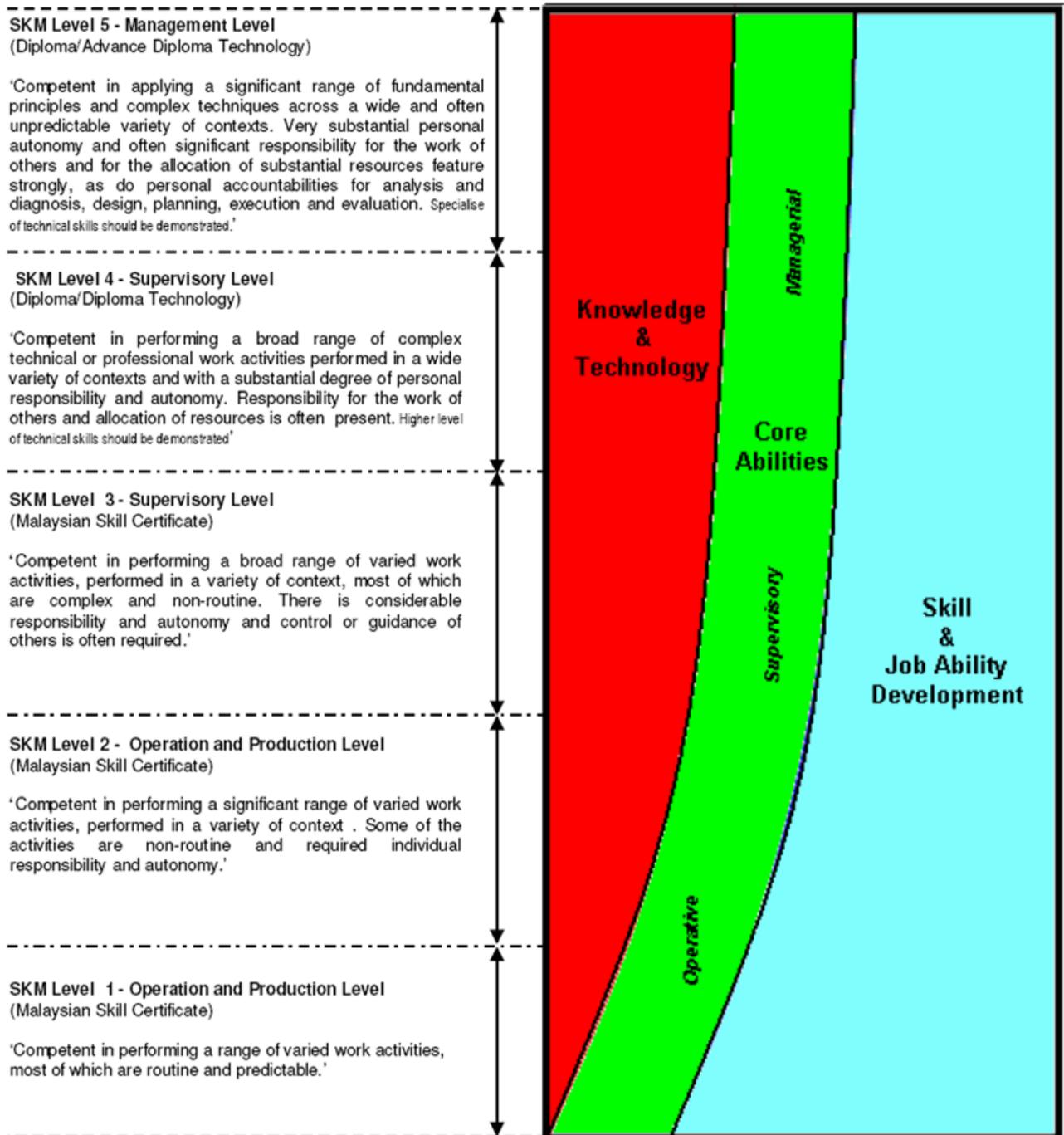
**Malaysia Skills Diploma  
Level 4:**

Competent in performing a broad range of complex technical or professional work activities performed in a wide variety of contexts and with a substantial degree of personal responsibility and autonomy. Responsibility for the work of others and allocation of resources is often present.

**Malaysia Skills Advanced  
Diploma Level 5:**

Competent in applying a significant range of fundamental principles and complex techniques across a wide and often unpredictable variety of contexts. Very substantial personal autonomy and often significant responsibility for the work of others and for the allocation of substantial resources features strongly, as do personal accountabilities for analysis, diagnosis, planning, execution and evaluation.

## Types of Skill Certification



## MALAYSIA OCCUPATIONAL SKILLS QUALIFICATION FRAMEWORK

| Level | Level Description   |
|-------|---|
| 1     | Achievement at this level reflects the ability to use relevant knowledge, skills and procedures to complete routine and predictable tasks that include responsibility for completing tasks and procedures subject to direction or guidance.   |
| 2     | Achievement at this level reflects the ability to select and use relevant knowledge, ideas, skills and procedures to complete well-defined tasks and address straightforward problem. It includes taking responsibility for completing tasks and procedures, and exercising autonomy and judgment subject to overall direction or guidance  |
| 3     | Achievement at this level reflects the ability to identify and use relevant understanding, methods and skills to complete task and address problems that are well defined with a measure of complexity. It includes taking responsibility for initiating and completing tasks and procedures as well as exercising autonomy and judgments within limited parameter. It also reflects awareness of different perspectives or approaches within an area of study or work  |
| 4     | Achievement at this level reflects the ability to identify and use relevant understanding, methods and skills to address problems that are well defined but complex and non-routine. It includes taking responsibility for overall courses of action as well as exercising autonomy and judgment within fairly broad parameters. It also reflects understanding of different perspective or approaches within an area of study or work  |
| 5     | Achievement at this level reflects the ability to identify and use relevant understanding, methods and skills to address broadly-defined, complex problems. It includes taking responsibility for planning and developing courses of action as well as exercising autonomy and judgment within broad parameters. It also reflects understanding of different perspectives, approaches or schools of thought and the reasoning behind them   |
| 6     | Achievement at this level reflects the ability to refine and use relevant understanding, methods and skills to address complex problems that have limited definition. It includes taking responsibility for planning and developing courses of action that are able to underpin substantial change or development, as well as exercising broad autonomy and judgment. It also reflects an understanding of different perspectives, approaches of schools of thought and the theories that underpin them   |
| 7     | Achievement at this level reflects the ability to reformulate and use relevant understanding, methodologies and approaches to address problematic situations that involve many interacting factors. It includes taking responsibility for planning and developing courses of action that initiate or underpin substantial change or development, as well as exercising broad autonomy and judgment. It also reflects an understanding of theoretical and relevant methodological perspectives, and how they affect their area of study or work  |
| 8     | Achievement at this level reflects the ability to develop original understanding and extend an area of knowledge or professional practice. It reflects the ability to address problematic situations that involve many complexes, interacting factors through initiating, designing and undertaking research, development or strategic activities. It involves the exercise of broad autonomy, judgement and leadership in sharing responsibility for the development of a field of work or knowledge, or for creating substantial professional or organisational change. It also reflects a critical understanding of relevant theoretical and methodological perspectives and how they affect the field of knowledge or work. |

*Source: Department of Skills Development (1)*

### **3.0 NDT and Its Impact in Malaysian Industry - Background of the Sector**

#### **3.1 Definition of NDT**

NDT is defined as the development and application of testing methods to examine materials and components in ways that do not impair future usefulness and serviceability of the parts that are being inspected. Due to the progress of Information and Communication Technology (ICT), its integration and implementation to advanced NDT methods compliments and augment conventional methods such as digital RT, phase array ultrasonic testing (PAUT), long range ultrasonic testing (LRUT), time of flight diffraction testing (TOFD), acoustic emission testing (AT), and etc.

#### **3.2 Basic Principles of NDT Methods**

##### **3.2.1 Radiographic Testing (RT)**

Radiography testing (RT) is a material testing technique that utilises electromagnetic waves to detect defects in an object or a component. This testing technique is applicable to a wide range of materials, running the range from metals to wood, and is of particular importance to steel and composite materials. This test method requires the use of an X-ray machine, which transmits electromagnetic radiation through an object. The medium of delivery of these electromagnetic radiations is usually a hand-held (portable) radiation device or something in a similar configuration (mobile or fix), in order to enhance handling and portability. These devices may emit X-Rays or carry radioisotope, which emit gamma-rays. These X-ray or gamma ray, which called photons emitted from the radiation device will enter an object, which acts as a target, and as it transverse through the object, some of its energy will be absorbed by the target. The excess energy will then pass through the target uneventfully, being collected by a radiographic film attached on the opposite side of the target. The measurement and analysis of the images formed on this film will enable the RT operator or inspector to check for flaws or defects in the target.

RT provides a great deal of information to NDT inspectors and engineers, such as verifying the thickness of a material, as well as its structural make-up. RT also alerts testers to internal cracks, voids or air pockets within the material. The RT technique is also capable of spotting weak spots, from which failure(s) might occur over time.

### **3.2.2 Ultrasonic Testing (UT)**

In the ultrasonic testing (UT) method, a very short ultrasonic pulse-wave, with centre frequencies ranging from 0.1-15MHz, and occasionally running up to 50MHz, is launched into materials to characterise it or detect internal flaws. A common example of the application of this method is the ultrasonic thickness measurement, which determines the thickness of the test object for purposes such as the monitoring of pipe-work corrosion. UT is often performed on steel and other metals and alloys, although it is also viable to be used on concrete, wood and composites, albeit with inferior resolution.

In UT, an ultrasound transducer connected to a diagnostic machine will produce an ultrasonic wave, which is then passed through the object being inspected. The transducer is typically separated from the test object by a couplant, such as oil and water. There are two methods of receiving the ultrasound waveform; which are reflection and attenuation. In the reflection (or pulse-echo) mode, the transducer sends and receives the pulsed waves as the "sound" is reflected back to the device. Reflected ultrasound is emitted from an interface, such as the back wall of an object, or an imperfection within the object. The diagnostic machine will display these results in the form of a signal, with amplitude representing the intensity of the reflection, and the distance representing the arrival time of the reflection. Meanwhile, in the attenuation (or through-transmission) mode, a transmitter emits ultrasound through one surface, while a separate receiver detects the amount reaching the other surface after travelling through the medium. Imperfections or other conditions in the space between the transmitter and receiver will reduce the amount of transmitted sound, making it visible during the detection process. Utilising a couplant increases the efficiency of the process by reducing the losses in the ultrasonic wave energy that might arise due to separation between the surfaces.

### **3.2.3 Magnetic Particle Testing (MT)**

Magnetic particle testing (MT) is a process designed to detect surface and slight-subsurface discontinuities of in ferromagnetic materials such as iron, nickel, cobalt, and its constituent alloys. The process places the generated magnetic field into a target material, and the target can then be magnetised via direct or indirect magnetisation. Direct magnetisation occurs when an electrical current is passed through the test object; forming a magnetic field in the material, while indirect magnetisation occurs when no electrical current is passed through the test object, but are rather applied from an outside source. The formed magnetic lines of force are perpendicular to the direction of the electric current, which may either be alternating current (AC), or some form of rectified AC which is also called direct current (DC).

A technician performing MT on a pipeline to check for stress corrosion cracking uses what is known as the "black and white" method. During MT inspection, a close-up of the surface of a component, an indication which shows stress corrosion cracking is revealed (in the form of an indication that is clusters of small black lines). Cracks, which would normally have been invisible, become detectable due to action of the magnetic particles clustering at the crack openings.

The presence of a surface or sub-surface discontinuity in the material permits the leakage of the magnetic flux, due to the fact that air cannot support as much magnetic field per unit volume compared to metals. Ferrous iron particles are then applied to the part, either in the dry or wet suspension mode. If an area of flux leakage is present, the particles will invariably be attracted to this area. The particle build-up that will eventually occur at the leakage area forms what is called an indication. This indication is the evaluation piece that will allow the MT operator or inspector to determine what it is, what may have caused it, and what action should be taken, if any.

### **3.2.4 Liquid Penetrant Testing (PT)**

Penetrant testing (PT) is a widely applied and low-cost inspection method, which is used to locate surface-breaking defects in all non-porous materials (metals, plastics, or

ceramics). The penetrant is applicable for all non-ferrous materials and ferrous materials, although for ferrous components, magnetic-particle inspection is generally preferred, due to its subsurface detection capability. The PT is used to detect surface defect in casting, forging and welding such as hairline cracks, surface porosity, leaks, and fatigue cracks on in-service components.

The PT method hinges on the mechanisms of the capillary action, where surface tension fluid low penetrates a clean and dry surface-breaking discontinuity. The penetrant may be introduced into to the test component by dipping, spraying, or brushing. After an acceptable amount of penetration time has passed, a developer is applied. The developer assists in drawing the penetrant out of the flaw, where an invisible indication is made visible to the inspector. Inspection is performed under an ultraviolet (UV) or white light, depending upon the type of dye used; fluorescent or non-fluorescent (visible).

### **3.2.5 Eddy Current Testing (ET)**

The Eddy current testing (ET) utilises electromagnetic induction to detect flaws in electrically conductive materials. This method is not without its limitation, however, primary among them are its viability for only conductive materials; an exposed surface must be obtained prior to analysis; varying type of surface finish might result in unconfirmed readings; the depth of penetration into the material is limited by the materials' conductivity; and flaws that lie parallel to the probe may be undetectable.

In a standard ET method, a circular coil capable of carrying electrical current is placed adjacent to the test specimen (which must be electrically conductive).The alternating current in the coil generates a changing magnetic field, which interacts with the test specimen and generates an eddy current. Some variations in the phase and magnitude of these eddy currents can be monitored using a second 'receiver' coil, or by measuring the changes to the current flowing in the primary 'excitation' coil. Any variations in the electrical conductivity or magnetic permeability of the test object, or the presence of any flaws, will cause a fluctuation in the eddy current, and a corresponding change in the phase and amplitude of the measured current. This is the

basis of the standard for eddy current inspection using flat coils, which is the most widely used eddy current inspection technique.

The advantages of this technique, however, more than make up for its shortcomings. It is capable of detecting very small cracks in or near the surface of the material, the steps needed for sample preparation is fairly minimal, and complex geometrical configurations are not a hindrance. It is also useful for making electrical conductivity and coating thickness measurements. The testing devices are portable, provide immediate feedback, and operate in a non-contact mode in almost all cases. Another ET technique worth mentioning is the pulsed eddy-current testing. A major advantage of this type of testing is that direct contact with the tested object is not required. The measurement can be performed through coatings, corrosion products and insulation materials. This way, even high temperature inspections are viable. In contrast to the conventional ET technique, the pulsed eddy-current allows multi-frequency operation.

### **3.3 Application of NDT in Malaysian Industry**

The NDT industry/operations are clustered under the manufacturing sector, in the heading of non-resource (machinery and equipment, metals and transport equipment) and resource-based (petrochemical) in the Malaysian third industrial master plan [2]. The primary role of NDT is to promote the production of reliable and high quality products for the export market, by ensuring the integrity of the components and materials via its application in the various industries. The skills of personnel are as imperative as top-notch equipments in this field. In the early 1970s, Malaysia heavily relied on the knowledge and skills of foreign experts, especially those operating in the oil and gas industry. NDT certification schemes were controlled and disbursed by foreign entities, and training programmes are fairly limited to in-house approaches. Most of the previous generation trained in NDT techniques acquired their trainings overseas, via foreign companies and foreign training centres. The establishment of a national oil company, PETRONAS, drastically shifted the perception of industrial education and training development in a multitude of industrial sectors locally. This change is caused by the strict regulations and enforcements imposed by this wealthy

industrial sector, which implements and enforces standards on par with international oil companies.

Concurrently, Regulations under Factories and Machinery Act 1967 (Act 139) enforced by the Malaysian Ministry of Labour requires that all boilers and pressure vessels produced overseas or locally to be thoroughly inspected in order to ensure the safety and security before, during and after operations. This requirement paved the way for the emergence of NDT technology in the forefront of industrial development in Malaysia. Initially, the most widely used NDT method is RT, which makes up about 70% of the NDT job. Although RT is a widely used industrial technique, the lack of training and understanding, and mishandling of radiation sources has resulted in workers being exposed to high-radiation doses, with many cases being referred to the Ministry of Health. This incident is deemed as serious, and in an effort to minimise these type of incidents and regulate the usage of radiation activities, the Atomic Energy Licensing 1984 (Act 304) was introduced and gazetted by the Ministry of Science, Technology and Innovation (MOSTI). This act requires all NDT companies or organisations possessing radiation or radiation related apparatus be registered and licensed under the Atomic Energy Licensing Board (AELB), and radiation workers are required to undergo proper training, which leads to a structured qualification and certification system.

In Malaysia, NDT has seen widespread usage in almost all industrial sectors. The method can be applied at an early stage of engineering processes such as manufacturing, fabrication, in-service, maintenance, installation and commissioning. Some examples of industries adopting NDT techniques are the oil and gas industry, power generation, petro-chemical, aerospace, transportation (automotive, railway, ship and aircraft), building construction, military, electronics, semiconductors, utilities, marine, defence etc. The majority of NDT methods are manually operated, except when involving large volume production, where semi or fully automatic operations are duly employed.

The most notable application of NDT in our history is its involvement in many turn-key projects, such as the installation of PETRONAS's 1400 km gas pipeline for the Peninsular Gas Utilisation Project (PGUP) from 1984-1996. It was in this project that

crawlers, a sophisticated device used for carrying an X-ray equipment or a gamma ray projector was first introduced in Malaysia [3,4]. It was reported that 70% of NDT activities were attributed to radiographic inspection of boiler tubes, cooling water pipe and storage tanks [4,5], with the express purpose of inspecting volumetric defects, with the remaining percentage for detecting planar and surface defects. Another example is the current project for laying 470 km 36” pipes diameter for the Sabah-Sarawak Gas Pipeline from Kimanis to Bintulu. In the manufacturing sector, automotive components, such as die-casting products, are inspected by the real time radiography by HICOM Die-casting, while stainless steel small bore tubes are inspected by an automatic eddy current system supplied by Kantzen Sdn. Bhd.

NDT is considered mandatory for aircraft component inspections in Malaysia. Its application and meeting of standards are also strictly controlled by the Department of Civil Aviation (DCA) [5]. Due to these stringent requirements, Malaysian Airlines System (MAS) maintains one of the best NDT facilities in Malaysia. Some other facilities that are involved in aircraft components’ inspection with regards to NDT are the Aircraft Inspection Repair and Overhaul Depot (AIROD), and Air Force Installation facilities throughout the country. In this sector, radiography is applied for the inspection of engine components, as well as aircraft structures. Some of these works were reported in [6,7].

#### **4.0 NDT Personnel Skill Development**

The reliability of the test result is very much dependent on the skill and experience of the NDT personnel. The application and usage of incorrect NDT method may lead to inaccurate or even completely mistaken results. Similarly, the misinterpretation of NDT results may cause unexpected plant or system failure, or even major industrial catastrophe. Due to the crucial nature of this aspect of NDT, the training and development of skilled personnel is considered as one of the most important agenda in the development of NDT technology in Malaysia.

During the early phases of the implementation of NDT technologies in Malaysia, most of the competent and skilled personnel were foreign experts and operators. They

were qualified and certified by well accepted Qualification and Certification Scheme (QCS), such as the American Society for Non-destructive Testing (ASNT) or the British Personnel Certification (PCN). Due to the prohibitive training and certification costs, very few locals had the opportunity to be formally qualified and certified by these schemes. Those lucky enough to qualify and had the means to do so were senior staff, whose main tasks are management and paperwork, instead of field inspection. Based on these shortcomings, the government has decided to take a positive action toward the establishment of QCS for the Industries. Coincidentally, at about the same time, i.e. 1980, the International Atomic Energy Agency (IAEA) launched a 5-year project emphasising the application of NDT technology. The Malaysian government seized upon this opportunity by joining this project. The implementation of QCS in NDT in Malaysia was delegated to the Jabatan Pembangunan Kemahiran (JPK) National (previously known as the National Industrial Training and Trade Certification Board-NITTCB and Majlis Latihan Vokasional Kebangsaan (MLVK)). For this purpose, an Ad-Hoc Committee, whose responsibility is to formulate the Trade Standard for the QCS, was established in January 1986. This committee comprises of 15 members; with each member representing a multitude of private sectors and government agencies. This was followed by the establishment of the Trade Test Panel in June 1986, whose task was to administer the conduct of the examination. The first Trade Test Standard for Industrial Radiographer was established and approved in 1986 [8]. At the same time, the Council has appointed the Malaysian Nuclear Agency (formerly known Unit Tenaga Nuklear (UTN) and the Malaysian Institute for Nuclear Technology Research (MINT), and SIRIM Berhad (formerly known the Standard and Industrial Research Institute of Malaysia (SIRIM)) to jointly formulate and conduct the National NDT Training Program. With this available infrastructure, the first National NDT Training Course on Industrial Radiography was conducted in August 1986, with 20 participants. Later, in 1989, another National Trade Standard for Radiographic Interpreter was established and implemented [9].

Active participation by all organisations and individuals involved in Industrial Radiography has been very significant, making these trades known amongst the industrial community within a very short period of time. For this reason, in 1991, the Department of Civil Aviation (DCA) expressed its approval to the scheme (limited to

Industrial Radiographer Level I only), and in 1992, was accepted as the only scheme recognized by the AELB for the Qualification and Certification of Industrial Radiographer.

The first ever formal NDT training conducted in accordance to the national standard was held in August 1986, with a total number of 39 participants. This training was considered a success, which has encouraged the organiser to pursue it further i.e. UTN and SIRIM. Table 1 illustrates the number of participants recorded as candidates qualified for taking certification examination as of August 2012 [10]. The table also reveals the fact that RT courses out-number the other NDT methods by a wide margin.

**Table 1: Summary of NDT Training Activities as of August 2012 (JPK)**

| Method       | RT          |            |           | UT         |            |          | PT         |           |          | MT        |           |          | ET         |           |          | RI        | TOTAL       |
|--------------|-------------|------------|-----------|------------|------------|----------|------------|-----------|----------|-----------|-----------|----------|------------|-----------|----------|-----------|-------------|
|              | L1          | L2         | L3        | L1         | L2         | L3       | L1         | L2        | L3       | L1        | L2        | L3       | L1         | L2        | L3       | L2        |             |
| 1986         | 39          | -          | -         | -          | -          | -        | -          | -         | -        | -         | -         | -        | -          | -         | -        | -         | 39          |
| 1987         | 40          | -          | -         | -          | -          | -        | -          | -         | -        | -         | -         | -        | -          | -         | -        | -         | 40          |
| 1988         | 42          | -          | -         | -          | -          | -        | -          | -         | -        | -         | -         | -        | -          | -         | -        | -         | 42          |
| 1989         | 47          | 12         | -         | 5          | 18         | -        | -          | -         | -        | -         | -         | -        | -          | -         | -        | -         | 82          |
| 1990         | 59          | 13         | -         | 28         | 9          | -        | -          | -         | -        | -         | -         | -        | -          | -         | -        | -         | 109         |
| 1991         | 45          | 14         | -         | 48         | 4          | -        | -          | -         | -        | -         | -         | -        | -          | -         | -        | -         | 111         |
| 1992         | 102         | 11         | -         | 24         | 13         | -        | -          | -         | -        | -         | -         | -        | -          | -         | -        | -         | 150         |
| 1993         | 256         | 11         | -         | 44         | 3          | -        | -          | -         | -        | -         | -         | -        | -          | -         | -        | -         | 314         |
| 1994         | 228         | 7          | -         | 27         | 7          | -        | 12         | -         | -        | 12        | -         | -        | -          | -         | -        | -         | 293         |
| 1995         | 214         | 8          | -         | 14         | 3          | -        | 20         | -         | -        | 18        | -         | -        | -          | -         | -        | -         | 227         |
| 1996         | 152         | 10         | -         | 20         | 2          | -        | 7          | 7         | -        | 5         | 7         | -        | -          | -         | -        | 14        | 224         |
| 1997         | 214         | 4          | -         | 10         | -          | -        | 14         | -         | -        | 15        | 1         | -        | -          | -         | -        | 13        | 271         |
| 1998         | 127         | 7          | -         | 6          | 5          | -        | -          | -         | -        | -         | -         | -        | 9          | 7         | -        | 12        | 173         |
| 1999         | 163         | -          | -         | 12         | 4          | -        | 16         | 5         | -        | 16        | 5         | -        | 5          | 3         | -        | 14        | 243         |
| 2000         | 196         | -          | 7         | 14         | 9          | -        | 14         | -         | -        | 11        | -         | -        | -          | -         | -        | 18        | 269         |
| 2001         | 78          | -          | -         | 3          | 2          | -        | -          | -         | -        | -         | -         | -        | 13         | 8         | -        | 3         | 107         |
| 2002         | 196         | 39         | -         | -          | 10         | -        | -          | -         | -        | -         | -         | -        | -          | -         | -        | -         | 245         |
| 2003         | 185         | -          | -         | 9          | -          | -        | -          | -         | -        | -         | -         | -        | 7          | 5         | -        | -         | 206         |
| 2004         | 107         | 10         | -         | 3          | -          | -        | 5          | -         | -        | 5         | -         | -        | 5          | 5         | -        | -         | 140         |
| 2005         | 248         | -          | -         | 3          | 14         | -        | 2          | -         | -        | 2         | -         | -        | -          | -         | -        | 6         | 275         |
| 2006         | 268         | 36         | -         | 73         | 77         | -        | -          | -         | -        | 4         | -         | -        | -          | -         | -        | -         | 458         |
| 2007         | 130         | 4          | -         | 92         | 78         | -        | 3          | -         | -        | -         | -         | -        | 11         | 2         | -        | -         | 320         |
| 2008         | 254         | 62         | -         | 110        | 90         | -        | 6          | -         | -        | 5         | -         | -        | 10         | 4         | -        | 19        | 560         |
| 2009         | 139         | 73         | 30        | 275        | 154        | -        | -          | -         | -        | -         | 29        | -        | 4          | 3         | -        | -         | 707         |
| 2010         | 242         | 35         | -         | 49         | 81         | -        | -          | 29        | -        | -         | 21        | -        | -          | -         | -        | -         | 457         |
| 2011         | 232         | 1          | -         | 1          | 2          | -        | 14         | 21        | -        | -         | -         | -        | 8          | 8         | -        | -         | 277         |
| 2012         | 113         | -          | -         | 36         | -          | -        | -          | -         | -        | -         | -         | -        | 29         | -         | -        | -         | 178         |
| <b>TOTAL</b> | <b>4296</b> | <b>357</b> | <b>37</b> | <b>906</b> | <b>585</b> | <b>-</b> | <b>113</b> | <b>62</b> | <b>-</b> | <b>93</b> | <b>63</b> | <b>-</b> | <b>101</b> | <b>14</b> | <b>-</b> | <b>99</b> | <b>6726</b> |

## **5.0 Human Resource Development (HRD) in NDT for the Local Industrial Sector**

Although sophisticated NDT equipment and excellent procedures are imperative, the absence of skilled and competent manpower automatically negate any advantages the equipment or procedures might incur. The ubiquitous availability of sophisticated NDT equipment in the world market will not pose a significant challenge to those intending to acquire it. From a national point of view, the biggest problem in our effort to capitalise from the benefit of NDT technology to Malaysia is to develop a sufficient number of skilled and competent personnel that are capable of operating the equipment, executing the inspection in accordance with an established and correct procedure, and finally, to interpret the results in accordance to an acceptable code of standards and specifications. The development of skilled and competent manpower is a long process that needs both careful planning and implementation. The process must take into consideration a number of factors, such as the national and international requirements, current and future industrial demands, and the economic benefit of the technology.

The need for skilled and competent NDT operators was first realised in Malaysia about twenty years ago. As a developing country, the government was obliged to undertake the necessary initiative to create awareness among industrial community on the importance of this subject. The government of Malaysia believed that such a problem can only be solved through a comprehensive HRD program; developed and implemented by a group of individuals representing organisations that have a wedged interest in the local growth of this technology [11].

HRD in NDT can be defined as “organised activities in a definite time period to allow a person to attain a specific level of knowledge and skill necessary for him to perform a specific job and subsequently to increase the possibility of improving job performance”. In NDT, HRD program covers activities on training, qualification and certification. These three distinct activities were clearly defined in ISO 9712 version 2012 [10] as follows:

- ❑ *NDT Training*: Process of instruction in theory and practice in the NDT method which certification is sought which takes the form of training courses to an approved syllabus, but shall not include the use of specimens used in practical examination. (Section 3.22 of ISO 9712 version 2012).
  
- ❑ *NDT qualification*: Demonstration of physical attributes, knowledge, skill, training, and experience required to properly perform NDT tasks (Section 3.24 of ISO 9712 version 2012).
  
- ❑ *NDT Certification*: Procedure leading to a written testimony of the qualification of an individual's level of competence in a given NDT method and industrial sector (Section 3.5 of ISO 9712 version 2012)

In developed countries such as the United Kingdom, United States, Canada, Australia, Japan, etc, HRD in NDT is governed by their respective national standards in order to ensure that the training program, the qualification and certification process would produce individuals with an acceptable and uniform level of competence within their respective country. These standards differ slightly from one country to another. These differences, although relatively minor from a technical standpoint, result in the differences in the level of NDT competency, which impedes inter-recognition of certificates issued by different countries.

The effort for harmonisation of NDT training, qualification and certification throughout the world was realised in the early 1970. A working group, under the International Committee for NDT (ICNDT) was established for this explicit purpose in 1973. This Group has been working intensively to produce a 'hopefully' internationally accepted standard, known as ISO 9712 (Qualification and Certification of NDT Personnel). This standard was developed by a group of experts, and has undergone many amendments before it is finally endorsed by the International Standard Organization in 1989. This standard is currently adopted by many countries as a basis for their HRD program for NDT.

The role of the IAEA in promoting the establishment of National Qualification and Certification Scheme for NDT personnel based on ISO 9712 is of paramount importance. It is by and large the effort of the IAEA that such schemes were established in many Latin American countries, Africa, West Asia and the Asia-Pacific Region. In the Asia-Pacific region, developing countries, under the umbrella of Regional Cooperative Agreement (RCA), such as Malaysia, South Korea, Japan, Australia, Pakistan and Indonesia have also implemented the scheme, which has helped the respective countries develop self-sufficiency in this area of technology.

### **5.1 Establishment of a Certification Body in Accordance with ISO 9712**

The most important step in planning a HRD programme for NDT at the national level is to establish a National Certification Body (NCB) that complies with the ISO 9712 requirement. According to this Standard, a certification body is defined as “an agency that administers procedures for certification of NDT personnel in accordance with the requirement of the standard”. This standard indicates that a Certification Body must fulfil the following conditions:

- a) Non profit organisation
- b) Do not directly involved in training
- c) Recognised by local and international NDT community
- d) Shall be supported by a specific committee

With this requirement, the choice for a certification body in any country is limited to either an NDT Society, or a designated government agency. Requirement (i) and (ii), however, discourage societies from taking this responsibility. Thus, the most likely candidate for this task is a government agency. However, it has to be kept in mind that any certification body shall not be directly involved in the provision of training.

In Malaysia, it was determined that an organisation by the name of National Vocational Training Council (NVTC), Ministry of Human Resources, fulfilled all of the requirement for a Certification Body. Currently, this organisation also acts as a

Certification Body for more than 60 other trades, such as welding, foreman, etc. This implicitly implies that NVTC already possesses the necessary infrastructure for the implementation of qualification and certification scheme for NDT personnel in Malaysia. After extensive discussions between the Malaysian Institute for Nuclear Technology Research (MINT), Standard and Industrial Research Institute of Malaysia (SIRIM), Atomic Energy Licensing Board (AELB) and few other organisations, in 1985, NVTC was officially appointed as the National Certification Body (NCB) for Qualification and Certification of NDT personnel.

For an effective implementation of the scheme, a group of local experts were appointed to assist the NVTC in this venture. These experts were mainly those who were trained through RCA/UNDP/IAEA Training Program. The program, which was started in 1979, had successfully produced a total number of 15 Malaysians who were ready to work together with experts from private organisations in order to initiate the implementation of the scheme.

## **5.2 Establishment of NDT Standard for Qualification and Certification**

The first task undertaken after the establishment of certification body was to establish a committee that fulfilled the requirement of Section 5.2 of ISO 9712. This committee would be responsible for the formulation of standards. In the case of Malaysia, this committee was established in mid-1985. Immediately after its establishment, the members of the committee met several times to formulate the standard. During these meetings, the members drafted the content of the standard, and at the same time, ensure that it is always in accordance with the ISO 9712 requirement. Generally, each standard was divided into two parts. The first part of this standard presents a guideline for the process of qualification and certification, while the second part outlined the syllabus for the NDT training course (in preparation for the examination). After this standard was completed, the document was tabled to the Trade Advisory Committee of MLVK for further examination and approval as a national document.

In order to speed up the process, Malaysia chose to develop these standards in stages. It started with radiography, and was invariably followed by other NDT methods. The

development of the standard for qualification and certification for an industrial radiographer took about a year, and was completed in 1986. The training programme commenced once the standard obtained national approval. This approach compartmentalized the approval of each method, which works on one training programme at a time, allowing the concentration of resources into one venture. Doing all of it simultaneously will spread the available resources thin, and will require four or five years to complete from the date of the establishment of Certification Body. The current tally is six NDT Standards were produced, approved and implemented for welded construction sector. These are Standard for Qualification and Certification of Industrial Radiographer (1986), Ultrasonic Tester (1987), Magnetic Particle Tester (1988), Liquid Penetrant Tester (1989), Radiographic Interpreter (1989) and Eddy Current tester (1995). Basically, the standards were derived to fulfil the requirements set forth by the ISO 9712. The standard for industrial radiographer was revised for the first time in 1989, and again in 1999.

The active participation by all organisations and individuals involved in the development of this national standard has been significant in making it known, accepted and recognised amongst the industrial community within a very short period of time. The trade was given the honour of having its representative deliver a special message in a special ceremony held in July 1990. In 1991, the Civil Aviation Authority of Malaysia formally recognized the scheme (for Industrial Radiographer Level I only), and in 1992, was accepted as the only scheme recognised by the AELB for the purpose of licensing or approving radiographic operator.

### **5.3 Implementation of Training Program in Accordance with National Standard**

The next step after the establishment of a Certification Body and approval of standards is the implementation of training program. To be able to conduct a training program, an organisation must have the required expertise, adequate staff and appropriate equipment and facility. Generally, almost all countries that participate in RCA/UNDP/IAEA project on the application of radiation in industry (which gave a good emphasise on NDT), including Malaysia and Indonesia, are capable of providing training facilities to their respective countries. For Malaysia, the Certification Body,

i.e. JPK has its own criteria of approving the competency of a training agency. After an extensive evaluation process, JPK approved Malaysian Nuclear Agency and SIRIM Berhad as competent training agencies to conduct NDT training courses, in accordance with the national standard. Expertise from Malaysian Nuclear Agency and SIRIM Berhad were then combined in order to form a task-force to conduct the course. Currently, two more training agencies have been approved by JPK as NDT training centre; namely Terengganu Advanced Technical Institute (TATI) and ITC Sdn. Bhd.

In Malaysia, the required expertise for the implementation of training courses was developed with the assistance of the IAEA through a series of RCA/IAEA/UNDP NDT training courses, which started in 1980. Their capability to teach was further upgraded by their participation in “Train-the-Trainer” program organised by Malaysian Nuclear Agency, with and without the help of the IAEA.

The first ever formal NDT training conducted in accordance to this standard was held in August 1986, with 39 candidates taking part. The chosen method was radiography level 1, and was considered a success, which encouraged the organisers to organise more courses. In 1992, the licensing authority (i.e. AELB) imposed a mandatory requirement for all radiographic operators in Malaysia to pass level 1 radiography testing examination. Such a requirement tremendously affected the implementation of the scheme.

Table 1 indicates that the number of person attending the NDT training courses increases very rapidly during the early stage of the implementation of scheme, and reaches its maximum within six years (i.e. in 1992) from the time the first training was held. Of all participants attending the courses, annually, about 50% of them were attending radiography training course. The reason for the prevalence of radiography is due to mandatory requirement imposed by the AELB to all radiography operators within the country. As for other NDT methods, efforts are still needed, and NDT practitioners are encouraged to acquire training, qualification and certification by the national scheme.

## **5.4 NDT Examination**

The examination is a final sequence of step in the HRD program for NDT, which is required before a certificate can be awarded to those who are qualified. Section 5.4 of ISO 9712 provides a guide for the appointment of examination centres, whereas Section 5.4.1 of the same standard provides the general guideline for the conduct of the examination. As required by Section 5.4.1, all documents, which include questions, procedures and instructions used in Malaysian examinations, were those that were prepared by the Trade Test Panel of JPK. Similarly, examiners were also appointed by the Certification Body. The results of the examination were graded by examiners, and finally revised and approved by the Trade Test Panel of JPK.

Until 2012 (as of August), a total of 6055 candidates have been trained and examined at the national level (Table 1), however, only 3196 of them (represents 52.7% of the total candidates) passed the examination and are certified, as indicated in Table 2. RT possesses the highest number of certified personnel (74.6%), followed by UT (15.7%), PT (3.5%), MT (3.4%), ET (1.9%) and RI (0.8%).

## **5.5 Certification**

Candidates who passed the examination and fulfil other requirements as stipulated in the standard were awarded with a certificate of competency, which is valid for a period of 5 years from the date of issue. At the end of the fifth year, the validity of this certificate may be extended for another five years if it complies with the requirement of Section 9.4.1 of ISO 9712. At the end of this validity period, i.e. ten years after its issuance, a certificate holder may require re-certification if they passed a simplified examination and satisfies a panel of examiner of their continuous involvement in NDT practice.

Table 2: Certified NDT personnel in Malaysia as of August 2012 (JPK)

| Method | RT   |     |    | UT  |     |    | PT |    |    | MT |    |    | ET |    |    | RI | TOTAL |
|--------|------|-----|----|-----|-----|----|----|----|----|----|----|----|----|----|----|----|-------|
| Year   | L1   | L2  | L3 | L1  | L2  | L3 | L1 | L2 | L3 | L1 | L2 | L3 | L1 | L2 | L3 | L2 |       |
| 1986   |      |     |    |     |     |    |    |    |    |    |    |    |    |    |    |    |       |
| 1987   |      |     |    |     |     |    |    |    |    |    |    |    |    |    |    |    |       |
| 1988   |      |     |    |     |     |    |    |    |    |    |    |    |    |    |    |    |       |
| 1989   | 21   | 7   | 0  | 1   | 2   | 0  | 0  | 0  |    | 0  | 0  |    | 0  | 0  |    |    | 31    |
| 1990   | 28   | 7   | 0  | 6   | 0   | 0  | 0  | 0  |    | 0  | 0  |    | 0  | 0  |    |    | 41    |
| 1991   | 24   | 8   | 0  | 20  | 0   | 0  | 0  | 0  |    | 0  | 0  |    | 0  | 0  |    |    | 52    |
| 1992   | 53   | 7   | 0  | 7   | 10  | 0  | 0  | 0  |    | 0  | 0  |    | 0  | 0  |    |    | 77    |
| 1993   | 119  | 1   | 0  | 16  | 2   | 0  | 0  | 0  |    | 0  | 0  |    | 0  | 0  |    |    | 138   |
| 1994   | 107  | 5   | 0  | 11  | 1   | 0  | 6  | 0  |    | 0  | 0  |    | 0  | 0  |    |    | 130   |
| 1995   | 82   | 4   | 0  | 6   | 1   | 0  | 10 | 0  |    | 0  | 0  |    | 0  | 0  |    |    | 103   |
| 1996   | 54   | 6   | 0  | 8   | 1   | 0  | 6  | 5  | 0  | 8  | 0  | 0  | 0  | 0  |    | 4  | 92    |
| 1997   | 103  | 3   | 0  | 4   | 0   | 0  | 9  | 0  | 0  | 10 | 0  | 0  | 0  | 0  |    | 5  | 134   |
| 1998   | 51   | 5   | 0  | 2   | 2   | 0  | 0  | 0  | 0  | 4  | 3  | 0  | 7  | 0  | 0  | 1  | 75    |
| 1999   | 67   | 0   | 0  | 8   | 0   | 0  | 2  | 2  | 0  | 8  | 1  | 0  | 3  | 0  | 0  | 6  | 97    |
| 2000   | 87   | 0   | 4  | 7   | 2   | 0  | 6  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 4  | 110   |
| 2001   | 43   | 0   | 0  | 2   | 1   | 0  | 0  | 0  | 0  | 5  | 2  | 0  | 8  | 0  | 0  | 2  | 63    |
| 2002   | 83   | 23  | 0  | 0   | 1   | 0  | 0  | 0  | 0  | 6  | 0  | 0  | 0  | 0  | 0  | 0  | 113   |
| 2003   | 98   | 0   | 0  | 5   | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 5  | 0  | 0  | 0  | 108   |
| 2004   | 50   | 7   | 0  | 2   | 0   | 0  | 5  | 0  | 0  | 0  | 0  | 0  | 5  | 0  | 0  | 0  | 69    |
| 2005   | 126  | 0   | 0  | 2   | 3   | 0  | 2  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 2  | 135   |
| 2006   | 116  | 24  | 0  | 34  | 15  | 0  | 0  | 0  | 0  | 5  | 0  | 0  | 0  | 0  | 0  | 0  | 194   |
| 2007   | 97   | 3   | 0  | 38  | 23  | 0  | 2  | 0  | 0  | 2  | 0  | 0  | 2  | 0  | 0  | 0  | 167   |
| 2008   | 187  | 31  | 0  | 43  | 33  | 0  | 4  | 0  | 0  | 4  | 0  | 0  | 4  | 3  | 0  | 0  | 309   |
| 2009   | 180  | 36  | 24 | 78  | 20  | 0  | 0  | 29 | 0  | 0  | 29 | 0  | 3  | 4  | 0  | 2  | 402   |
| 2010   | 169  | 29  | 0  | 31  | 33  | 3  | 0  | 20 | 0  | 4  | 21 | 0  | 0  | 0  | 0  | 0  | 310   |
| 2011   | 120  | 1   | 5  | 2   | 5   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 8  | 11 | 0  | 0  | 152   |
| 2012   | 73   | 5   | 0  | 0   | 5   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 83    |
| TOTAL  | 2138 | 212 | 33 | 340 | 160 | 3  | 52 | 56 | 0  | 56 | 56 | 0  | 45 | 19 | 0  | 26 | 3196  |

## 6.0 Industrial Competition at International Level

NDT personnel who gained certification from Malaysia are being recognised in various countries, particularly in the Middle East. This is by and large due to the fact that the JPK scheme utilises international standards, such as ISO 9712, as its main reference and framework document. Another factor that might also play a major role in foreign recognition of Malaysia's certification scheme is the presence of PETRONAS in many of these countries. PETRONAS adopted and enforces codes and

practices that are in tandem with the certification schemes, which makes it widespread and easily recognisable in foreign countries. Many foreign nationals have also been trained by the recognised training centres such as Malaysian Nuclear Agency or SIRIM Berhad, TATI and iTC Skills Development Sdn. Bhd. from which they obtained NDT certificates. Currently, the national scheme has been accredited to ISO 17024 (Conformity assessment-General Requirement for Bodies operating certification of persons), as this will place the Malaysian National Certification programme at the forefront of NDT technologies. Besides Malaysia, New Zealand, Australia and China have also complied with this ISO standard.

### **6.1 Standards Related to Quality System for NDT Organisations**

As mentioned earlier, the reliability of NDT results depend on many factors. NDT experts throughout the world constantly make the effort to ensure that organisations providing services to industries are capable of delivering reliable and accurate data to their respective clients. A number of quality assurance systems were introduced, which are related to the application of this technology. These systems include:

- a) ISO 9001 Version 2000: Model for quality assurance in design, development, production and installation and servicing
- b) ISO 17020: General criteria for the operation of various types of performing inspection
- c) ISO 17025: Accreditation of laboratories performing testing and calibration
- d) ISO 17024: Conformity assessment-General Requirement for Bodies operating certification of persons
- e) ISO 9712 (2012): Non-destructive Testing-Qualification and Certification of Personnel

ISO 9001 is a standard that emphasises the management aspects of any organisation, including NDT companies. The technical consideration is omitted from this document. However, in Malaysia, getting NDT organisation to be certified in

accordance to this standard is considered as a significant step toward elevating the status of these organizations to a level acceptable by the end users. Currently, there are three NDT organisations in Malaysia certified to this standard, and it is expected that the number will continue to grow from in the near future

Both the ISO 17020 and ISO 17025 standards are related to the accreditation of NDT laboratory. NDT organisations throughout the world are still debating the subject of the relevance of any of these standards to be applied for accreditation of NDT laboratories. In some countries, NDT organisations choose to be accredited to ISO 17020, whereas others are comfortable with ISO 17025. In Malaysia, only two NDT organizations, namely SIRIM and AIROD, are accredited, and both were accredited in accordance with ISO 17025.

ISO 9712 is an international standard developed by the International Standard Organisation that is meant for the qualification and certification of NDT personnel. As a matter of fact, this standard was developed with the intention of harmonising the practice of qualification and certification of NDT personnel throughout the world. As a member of global community, Malaysia, when developing its own standard for qualification and certification of NDT personnel back in 1986, chose to use this standard as its main reference. Although it is not 100% identical to ISO 9712, the Malaysian standard has proven its effectiveness in qualifying and certifying NDT personnel for the past two decades. Many of those certified by this standard are currently providing inspection services to big industries, which include PETRONAS and Tenaga Nasional Berhad (TNB).

Many countries throughout the world claimed that their NDT certification bodies obtained their qualification and certification activities in accordance with ISO 9712. The members of NDT community in the world agree that a method need to be established to verify this claim. One of the best methods of verifying this claim is by having these certification bodies accredited to an internationally accepted standard, with the ISO 17024 being chosen, which is the standard that outlines the requirements for bodies operating certification of personnel. In developed countries such as United States, United Kingdom and European Union, almost all NDT certification bodies were accredited to this standard. However, in many other countries, especially

developing countries like Malaysia, the process is still in its infancy, and efforts are being taken to move toward this direction.

## **6.2 Route to Harmonisation of Qualification and Certification Practice Adopted by Regional Cooperative Agreement (RCA) Member States**

The harmonisation of NDT qualification and certification practice is a big step towards the unification of the global qualification and certification systems. This is absolutely necessary to members of the NDT community, due to the fact that in many cases, NDT personnel are involved in inspection of components that are manufactured for export purposes. In this case, each importer imposes their own requirement with regards to the qualification and certification of the NDT personnel involved in inspecting their components. This creates chaos, as one individual will need to undertake multiple examinations in order to satisfy these multiple requirements. The unification of the certification system will lead to mutual recognition of the NDT certificate, thus eliminating the need for multiple examinations.

The harmonisation of certification practice can only be achieved if the national certification bodies in all of the countries are accredited to the same standard; namely ISO 17024. In the RCA region, two countries, namely Australia and New Zealand, are in mutual agreement and consent. Both were accredited to ISO 17024, and between these countries, a Mutual Recognition Agreement (MRA) was signed and adopted. With the help of the IAEA, such an agreement will be expanded for the whole RCA region, which includes Malaysia. NDT experts representing RCA member-states in their meeting in Dhaka in 2003 and Colombo in 2005 agreed that the following route must be followed by each country who wishes to be a party of MRA:

- Having recognised National Certifying Body
- Becoming members of International Committee for NDT (ICNDT) or Asia- Pacific Committee for NDT (APCNDT)
- Having a National Qualification and Certification Scheme in accordance with ISO 9712

- Having the certifying body conform to ISO 17024
- Having an NCB accredited by an International Accredited Forum (IAF)
- recognised body
- Scheme accepted by APCNDT
- Application for recognition
- Endorsement for mutual recognition

Once requirements 1 to 5 listed above are fulfilled, the application for recognition can be submitted to a special Committee at the APCNDT. An assessment will be made by the appointed experts and if found suitable, the country will be endorsed as qualified to be a party of MRA, joining Australia and New Zealand. Malaysia is currently at the fourth stage on the route for harmonisation. In order to qualify to be a party of MRA, Malaysia must be able to proceed to stage 5, where our National Qualification and Certification Body, namely the JPK, must acquire accreditation to ISO 17024.

As compared with other countries within the RCA region, the situation in Malaysia is very encouraging, as the JPK has issued a letter (upon request by the IAEA) of intent to be a party of MRA. Meetings and discussions with many parties on this particular subject matter, including those with the Malaysian NDT Society (MSNT), training agencies, PETRONAS, NDT Companies and JPK were held, and an agreement was made that indeed Malaysia must strive toward accreditation to ISO 17024 if it wishes to remain as one of the global partners in NDT. The National Representative for Malaysia, in a meeting of representatives from RCA member states in Auckland, New Zealand, in December 2006 has committed 2020 as the year Malaysia is expected to be a signatory of MRA in RCA member states.

### **6.3 Malaysian Progress Related to Accreditation of NCB**

Although Malaysia has its own NCB for NDT since 1986, the subject of MRA has not been brought up until 2003, when a representative from NCB attended a National Representative Meeting held in Bangladesh. After this meeting, the NCB has shown its interest, and another representative was sent to a meeting held in Sri Lanka in

2005. The matter became more serious when the JPK called for a meeting between a team of Legal Advisors, and the National Representative for NDT, specifically to discuss the repercussion of being a signatory of MRA. The success of the meeting was very encouraging to the point that a week later, a letter was sent to the IAEA confirming Malaysia's commitment to be a party of this agreement.

Meanwhile, another development in the same area was noticed when the Department of Standard, Malaysia, for the first time, organised a National Training Course on the ISO 17024, with the help of an expert from Australia. The course was successful and managed to achieve its target of creating awareness on the importance of the subject matter. The matter was further discussed by the members of NDT Trade Advisory Committee under the JPK, and a number of action plans were drawn toward achieving the objective of NCB accreditation by 2012. Finally, in October 2012 JPK was accredited to ISO 17024 by Standard Malaysia.

#### **6.4 Reasons for Accreditation of NCB**

Most large industries in Malaysia are certified to certain quality systems such as ISO 9001 version 2000, which requires them to audit the quality system of any affiliated organisations. Naturally, these organisations support the move to accredit the NCB. Accreditation becomes necessary for the following reasons:

- To make Malaysia qualify to be a party of MRA
- To ascertain that the NCB has a commitment to the quality and competence of NDT personnel it certified
- To confirm that certified NDT personnel are able to perform to a standard set internationally and expected by their industry.
- To allow nationally certified NDT personnel to perform their duty of inspecting components regardless where the components is to be exported
- Promoting Malaysian NDT companies that employed these personnel to operate internationally

- To recognise the technical competence of an individuals
- To assess the effectiveness of the quality system of the NCB and its staff

## **7.0 Methodology of NDT Occupational Analysis**

In conducting the Occupational Analysis (OA), a kick-off meeting was held to primarily strategise the Plan of Action in accordance to the guidelines, as presented by JPK in terms of scope of study, time frame and representation by a panel of NDT experts from both the public and private sector, as stipulated in the letter of offer. After the kick-off meeting, a Plan of Action was formulated, taking into consideration the activities and the required time frame. Below are the main steps that were taken in producing the Occupational Definition for the respective job titles obtained in the OA:

- a) Determine the main sub sectors, job areas and job sub areas in the sector.
- b) Identify the job titles
- c) Identify the job scope

### **(i) Literature Survey**

As outlined by the guidelines, a literature survey on the NDT, sub-sector of Machinery and Equipment was conducted in order to provide insight on the scope, policy, program, activities in the context of the Malaysian scenario and international challenges. The scope covered under this research includes definitions, current analysis of the sector/sub sector, current status of the NDT industry sector, NDT skilled workers requirement in the local industry, and the industrial competition at the international level.

## **(ii) Identifying Experts from the Industry & Public Sectors**

The literature search findings were used as a guide to identify the scope of occupational study and analysis. Based on the present status of NDT companies, NDT groups (private and government agencies) in Malaysia, which can be accessed from the registration list of Malaysian Society for Non Destructive Testing (MSNT), several NDT experts for NDT-sub-sector of Machinery and Equipment were identified and shortlisted for further communications and contacts. The lists of NDT experts contacted and confirmed are shown in Annex 1.

## **(iii) Establish Contact with the NDT Sector Experts**

A pool of NDT experts from the industry and public sector were contacted, and a working relationship has been established with these experts. The list of experts, who participated in these activities, is provided in Annex 1.

## **(iv) Information Gathering**

In the process of gathering the information, two methods were adopted, namely;

- a) OA brainstorming, and
- b) Developing a Curriculum (DACUM) session.

The OA brainstorming and DACUM session were attended by the expert panels, who discussed the different NDT sub-sectors and areas. The information gathered was then used as the input for the OA of the said industry.

## **(v) Analysing the Information**

Based on the conducted activities, substantial data and information, such as sub sector, job area, job sub-area, and job level were collected. The data and information were discussed and analysed in several workshops, attended by selected NDT key personnel and NDT experts from both the public and private sectors. The attendance

of these NDT key personnel and experts was to invariably assist MSNT as an Industrial Lead Body (ILB) in the development of the OA for this sector.

During this session, attempts to reframe the NDT Sub sector (Sector – Machinery and Equipment) in Malaysia were conducted using the following framework:

- a) Scope of the NDT sub sectors
- b) Main job area and job sub area
- c) Major occupational group of the industry
- d) Job title
- e) Hierarchy structure (Level 1 – 8)
- f) Occupational definition

**(vi) Organise Workshop with Expert Panels**

Workshops were conducted in the development of the OA of the NDT sub sectors. The details of the workshops are as below:

Held on the 1<sup>st</sup> to 3<sup>rd</sup> June, 13<sup>th</sup> to 15<sup>th</sup> July, 2012 at the Lexus Hotel, Port Dickson, Negeri Sembilan and 2<sup>nd</sup> August 2012 at Malaysian Nuclear Agency. The objectives of the workshop are:

- Presentation of preliminary findings
- Outline of Job Title
- Career structure
- Hierarchy structure (Level 1 – 8)
- Occupational Definition
- Occupational Analysis Session
- Validation of the findings

Held on the 7-9 September 2012 at the Lexus, Port Dickson, Negeri Sembilan and 21<sup>st</sup> September 2012 at the Malaysian Nuclear Agency. The objectives of the workshop were to validate and verify (proofreading) of:

- Job Titles
- Career structure
- Hierarchy structure ( Level 1 – 8)
- Occupational Definition
- NOSS Sub-sector NDT - Oil and Gas for RT, UT, MT,PT, ET and VT.

## **8.0 Findings**

The findings from the research of the Sub sector-NDT (Sector - Machinery and Equipment), Occupational Analysis can be divided into four categories, which include the following:

- a) The existing job titles
- b) Proposed job titles
- c) The mapping between the proposed job titles to the existing ones
- d) Levelling and entry level justification

### **8.1 Existing Occupational Structure/Job Title and Hierarchy of Sub sectors NDT**

Based on the present NOSS document, the existing Occupational Structure (OS) for sub sector NDT (Sector - Machinery and Equipment) identified 16 unique job titles (see Table 3). These job titles mainly concern job areas and job sub-areas for welded construction and engineering components in the industrial sector related to oil and

gas, power and energy. There are only three levels (Level 1 - 3) of hierarchy offered for these job titles, which cover all job areas, namely RT, UT, PT, MT, ET and VT. This is in line with the international practice and standards. Examples of International Standard that stipulate the process of certification for NDT personnel Level 1 - 3 are given below:

- ISO 9712 (2012) Non-destructive testing – Qualification and certification of personnel
- ASNT- American Society for Non-destructive Testing
- PCN- Personnel Certification of NDT (UK)

Table 3: Existing occupational structure (OS) for sub sector NDT

| No. | Technology/Job Area | Job Titles               | Hierarchy | Job Sub Area           |
|-----|---------------------|--------------------------|-----------|------------------------|
| 1   | Radiography         | Industrial Radiographer  | Level 1   | Welded construction    |
| 2   |                     | Industrial Radiographer  | Level 2   | Welded construction    |
| 3   |                     | Industrial Radiographer  | Level 3   | Welded construction    |
| 4   |                     | Radiography Interpreter  | Level 2   | Welded construction    |
| 5   | Ultrasonic          | Ultrasonic Tester        | Level 1   | Welded construction    |
| 6   |                     | Ultrasonic Tester        | Level 2   | Welded construction    |
| 7   |                     | Ultrasonic Tester        | Level 3   | Welded construction    |
| 8   | Magnetic Particle   | Magnetic Particle Tester | Level 1   | Welded construction    |
| 9   |                     | Magnetic Particle Tester | Level 2   | Welded construction    |
| 10  |                     | Magnetic Particle Tester | Level 3   | Welded construction    |
| 11  | Liquid Penetrant    | Liquid Penetrant Tester  | Level 1   | Welded construction    |
| 12  |                     | Liquid Penetrant Tester  | Level 2   | Welded construction    |
| 13  |                     | Liquid Penetrant Tester  | Level 3   | Welded construction    |
| 14  | Eddy Current        | Eddy Current Tester      | Level 1   | Engineering Components |
| 15  |                     | Eddy Current Tester      | Level 2   | Engineering Components |
| 16  |                     | Eddy Current Tester      | Level 3   | Engineering Components |

## 8.2 Newly Identified Job Area for Subsector NDT

Based on the discussion held during the workshop at Port Dickson (1<sup>st</sup> to 3<sup>rd</sup> June 2012 and 13<sup>th</sup> to 15<sup>th</sup> 2012) and the Malaysian Nuclear Agency (2<sup>nd</sup> August 2012) on occupational analysis of Sector Machinery and Equipment for sub-sector NDT, the panel of experts agreed on the collective conclusion that NDT is divided into five major sub sectors namely:

- Oil and Gas  
Example activities concerning pressure vessels, boilers, piping, tanks etc
  
- Aerospace  
Examples activity concerning material, engineering component, structures in aircraft, helicopter
  
- Transportation  
Examples activity concerning automotive, railway, ship
  
- Concrete Construction  
Examples activity concerning building, bridges, dam, road
  
- Nuclear Power  
Similar in oil and gas except during maintenance and in-service inspection is done under radiation environments.

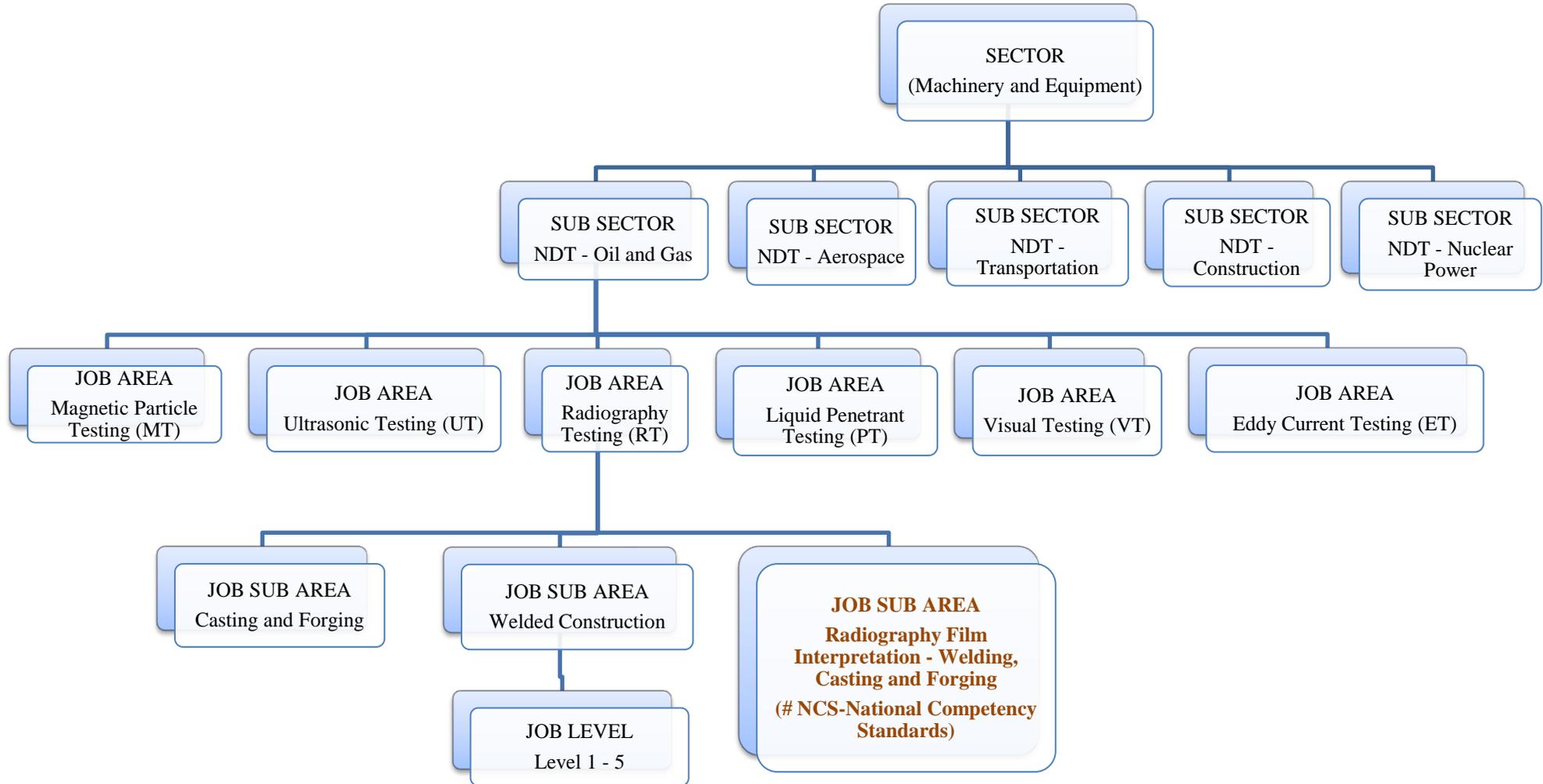
For these sub sectors only oil and gas and power (non-nuclear) are considered similar to the existing job areas. Looking at present and future scenario in the NDT sector globally and in Malaysia, the panel of NDT experts, after consultation with the facilitators and industrial players concerned, have agreed to propose the following new occupational structure (OS) (Figure 1). From this new OS, for each sub sector NDT, for example oil and gas, it can be further divided into job-areas, namely RT, UT, MT, PT and ET. For each job-area activities, it can be applied to components which have been processed either by a welding process (welded construction) or by

casting and forging, which is referred as job sub areas. However, for VT its can be applied to cover for all engineering components. The personnel involved in each job sub area can be further classified into five job levels that is level 1 to level 5.

According to JPK, the hierarchy for the job level can be classified to up to level 8, but in the case of NDT, the job level for all job area and job sub area, the panel of NDT experts and industrial sector agreed at a maximum of 5 levels. From these five levels, the panel of NDT experts also agreed to maintain level 1 to level 3 as the *status quo*, in order to adhere to ISO9712 version 2012, and ISO17024 requirements. The addition of level 4 and level 5 is needed for future human capital and technology expansion in the area of sub-sector NDT, especially in the technical and management aspect, while levels 1, 2 and 3 will take cares only the technical aspect of NDT.

The new OS for all sub sectors are show in Tables 4 to 8.

**Figure 1: Flow Chart for Constructing Occupational Structure (OS)**



**Table 4: Occupational Structure (OS) for Personnel (Job Title) in Oil and Gas Sub Sector**

| Sector       | MACHINERY AND EQUIPMENT                     |   |  |   |   |   |   |   |   |   |                         |
|--------------|---|---|--|---|---|---|---|---|---|---|-------------------------|
| Sub-Sector   | NON DESTRUCTIVE TESTING (NDT) - OIL AND GAS |   |  |   |   |   |   |   |   |   |                         |
| Job Area     | RADIOGRAPHY TESTING (RT)                    |   |  | ULTRASONIC TESTING (UT)                     |   | MAGNETIC PARTICLE TESTING (MT)              |   | LIQUID PENETRANT TESTING (PT)               |   | EDDY CURRENT TESTING (ET)               | VISUAL TESTING (VT)     |
| Job Sub Area | Welded Construction                         | Casting and Forging                         | Welded, Casting and Forging  | Welded Construction                         | Casting and Forging                         | Welded Construction                         | Casting and Forging                         | Welded Construction                         | Casting and Forging                         | Tubes and Plate                         | Engineering Component   |
| Job Level    |   |   |  |   |   |   |   |   |   |   |                         |
| 5            | NDT Manager                                 |   |  |   |   |   |   |   |   |   |                         |
| 4            | NDT Technical Executive                     |   |  |   |   |   |   |   |   |   |                         |
| 3            | RT Senior Technician-Welded Construction    | RT Senior Technician-Casting and Forging    | RT Technician-Film Interpreter # NCS-National Competency Standards | UT Senior Technician-Welded Construction    | UT Senior Technician-Casting and Forging    | MT Senior Technician-Welded Construction    | MT Senior Technician-Casting and Forging    | PT Senior Technician-Welded Construction    | PT Senior Technician-Casting and Forging    | ET Senior Technician-Tubes and Plate    | VT Senior Technician    |
| 2            | RT Technician-Welded Construction           | RT Technician-Casting and Forging           |  | UT Technician-Welded Construction           | UT Technician-Casting and Forging           | MT Technician-Welded Construction           | MT Technician-Casting and Forging           | PT Technician-Welded Construction           | PT Technician-Casting and Forging           | ET Technician-Tubes and Plate           | VT Technician           |
| 1            | RT Assistant Technician-Welded Construction | RT Assistant Technician-Casting and Forging |  | UT Assistant Technician-Welded Construction | UT Assistant Technician-Casting and Forging | MT Assistant Technician-Welded Construction | MT Assistant Technician-Casting and Forging | PT Assistant Technician-Welded Construction | PT Assistant Technician-Casting and Forging | ET Assistant Technician-Tube and Plates | VT Assistant Technician |

Note: NCS-National Competency Standards will be developed separately for Radiographic Film Interpretation.

**Table 5: Occupational Structure (OS) for Personnel (Job Title) in Aerospace Sub Sector**

| <b>Sector</b>       | <b>MACHINERY AND EQUIPMENT</b>                   |                                   |  |  |  |  |  |
|---------------------|--|-----------------------------------|--|--|--|--|--|
| <b>Sub-Sector</b>   | <b>NON DESTRUCTIVE TESTING (NDT) - AEROSPACE</b> |                                   |  |  |  |  |  |
| <b>Job Area</b>     | <b>RADIOGRAPHY TESTING (RT)</b>                  |                                   | <b>ULTRASONIC TESTING (UT)</b>             | <b>MAGNETIC PARTICLE TESTING (MT)</b>      | <b>LIQUID PENETRANT TESTING (PT)</b>       | <b>EDDY CURRENT TESTING (ET)</b>           | <b>INFRARED THERMOGRAPHIC TESTING (TT)</b> |
| <b>Job Sub Area</b> | Materials, Components and Structures (MCS)       | Light and Dense Metal Welds (LDW) | Materials, Components and Structures (MCS) | Components and Structures (CS)             |
| <b>Job Level</b>    |  |                                   |  |  |  |  |  |
| <b>5</b>            | NDT Manager                                      |                                   |  |  |  |  |  |
| <b>4</b>            | NDT Technical Executive                          |                                   |  |  |  |  |  |
| <b>3</b>            | RT Engineer- MCS                                 | RT Engineer- LDW                  | UT Engineer - MCS                          | MT Engineer- MCS                           | PT Engineer- MCS                           | ET Engineer- MCS                           | TT Engineer - CS                           |
| <b>2</b>            | RT Senior Technician- MCS                        | RT Senior Technician- LDW         | UT Technician - MCS                        | MT Technician- MCS                         | PT Technician- MCS                         | ET Technician- MCS                         | TT Technician - CS                         |
| <b>1</b>            | RT Technician- MCS                               | RT Technician- LDW                | UT Technician - MCS                        | MT Technician - MCS                        | PT Technician - MCS                        | ET Technician - MCS                        | TT Technician - CS                         |

**Table 6: Occupational Structure (OS) for Personnel (Job Title) in Transportation Sub Sector**

| Sector       | MACHINERY AND EQUIPMENT                        |   |  |   |   |   |   |   |   |   |
|--------------|--|---|--|---|---|---|---|---|---|---|
| Sub-Sector   | NON DESTRUCTIVE TESTING (NDT) - TRANSPORTATION |   |  |   |   |   |   |   |   |   |
| Job Area     | RADIOGRAPHIC TESTING (RT)                      |   |  | ULTRASONIC TESTING (UT)                     |   | MAGNETIC PARTICLE TESTING (MT)              |   | LIQUID PENETRANT TESTING (PT)               |   | EDDY CURRENT TESTING (ET)               |
| Job Sub Area | Welded Construction                            | Casting and Forging                         | Welded, Casting and Forging  | Welded Construction                         | Casting and Forging                         | Welded Construction                         | Casting and Forging                         | Welded Construction                         | Casting and Forging                         | Tubes and Plate                         |
| 5            | NDT Manager                                    |   |  |   |   |   |   |   |   |   |
| 4            | NDT Technical Executive                        |   |  |   |   |   |   |   |   |   |
| 3            | RT Senior Technician-Welded Construction       | RT Senior Technician-Casting and Forging    | RT Technician-Film Interpreter # NCS-National Competency Standards | UT Senior Technician-Welded Construction    | UT Senior Technician-Casting and Forging    | MT Senior Technician-Welded Construction    | MT Senior Technician-Casting and Forging    | PT Senior Technician-Welded Construction    | PT Senior Technician-Casting and Forging    | ET Senior Technician-Tubes and Plate    |
| 2            | RT Technician-Welded Construction              | RT Technician-Casting and Forging           |  | UT Technician-Welded Construction           | UT Technician-Casting and Forging           | MT Technician-Welded Construction           | MT Technician-Casting and Forging           | PT Technician-Welded Construction           | PT Technician-Casting and Forging           | ET Technician-Tubes and Plate           |
| 1            | RT Assistant Technician-Welded Construction    | RT Assistant Technician-Casting and Forging |  | UT Assistant Technician-Welded Construction | UT Assistant Technician-Casting and Forging | MT Assistant Technician-Welded Construction | MT Assistant Technician-Casting and Forging | PT Assistant Technician-Welded Construction | PT Assistant Technician-Casting and Forging | ET Assistant Technician-Tube and Plates |

Notes:

1. For level 1 to level 3 the job titles are similar to job titles in oil and gas but for entry into level 4 and level 5, prerequisites of level 3 in oil and gas are required.
2. NCS-National Competency Standards will be developed separately for Radiographic Film Interpretation.

**Table 7: Occupational Structure (OS) for Personnel (Job Title) in Concrete Construction Sub Sector**

| <b>Sector</b>       | <b>MACHINERY AND EQUIPMENT</b>                               |  |   |
|---------------------|--|--|---|
| <b>Sub-Sector</b>   | <b>NON DESTRUCTIVE TESTING (NDT) - CONCRETE CONSTRUCTION</b> |  |   |
| <b>Job Area</b>     | <b>ULTRASONIC TESTING (UT)</b>                               | <b>RADIOGRAPHIC TESTING (RT)</b>         | <b>CONCRETE EVALUATION TESTING (CET)</b>  |
| <b>Job Sub Area</b> | <b>Structural Concrete</b>                                   | <b>Structural Concrete</b>               | <b>Structural Concrete</b>                |
| <b>Job Level</b>    |  |  |   |
| <b>5</b>            | NDT Concrete Manager   |  |   |
| <b>4</b>            | NDT Concrete Technical Executive                             |  |   |
| <b>3</b>            | UT Senior Technician Structural Concrete                     | RT Senior Technician Structural Concrete | CET Senior Technician Structural Concrete |
| <b>2</b>            | UT Technician Structural Concrete                            | RT Technician Structural Concrete        | CET Technician Structural Concrete        |
| <b>1</b>            | -  | -  | -   |

**Table 8: Occupational Structure (OS) for Personnel (Job Title) in Nuclear Power Sub Sector**

| Sector       | MACHINERY AND EQUIPMENT                       |   |  |   |   |   |   |   |   |   |                         |
|--------------|---|---|--|---|---|---|---|---|---|---|-------------------------|
| Sub-Sector   | NON DESTRUCTIVE TESTING (NDT) - NUCLEAR POWER |   |  |   |   |   |   |   |   |   |                         |
| Job Area     | RADIOGRAPHY TESTING (RT)                      |   |  | ULTRASONIC TESTING (UT)                     |   | MAGNETIC PARTICLE TESTING (MT)              |   | LIQUID PENETRANT TESTING (PT)               |   | EDDY CURRENT TESTING (ET)               | VISUAL TESTING (VT)     |
| Job Sub Area | Welded Construction                           | Casting and Forging                         | Welded, Casting and Forging  | Welded Construction                         | Casting and Forging                         | Welded Construction                         | Casting and Forging                         | Welded Construction                         | Casting and Forging                         | Tubes and Plate                         | Engineering Component   |
| Job Level    |   |   |  |   |   |   |   |   |   |   |                         |
| 5            | NDT Manager                                   |   |  |   |   |   |   |   |   |   |                         |
| 4            | NDT Technical Executive                       |   |  |   |   |   |   |   |   |   |                         |
| 3            | RT Senior Technician-Welded Construction      | RT Senior Technician-Casting and Forging    | RT Technician-Film Interpreter # NCS-National Competency Standards | UT Senior Technician-Welded Construction    | UT Senior Technician-Casting and Forging    | MT Senior Technician-Welded Construction    | MT Senior Technician-Casting and Forging    | PT Senior Technician-Welded Construction    | PT Senior Technician-Casting and Forging    | ET Senior Technician-Tubes and Plate    | VT Senior Technician    |
| 2            | RT Technician-Welded Construction             | RT Technician-Casting and Forging           |  | UT Technician-Welded Construction           | UT Technician-Casting and Forging           | MT Technician-Welded Construction           | MT Technician-Casting and Forging           | PT Technician-Welded Construction           | PT Technician-Casting and Forging           | ET Technician-Tubes and Plate           | VT Technician           |
| 1            | RT Assistant Technician-Welded Construction   | RT Assistant Technician-Casting and Forging |  | UT Assistant Technician-Welded Construction | UT Assistant Technician-Casting and Forging | MT Assistant Technician-Welded Construction | MT Assistant Technician-Casting and Forging | PT Assistant Technician-Welded Construction | PT Assistant Technician-Casting and Forging | ET Assistant Technician-Tube and Plates | VT Assistant Technician |

Notes: For level 1 to level 3 the job titles are similar to job titles in oil and gas but for entry into level 4 and level 5, prerequisites of level 3 in oil and gas are required. Apart from level 3 requirements as in oil and gas, additional provision in radiation safety is mandatory for entry.

### 8.3 Job Titles

In sub-sector NDT (Oil and Gas), there are 6 job-areas and job-sub areas, namely RT (Welded Construction and Casting and Forging), UT (Welded Construction and Casting and Forging), MT (Welded Construction and Casting and Forging), PT (Welded Construction and Casting and Forging), ET (Tube and Plate) and VT (Engineering Component). From Table 4 to 8, a total of 124 job titles have been identified for all job areas, job sub-areas and job levels. For example, in the NDT-oil and gas sub sector, the job titles for RT - Welded Construction for all levels are as followed:

| Level      | Old Job Title                                  | New Job Title                                    |
|------------|--|--|
| RT Level 1 | Industrial Radiographer<br>Welded Construction | RT - Assistant Technician<br>Welded Construction |
| RT Level 2 | Industrial Radiographer<br>Welded Construction | RT - Technician Welded<br>Construction           |
| RT Level 3 | Industrial Radiographer<br>Welded Construction | RT - Senior Technician<br>Welded Construction    |
| RT Level 4 | None   | NDT Technical Executive                          |
| RT Level 5 | None   | NDT Manager                                      |

For other job areas and job sub areas, similar arrangements for job titles are applied. All the job titles and its occupational definitions for all NDT sub sectors are listed in Annex 2 to Annex 6.

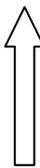
### 8.4 Entry Level

The entry level for sub sector oil and gas, aerospace, transportation and nuclear power is Level 1 (refer Tables 4, 5, 6 and 8). For concrete construction the entry level is level 2 (refer Table 7).

Entry pre-requisites for all sub sectors are highlighted as follows:

- a) Entry level for **normal route** for all sub sectors begin with Level 1 except for concrete construction sub sectors, where it begin with Level 2. *Note: Candidates who wish to enter **direct access** route to Level 2 or Level 3 shall comply with JPK certification requirements.*
- b) For all sub sectors, entry to Level 4 requires candidates to possess NDT certification, at least two Level 3 certificates in other job sub area.
- c) For all sub sector entry to Level 5 requires candidates to possess Level 4 in the same job area and job sub area.
- d) Additionally, for Level 4 subjects such as industrial safety, advanced NDT, material technology and management are included, while for the nuclear power sub sector, radiation safety becomes mandatory.
- e) Any candidates who possess Level 3 in sub sector oil and gas is also eligible to enter Level 4 and Level 5 in sub sectors transportation and nuclear power.

| <b>HIERACHY</b> | <b>OIL AND GAS SUB SECTOR</b>   |
|-----------------|---|
|                 | ENTRY PREREQUISITES   |
| Level 5         | <ol style="list-style-type: none"> <li>1. Possess Level 4 in Oil and Gas Sub-Sector</li> <li>2. Subjects on industrial safety, material technology and management are added</li> <li>3. Advanced NDT</li> </ol>   |
| Level 4         | <ol style="list-style-type: none"> <li>1. Possess at least two Level 3 certificates of different job areas in Oil and Gas Sub-Sector.</li> <li>2. Subjects on industrial safety, material technology and management are added</li> <li>3. Advanced NDT</li> </ol> |
| Level 3         |    |
| Level 2         |   |
| Level 1         |   |
|                 |   |

| <b>HIERACHY</b> | <b>AEROSPACE SUB SECTOR</b>   |
|-----------------|---|
|                 | <b>ENTRY PREREQUISITES</b>  |
| Level 5         | <ol style="list-style-type: none"> <li>1. Possess Level 4 in Aerospace Sub-Sector</li> <li>2. Subjects on industrial safety, material technology and management are added</li> <li>3. Advanced NDT</li> </ol>   |
| Level 4         | <ol style="list-style-type: none"> <li>1. Possess at least two Level 3 certificates of different job areas in Aerospace Sub-Sector.</li> <li>2. Subjects on industrial safety, material technology and management are added</li> <li>3. Advanced NDT</li> </ol> |
| Level 3         |    |
| Level 2         |   |
| Level 1         |   |

| <b>HIERACHY</b> | <b>TRANSPORTATION SUB SECTOR</b>   |
|-----------------|--|
|                 | <b>ENTRY PREREQUISITES</b>   |
| Level 5         | <ol style="list-style-type: none"> <li>1. Possess Level 4 in Transportation Sub-Sector</li> <li>2. Subjects on industrial safety, material technology and management are added</li> <li>3. Advanced NDT</li> </ol>   |
| Level 4         | <ol style="list-style-type: none"> <li>1. Possess at least two Level 3 certificates of different job areas in Transportation Sub-Sector.</li> <li>2. Subjects on industrial safety, material technology and management are added</li> <li>3. Advanced NDT</li> </ol> |
| Level 3         |   |
| Level 2         |  |
| Level 1         |  |

| <b>HIERACHY</b> | <b>CONCRETE CONSTRUCTION SUB SECTOR</b>   |
|-----------------|---|
|                 | ENTRY PREREQUISITES   |
| Level 5         | <ol style="list-style-type: none"> <li>1. Possess Level 4 in Concrete Construction Sub-Sector</li> <li>2. Subjects on industrial safety, material technology and management are added</li> <li>3. Advanced NDT</li> </ol>   |
| Level 4         | <ol style="list-style-type: none"> <li>1. Possess at least two Level 3 certificates of different job areas in Concrete Construction Sub-Sector.</li> <li>2. Subjects on industrial safety, material technology and management are added</li> <li>3. Advanced NDT</li> </ol> |
| Level 3         |    |
| Level 2         |   |

| <b>HIERACHY</b> | <b>NUCLEAR POWER SUB SECTOR</b>  |
|-----------------|--|
|                 | ENTRY PREREQUISITES  |
| Level 5         | <ol style="list-style-type: none"> <li>1. Possess Level 4 in Nuclear Power Sub-Sector</li> <li>2. Subjects on industrial safety, material technology and management are added</li> <li>3. Subject on radiation safety is mandatory.</li> <li>4. Subjects on material technology and management are added</li> <li>5. Advanced NDT</li> </ol>   |
| Level 4         | <ol style="list-style-type: none"> <li>1. Possess at least two Level 3 certificates of different job areas in Nuclear Power Sub-Sector.</li> <li>2. Subjects on industrial safety, material technology and management are added</li> <li>3. Subject on radiation safety is mandatory.</li> <li>4. Subjects on material technology and management are added</li> <li>5. Advanced NDT</li> </ol> |
| Level 3         |   |
| Level 2         |  |
| Level 1         |  |

However Occupational Area Structure (OAS) for RT Welded Construction (Level 1) Personnel, the panel experts proposed the following hierarchy (Table 9).

**Table 9: Occupational Area Structure (OAS) for RT Welded Construction (Level 1) Personnel**

|                     |   |                         |   |
|---------------------|---|-------------------------|---|
| <b>SECTOR</b>       | MACHINERY AND EQUIPMENT                     |                         |   |
| <b>SUB SECTOR</b>   | NON DESTRUCTIVE TESTING (NDT) - OIL AND GAS |                         |   |
| <b>JOB AREA</b>     | RADIOGRAPHIC TESTING (RT)                   |                         |   |
| <b>JOB SUB AREA</b> | WELDED CONSTRUCTION                         | CASTING AND FORGING     | WELDING, CASTING AND FORGING  |
| <b>JOB LEVEL</b>    | STRUCTURE                                   |                         |   |
| <b>Level 5</b>      | NDT MANAGEMENT                              |                         |   |
| <b>Level 4</b>      | NDT MANAGEMENT                              |                         |   |
| <b>Level 3</b>      | RT –Welded Construction                     | RT- Casting and Forging | Radiographic Testing Technician-Film Interpreter<br># NCS-National Competency Standards |
| <b>Level 2</b>      | RT- Welded Construction                     | RT- Casting and Forging |   |
| <b>Level 1</b>      | RT –Welded Construction                     | RT- Casting and Forging |   |

## 9.0 Conclusions and recommendations

Based on the recommendations by the panel of experts, it is concluded that 124 job titles for 5 industrial sub sectors have been identified for NDT. The panel also

emphasised that the development of occupational analysis in the oil and gas industrial sub sector will first be focused upon in this survey. The corresponding NOSS for level 1, level 2 and level 3 in job areas for both RT- and UT-welded construction will then be firstly developed, while the remaining industrial sub sectors and NDT job area will be recommended for future projects. It is also highlighted that for future projects, industrial sub sectors for aerospace and nuclear power will be recommended, which will include advanced NDT techniques. This effort is in line with the government's encouragement on high-value added and high income impact regarding future manpower development.

## 10.0 References

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## **LIST OF ANNEXURES**

- Annex 1: List of panel experts and facilitator of the NDT Sector Occupational Analysis Development
- Annex 2: Occupational Definitions in the NDT for oil and gas sub sector
- Annex 3: Occupational Definitions in the NDT for aerospace sub sector
- Annex 4: Occupational Definitions in the NDT for transportation sub sector
- Annex 5: Occupational Definitions in the NDT for concrete construction subsector
- Annex 6: Occupational Definitions in the NDT for nuclear power sub sector

**Annex 1:** List of panel experts and facilitator of the NDT Sector Occupational Analysis Development

| PANEL EXPERT |                                  |  |
|--------------|----------------------------------|--|
| 1.           | Dr. Abd. Nassir bin Ibrahim      | Director of Industrial Technology, Agensi Nuklear Malaysia |
| 2.           | Dr. Khazali bin Haji Mohd Zin    | Vice President, MSNT                                       |
| 3.           | Dr. Azali bin Muhammad           | Member of Board of Director, MSNT                          |
| 4.           | Dr. Ab. Razak bin Hamzah         | Member of Board of Director, MSNT                          |
| 5.           | Dr. Badrol bin Ahmad             | Chief Technology Officer, TNB Research Sdn. Bhd.           |
| 6.           | Dr. Mohamad Pauzi bin Ismail     | NDT Manager, Agensi Nuklear Malaysia                       |
| 7.           | Azhar bin Azmi                   | Senior research officer, Agensi Nuklear Malaysia           |
| 8.           | Mohd Aris Fathillah bin Saleh    | Senior consultant, SIRIM BERHAD                            |
| 9.           | Huzeir bin Abdul Halim           | Manager, Intestmal Holding                                 |
| 10.          | Suri bin Taib                    | Principal Technician, SIRIM BERHAD                         |
| 11.          | Aptu bin Saman                   | Executive Director, Care Ion Technologist Sdn. Bhd.        |
| 12.          | Mohd Diah bin Baba               | Operations Director, Nusantara Technologies Sdn. Bhd.      |
| 13.          | Mohd. Alamin bin Pardi           | QA Manager, Malaysia Airlines                              |
| 14.          | Pn. Nurul A'in binti Ahmad Latif | Research Officer, Agensi Nuklear Malaysia                  |
| 15.          | Cik Noorhazleena binti Azaman    | Research Officer, Agensi Nuklear Malaysia                  |
| FACILLITATOR |                                  |  |
| 16.          | Awaldin bin Mohd Arif            | Managing Director, ITI Sdn. Bhd                            |

- Annex 2** : Occupational Definitions in the NDT Sector for **OIL and GAS SUB SECTOR**
- Annex 2.1** : Radiography Testing (RT)
- Annex 2.1.1** : Welded Construction



## **OCCUPATIONAL DEFINITION**

### **Radiographic Testing Level 1**

#### **RADIOGRAPHIC TESTING ASSISTANT TECHNICIAN (WELDED CONSTRUCTION)**

A Radiographic Testing Assistant Technician (Welded Construction) is designated as the person who set up the equipment and performs radiographic testing on welded construction and film processing according to specific written instructions under the supervision of a level 2 or level 3 personnel.

A Radiographic Testing Assistant Technician (Welded Construction) should be able to:

1. Perform the x-ray and gamma radiography testing equipment's periodic check
2. Perform the x-ray and gamma ray radiographic testing equipment's storage
3. Transport the x-ray and gamma ray radiographic testing equipment
4. Perform the x-ray and gamma ray radiographic testing inventory control
5. Prepare the x-ray and gamma ray radiographic testing area
6. Setup the x-ray and gamma ray radiographic testing equipment
7. Perform x-ray and gamma ray radiographic testing
8. Perform automatic and manual film processing preparation
9. Perform automatic and manual film processing
10. Record and classify the x-ray and gamma ray radiographic testing welded construction results of the tests
11. Prepare the x-ray and gamma ray radiographic testing test reports.
12. Perform and implement established safety and security procedures.

***NOTE:** Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 2

### **RADIOGRAPHIC TESTING TECHNICIAN (WELDED CONSTRUCTION)**

A Radiographic Testing Technician (Welded Construction) is expected to set up and verify the equipment, perform and coordinate radiographic testing, film interpretation and evaluation, and prepare radiographic testing on welded construction written instructions according to the applicable codes, standards specifications or procedures.

A Radiographic Testing Technician (Welded Construction) should be able to:

1. Perform and coordinate x-ray and gamma ray radiographic testing inventory control and the equipment's periodic check
2. Perform and coordinate x-ray and gamma ray radiographic testing equipment's transportation and storage
3. Prepare x-ray and gamma ray radiographic testing instructions according to the applicable Radiographic Testing Procedures
4. Setup and verify the x-ray and gamma ray radiographic testing equipment's settings
5. Perform and coordinate x-ray and gamma ray radiographic testing work activities at par or below level 2
6. Select and define the limitations and advantages of the applications of the testing methods
7. Provide x-ray and gamma ray radiographic testing guidance for personnel at par or below level 2
8. Perform radiographic film interpretation on welded construction items in accordance to applied codes, standards& specifications

9. Prepare the x-ray and gamma ray radiographic testing reports, film interpretation and evaluation according to applicable codes, standards, specifications or procedures
10. Record and classify the x-ray and gamma ray radiographic welded construction results of the tests
11. Monitor the x-ray and gamma ray equipment's maintenance, storage, inventory, transportation and etc.
12. Perform and implement established safety and security procedures.



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 3

### **RADIOGRAPHIC TESTING SENIOR TECHNICIAN (WELDED CONSTRUCTION)**

A Radiographic Testing Senior Technician (Welded Construction) is expected to coordinate the deployment and usage of radiographic testing equipment maintenance, storage, transportation and inventory control, coordinate radiographic testing activities, verify test reports, prepare and validate radiographic testing procedures and instructions, conduct technical briefings and on-the-job training, and interpret codes, standards, specifications and procedures.

A Radiographic Testing Senior Technician (Welded Construction) should be able to:

1. Assume full responsibility for radiographic testing facility and staff technical development.
2. Develop radiographic testing procedures
3. Validate radiographic testing procedures from clients/sub-contractors
4. Approve radiographic testing procedure that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret radiographic testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate radiographic testing instructions and procedures
7. Designate and prepare a particular test technique, instructions and procedures for a follow up radiographic testing mock-up
8. Provide radiographic testing guidance for personnel at and below levels
9. Coordinate radiographic testing equipment periodic check and maintenance

10. Coordinate radiographic testing equipment's storage, transportation and inventory control
11. Verify radiographic testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise radiographic testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review the procedures, equipment and personnel for NDT testing for designated projects, act as witnesses to performance testing, and prepare progress reports. They are also expected to assume the responsibility of maintaining constant contact with a client and the relevant authorities, and also ensure that all of the legal requirements that are imposed by a client and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Assume full responsibility for an NDT facility and personnel development
2. Review NDT procedures
3. Validate NDT procedures from clients/sub-contractors
4. Approve NDT procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness and validate NDT procedures
7. Review test techniques, instructions and procedures for a follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT training
11. Conduct appraisal on NDT personnel's work performance
12. Carry out audit on NDT equipment and accessories

13. Prepare progress reports of NDT performed at various stages of projects
14. Prepare job specifications for senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Radiographic Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to come up with NDT plan requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendation based on these results. They are also expected to assume the responsibility for organizing the implementation of the NDT plan, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage, all of the NDT requirements of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT projects tender specifications that are to be incorporated into the overall bidding documents
4. Develop NDT performance test during the construction stage
5. Identify specific NDT methods requirements for the projects
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspections, based on the cost and technical capabilities of the service provider
9. Recommend further action(s) to be taken, based on NDT results in the projects

10. Organise project management review meetings

- Annex 2** : Occupational Definitions in the NDT Sector for **OIL and GAS SUB SECTOR**
- Annex 2.1** : Radiography Testing (RT)
- Annex 2.1.2** : Casting and Forging



## OCCUPATIONAL DEFINITION

### Radiographic Testing Level 1

#### RADIOGRAPHIC TESTING ASSISTANT TECHNICIAN (CASTING AND FORGING)

A Radiographic Testing Assistant Technician (Casting and Forging) is expected to set up the equipment and perform radiographic testing on casting and forging, and film processing according to specific written instructions under the supervision of a level 2 or level 3 personnel.

A Radiographic Testing Assistant Technician (Casting and forging) should be able to:

1. Perform the x-ray and gamma radiography testing equipment's periodic check
2. Perform the x-ray and gamma ray radiographic testing equipment's storage
3. Transport the x-ray and gamma ray radiographic testing equipment
4. Perform the x-ray and gamma ray radiographic testing inventory control
5. Prepare the x-ray and gamma ray radiographic testing area
6. Setup the x-ray and gamma ray radiographic testing equipment
7. Perform x-ray and gamma ray radiographic testing
8. Perform automatic and manual film processing preparation
9. Perform automatic and manual film processing
10. Record and classify the x-ray and gamma ray radiographic testing casting and forging results of the tests
11. Prepare x-ray and gamma ray radiographic testing test reports.
12. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 2

### **RADIOGRAPHIC TESTING TECHNICIAN (CASTING AND FORGING)**

A Radiographic Testing Technician (Casting and Forging) is expected to set up and verify the equipment, perform and coordinate radiographic testing, film interpretation and evaluation, and prepare radiographic testing on casting and forging written instructions according to applicable codes, standards specifications or procedures.

A Radiographic Testing Technician (Casting and Forging) should be able to:

1. Perform and coordinate x-ray and gamma ray radiographic testing inventory control and the equipment's periodic check
2. Perform and coordinate x-ray and gamma ray radiographic testing equipment's transportation and storage
3. Prepare x-ray and gamma ray radiographic testing instructions according to the applicable Radiographic Testing Procedures
4. Setup and verify the x-ray and gamma ray radiographic testing equipment's settings
5. Perform and coordinate x-ray and gamma ray radiographic testing work activities at par or below level 2
6. Select and define the limitations and advantages of the applications of the testing methods
7. Provide x-ray and gamma ray radiographic testing guidance for personnel at par or below level 2
8. Perform radiographic film interpretation on casting and forging items in accordance to applied codes, standards& specifications

9. Prepare x-ray and gamma ray radiographic testing report, film interpretation and evaluation results according to applicable codes, standards, specifications or procedures
10. Record and classify the x-ray and gamma ray radiographic casting and forging results of the tests
11. Monitor x-ray and gamma ray equipment maintenance, storage, inventory, transportation and etc.
12. Perform and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

### **Radiographic Testing Level 3**

#### **RADIOGRAPHIC TESTING SENIOR TECHNICIAN (CASTING AND FORGING)**

A Radiographic Testing Senior Technician (Casting and Forging) is expected to coordinate radiographic testing equipment's maintenance, storage, transportation and inventory control, coordinate radiographic testing activities, verify test reports, prepare and validate radiographic testing procedures and instructions, conduct technical briefings and on-the-job training, and interpret codes, standards, specifications and procedures.

A Radiographic Testing Senior Technician (Casting and Forging) should be able to:

1. Assume full responsibility for radiographic testing facility and staff technical development.
2. Develop radiographic testing procedures
3. Validate radiographic testing procedures from clients/sub-contractors
4. Approve radiographic testing procedures that are to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret radiographic testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate radiographic testing instructions and procedures
7. Designate and prepare a particular test technique, instructions and procedures for a follow up radiographic testing mock-up
8. Provide radiographic testing guidance for personnel at par and lower levels
9. Coordinate the radiographic testing equipment's periodic check and maintenance

10. Coordinate the radiographic testing equipment's storage, transportation and inventory control
11. Verify radiographic testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise radiographic testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review procedures, equipment and personnel for the purpose of NDT testing for designated projects, witness the performance of the test and prepare progress reports. They are also expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from client/sub-contractors
4. Approve NDT procedures that are to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT training
11. Conduct appraisal on NDT personnel work performance
12. Carry out audit on NDT equipment and accessories

13. Prepare progress NDT reports performed at various stages of projects
14. Prepare job specifications for senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Radiographic Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan NDT requirements, develop NDT related quality plans, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the NDT plans, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage, all of the NDT requirements of engineering components, parts and systems to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT projects tender specifications that are to be incorporated into the overall bidding documents
4. Develop NDT performance test during the construction stage
5. Identify specific NDT methods requirements for the project
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspections, based on cost and technical capabilities of the service provider
9. Recommend further action(s) to be taken based on NDT results in the projects

10. Organise project management review meetings

- Annex 2** : Occupational Definitions in the NDT Sector for **OIL and GAS SUB SECTOR**
- Annex 2.2** : Ultrasonic Testing (UT)
- Annex 2.2.1** : Welded Construction



## OCCUPATIONAL DEFINITION

### Ultrasonic Testing Level 1

#### ULTRASONIC TESTING ASSISTANT TECHNICIAN (WELDED CONSTRUCTION)

An Ultrasonic Testing Assistant Technician (Welded Construction) is expected to set up the ultrasonic testing equipment and perform ultrasonic testing on welded construction according to specific written instructions under the supervision of a level 2 or level 3 personnel.

An Ultrasonic Testing Assistant Technician (Welded Construction) should be able to:

1. Perform the ultrasonic testing equipment's inventory and storage control
2. Perform the ultrasonic testing apparatus and equipment's periodic check
3. Set up the ultrasonic testing equipment
4. Perform ultrasonic testing Inspection surface area preparation
5. Perform thickness measurement ultrasonic testing
6. Perform lamination ultrasonic testing
7. Record and classify the ultrasonic testing on welded construction results
8. Prepare ultrasonic testing test reports.
9. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test result.*



## OCCUPATIONAL DEFINITION

### Ultrasonic Testing Level 2

#### ULTRASONIC TESTING TECHNICIAN (WELDED CONSTRUCTION)

An Ultrasonic Testing Technician (Welded Construction) is expected to prepare the ultrasonic testing instructions, provide the ultrasonic testing guidance, perform ultrasonic testing on welded construction, and interpret ultrasonic flaw and evaluation according to established procedures.

An Ultrasonic Testing Technician (Welded Construction) should be able to:

1. Select and define the limitations and advantages of application of the ultrasonic testing technique
2. Prepare ultrasonic testing instructions according to the applicable ultrasonic testing procedures.
3. Perform and coordinate the ultrasonic testing equipment's calibration and maintenance
4. Perform and coordinate the ultrasonic testing equipment's inventory and storage control
5. Set up and verify the ultrasonic testing equipment's settings
6. Perform groove plates ultrasonic testing
7. Perform pipe ultrasonic testing
8. Perform nozzle ultrasonic testing
9. Perform TKY joint ultrasonic testing
10. Perform ultrasonic testing interpretation and evaluation according to codes, standards, specifications and procedures
11. Report the results of ultrasonic testing on welded construction.
12. Perform and supervise all ultrasonic testing tasks at par or below level 2

13. Provide ultrasonic testing guidance for personnel at par or below level 2
14. Perform, implement and coordinate established safety and security procedures



## OCCUPATIONAL DEFINITION

Ultrasonic Testing Level 3

### ULTRASONIC TESTING SENIOR TECHNICIAN (WELDED CONSTRUCTION)

An Ultrasonic Testing Senior Technician (Welded Construction) is expected to develop and validate ultrasonic testing instructions and procedures, conduct technical briefings and on-the-job training, prepare follow up inspection proposal, and verify and interpret ultrasonic testing report, codes, standards, specification and procedures.

An Ultrasonic Testing Senior Technician (Welded Construction) should be able to:

1. Assume full responsibility for Ultrasonic testing facility and staff technical development
2. Develop Ultrasonic testing procedures
3. Validate Ultrasonic testing procedures from clients/sub-contractors
4. Approve Ultrasonic testing procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret Ultrasonic testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate Ultrasonic testing instructions and procedures
7. Designate and prepare the particular test technique, instructions and procedures for a follow up Ultrasonic testing mock-up
8. Provide Ultrasonic testing guidance for personnel at par and lower levels
9. Coordinate Ultrasonic testing equipment periodic check and maintenance
10. Coordinate Ultrasonic testing equipment's storage, transportation and inventory control
11. Verify Ultrasonic testing reports

12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise Ultrasonic testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Ultrasonic Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review procedures, equipment and personnel for NDT testing for designated projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from clients/sub-contractors
4. Approve NDT procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT training
11. Conduct appraisal on NDT personnel work performance
12. Carry out audit on NDT equipment and accessories

13. Prepare progress reports of NDT performed at various stages of projects
14. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Ultrasonic Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to come up with NDT plan requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the NDT plan, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage, all of the NDT requirements of engineering components, parts and systems to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT projects tender specifications that are to be incorporated into the overall bidding documents
4. Develop NDT performance test during the construction stage
5. Identify specific NDT methods requirements for the project
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspections, based on cost and technical capabilities of the service provider
9. Recommend further action(s) to be taken, based on NDT results in the projects

10. Organise project management review meetings

- Annex 2** : Occupational Definitions in the NDT Sector for **OIL and GAS SUB SECTOR**
- Annex 2.2** : Ultrasonic Testing (UT)
- Annex 2.2.2** : Casting and Forging



## OCCUPATIONAL DEFINITION

### Ultrasonic Testing Level 1

#### ULTRASONIC TESTING ASSISTANT TECHNICIAN (CASTING AND FORGING)

An Ultrasonic Testing Assistant Technician (Casting and Forging) is expected to set up the ultrasonic testing equipment and perform ultrasonic testing on casting and forging according to specific written instructions under the supervision of a level 2 or level 3 personnel.

An Ultrasonic Testing Assistant Technician (Casting and Forging) should be able to:

1. Perform the ultrasonic testing equipment's inventory and storage control
2. Perform the ultrasonic testing apparatus and equipment's periodic check
3. Set up the ultrasonic testing equipment
4. Perform ultrasonic testing inspection surface area preparation
5. Perform thickness measurement ultrasonic testing
6. Perform ultrasonic testing using longitudinal wave probe
7. Record and classify the ultrasonic testing on casting and forging results
8. Prepare ultrasonic testing test reports.
9. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Ultrasonic Testing Level 2

### **ULTRASONIC TESTING TECHNICIAN (CASTING AND FORGING)**

An Ultrasonic Testing Technician (Casting and Forging) is expected to prepare the ultrasonic testing instructions; provide ultrasonic testing guidance, perform ultrasonic testing on casting and forging, and carry out ultrasonic flaw interpretation and evaluation according to specific written established procedures.

An Ultrasonic Testing Technician (Casting and Forging) should be able to:

1. Select and define the limitations and advantages of the applications of the ultrasonic testing technique
2. Prepare ultrasonic testing instructions according to the applicable ultrasonic testing procedures.
3. Perform and coordinate ultrasonic testing equipment's calibration and maintenance
4. Perform and coordinate ultrasonic testing equipment inventory and storage control
5. Set up and verify the ultrasonic testing equipment's settings
6. Perform ultrasonic testing using longitudinal and shear wave probe
7. Perform ultrasonic testing interpretation and evaluation according to codes, standards, specifications and procedures
8. Report the results of ultrasonic testing on casting and forging.
9. Perform and supervise all ultrasonic testing tasks at par or below level 2
10. Provide ultrasonic testing guidance for personnel at par or below level 2

11. Perform, implement and coordinate established safety and security procedures



## OCCUPATIONAL DEFINITION

Ultrasonic Testing Level 3

### ULTRASONIC TESTING SENIOR TECHNICIAN (CASTING AND FORGING)

An Ultrasonic Testing Senior Technician (Casting and Forging) is expected to develop and validate ultrasonic testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret ultrasonic testing reports, codes, standards, specifications and procedures.

An Ultrasonic Testing Senior Technician (Casting and Forging) should be able to:

1. Assume full responsibility for ultrasonic testing facility and staff technical development
2. Develop ultrasonic testing procedures
3. Validate ultrasonic testing procedures from clients/sub-contractors
4. Approve ultrasonic testing procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret ultrasonic testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate Ultrasonic testing instructions and procedures
7. Designate and prepare the particular test technique, instructions and procedures for a follow up Ultrasonic testing mock-up
8. Provide ultrasonic testing guidance for personnel at par and lower levels
9. Coordinate the ultrasonic testing equipment's periodic check and maintenance

10. Coordinate ultrasonic testing equipment's storage, transportation and inventory control
11. Verify ultrasonic testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise ultrasonic testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Ultrasonic Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review procedures, the equipment and personnel for NDT testing for designated projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility in maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from clients/sub-contractors
4. Approve NDT procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness and validate NDT procedures
7. Review test techniques, instructions and procedures for a follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT training
11. Conduct appraisal on NDT personnel work performance
12. Carry out audit on NDT equipment and accessories

13. Prepare progress NDT reports performed at various stages of the projects
14. Prepare job specifications for senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Ultrasonic Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan NDT requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the NDT plan, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage, all of the NDT requirements of engineering components, parts and systems to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT projects tender specifications that are to be incorporated into the overall bidding document
4. Develop NDT performance test during the construction stage
5. Identify specific NDT methods requirements for the project
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspections, based on cost and technical capabilities of the service provider
9. Recommend further action(s) to be taken based on NDT results in the projects

## 11. Organise project management review meetings

- Annex 2** : Occupational Definitions in the NDT Sector for **OIL and GAS SUB SECTOR**
- Annex 2.3** : Liquid Penetrant Testing (PT)
- Annex 2.3.1** : Welded Construction



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 1

#### MAGNETIC PARTICLE TESTING ASSISTANT TECHNICIAN (WELDED CONSTRUCTION)

A Magnetic Particle Testing Assistant Technician (Welded Construction) is expected to set up equipment and perform testing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Magnetic Particle Testing Assistant Technician (Welded Construction) should be able to:

1. Perform the Magnetic Particle Testing Equipment's Periodic Check
2. Perform the Magnetic Particle inventory control and equipment's storage
3. Set up the Magnetic Particle Testing Equipment
4. Perform Magnetic Particle Testing Surface Area Preparation
5. Perform Fluorescent and Visible Magnetic Particle Testing
6. Perform Wet and Dry Magnetic Particle Testing
7. Record and classify the results of the tests
8. Prepare Magnetic Particle Testing report
9. Perform and implement established safety and security procedures

***NOTE:** Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 2

### **MAGNETIC PARTICLE TESTING TECHNICIAN (WELDED CONSTRUCTION)**

A Magnetic Particle Testing Technician (Welded Construction) is expected to set up and verify the equipment's settings, prepare Magnetic Particle Testing instructions, perform the testing, interpret and evaluate the results according to designated codes, standards, specifications and procedures.

A Magnetic Particle Testing Technician (Welded Construction) should be able to:

1. Prepare Magnetic Particle Testing Work Instruction according to designated codes, standards, specifications and procedures
2. Provide Magnetic Particle Testing Guidance for personnel at par or below level 2
3. Select and define the limitations and advantages of application of the testing method
4. Set up and verify the equipment's settings
5. Perform and supervise Magnetic Particle Testing activities
6. Perform and supervise all Magnetic Particle Testing tasks at par or below level 2
7. Perform the interpretation and evaluation results according to applicable codes, standards, specifications or procedure
8. Report the results of Magnetic Particle Testing
9. Perform and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 3

### **MAGNETIC PARTICLE TESTING SENIOR TECHNICIAN (WELDED CONSTRUCTION)**

A Magnetic Particle Testing Senior Technician (Welded Construction) is expected to develop and validate the Magnetic Particle testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret testing reports, codes, standards, specification and procedures.

A Magnetic Particle Testing Senior Technician (Welded Construction) should be able to:

1. Verify Magnetic Particle Testing Reports
2. Prepare Magnetic Particle Testing Procedures
3. Validate Magnetic Particle Testing Procedures And Instructions
4. Prepare Magnetic Particle Testing technical proposal
5. Coordinate Magnetic Particle Testing Equipment's Calibration And Validation
6. Conduct Technical Briefings
7. Supervise and coordinate Magnetic Particle Testing Activities
8. Conduct on-the-job training
9. Assume full responsibility for a test facility or examination centre and staff
10. Establish and review editorials for technical correctness
11. Interpret codes, standards, specifications and procedures
12. Perform, coordinate and supervise all Magnetic Particle Testing tasks at all levels

13. Provide Magnetic Particle Testing guidance for personnel at all levels
14. Perform, coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate procedures, equipment and personnel for magnetic particle testing in designated NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify magnetic particle testing procedures that are applicable for a particular magnetic particle testing projects
2. Evaluate and qualify magnetic particle testing equipment and other facilities that are to be used for magnetic particle testing projects
3. Evaluate and qualify magnetic particle testing personnel involved in magnetic particle testing projects
4. Periodic monitoring of magnetic particle testing performance in magnetic particle testing projects
5. Prepare and present progress magnetic particle testing reports performed at various stage to magnetic particle testing projects client
6. Prepare job specifications for senior Technicians, Technicians and Assistant Technicians
7. Witness magnetic particle testing performed by Technicians at the fabrication shops or sites

8. Provide storage area and security for magnetic particle equipment used for inspection at magnetic particle testing project sites
9. Liaise with the authorities (e.g. DOSH, NIOSH) on matters related to magnetic particle testing projects
10. Understand relevant codes and standards that are applicable for a particular magnetic particle testing project



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 5

#### NDT MANAGER

A NDT Manager is designated to plan magnetic particle testing requirements, develop magnetic particle testing related quality plan, evaluate magnetic particle testing results for magnetic particle testing projects and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the magnetic particle testing, and ensure that these plans are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage, all of the magnetic particle testing projects requirements of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where magnetic particle testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop magnetic particle testing projects tender specifications that are to be incorporated into the overall bidding documents
4. Develop magnetic particle testing performance test during the construction stage of magnetic particle testing projects
5. Identify requirements for magnetic particle testing for specific magnetic particle testing projects
6. Identifying correct magnetic particle testing methods to be applied in magnetic particle testing projects
7. Establish a sampling size and location for magnetic particle testing projects

8. Evaluate magnetic particle testing during magnetic particle testing projects tender submission
9. Select the most suitable magnetic particle testing service provider as a backup or a sub-contractor to perform inspection during magnetic particle testing projects, based on cost and technical capabilities of the service provider
10. Approved magnetic particle testing procedures that are to be applied in magnetic particle testing projects, in accordance to the applicable codes, standards and specifications
11. Review the results of magnetic particle testing.
12. Recommend further action(s) to be taken based on magnetic particle testing results in magnetic particle testing projects

- Annex 2** : Occupational Definitions in the NDT Sector for **OIL and GAS SUB SECTOR**
- Annex 2.3** : Magnetic Particle Testing (MT)
- Annex 2.3.2** : Casting and Forging



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 1

#### MAGNETIC PARTICLE TESTING ASSISTANT TECHNICIAN (CASTING AND FORGING)

A Magnetic Particle Testing Assistant Technician (Casting and Forging) is expected to set up the magnetic particle testing equipment and perform magnetic particle testing on casting and forging according to specific written instructions under the supervision of a level 2 or level 3 personnel.

A Magnetic Particle Testing Assistant Technician (Casting and Forging) should be able to:

1. Perform the magnetic particle testing equipment's inventory and storage control
2. Perform the magnetic particle testing apparatus and equipment's periodic check
3. Set up the magnetic particle testing equipment
4. Perform magnetic particle testing inspection surface area preparation
5. Perform magnetic particle testing
6. Record and classify the magnetic particle on casting and forging results
7. Prepare magnetic particle testing test reports.
8. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

### **Magnetic Particle Testing Level 2**

#### **MAGNETIC PARTICLE TESTING TECHNICIAN (CASTING AND FORGING)**

A Magnetic Particle Testing Technician (Casting and Forging) is expected to prepare the magnetic particle testing instructions, provide magnetic particle testing guidance, perform magnetic particle testing on casting and forging, and carry out magnetic particle defect interpretation and evaluation according to specific written established procedures.

A Magnetic Particle Testing Technician (Casting and Forging) should be able to:

1. Select and define the limitations and advantages of application of the magnetic particle testing technique
2. Prepare magnetic particle testing instructions according to the applicable magnetic particle testing procedures.
3. Perform and coordinate magnetic particle testing equipment's calibration and maintenance
4. Perform and coordinate magnetic particle testing equipment's inventory and storage control
5. Set up and verify magnetic particle testing equipment's settings
6. Perform magnetic particle testing
7. Perform magnetic particle testing interpretation and evaluation according to codes, standards, specifications and procedures
8. Report the results of magnetic particle testing on casting and forging.
9. Perform and supervise all magnetic particle testing tasks at par or below level

10. Provide magnetic particle testing guidance for personnel at par or below level 2
11. Perform, implement and coordinate established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 3

### **MAGNETIC PARTICLE TESTING SENIOR TECHNICIAN (CASTING AND FORGING)**

A Magnetic Particle Testing Senior Technician (Casting and Forging) is expected to develop and validate the magnetic particle testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret magnetic particle testing report, codes, standards, specification and procedures.

A Magnetic Particle Testing Senior Technician (Casting and Forging) shall be able to:

1. Assume full responsibility for magnetic particle testing facility and staff technical development
2. Develop magnetic particle testing procedures
3. Validate magnetic particle testing procedures from clients/sub-contractors
4. Approve magnetic particle testing procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret magnetic particle testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate magnetic particle testing instructions and procedures
7. Designate and prepare the particular test technique, instructions and procedures for a follow up magnetic particle testing mock-up
8. Provide magnetic particle testing guidance for personnel at par and lower levels

9. Coordinate magnetic particle testing equipment's periodic check and maintenance
10. Coordinate magnetic particle testing equipment's storage, transportation and inventory control
11. Verify magnetic particle testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise ultrasonic testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review the procedures, equipment and personnel for NDT testing for designated projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from clients/sub-contractors
4. Approve NDT procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for a follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT training
11. Conduct appraisal on NDT personnel work performance
12. Carry out audit on NDT equipment and accessories

13. Prepare progress reports of NDT performed at various stages of projects
14. Prepare job specifications for senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan NDT requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the NDT plan, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage, all of the NDT requirements of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT projects tender specification to be incorporated into the overall bidding document
4. Develop NDT performance test during the construction stage
5. Identify specific NDT methods requirements for the project
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspections, based on cost and technical capabilities of the service provider
9. Recommend further action(s) to be taken based on NDT results in the projects

12. Organise project management review meetings

- Annex 2** : Occupational Definitions in the NDT Sector for **OIL and GAS SUB SECTOR**
- Annex 2.4** : Liquid Penetrant Testing (PT)
- Annex 2.4.1** : Welded Construction



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 1

#### LIQUID PENETRANT TESTING ASSISTANT TECHNICIAN (WELDED CONSTRUCTION)

A Liquid Penetrant Testing Assistant Technician (Welded Construction) is expected to set up the equipment and perform testing according to specific written instructions under the supervision of a level 2 or level 3 personnel.

A Liquid Penetrant Testing Assistant Technician (Welded Construction) should be able to:

1. Perform the Penetrant Testing Equipment's Periodic Check
2. Perform the Penetrant Testing inventory control and equipment's storage
3. Set up the Penetrant Testing Equipment
4. Perform Penetrant Testing Surface Area Preparation
5. Perform Fluorescent and Visible Penetrant Testing
6. Perform Wet and Dry Penetrant Testing
7. Record and classify the results of the tests
8. Prepare the Penetrant Particle Testing reports
9. Perform and implement established safety and security procedures

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Liquid Penetrant Testing Level 2

### **LIQUID PENETRANT TESTING TECHNICIAN (WELDED CONSTRUCTION)**

A Liquid Penetrant Testing Technician (Welded Construction) is expected to set up and verify the equipment's settings, prepare Penetrant Testing instructions, perform the test, interpret and evaluate the results according to the designated codes, standards, specifications and procedures.

A Liquid Penetrant Testing Technician (Welded Construction) should be able to:

1. Prepare the Penetrant Testing Work instructions according to designated codes, standards, specifications and procedures
2. Provide Penetrant Testing Guidance for personnel at par or below level 2
3. Select and define the limitations and advantages of application of the testing method
4. Set up and verify the equipment's settings
5. Perform and supervise Penetrant Testing activities
6. Perform and supervise all Penetrant Testing tasks at par or below level 2
7. Interpret and evaluate results according to the applicable codes, standards, specifications or procedure
8. Report the results of Penetrant Testing
9. Perform and implement established safety and security procedures



## OCCUPATIONAL DEFINITION

Liquid Penetrant Testing Level 3

### LIQUID PENETRANT TESTING SENIOR TECHNICIAN (WELDED CONSTRUCTION)

A Liquid Penetrant Testing Senior Technician (Welded Construction) is expected to develop and validate the Penetrant testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret testing report, codes, standards, specification and procedures.

A Liquid Penetrant Testing Senior Technician (Welded Construction) be able to:

1. Verify Penetrant Testing Report
2. Prepare Penetrant Testing Procedure
3. Validate Penetrant Testing Procedures And Instruction
4. Prepare Penetrant Testing technical proposal
5. Coordinate Penetrant Testing Equipment Calibration And Validation
6. Conduct Technical Briefings
7. Supervise and coordinate Penetrant Testing Activities
8. Conduct on-the-job Training
9. Assume full responsibility for a test facility or examination centre and staff
10. Establish and review editorials for technical correctness
11. Interpret codes, standards, specifications and procedures
12. Perform, coordinate and supervise all Penetrant Testing tasks at all levels
13. Provide Penetrant Testing guidance for personnel at all levels
14. Perform, coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Liquid Penetrant Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate procedures, equipment and personnel for magnetic particle testing in NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify penetrant testing procedures that are applicable for a particular magnetic particle testing projects
2. Evaluate and qualify penetrant testing equipment and other facilities to be used for magnetic particle testing projects
3. Evaluate and qualify penetrant testing personnel involved in magnetic particle testing projects
4. Periodically monitor of penetrant testing performance in penetrant testing projects
5. Prepare and present progress reports of penetrant testing performed at various stage to the penetrant testing project clients
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness penetrant testing performed by Technicians at the fabrication shops or sites

8. Provide a storage area and security for magnetic particle equipment used for inspection at magnetic particle testing project sites
9. Liaise with the authorities (e.g. DOSH, NIOSH) on matters related to penetrant testing projects
10. Understand the relevant codes and standards that are applicable for a particular penetrant testing project



## **OCCUPATIONAL DEFINITION**

### Liquid Penetrant Testing Level 5

#### **NDT MANAGER**

A NDT Manager is expected to plan penetrant testing requirements, develop penetrant testing related quality plans, evaluate the penetrant testing results for penetrant testing projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the penetrant testing plans, and ensure that these are carried out in a professional and safe manner.

A NDT manager should be able to:

1. Plan, during the design stage, all of the penetrant testing projects requirements for the engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where penetrant testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop penetrant particle testing projects tender specifications that are to be incorporated into the overall bidding document
4. Develop penetrant particle testing performance test during the construction stage of penetrant testing projects
5. Identify the requirements for penetrant testing for specific penetrant testing projects
6. Identifying the correct penetrant testing methods that are to be applied in penetrant testing projects
7. Establishing sampling size and location for penetrant testing projects

8. Evaluate penetrant testing during magnetic particle testing projects tender submission
9. Select the most suitable penetrant testing service provider as a backup or a sub-contractor to perform inspection during magnetic particle testing projects, based on cost and the technical capabilities of the service provider
10. Approve penetrant testing procedures that are to be applied in penetrant testing projects, in accordance with applicable codes, standards and specifications
11. Review the results of magnetic particle testing.
12. Recommend further action(s) to be taken based on magnetic particle testing results in magnetic particle testing projects

- Annex 2** : Occupational Definitions in the NDT Sector for **OIL and GAS SUB SECTOR**
- Annex 2.4** : Liquid Penetrant Testing (PT)
- Annex 2.4.2** : Casting and Forging



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 1

#### LIQUID PENETRANT TESTING ASSISTANT TECHNICIAN (CASTING AND FORGING)

A Liquid Penetrant Testing Assistant Technician (Casting and Forging) is expected to set up the penetrant testing equipment and perform penetrant magnetic particle testing on casting and forging according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Liquid Penetrant Testing Assistant Technician (Casting and Forging) should be able to:

1. Perform the penetrant testing equipment's inventory and storage control
2. Perform the penetrant testing apparatus and equipment's periodic check
3. Set up the penetrant testing equipment
4. Perform the penetrant testing inspection surface area preparation
5. Perform penetrant testing
6. Record and classify the penetrant on casting and forging results
7. Prepare penetrant testing test reports.
8. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

### Liquid Penetrant Testing Level 2

#### **LIQUID PENETRANT TESTING TECHNICIAN (CASTING AND FORGING)**

A Penetrant Testing Technician (Casting and Forging) is expected to prepare the penetrant testing instructions, provide penetrant testing guidance, perform penetrant testing on casting and forging, and carry out penetrant defect interpretation and evaluation according to specific written established procedures.

A Penetrant Testing Technician (Casting and Forging) should be able to:

1. Select and define the limitations and advantages of application of the penetrant testing technique
2. Prepare penetrant testing instructions according to applicable penetrant testing procedures.
3. Perform and coordinate the penetrant testing equipment's calibration and maintenance
4. Perform and coordinate the penetrant testing equipment's inventory and storage control
5. Set up and verify the penetrant testing equipment's settings
6. Perform penetrant testing
7. Perform penetrant testing interpretation and evaluation according to codes, standards, specifications and procedures
8. Report the results of penetrant testing on casting and forging.
9. Perform and supervise all penetrant testing tasks at par or below level 2
10. Provide penetrant testing guidance for personnel at par or below level 2

11. Perform, implement and coordinate established safety and security procedures



## **OCCUPATIONAL DEFINITION**

### Liquid Penetrant Testing Level 3

#### **LIQUID PENETRANT TESTING SENIOR TECHNICIAN (CASTING AND FORGING)**

A Liquid Penetrant Testing Senior Technician (Casting and Forging) is expected to develop and validate the penetrant testing instruction and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret penetrant testing report, codes, standards, specification and procedures.

A Liquid Penetrant Testing Senior Technician (Casting and Forging) should be able to:

1. Assume full responsibility for penetrant testing facility and staff technical development
2. Develop penetrant testing procedures
3. Validate penetrant testing procedures from clients/sub-contractors
4. Approve penetrant testing procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret penetrant testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate penetrant testing instructions and procedures
7. Designate and prepare a particular test technique, instructions and procedures for a follow up penetrant testing mock-up
8. Provide penetrant testing guidance for personnel at par and lower levels
9. Coordinate penetrant testing equipment's periodic check and maintenance

10. Coordinate penetrant testing equipment's storage, transportation and inventory control
11. Verify penetrant testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise penetrant testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Liquid Penetrant Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review procedures, equipment and personnel for NDT testing for designated projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from clients/sub-contractors
4. Approve NDT procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for a follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT training
11. Conduct appraisal on NDT personnel work performance
12. Carry out audit on NDT equipment and accessories

13. Prepare progress reports of NDT performed at various stages of projects
14. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan NDT requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the NDT plan, and ensure that these plans are carried out in a professional and safe manner.

A NDT Manager shall be able to:

1. Plan, during the design stage, all of the NDT requirements for engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT projects tender specification to be incorporated into the overall bidding document
4. Develop NDT performance test during the construction stage
5. Identify specific NDT methods requirements for the project
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspections, based on cost and technical capabilities of the service provider
9. Recommend further action(s) to be taken based on NDT results in the projects

10. Organise project management review meetings

- Annex 2** : Occupational Definitions in the NDT Sector for **OIL and GAS SUB SECTOR**
- Annex 2.5** : Eddy Current Testing (ET)
- Annex 2.5.1** : Tubes and Plates



## OCCUPATIONAL DEFINITION

Eddy Current Testing level 1

### EDDY CURRENT TESTING ASSISTANT TECHNICIAN (TUBES AND PLATES)

An Eddy Current Testing Assistant Technician (Tubes and Plates) is expected to set up the equipment and perform testing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

An Eddy Current Testing Assistant Technician (Tubes and Plates) shall be able to:

1. Perform the Eddy Current Testing Equipment's Periodic Check
2. Perform the inventory control and equipment's storage
3. Set up Eddy Current Testing Equipment
4. Perform Eddy Current Testing Surface Area Preparation
5. Perform Conductivity Inspection
6. Perform Surface Inspection
7. Perform Thin Material's Thickness Measurement
8. Perform Bolt Hole Inspection
9. Record and classify the results of the tests
10. Prepare Eddy Current test reports
11. Perform and implement established safety and security procedures

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Eddy Current Testing level 2

### **EDDY CURRENT TESTING TECHNICIAN (TUBES AND PLATES)**

An Eddy Current Testing Technician (Tubes and Plates) is expected to set up and verify the equipment settings, prepare Eddy Current Testing work instructions, perform testing, and interpret and evaluate results according to the designated codes, standards, specifications and procedures.

An Eddy Current Testing Technician (Tubes and Plates) should be able to:

1. Prepare Eddy Current Testing Work Instruction according to established codes, standards, specifications and procedures
2. Provide Eddy Current Testing Guidance for personnel at par or below level 2
3. Select and define the limitations and advantages of the applications of the testing method
4. Set up and verify the equipment's settings
5. Perform Tubing Inspection
6. Perform and supervise Eddy Current Testing Work
7. Perform Interpretation and evaluation results according to applicable codes, standards, specifications or procedures
8. Report the results of non-destructive tests
9. Perform and implement established safety and security procedures



## OCCUPATIONAL DEFINITION

Eddy Current Testing level 3

### EDDY CURRENT TESTING SENIOR TECHNICIAN (TUBES AND PLATES)

An Eddy Current Testing Senior Technician (Tubes and Plates) is expected to develop and validate ultrasonic testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up to inspection proposals, and verify and interpret ultrasonic testing reports, codes, standards, specification and procedures.

An Eddy Current Testing Senior Technician (Tubes and Plates) should be able to:

1. Verify Eddy Current Testing Reports
2. Prepare Eddy Current Testing Procedures
3. Validate Eddy Current Testing Procedures And Instructions
4. Prepare Eddy Current Testing technical proposal
5. Coordinate Eddy Current Testing Equipment Calibration And Validation
6. Conduct technical briefings
7. Supervise and coordinate Eddy Current Testing Work Activities
8. Conduct on-the-job training
9. Assume full responsibility for a test facility, examination centre, and staff
10. Establish and review editorials for technical correctness
11. Interpret codes, standards, specifications and procedures
12. Perform, coordinate and supervise Eddy Current Testing at all levels
13. Provide guidance for personnel at all levels
14. Perform, coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Eddy Current Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate procedures, equipment and personnel for eddy current testing for designated NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility for maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by a client and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify NDT procedures that are applicable for a particular NDT testing projects
2. Evaluate and qualify NDT equipment and other facilities that are to be used NDT projects
3. Evaluate and qualify NDT personnel that are involved in NDT testing projects
4. Periodic monitoring of NDT testing performance in NDT testing projects
5. Prepare and present progress reports of NDT performed at various stages to the NDT testing projects client
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness NDT testing performed by Technicians at the fabrication shops or sites
8. Provide a storage area and security for NDT equipment used for inspection at NDT testing project sites

9. Liaise with the authorities (e.g AELB, DOSH, NIOSH) on matters related to NDT testing projects
10. Understand the relevant codes and standards that are applicable for a particular NDT testing project



## OCCUPATIONAL DEFINITION

### Eddy Current Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to come up with an NDT testing plan requirement, develop NDT testing related quality plan, evaluate NDT testing results for NDT testing projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the NDT testing, and ensure that these are carried out in a professional and safe manner.

A NDT Manager shall be able to:

1. Plan, during the design stage, all of the NDT testing projects' requirement of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop NDT testing projects tender specifications that are to be incorporated into the overall bidding document
4. Develop NDT testing performance test during the construction stage of NDT testing projects
5. Identify requirements for non-destructive testing for specific NDT testing projects
6. Identifying correct NDT testing methods that are to be applied in NDT testing projects
7. Establish a sampling size and location for NDT testing projects

8. Evaluate non-destructive testing during NDT testing projects tender submission
9. Select the most suitable NDT testing service provider as a backup or a sub-contractor to perform inspection during NDT testing projects, based on cost and technical capabilities of the service provider
10. Approved NDT testing procedures that are to be applied in non-destructive testing projects, in accordance with the applicable codes, standards and specifications
11. Review the results of non-destructive testing in NDT testing projects
12. Recommend further action(s) to be taken based on non-destructive testing results in NDT testing projects

- Annex 2** : Occupational Definitions in the NDT Sector for **OIL and GAS SUB SECTOR**
- Annex 2.6** : Visual Testing (VT)
- Annex 2.6.1** : Engineering Components



## OCCUPATIONAL DEFINITION

### Visual Testing Level 1

#### VISUAL TESTING ASSISTANT TECHNICIAN (ENGINEERING COMPONENT)

A Visual Testing Assistant Technician (Engineering Component) is expected to set up the equipment and perform visual inspection and image processing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Visual Testing Assistant Technician (Engineering Component) shall be able to:

1. Perform the visual inspection equipment's periodic check
2. Perform the visual inspection equipment's storage
3. Transport the visual inspection equipment
4. Perform visual inspection inventory control
5. Prepare the visual inspection area
6. Setup the visual inspection equipment
7. Perform visual inspection testing
8. Prepare for image recording, storing and retrieving
9. Perform image recording, storing and retrieving
10. Record and classify test result of visual inspection
11. Prepare visual inspection test report
12. Perform and implement safety and security procedure.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Visual Testing Level 2

### **VISUAL TESTING TECHNICIAN (ENGINEERING COMPONENT)**

A Visual Testing Technician (Engineering Component) is expected to set up and verify the equipment, perform and coordinate visual inspections, film interpretation and evaluation, and prepare the visual inspection written instructions according to the applicable codes, standards specifications and procedures.

A Visual Testing Technician (Engineering Component) should be able to:

1. Perform and coordinate the x-ray and gamma ray visual inspection inventory control and equipment's periodic check
2. Perform and coordinate the visual inspection equipment's transportation and storage
3. Prepare the visual inspection instruction according to applicable visual inspection procedures
4. Setup and verify the visual inspection equipment's settings
5. Perform and coordinate visual inspection work activities at par or below level 2
6. Select and define the limitations and advantages of application of the inspection methods
7. Provide visual inspection guidance for personnel at par or below level 2
8. Interpret the test result in accordance to the applied codes, standards& specifications

9. Prepare visual inspection reports, interpretation and the evaluation of test results according to the applicable codes, standards, specifications or procedures
10. Record and classify the visual inspection results
11. Monitor the visual inspection equipment's maintenance, storage, inventory, transportation and etc.
12. Perform and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Visual Testing Level 3

### **VISUAL TESTING SENIOR TECHNICIAN (ENGINEERING COMPONENT)**

A Visual Testing Senior Technician (Engineering Component) is expected to coordinate the visual inspection equipment's maintenance, storage, transportation and inventory control, coordinate visual inspection activities, verify test reports, prepare and validate visual inspection procedures and instructions, and conduct technical briefings and on-the-job training, interpret codes, standards, specifications and procedures.

A Visual Testing Senior Technician (Engineering Components) should be able to:

1. Assume full responsibility for visual inspection facility and staff technical development
2. Develop visual inspection procedures
3. Validate visual inspection procedures from clients/sub-contractors
4. Approve visual inspection procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret visual inspection codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate visual inspection instructions and procedures
7. Designate and prepare the particular test technique, instructions and procedures for a follow up visual inspection mock-up
8. Provide visual inspection guidance for personnel at par and lower levels
9. Coordinate the visual inspection equipment's periodic check and maintenance

10. Coordinate the visual inspection equipment's storage, transportation and inventory control
11. Verify visual inspection reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise visual inspection activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## OCCUPATIONAL DEFINITION

Visual Testing Level 4

### NDT TECHNICAL EXECUTIVE

A NDT Technical Executive is expected to evaluate procedures, equipment and personnel for eddy current testing for designated NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility for maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by a client and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify NDT procedures that are applicable for a particular NDT testing projects
2. Evaluate and qualify NDT equipment and other facilities that are to be used NDT projects
3. Evaluate and qualify NDT personnel that are involved in NDT testing projects
4. Periodic monitoring of NDT testing performance in NDT testing projects
5. Prepare and present progress reports of NDT performed at various stages to the NDT testing projects client
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness NDT testing performed by Technicians at the fabrication shops or sites
8. Provide a storage area and security for NDT equipment used for inspection at NDT testing project sites

9. Liaise with the authorities (e.g AELB, DOSH, NIOSH) on matters related to NDT testing projects
10. Understand the relevant codes and standards that are applicable for a particular NDT testing project



## OCCUPATIONAL DEFINITION

Visual Testing Level 5

### NDT MANAGER

A NDT Manager is expected to come up with an NDT testing plan requirement, develop NDT testing related quality plan, evaluate NDT testing results for NDT testing projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the NDT testing, and ensure that these are carried out in a professional and safe manner.

A NDT Manager shall be able to:

1. Plan, during the design stage, all of the NDT testing projects' requirement of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop NDT testing projects tender specifications that are to be incorporated into the overall bidding document
4. Develop NDT testing performance test during the construction stage of NDT testing projects
5. Identify requirements for non-destructive testing for specific NDT testing projects
6. Identifying correct NDT testing methods that are to be applied in NDT testing projects
7. Establish a sampling size and location for NDT testing projects

8. Evaluate non-destructive testing during NDT testing projects tender submission
9. Select the most suitable NDT testing service provider as a backup or a sub-contractor to perform inspection during NDT testing projects, based on cost and technical capabilities of the service provider
10. Approved NDT testing procedures that are to be applied in non-destructive testing projects, in accordance with the applicable codes, standards and specifications
11. Review the results of non-destructive testing in NDT testing projects
12. Recommend further action(s) to be taken based on non-destructive testing results in NDT testing projects

- Annex 3** : Occupational Definitions in the NDT Sector for **AEROSPACE SUB SECTOR**
- Annex 3.1** : Radiography Testing (RT)
- Annex 3.1.1** : Materials, Components and Structures



## **OCCUPATIONAL DEFINITION**

### **Radiographic Testing Level 1**

#### **RADIOGRAPHIC TESTING TECHNICIAN (MATERIALS, COMPONENTS AND STRUCTURES)**

A Radiographic Testing Technician (Materials, Components and Structures) is expected to set up the equipment, perform radiographic testing and film processing according to specific written instructions under the supervision of a level 2 or level 3 personnel, appropriately certified for aerospace sector.

A Radiographic Testing Technician (Materials, Components and Structures) should be able to:

1. Perform a general periodic check of all the x-ray and gamma ray apparatus and ancillary equipment, including storage area.
2. Transport various RT equipment, including all of its relevant accessories
3. Maintain and update an inventory list of all x-ray and gamma ray apparatus, and associated ancillary equipment.
4. Prepare the RT area, including erecting a radiation barrier for open site testing.
5. Prepare films and manual processing chemicals for RT activities.
6. Setup x-ray and gamma ray radiography testing equipment
7. Perform x-ray and gamma Ray radiography testing
8. Perform automatic and manual film processing including pre and post preparation
9. Determine the quality of radiographs produced prior to interpretation process.
10. Assist to prepare x-ray and gamma Ray test reports.
11. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

### **Radiographic Testing Level 2**

#### **RADIOGRAPHIC TESTING SENIOR TECHNICIAN (MATERIALS, COMPONENTS AND STRUCTURES)**

A Radiographic Testing Senior Technician (Materials, Components and Structures) is expected to set up and verify the equipment, perform and coordinate radiographic testing, film interpretation and evaluation, and prepare radiographic testing written instructions according to the relevant codes, standards specifications or procedures, which are applicable for the Aerospace Sector.

A Radiographic Testing Senior Technician (Materials, Components and Structures) should be able to:

1. Perform and coordinate RT inventory control and the equipment's periodic check
2. Perform and coordinate the RT equipment's transportation and storage
3. Prepare the RT instruction according to applicable codes, standards, specifications or procedures
4. Setup and verify RT equipment's settings
5. Perform and coordinate RT Work activities at par or below level 2
6. Select and define the limitations and advantages of the applications of the testing methods
7. Provide RT techniques for RT personnel.
8. Record and classify the RT test results
9. Prepare RT test report, film interpretation and evaluation results according to applicable codes, standards, specifications or procedures
10. Perform and implement established safety and security procedures.

Note: The designated individual must possess an AELB supervisor's license



## **OCCUPATIONAL DEFINITION**

### **Radiographic Testing Level 3**

#### **RADIOGRAPHIC TESTING ENGINEER (MATERIALS, COMPONENTS AND STRUCTURES)**

A Radiographic Testing Engineer (Materials, Components and Structures) is expected to coordinate the radiographic testing equipment's maintenance, storage, transportation and inventory control, coordinate radiography testing activities, verify test reports, prepare, validate and approve radiographic testing procedures and instructions, conduct technical briefings and on-the-job training, and interpret codes, standards, specifications and procedures, which are applicable for Aerospace Sector.

A Radiographic Testing Engineer (Materials, Components and Structures) should be able to:

1. Coordinate the RT equipment's periodic check and maintenance
2. Coordinate the RT equipment's storage, transportation and inventory control
3. Verify RT reports
4. Prepare RT procedures
5. Establish, review and validate procedures/reports/documents in editorials for technical correctness
6. Validate RT procedures and instructions
7. Provide RT guidance for personnel at all levels
8. Designate and prepare the particular test methods, instructions and procedures for follow up RT proposal
9. Conduct technical briefings to all parties, including management and customers

10. Conduct NDT training which includes classroom and on job practical training (OJT).
11. Coordinate and supervise RT activities at all levels
12. Interpret RT codes, standards, specifications and procedures.
13. Approve NDT techniques prepared by Level 2 personnel.
14. Coordinate and implement established safety and security procedures.



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate the procedures, equipment and personnel for radiographic testing in NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify RT procedures that are applicable for a particular radiographic testing projects
2. Evaluate and qualify radiographic testing equipment and other facilities that are to be used for RT projects
3. Evaluate and qualify NDT personnel involved in RT projects
4. Periodically monitor performances in radiographic testing
5. Prepare and present progress reports of RT that are performed at various stages to customers
6. Prepare job specifications for NDT Engineers, Senior Technicians, Technicians and Assistant Technicians
7. Witness, supervise and monitor RT performed by NDT personnel at fabrication shops or sites.
8. Provide a storage area for industrial radiographic source that are used for inspection at RT project sites.

9. Liaise with the authorities (e.g. AELB, DOSH, NIOSH) on matters related to the radiographic testing projects
10. Understand the relevant codes and standards that are applicable to a particular radiographic testing project



## **OCCUPATIONAL DEFINITION**

### **Radiographic Testing Level 5**

#### **NDT MANAGER**

A NDT Manager designated to RT will plan work requirements, develop related quality plan and evaluate testing results from RT projects, and provide further recommendations based on these results. He will also assume the responsibility for organising the implementation of the RT's plan, and will ensure that these are carried out in a professional manner, complying with all the designated safety requirements.

A NDT Manager should be able to:

1. Plan, during the design stage of RT projects, all of the requirements for engineering components, parts and systems to be inspected
2. Develop quality plan (stages where RT projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop RT projects tender specifications that are to be incorporated into the overall bidding document
4. Develop performance test during the construction stage of radiographic testing projects
5. Identify the requirements for specific radiographic testing projects
6. Identify the correct radiographic testing methods that are to be applied in radiographic testing projects
7. Establish a sampling size and location for radiographic testing projects, if required.
8. Carry out the evaluation of radiographic testing for project tender submission

9. Select the most suitable radiographic testing service providers as a backup or a sub-contractor to perform inspections during radiographic testing projects, based on cost and technical capabilities of the service provider
10. Approve radiographic testing procedures that are to be applied in projects following applicable code standard and specification
11. Review the results of radiographic testing as required.
12. Recommend further action(s) to be taken based on radiographic testing results.

- Annex 3** : Occupational Definitions in the NDT Sector for **AEROSPACE SUB SECTOR**
- Annex 3.1** : Radiography Testing (RT)
- Annex 3.1.2** : Light and Dense Metal Welds



## **OCCUPATIONAL DEFINITION**

### **Radiographic Testing Level 1**

#### **RADIOGRAPHIC TESTING TECHNICIAN (LIGHT AND DENSE METAL WELDS)**

A Radiographic Testing Technician (Light and Dense Metal Welds) is expected to set up the equipment and perform the radiographic testing and film processing according to specific written instructions under the supervision of a level 2 or level 3 personnel, appropriately certified for the aerospace sector.

A Radiographic Testing Technician (Light and Dense Metal Welds) should be able to:

1. Perform a general periodic check of all the x-ray and gamma ray apparatus and ancillary equipment, including its storage area.
2. Transport various RT equipment, including all of the relevant accessories
3. Maintain and update an inventory list of all the x-ray and gamma ray apparatus, and associated ancillary equipment.
4. Prepare the RT area, including erecting a radiation barrier for open site testing.
5. Prepare films and manual processing chemicals for RT activities.
6. Setup x-ray and gamma ray radiography testing equipment
7. Perform x-ray and gamma Ray radiography testing
8. Perform automatic and manual film processing, including pre and post preparation
9. Determine the quality of radiographs produced prior to interpretation process.
10. Assist to prepare x-ray and gamma Ray test report.
11. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

### **Radiographic Testing Level 2**

#### **RADIOGRAPHIC TESTING SENIOR TECHNICIAN (LIGHT AND DENSE METAL WELDS)**

A Radiographic Testing Senior Technician (Light and Dense Metal Welds) is expected to set up and verify the equipment, perform and coordinate radiographic testing, film interpretation and evaluation, and prepare the radiographic testing written instructions according to the relevant codes, standards specifications or procedures, which are applicable for the Aerospace Sector.

A Radiographic Testing Senior Technician (Light and Dense Metal Welds) should be able to:

1. Perform and coordinate the RT's inventory control and equipment periodic check
2. Perform and coordinate the RT equipment's transportation and storage
3. Prepare RT instruction according to applicable codes, standards, specifications or procedures
4. Setup and verify RT equipment settings
5. Perform and coordinate RT Work activities at par or below level 2
6. Select and define the limitations and advantages of application of the testing methods
7. Provide RT techniques for RT personnel.
8. Record and classify the RT test results
9. Prepare RT test report, film interpretation and evaluation results according to applicable codes, standards, specifications or procedures
10. Perform and implement established safety and security procedures.

Note: The individual must possess an AELB supervisor's license



## **OCCUPATIONAL DEFINITION**

### **Radiographic Testing Level 3**

#### **RADIOGRAPHIC TESTING ENGINEER (LIGHT AND DENSE METAL WELDS)**

A Radiographic Testing Engineer (Light and Dense Metal Welds) is expected to coordinate the radiographic testing equipment's maintenance, storage, transportation and inventory control, coordinate the radiography testing activities, verify test reports, prepare, validate and approve radiographic testing procedures and instructions, conduct technical briefings and on-the-job training, and interpret codes, standards, specifications and procedures, which are applicable for the Aerospace Sector.

A Radiographic Testing Engineer (Light and Dense Metal Welds) should be able to:

1. Coordinate the RT equipment's periodic check and maintenance
2. Coordinate the RT equipment's storage, transportation and inventory control
3. Verify RT reports
4. Prepare RT procedures
5. Establish, review and validate procedures/reports/documents editorials for technical correctness
6. Validate RT procedures and instructions
7. Provide RT guidance for personnel at all levels
8. Designate and prepare the particular test methods, instructions and procedures for a follow up RT proposal
9. Conduct technical briefings to all parties, including the management and customers

10. Conduct NDT training which includes classroom and on job practical training (OJT).
11. Coordinate and supervise RT activities at all levels
12. Interpret RT codes, standards, specifications and procedures.
13. Approve NDT techniques prepared by Level 2 personnel.
14. Coordinate and implement established safety and security procedures.



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate the procedures, equipment and personnel for radiographic testing in NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify RT procedures that are applicable for a particular radiographic testing projects
2. Evaluate and qualify radiographic testing equipment and other facilities that are to be used for RT projects
3. Evaluate and qualify NDT personnel involved in RT projects
4. Periodically monitor the performance of radiographic testing
5. Prepare and present progress reports of RT performed at various stages to customers.
6. Prepare job specifications for NDT Engineers, Senior Technicians, Technicians and Assistant Technicians
7. Witness, supervise and monitor RT performed by NDT personnel at fabrication shops or sites.
8. Provide a storage area for the industrial radiographic source used for inspection at RT project sites.

9. Liaise with the authorities (e.g. AELB, DOSH, NIOSH) on matters related to radiographic testing projects
10. Understand the relevant codes and standards that are applicable to a particular radiographic testing project



## OCCUPATIONAL DEFINITION

### Radiographic Testing Level 5

#### NDT MANAGER

A NDT Manager designated to RT is expected to plan work requirements, develop related quality plan, evaluate testing results from RT projects, and provide further recommendations based on these results. They are expected to assume the responsibility for organizing the implementation of the RT plan, and will ensure that these are carried out in a professional manner, complying with all designated safety requirements.

A NDT Manager should be able to:

1. Plan, during the design stage of RT projects, all of the requirements for engineering components, parts and systems to be inspected
2. Develop quality plan (stages where RT projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop RT projects tender specifications that are to be incorporated into the overall bidding document
4. Develop performance test during the construction stage of radiographic testing projects
5. Identify requirements for specific radiographic testing projects
6. Identify correct radiographic testing methods to be applied in radiographic testing projects
7. Establish a sampling size and location for radiographic testing projects, if required.
8. Carry out evaluation of radiographic testing for project tender submission

9. Select the most suitable radiographic testing service providers as a backup or a sub-contractor to perform inspections during radiographic testing projects, based on cost and the technical capabilities of the service provider
10. Approve radiographic testing procedures that are to be applied in projects following applicable codes, standards and specifications
11. Review the results of radiographic testing as required.
12. Recommend further action(s) to be taken based on radiographic testing results.

- Annex 3** : Occupational Definitions in the NDT Sector for **AEROSPACE SUB SECTOR**
- Annex 3.2** : Ultrasonic Testing (UT)
- Annex 3.2.1** : Materials, Components and Structures



## OCCUPATIONAL DEFINITION

Ultrasonic Testing level 1

### ULTRASONIC TESTING TECHNICIAN (MATERIALS, COMPONENTS AND STRUCTURES)

An Ultrasonic Testing Technician (Materials, Components and Structures) is expected to set up the UT equipment and perform the ultrasonic testing according to specific written instructions under the supervision of a level 2 or level 3 personnel.

A Ultrasonic Testing Technician (Materials, Components and Structures) should be able to:

1. Perform the UT Equipment's inventory and storage control
2. Perform the UT Apparatus and Equipment's Periodic Check
3. Set up the UT equipment
4. Perform the UT Inspection Surface Area Preparation
5. Perform thickness Gauge UT
6. Perform lamination UT
7. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Ultrasonic Testing level 2

### **ULTRASONIC TESTING TECHNICIAN (MATERIALS, COMPONENTS AND STRUCTURES)**

An Ultrasonic Testing Technician (Materials, Components and Structures) is expected to prepare the UT's instruction and provide guidance to perform ultrasonic testing, and carry out ultrasonic flaw interpretation and evaluation according to specific written established procedures.

An Ultrasonic Testing Technician (Materials, Components and Structures) should be able to:

1. Select and define the limitations and advantages of application of the UT
2. Prepare UT instruction according to codes, standards, specifications and procedures
3. Perform and coordinate UT calibration and maintenance
4. Perform and coordinate UT Equipment's inventory and storage control
5. Set up and verify UT equipment's settings
6. Perform UT in various techniques, which may include immersion, through transmission and pulse echo on metallic and non-metallic parts
7. Perform disbond and delamination UT on composite parts using various techniques such as resonance, mechanical impedance analysis and pitch and catch.
8. Perform UT interpretation and evaluation according to established codes, standards, specifications and procedures
9. Report the results of UT
10. Perform and supervise all UT tasks at par or below level 2

11. Conduct UT training, which include theoretical and practical parts for personnel up to level 2
12. Prepare UT techniques to be approved by UT Level 3
13. Perform, implement and coordinate established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Ultrasonic Testing Level 3

### **ULTRASONIC TESTING ENGINEER (MATERIALS, COMPONENTS AND STRUCTURES)**

An Ultrasonic Testing Engineer (Materials, Components and Structures) is expected to develop and validate ultrasonic testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret ultrasonic testing report, codes, standards, specification and procedures.

An Ultrasonic Testing Engineer (Materials, Components and Structures) should be able to:

1. Prepare and develop UT Procedures
2. Prepare a follow up Inspection proposal
3. Validate UT Procedures and Instruction
4. Verify UT Reports
5. Coordinate UT Equipment Calibration and Validation
6. Conduct Technical Briefings
7. Supervise and coordinate UT Work Activities
8. Conduct on-the-job training
9. Provide UT Work guidance for personnel at all levels
10. Assume full responsibility for a test facility, examination centre, and staff
11. Establish and review editorials for technical correctness
12. Interpret codes, standards, specifications and procedures
13. Carry out and supervise all UT tasks at all levels

14. Provide, implement and coordinate established safety and security procedures



## **OCCUPATIONAL DEFINITION**

### Ultrasonic Testing Level 4

#### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate the procedures, equipment and personnel for UT in ultrasonic inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by customers and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify UT procedures that are applicable for a particular ultrasonic testing projects
2. Evaluate and qualify UT equipment and other facilities that are to be used for ultrasonic testing projects
3. Evaluate and qualify NDT personnel involved in ultrasonic testing projects
4. Periodic monitoring performance in ultrasonic testing projects
5. Prepare and present progress reports of UT performed at various stages to customers
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness ultrasonic testing performed by Technicians at the fabrication shops
8. Provide a storage area and security for ultrasonic equipments used for inspection at ultrasonic testing project sites
9. Liaise with the authorities (e.g. DOSH, NIOSH) on matters related to ultrasonic testing projects

10. Understand the relevant codes and standards that are applicable for particular ultrasonic testing projects



## OCCUPATIONAL DEFINITION

### Ultrasonic Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan the ultrasonic testing requirements, develop an ultrasonic testing related quality plan, evaluate the ultrasonic testing results for ultrasonic testing projects, and provide further recommendations based on these results. They are expected to assume the responsibility for organizing the implementation of the ultrasonic testing plan, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage of ultrasonic testing projects, all of the requirements for engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where ultrasonic testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop ultrasonic testing projects tender specifications that are to be incorporated into the overall bidding document
4. Develop ultrasonic testing performance test during the construction stage of ultrasonic testing projects
5. Identify the requirements for ultrasonic testing for specific ultrasonic testing projects
6. Identify the correct ultrasonic testing methods that are to be applied in ultrasonic testing projects
7. Establish a sampling size and location for ultrasonic testing projects

8. Evaluate ultrasonic testing document tender for submission
9. Select the most suitable ultrasonic testing service provider as a backup or a sub-contractor to perform inspections during ultrasonic testing projects, based on cost and the technical capabilities of the service provider
10. Approve ultrasonic testing procedures that are to be applied in ultrasonic testing projects, in accordance to the applicable codes, standards and specifications
11. Review the results of ultrasonic testing in ultrasonic testing projects
12. Recommend further action(s) to be taken based on ultrasonic testing results in ultrasonic testing projects
13. Perform overall management and administration of an NDT team/company, encompassing all business elements, including the financial aspects of a company.

- Annex 3** : Occupational Definitions in the NDT Sector for **AEROSPACE SUB SECTOR**
- Annex 3.3** : Magnetic Particle Testing (MT)
- Annex 3.3.1** : Materials, Components and Structures



## OCCUPATIONAL DEFINITION

Magnetic Particle Testing level 1

### MAGNETIC PARTICLE TESTING TECHNICIAN (MATERIALS, COMPONENTS AND STRUCTURES)

A Magnetic Particle Testing Technician (Materials, Components and Structures) is expected to set up the equipment and perform testing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Magnetic Particle Testing Technician (Materials, Components and Structures) should be able to:

1. Perform the Magnetic Particle Testing Equipment's Periodic Check
2. Perform the Magnetic Particle inventory control and equipment's storage
3. Set up the Magnetic Particle Testing Equipment
4. Perform Magnetic Particle Testing Surface Area Preparation
5. Perform Fluorescent and Visible Magnetic Particle Testing
6. Perform Wet and Dry Magnetic Particle Testing
7. Record and classify the results of the tests
8. Prepare Magnetic Particle Testing reports
9. Perform and implement established safety and security procedures

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## OCCUPATIONAL DEFINITION

Magnetic Particle Testing level 2

### MAGNETIC PARTICLE TESTING TECHNICIAN (MATERIALS, COMPONENTS AND STRUCTURES)

A Magnetic Particle Testing Technician (Materials, Components and Structures) is expected to set up and verify the equipment's settings, prepare Magnetic Particle Testing instructions, perform the testing, and interpret and evaluate the results according to the designated codes, standards, specifications and procedures.

A Magnetic Particle Testing Technician (Materials, Components and Structures) should be able to:

1. Prepare Magnetic Particle Testing Work Instruction according to codes, standards, specifications and procedures
2. Provide Magnetic Particle Testing Guidance for personnel at par or below level 2
3. Select and define the limitations and advantages of application of the testing method
4. Set up and verify the equipment's settings
5. Perform and supervise Magnetic Particle Testing activities
6. Perform and supervise all Magnetic Particle Testing tasks at par or below level 2
7. Interpret and evaluate the results according to applicable codes, standards, specifications or procedure
8. Report the results of Magnetic Particle Testing
9. Perform and implement established safety and security procedures



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 3

#### MAGNETIC PARTICLE TESTING ENGINEER (MATERIALS, COMPONENTS AND STRUCTURES)

A Magnetic Particle Testing Engineer (Materials, Components and Structures) is expected to develop and validate Magnetic Particle testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret the testing reports, codes, standards, specification and procedures.

A Magnetic Particle Testing Engineer (Materials, Components and Structures) should be able to:

1. Verify Magnetic Particle Testing Reports
2. Prepare Magnetic Particle Testing Procedures
3. Validate Magnetic Particle Testing Procedures And Instruction
4. Prepare Magnetic Particle Testing technical proposal
5. Coordinate Magnetic Particle Testing Equipment Calibration And Validation
6. Conduct technical briefings
7. Supervise and coordinate Magnetic Particle Testing Activities
8. Conduct on-the-job training
9. Assume full responsibility for a test facility, examination centre, and staff
10. Establish and review editorials for technical correctness
11. Interpret codes, standards, specifications and procedures
12. Perform, coordinate and supervise all Magnetic Particle Testing tasks at all levels
13. Provide Magnetic Particle Testing guidance for personnel at all levels

14. Perform, coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate the procedures, equipment and personnel for magnetic particle testing in NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements imposed by a client and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify magnetic particle testing procedures that are applicable for a particular magnetic particle testing projects
2. Evaluate and qualify magnetic particle testing equipment and other facilities that are to be used for magnetic particle testing projects
3. Evaluate and qualify magnetic particle testing personnel involved in magnetic particle testing projects
4. Periodically monitor magnetic particle testing performance in magnetic particle testing projects
5. Prepare and present progress reports of magnetic particle testing performed on at various stage to magnetic particle testing projects client
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness magnetic particle testing performed by Technicians at the fabrication shops or sites

8. Provide a storage area and security for magnetic particle equipment used for inspection at magnetic particle testing project sites
9. Liaise with the authorities (e.g. DOSH, NIOSH) on matters related to magnetic particle testing projects
10. Understand the relevant codes and standards that are applicable for a particular magnetic particle testing project



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan the magnetic particle testing requirements, develop the magnetic particle testing related quality plan, evaluate the magnetic particle testing results for magnetic particle testing projects, and provide further recommendations based on these results. They are expected to assume the responsibility for organizing the implementation of the magnetic particle testing, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage of magnetic particle testing projects, all of the requirement of engineering components, parts and system to be inspected
2. Develop quality plan (stages where magnetic particle testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop magnetic particle testing projects tender specifications to be incorporated into the overall bidding documents
4. Develop magnetic particle testing performance test during the construction stage of magnetic particle testing projects
5. Identify the requirements for magnetic particle testing for specific magnetic particle testing projects
6. Identifying the correct magnetic particle testing methods that are to be applied in magnetic particle testing projects
7. Establish a sampling size and location for magnetic particle testing projects

8. Evaluate magnetic particle testing during magnetic particle testing projects tender submission
9. Select the most suitable magnetic particle testing service provider as a backup or a sub-contractor to perform inspections during magnetic particle testing projects, based on cost and the technical capabilities of the service provider
10. Approve magnetic particle testing procedures that are to be applied in magnetic particle testing projects, in accordance with the applicable codes, standards, and specifications
11. Review the results of magnetic particle testing.
12. Recommend further action(s) to be taken based on magnetic particle testing results in magnetic particle testing projects

- Annex 3** : Occupational Definitions in the NDT Sector for **AEROSPACE SUB SECTOR**
- Annex 3.4** : Liquid Penetrant Testing (PT)
- Annex 3.4.1** : Materials, Components and Structures



## OCCUPATIONAL DEFINITION

Liquid Penetrant Testing level 1

### LIQUID PENETRANT TESTING TECHNICIAN (MATERIALS, COMPONENTS AND STRUCTURES)

A Liquid Penetrant Testing Technician (Materials, Components and Structures) is expected to set up the equipment and perform testing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Liquid Penetrant Testing Technician (Materials, Components and Structures) should be able to:

1. Perform PT Equipment's Periodic Check
2. Perform the inventory control and equipment's storage
3. Set up the PT Equipment
4. Perform PT Surface Area Preparation
5. Perform visible & fluorescent PT
6. Perform PT
7. Record and classify the results of the tests
8. Prepare the PT test reports
9. Perform and implement established safety and security procedures

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

### Liquid Penetrant Testing Level 2

#### **LIQUID PENETRANT TESTING TECHNICIAN (MATERIALS, COMPONENTS AND STRUCTURES)**

A Liquid Penetrant Testing Technician (Materials, Components and Structures) is expected to set up and verify the equipment's settings, prepare the PT Work Instruction, perform the testing, and interpret and evaluate the results according to the designated codes, standards, specifications and procedures.

A Liquid Penetrant Testing Technician (Materials, Components and Structures) should be able to:

1. Prepare the PT Work Instruction according to codes, standards, specifications and procedures
2. Provide PT Guidance for personnel at par or below level 2
3. Select and define the limitations and advantages of the applications of the testing method
4. Set up and verify the equipment's settings
5. Perform and supervise PT Work
6. Perform and supervise all tasks at par or below level 2
7. Interpret and evaluate the results according to applicable codes, standards, specifications or procedure
8. Report the results of PT
9. Perform and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

### Liquid Penetrant Testing Level 3

#### **LIQUID PENETRANT TESTING ENGINEERS (MATERIALS, COMPONENTS AND STRUCTURES)**

A Liquid Penetrant Testing Engineers (Materials, Components and Structures) is expected to develop and validate the testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret the testing reports, codes, standards, specification and procedures.

A Liquid Penetrant Testing Engineers (Materials, Components and Structures) should be able to:

1. Verify PT Reports
2. Prepare PT Procedures
3. Validate PT Procedures and Instructions
4. Prepare PT technical proposal
5. Coordinate PT Equipment Calibration And Validation
6. Conduct technical briefings
7. Supervise and coordinate PT Work Activities
8. Conduct on-the-job training
9. Assume full responsibility for a test facility or examination centre and staff
10. Establish and review editorials for technical correctness
11. Interpret codes, standards, specifications and procedures
12. Perform, coordinate and supervise all tasks at all levels
13. Provide guidance for personnel at all levels

14. Perform, coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Liquid Penetrant Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate the procedures, equipment and personnel for PT in NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and ensure that all of the legal requirements that are imposed by customers and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify PT procedures that are applicable for a particular PT project
2. Evaluate and qualify PT equipment and other facilities that are to be used for PT projects
3. Evaluate and qualify PT personnel involved in PT projects
4. Periodically monitor PT performance in PT projects
5. Prepare and present PT progress report performed at various stages to customers
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness, supervise and monitor PT performed by NDT personnel at the fabrication shops or sites
8. Provide storage area and security for PT equipment used for inspection at project sites

9. Liaise with the authorities (e.g. DOSH, NIOSH) on matters related to PT projects.
10. Understand the relevant codes and standards that are applicable for a particular PT project



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan the PT requirements, develop PT-related quality plan, evaluate the results for PT projects, and provide further recommendations based on these results. They are expected to assume the responsibility for organizing the implementation of PT, and to ensure that these plans are carried out in a professional manner, complying with the designated safety requirements.

A NDT Manager should be able to:

1. Plan, during the design stage of PT projects, all of the requirements of engineering components, parts and systems to be inspected
2. Develop quality plan (stages where PT projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop PT project tender specifications that are to be incorporated into the overall bidding document
4. Develop performance test during the construction stage of PT projects.
5. Identify the requirements for specific PT projects
6. Identify the correct methods to be applied in PT projects
7. Establish a sampling size and location for PT projects
8. Evaluate PT project tender submission
9. Select the most suitable PT service provider as a backup or a sub-contractor to perform inspection during PT projects, based on cost and the technical capabilities of the service provider
10. Approve PT procedures that are to be applied in PT projects against applicable codes, standards and specifications

11. Review the results of PT projects
12. Recommend further action(s) to be taken based on results in PT project

- Annex 3** : Occupational Definitions in the NDT Sector for **AEROSPACE SUB SECTOR**
- Annex 3.5** : Eddy Current Testing (ET)
- Annex 3.5.1** : Materials, Components and Structures



## OCCUPATIONAL DEFINITION

### Eddy Current Testing Level 1

#### EDDY CURRENT TESTING TECHNICIAN (MATERIALS, COMPONENTS AND STRUCTURES)

An Eddy Current Testing Technician (Materials, Components and Structures) is expected to set up the equipment and perform eddy current testing according to specific written instructions under the supervision of a level 2 or level 3 personnel, appropriately certified for the aerospace sector.

An Eddy Current Testing Technician (Materials, Components and Structures) should be able to:

1. Perform a general periodic check of all eddy current equipment.
2. Prepare and transport eddy current instruments and its accessories, in accordance with a given check list.
3. Maintain and update an inventory list of all eddy current instrument including calibration standards, probes, cables & leads, and associated ancillary equipment.
4. Carry out calibration according to a given procedures/techniques.
5. Carry out eddy current inspection in accordance with specific techniques, using specific equipment and probe(s).
6. Assist in preparing the NDT test report.
7. Perform and implement safety and security procedure in accordance with local SHSE requirements.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

### **Eddy Current Testing Level 2**

#### **EDDY CURRENT TESTING TECHNICIAN (MATERIALS, COMPONENTS AND STRUCTURES)**

An Eddy Current Testing Technician (Materials, Components and Structures) is expected to set up and verify the equipment, perform and coordinate eddy current testing, prepare eddy current testing written instructions in accordance with the relevant codes, standards, specifications or procedures, which are applicable for the Aerospace Sector.

An Eddy Current Testing Technician (Materials, Components and Structures) should be able to:

1. Perform ET inventory control and the equipment's periodic check
2. Perform ET equipment's transportation and storage
3. Setup and verify ET equipment's settings
4. Perform ET inspection independently following a given technique.
5. Select and define the limitations and advantages of application of the testing methods
6. Prepare the ET technique for use.
7. Evaluate ET signals and indications and decide to accept or reject the indications.
8. Prepare NDT report on completion of inspection.
9. Perform and implement established safety and security procedures.



## **OCCUPATIONAL DEFINITION**

Eddy Current Testing (ET) Level 3

### **EDDY CURRENT TESTING ENGINEER (MATERIALS, COMPONENTS AND STRUCTURES)**

An Eddy Current Testing Engineer (Materials, Components and Structures) is expected to take charge of the ET equipment's maintenance, storage, transportation and inventory control, coordinate ET inspection activities, verify test reports, prepare and validate ET techniques and procedures, conduct technical briefings and on-the-job training, and interpret codes, standards, specifications and procedures, which are applicable to the Aerospace Sector.

An Eddy Current Testing Engineer (Materials, Components and Structures) should be able to:

1. Coordinate the ET equipment's periodic check and maintenance
2. Coordinate the ET's equipment storage, transportation and inventory control
3. Verify ET test reports
4. Establish and review editorials for technical correctness
5. Validate ET procedures and instructions
6. Provide ET guidance for personnel at all levels
7. Conduct technical briefings
8. Conduct NDT training, which includes classroom and on job training (OJT) practical training.
9. Coordinate and supervise ET activities at all levels
10. Interpret ET inspection codes, standards, specifications and procedures.
11. Approve NDT techniques prepared by Level 2 personnel.
12. Coordinate and implement established safety and security procedures.



## **OCCUPATIONAL DEFINITION**

Eddy Current Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate the procedures, equipment and personnel for ET in the NDT inspection projects, witness performance testing and prepare progress reports. They are expected to assume the responsibility in maintaining contact with the clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by a client and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate ET procedures that are applicable for particular test projects
2. Evaluate and qualify ET equipment and other facilities that are to be used for ET projects
3. Evaluate and qualify NDT personnel involved in ET projects
4. Prepare and present progress ET test reports performed at various stages to customers.
5. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
6. Witness ET inspection performed by Technicians at the fabrication shops or sites.
7. Understand the relevant codes and standards that are applicable for particular ET projects.



## OCCUPATIONAL DEFINITION

### Eddy Current Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan ET requirements, develop ET related quality plan, evaluate ET results, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the ET plan, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage of ET projects, all of the required engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where ET projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop ET projects tender specifications that are to be incorporated into the overall bidding documents
4. Identify the requirements for ET inspection for specific ET projects
5. Identify the correct ET methods to be applied in ET projects
6. Establish a sampling size and location for ET projects
7. Select the most suitable ET service providers as a backup or a sub-contractor to perform inspections, based on cost and the technical capabilities of the service provider
8. Approve ET procedures that are to be applied in ET projects, in accordance with the applicable codes, standards, and specifications
9. Review the results of the ET test

10. Recommend further action(s) to be taken based on ET results

- Annex 3** : Occupational Definitions in the NDT Sector for **AEROSPACE SUB SECTOR**
- Annex 3.6** : Infrared Thermographic Testing (TT)
- Annex 3.6.1** : Components and Structures



## OCCUPATIONAL DEFINITION

Infrared Thermographic Testing level 1

### INFRARED THERMOGRAPHIC TESTING TECHNICIAN (COMPONENTS AND STRUCTURES)

An Infrared Thermographic Testing Technician (Components and Structures) is expected to set up the equipment and perform the testing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

An Infrared Thermographic Testing Technician (Components and Structures) should be able to:

1. Perform the TT Equipment's Periodic Check
2. Perform the TT inventory control and equipment's storage
3. Set up the TT Equipment
4. Perform TT Area Preparation
5. Record and classify the results of the tests
6. Prepare the TT test report
7. Perform and implement established safety and security procedures

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Infrared Thermographic Testing level 2

### **INFRARED THERMOGRAPHIC TESTING TECHNICIAN (COMPONENTS AND STRUCTURES)**

An Infrared Thermographic Testing Technician (Components and Structures) is expected to set up and verify the equipment's settings, prepare TT instruction, perform the testing, interpretation and evaluation of the results according to the designated codes, standards, specifications and procedures.

An Infrared Thermographic Testing Technician (Components and Structures) should be able to:

1. Prepare TT Work Instruction according to codes, standards, specifications and procedures
2. Provide TT Guidance for personnel at or below level 2
3. Select and define the limitations and advantages of application of the testing method
4. Set up and verify equipment settings
5. Perform and supervise TT activities
6. Perform and supervise all TT tasks at or below level 2
7. Perform Interpretation and evaluation results according to applicable codes, standards, specifications or procedure
8. Report the results of TT
9. Perform and implement safety and security procedure



## **OCCUPATIONAL DEFINITION**

Infrared Thermographic Testing level 3

### **INFRARED THERMOGRAPHIC TESTING ENGINEER (COMPONENTS AND STRUCTURES)**

An Infrared Thermographic Testing Engineer (Components and Structures) is expected to develop and validate TT instruction and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret testing reports, codes, standards, specification and procedures.

An Infrared Thermographic Testing Engineer (Components and Structures) should be able to:

1. Verify TT Reports
2. Prepare TT Procedures
3. Validate TT Procedures And Instruction
4. Prepare the TT technical proposal
5. Coordinate the TT's Equipment Calibration And Validation
6. Conduct Technical Briefings
7. Supervise and coordinate TT activities
8. Conduct on-the-job training
9. Assume full responsibility for a test facility, examination centre, and staff
10. Establish and review editorial for technical correctness
11. Interpret codes, standards, specifications and procedures
12. Perform, coordinate and supervise all TT-related tasks at all levels
13. Provide TT guidance for personnel at all levels
14. Perform, coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

### **Infrared Thermographic Testing Level 4**

#### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate procedures, equipment and personnel for TT in NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify TT procedures that are applicable for a particular TT project
2. Evaluate and qualify TT equipment and other facilities to be used for TT projects
3. Evaluate and qualify TT personnel that are involved in TT projects
4. Periodic monitoring of TT performance in TT projects
5. Prepare and present TT progress report that are performed at various stages to the TT project's clients
6. Prepare the job specifications for the Senior Technicians, Technicians and Assistant Technicians
7. Witness TT performed by the Technicians at the fabrication shops or sites
8. Provide a storage area and security for TT equipment for inspection at TT project sites
9. Liaise with the authorities (e.g. DOSH, NIOSH) on matters related to TT projects

10. Understand the relevant codes and standards that are applicable for particular TT projects



## OCCUPATIONAL DEFINITION

### Infrared Thermographic Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan TT requirements, develop TT related quality plan, evaluate the TT's results for TT projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organising the implementation of TT, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage of TT projects, all of the required engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where TT projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop TT projects tender specifications that are to be incorporated into the overall bidding documents
4. Develop TT performance test during the construction stage of the TT projects
5. Identify the requirements of TT for specific TT projects
6. Identifying the correct TT methods that are to be applied in TT projects
7. Establish a sampling size and location for TT projects
8. Evaluate TT during the TT projects' tender submission
9. Select the most suitable TT service provider as a backup or a sub-contractor for inspection during the commencement of the TT projects, based on cost and the technical capabilities of the service provider

10. Approve TT procedures that is going to be applied in TT projects that are up to the applicable codes, standards and specifications
11. Review the results of TT testing
12. Recommend further action(s) to be taken based on TT results in TT projects

- Annex 4** : Occupational Definitions in the NDT Sector for **TRANSPORTATION SUB SECTOR**
- Annex 4.1** : Radiography Testing (RT)
- Annex 4.1.1** : Welded Construction



## OCCUPATIONAL DEFINITION

### Radiographic Testing Level 1

#### RADIOGRAPHIC TESTING ASSISTANT TECHNICIAN (WELDED CONSTRUCTION)

A Radiographic Testing Assistant Technician (Welded Construction) is expected to set up the equipment and perform radiographic testing on welded construction and film processing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Radiographic Testing Assistant Technician (Welded Construction) should be able to:

1. Perform the periodic checks on x-ray and gamma radiography testing equipment
2. Perform the x-ray and gamma ray radiographic testing equipment's storage
3. Transport the x-ray and gamma ray radiographic testing equipment
4. Perform x-ray and gamma ray radiographic testing inventory control
5. Prepare the x-ray and gamma ray radiographic testing area
6. Setup the x-ray and gamma ray radiographic testing equipment
7. Perform the x-ray and gamma ray radiographic testing
8. Perform automatic and manual film processing preparation
9. Perform automatic and manual film processing
10. Record and classify the x-ray and gamma ray radiographic testing welded construction results of the tests
11. Prepare x-ray and gamma ray radiographic testing test report.
12. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 2

### **RADIOGRAPHIC TESTING TECHNICIAN (WELDED CONSTRUCTION)**

A Radiographic Testing Technician (Welded Construction) is expected to set up and verify the equipment, perform and coordinate radiographic testing, film interpretation and evaluation, and prepare radiographic testing on welded construction written instructions according to the applicable codes, standards specifications or procedures.

A Radiographic Testing Technician (Welded Construction) should be able to:

1. Perform and coordinate the x-ray and gamma ray radiographic testing inventory control and equipment's periodic check ups
2. Perform and coordinate x-ray and gamma ray radiographic testing equipment's transportation and storage
3. Prepare x-ray and gamma ray radiographic testing instructions according to applicable Radiographic Testing Procedures
4. Setup and verify x-ray and gamma ray radiographic testing equipment's settings
5. Perform and coordinate x-ray and gamma ray radiographic testing work activities at par or below level 2
6. Select and define the limitations and advantages of the applications of the testing methods
7. Provide x-ray and gamma ray radiographic testing guidance for personnel at par or below level 2
8. Perform radiographic film interpretation on welded construction items in accordance to applied codes, standards & specifications

9. Prepare x-ray and gamma ray radiographic testing report, film interpretation and evaluation results according to applicable codes, standards, specifications or procedures
10. Record and classify the x-ray and gamma ray radiographic welded construction results of the tests
11. Monitor the x-ray and gamma ray equipment's maintenance, storage, inventory, transportation and etc.
12. Perform and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 3

### **RADIOGRAPHIC TESTING SENIOR TECHNICIAN (WELDED CONSTRUCTION)**

A Radiographic Testing Senior Technician (Welded Construction) is expected to coordinate the radiographic testing equipment's maintenance, storage, transportation and inventory control, coordinate radiographic testing activities, verify test reports, prepare and validate radiographic testing procedures and instructions, conduct technical briefings and on-the-job training, and interpret codes, standards, specifications and procedures.

A Radiographic Testing Senior Technician (Welded Construction) should be able to:

1. Assume full responsibility for radiographic testing facility and staff technical development.
2. Develop radiographic testing procedures
3. Validate radiographic testing procedures from client/sub-contractors
4. Approve radiographic testing procedures that are to be applied for projects in accordance with applicable code, standard and specification
5. Interpret radiographic testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate radiographic testing instructions and procedures
7. Designate and prepare a particular test technique, instructions and procedures for follow up radiographic testing mock-up
8. Provide radiographic testing guidance for personnel at par and lower levels
9. Coordinate radiographic testing equipment's periodic check and maintenance

10. Coordinate radiographic testing equipment storage, transportation and inventory control
11. Verify radiographic testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise radiographic testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review the procedures, equipment and personnel for NDT testing for designated projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility in maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from client/sub-contractors
4. Approve NDT procedures that are to be applied for projects, in accordance with applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorial and technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for follow up NDT mock-up (performance test)
8. Review NDT reports
9. Organize and conduct technical meeting
10. Conduct NDT training
11. Conduct appraisal on the NDT personnel's work performance
12. Carry out an audit on the NDT's equipment and accessories

13. Prepare NDT progress reports performed on/at various stages of projects
14. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Radiographic Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan NDT requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organising the implementation of the NDT plan, and ensure that these plans are carried out in a professional and safe manner.

A NDT Manager shall be able to:

1. Plan, during the design stage of NDT, all of the requirements for engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop the NDT projects' tender specification that are to be incorporated into the overall bidding documents
4. Develop the NDT performance test during the construction stage
5. Identify specific NDT methods requirements for the designated project
6. Establish an NDT work distribution, sampling size and location for the designated projects
7. Evaluate the NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspections, based on the cost and technical capabilities of the service provider

9. Recommend further action(s) to be taken, based on the NDT's results in the projects
10. Organise project management review meetings

- Annex 4** : Occupational Definitions in the NDT Sector for  
**TRANSPORTATION SUB SECTOR**
- Annex 4.1** : Radiography Testing (RT)
- Annex 4.1.2** : Casting and Forging



## OCCUPATIONAL DEFINITION

### Radiographic Testing Level 1

#### RADIOGRAPHIC TESTING ASSISTANT TECHNICIAN (CASTING AND FORGING)

A Radiographic Testing Assistant Technician (Casting and Forging) is expected to set up the equipment, perform radiographic testing on casting and forging and film processing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

An Radiographic Testing Assistant Technician (Casting and Forging) should be able to:

1. Perform the x-ray and gamma radiography testing equipment's periodic check ups
2. Perform the x-ray and gamma ray radiographic testing equipment's storage
3. Transport the x-ray and gamma ray radiographic testing equipment
4. Perform x-ray and gamma ray radiographic testing inventory control
5. Prepare x-ray and gamma ray radiographic testing area
6. Setup x-ray and gamma ray radiographic testing equipment
7. Perform x-ray and gamma ray radiographic testing
8. Perform automatic and manual film processing preparation
9. Perform automatic and manual film processing
10. Record and classify the x-ray and gamma ray radiographic testing casting and forging results of the tests
11. Prepare x-ray and gamma ray radiographic testing test reports.
12. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 2

### **RADIOGRAPHIC TESTING TECHNICIAN (CASTING AND FORGING)**

A Radiographic Testing Technician (Casting and Forging) is expected to set up and verify the equipment, perform and coordinate radiographic testing, film interpretation and evaluation, prepare radiographic testing on casting and forging written instructions according to the applicable codes, standards specifications or procedures.

A Radiographic Testing Technician (Casting and Forging) should be able to:

1. Perform and coordinate x-ray and gamma ray radiographic testing inventory control and the equipment's periodic check
2. Perform and coordinate x-ray and gamma ray radiographic testing equipment's transportation and storage
3. Prepare x-ray and gamma ray radiographic testing instructions according to the applicable Radiographic Testing Procedures
4. Setup and verify x-ray and gamma ray radiographic testing equipment's settings
5. Perform and coordinate x-ray and gamma ray radiographic testing work activities at par or below level 2
6. Select and define the limitations and advantages of application of the testing methods
7. Provide x-ray and gamma ray radiographic testing guidance for personnel at par or below level 2
8. Perform radiographic film interpretation on casting and forging items in accordance to applied codes, standards & specifications

9. Prepare the x-ray and gamma ray radiographic testing report, film interpretation and evaluation results according to applicable codes, standards, specifications or procedures
10. Record and classify the x-ray and gamma ray radiographic casting and forging results of the tests
11. Monitor the x-ray and gamma ray equipment's maintenance, storage, inventory, transportation and etc.
12. Perform and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 3

### **RADIOGRAPHIC TESTING SENIOR TECHNICIAN (CASTING AND FORGING)**

A Radiographic Testing Senior Technician (Casting and Forging) is expected to coordinate the radiographic testing equipment's maintenance, storage, transportation and inventory control, coordinate radiographic testing activities, verify test reports, prepare and validate radiographic testing procedures and instructions, conduct technical briefings and on-the-job training, and interpret codes, standards, specifications and procedures.

A Radiographic Testing Senior Technician (Casting and Forging) should be able to:

1. Assume full responsibility for radiographic testing facility and staff technical development.
2. Develop radiographic testing procedures
3. Validate radiographic testing procedures from clients/sub-contractors
4. Approve radiographic testing procedures that are to be applied for designated projects in accordance to the applicable codes, standards and specifications
5. Interpret radiographic testing codes, standards, specifications and procedures
6. Establish and review editorial and technical correctness, and validate radiographic testing instructions and procedures
7. Designate and prepare a particular test technique, instructions and procedures for a follow up radiographic testing mock-up
8. Provide radiographic testing guidance for personnel at the same or lower levels
9. Coordinate radiographic testing equipment periodic checks and maintenance

10. Coordinate radiographic testing equipment storage, transportation and inventory control
11. Verify radiographic testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise radiographic testing activities at par or lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review the procedures, equipment and personnel for NDT testing for designated projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from clients/sub-contractors
4. Approve NDT procedures that are to be applied for projects, in accordance with the applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorial and technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for a follow up NDT mock-up (performance test)
8. Review NDT reports
9. Organise and conduct technical meetings
10. Conduct NDT training
11. Carry out appraisals on the NDT personnel's work performance
12. Carry out audits on NDT's equipment and accessories

13. Prepare progress NDT reports performed at various stages of projects
14. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Radiographic Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan NDT requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are expected to assume the responsibility for organizing the implementation of the NDT plan, and ensure that these are carried out in a professional and safe manner.

A NDT Manager shall be able to:

1. Plan, during the design stage of NDT's requirements of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop the NDT projects' tender specifications that are to be incorporated into the overall bidding documents
4. Develop the NDT performance test during the construction stage
5. Identify specific NDT methods requirements' for designated projects
6. Establish an NDT work distribution, sampling size and location for the designated projects
7. Evaluate the NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform the NDT inspections, based on cost and the technical capabilities of the service provider

9. Recommend further action(s) to be taken, based on the NDT results in the projects
10. Organise project management review meetings

- Annex 4** : Occupational Definitions in the NDT Sector for  
**TRANSPORTATION SUB SECTOR**
- Annex 4.2** : Ultrasonic Testing (UT)
- Annex 4.2.1** : Welded Construction



## OCCUPATIONAL DEFINITION

Ultrasonic Testing level 1

### ULTRASONIC TESTING ASSISTANT TECHNICIAN (WELDED CONSTRUCTION)

An Ultrasonic Testing Assistant Technician (Welded Construction) is expected to set up the ultrasonic testing equipment and perform ultrasonic testing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

An Ultrasonic Testing Assistant Technician (Welded Construction) should be able to:

1. Perform the Ultrasonic Testing Equipment's inventory and storage control
2. Perform the Ultrasonic Testing Apparatus and Equipment's Periodic Check
3. Set up the Ultrasonic Testing equipment
4. Perform the Ultrasonic Testing Inspection Surface Area Preparation
5. Perform Thickness Gauge Ultrasonic Testing
6. Perform Lamination Ultrasonic Testing
7. Record and classify the Ultrasonic Testing results
8. Report the Ultrasonic Testing results
9. Perform and implement established safety and security procedure.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## OCCUPATIONAL DEFINITION

Ultrasonic Testing level 2

### ULTRASONIC TESTING TECHNICIAN (WELDED CONSTRUCTION)

An Ultrasonic Testing Technician (Welded Construction) Technician is expected to prepare the ultrasonic testing instruction, provide ultrasonic testing guidance, perform ultrasonic testing, and carry out ultrasonic flaw interpretation and evaluation according to specific written established procedures.

An Ultrasonic Testing Technician (Welded Construction) should be able to:

1. Select and define the limitations and advantages of application of the Ultrasonic testing technique
2. Prepare Ultrasonic Testing Instruction according to codes, standards, specifications and procedures
3. Perform and coordinate the Ultrasonic Testing Equipment's calibration and maintenance
4. Perform and coordinate the Ultrasonic Testing Equipment's inventory and storage control
5. Set up and verify the Ultrasonic Testing equipment's settings
6. Perform Groove Plates Ultrasonic Testing
7. Perform Pipe Ultrasonic Testing
8. Perform Nozzle Ultrasonic Testing
9. Perform TKY Joint Ultrasonic Testing
10. Perform Ultrasonic Testing interpretation and evaluation according to codes, standards, specifications and procedures
11. Report the results of Ultrasonic Testing
12. Perform and supervise all Ultrasonic Testing tasks at par or below level 2

13. Provide Ultrasonic Testing Guidance for personnel at par or below level 2
14. Perform, implement and coordinate established safety and security procedures



## OCCUPATIONAL DEFINITION

Ultrasonic Testing level 3

### ULTRASONIC TESTING SENIOR TECHNICIAN (WELDED CONSTRUCTION)

An Ultrasonic Testing Senior Technician (Welded Construction) is expected to develop and validate the ultrasonic testing instruction and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret ultrasonic testing reports, codes, standards, specifications and procedures.

An Ultrasonic Testing Senior Technician (Welded Construction) should be able to:

1. Prepare and develop Ultrasonic Testing Procedures
2. Prepare a follow up Inspection proposal
3. Validate both the Ultrasonic Testing Procedures and Instruction
4. Verify the Ultrasonic Testing Report
5. Coordinate the Ultrasonic Testing Equipment Calibration and Validation
6. Conduct Technical Briefings
7. Supervise and coordinate Ultrasonic Testing Work Activities
8. Conduct on-the-job training
9. Provide Ultrasonic Testing Work guidance for personnel at all levels
10. Assume full responsibility for a test facility, examination centre, and staff
11. Establish and review editorial for technical correctness
12. Interpret codes, standards, specifications and procedures
13. Carry out and supervise all Ultrasonic Testing tasks at all levels
14. Provide, implement and coordinate established safety and security procedures



## OCCUPATIONAL DEFINITION

### Ultrasonic Testing Level 4

#### NDT TECHNICAL EXECUTIVE

A NDT Technical Executive is expected to evaluate procedures, equipment and personnel for ultrasonic testing in ultrasonic inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the authorities are being duly complied with.

A NDT Technical Executive shall be able to:

1. Evaluate and qualify ultrasonic testing procedures that are applicable for a designated ultrasonic testing project
2. Evaluate and qualify ultrasonic testing equipment and other facilities that are to be used for designated ultrasonic testing project(s)
3. Evaluate and qualify ultrasonic testing personnel involved in ultrasonic testing projects
4. Periodically monitor ultrasonic testing performance in ultrasonic testing projects
5. Prepare and present progress reports of ultrasonic testing performed at various stages to ultrasonic testing's project clients
6. Prepare the job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness the ultrasonic testing performed by Technicians at the fabrication shops
8. Provide a storage area and security for ultrasonic equipments that are used for inspection at ultrasonic testing project sites

9. Liaise with the authorities (e.g. AELB, DOSH, NIOSH, SPAD etc) on matters related to ultrasonic testing projects
10. Understand the relevant codes and standards that are applicable for particular ultrasonic testing projects



## OCCUPATIONAL DEFINITION

Ultrasonic Level 5

### NDT TESTING MANAGER

A NDT Manager is expected to plan ultrasonic testing requirements, develop ultrasonic testing related quality plan, evaluate ultrasonic testing results for ultrasonic testing projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organising the implementation of the ultrasonic testing, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage of the ultrasonic testing projects, all of the required of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where ultrasonic testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop ultrasonic testing projects tender specifications that are to be incorporated into the overall bidding documents
4. Develop ultrasonic testing performance test during the construction stage of ultrasonic testing projects
5. Identify the requirements for ultrasonic testing for specific ultrasonic testing projects
6. Identifying the correct ultrasonic testing methods that are to be applied in ultrasonic testing projects
7. Establish a sampling size and location for ultrasonic testing projects
8. Evaluate the ultrasonic testing document tender for submission

9. Select the most suitable ultrasonic testing service provider as a backup or a sub-contractor to perform inspections during ultrasonic testing projects, based on cost and the technical capabilities of the service provider
10. Approve ultrasonic testing procedures that are to be applied in ultrasonic testing projects, in accordance with the applicable codes, standards and specifications
11. Review the results of ultrasonic testing in ultrasonic testing projects
12. Recommend further action(s) to be taken based on ultrasonic testing results in ultrasonic testing projects

- Annex 4** : Occupational Definitions in the NDT Sector for **TRANSPORTATION SUB SECTOR**
- Annex 4.2** : Ultrasonic Testing (UT)
- Annex 4.2.2** : Casting and Forging



## OCCUPATIONAL DEFINITION

Ultrasonic Testing level 1

### ULTRASONIC TESTING ASSISTANT TECHNICIAN (CASTING AND FORGING)

An Ultrasonic Testing Assistant Technician (Casting and Forging) is expected to set up the ultrasonic testing equipment and perform ultrasonic testing on casting and forging according to specific written instructions under the supervision of a level 2 or level 3 personnel,

An Ultrasonic Testing Assistant Technician (Casting and Forging) should be able to:

1. Perform the ultrasonic testing equipment's inventory and storage control
2. Perform the ultrasonic testing apparatus and equipment's periodic check
3. Set up the ultrasonic testing equipment
4. Perform ultrasonic testing inspection surface area preparation
5. Perform thickness measurement ultrasonic testing
6. Perform ultrasonic testing using longitudinal wave probe
7. Record and classify the ultrasonic testing on casting and forging results
8. Prepare ultrasonic testing test report.
9. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Ultrasonic Testing level 2

### **ULTRASONIC TESTING TECHNICIAN (CASTING AND FORGING)**

An Ultrasonic Testing Technician (Casting and Forging) is expected to prepare the ultrasonic testing instructions, provide ultrasonic testing guidance, perform ultrasonic testing on casting and forging, and carry out ultrasonic flaw interpretation and evaluation according to specific written established procedures.

An Ultrasonic Testing Technician (Casting and Forging) should be able to:

1. Select and define the limitations and advantages of the application of the ultrasonic testing technique
2. Prepare the ultrasonic testing instructions according to applicable ultrasonic testing procedures.
3. Perform and coordinate the ultrasonic testing equipment's calibration and maintenance
4. Perform and coordinate the ultrasonic testing equipment's inventory and storage control
5. Set up and verify the ultrasonic testing equipment's settings
6. Perform ultrasonic testing using longitudinal and shear wave probe
7. Perform ultrasonic testing interpretation and evaluation according to codes, standards, specifications and procedures
8. Report the results of ultrasonic testing on casting and forging.
9. Perform and supervise all ultrasonic testing tasks at par or below level 2
10. Provide ultrasonic testing guidance for personnel at par or below level 2

11. Perform, implement and coordinate established safety and security procedures



## OCCUPATIONAL DEFINITION

Ultrasonic Testing level 3

### ULTRASONIC TESTING SENIOR TECHNICIAN (CASTING AND FORGING)

An Ultrasonic Senior Technician (Casting and Forging) is expected to develop and validate the ultrasonic testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret ultrasonic testing reports, codes, standards, specifications and procedures.

An Ultrasonic Senior Technician (Casting and Forging) should be able to:

1. Assume full responsibility for ultrasonic testing facility and staff technical development
2. Develop the ultrasonic testing procedures
3. Validate the ultrasonic testing procedures from clients/sub-contractors
4. Approve ultrasonic testing procedure that are to be applied in designated projects, in accordance with the applicable codes, standards and specifications
5. Interpret ultrasonic testing codes, standards, specifications and procedures
6. Establish and review editorial for technical correctness, and validate Ultrasonic testing instructions and procedures
7. Designate and prepare the particular test technique, instructions and procedures for follow up Ultrasonic testing mock-up
8. Provide ultrasonic testing guidance for personnel at par and lower levels
9. Coordinate the ultrasonic testing equipment's periodic check and maintenance

10. Coordinate the ultrasonic testing equipment's storage, transportation and inventory control
11. Verify ultrasonic testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise ultrasonic testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

### Ultrasonic Testing Level 4

#### **NDT TECHNICAL EXECUTIVE**

An NDT Technical Executive is expected to evaluate procedures, equipment and personnel for ultrasonic testing in designated ultrasonic inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are being imposed by clients and the relevant authorities are being duly complied with.

An NDT Testing Technical Executive shall be able to:

1. Evaluate and qualify ultrasonic testing procedures that are applicable for a designated ultrasonic testing projects
2. Evaluate and qualify the ultrasonic testing equipment's and other facilities to be used for ultrasonic testing projects
3. Evaluate and qualify ultrasonic testing personnel involved in ultrasonic testing projects
4. Periodic monitoring of ultrasonic testing performance in ultrasonic testing projects
5. Prepare and present progress reports of ultrasonic testing performed at various stages to the ultrasonic testing projects' client
6. Prepare the job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness ultrasonic testing performed by Technicians at the fabrication shops
8. Provide a storage area and security for the ultrasonic equipment being used for inspection at ultrasonic testing project sites

9. Liaise with the authorities (e.g. AELB, DOSH, NIOSH) on matters related to ultrasonic testing projects
10. Understand the relevant codes and standards that are applicable for particular ultrasonic testing projects



## OCCUPATIONAL DEFINITION

### Ultrasonic Testing Level 5

#### NDT MANAGER

An NDT Manager is expected to plan ultrasonic testing requirements, develop ultrasonic testing related quality plan, evaluate ultrasonic testing results for ultrasonic testing projects, and provide further recommendations based on these results. They are expected to assume the responsibility of organising the implementation of the ultrasonic testing plan, and ensure that these are carried out in a professional and safe manner.

An NDT Manager should be able to:

1. Plan, during the design stage of ultrasonic testing projects, all of the required of engineering components, parts and systems to be inspected
2. Develop quality plan (stages where ultrasonic testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop the ultrasonic testing projects' tender specifications that are to be incorporated into the overall bidding documents
4. Develop ultrasonic testing performance test during the construction stage of ultrasonic testing projects
5. Identify the requirements for ultrasonic testing for specific ultrasonic testing projects
6. Identifying the correct ultrasonic testing methods that are to be applied in designated ultrasonic testing projects
7. Establish a sampling size and location for ultrasonic testing projects
8. Evaluate ultrasonic testing document tender for submission

9. Select the most suitable ultrasonic testing service provider as a backup or a sub-contractor to perform inspections during the ultrasonic testing projects, based on cost and the technical capabilities of the service provider
10. Approve ultrasonic testing procedures that are to be applied in ultrasonic testing projects in accordance to the applicable codes, standards and specifications
11. Review the results of ultrasonic testing in ultrasonic testing projects
12. Recommend further action(s) to be taken based on ultrasonic testing results in ultrasonic testing projects

- Annex 4** : Occupational Definitions in the NDT Sector for **TRANSPORTATION SUB SECTOR**
- Annex 4.3** : Magnetic Particle Testing (MT)
- Annex 4.3.1** : Welded Construction



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 1

#### MAGNETIC PARTICLE TESTING ASSISTANT TECHNICIAN (WELDED CONSTRUCTION)

A Magnetic Particle Testing Assistant Technician (Welded Construction) is expected to set up equipment and perform testing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Magnetic Particle Testing Assistant Technician (Welded Construction) should be able to:

1. Perform the Magnetic Particle Testing Equipment's Periodic Check
2. Perform the Magnetic Particle inventory control and equipment's storage
3. Set up the Magnetic Particle Testing Equipment
4. Perform Magnetic Particle Testing Surface Area Preparation
5. Perform Fluorescent and Visible Magnetic Particle Testing
6. Perform Wet and Dry Magnetic Particle Testing
7. Record and classify the results of the tests
8. Prepare Magnetic Particle Testing report
9. Perform and implement established safety and security procedures

***NOTE:** Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 2

### **MAGNETIC PARTICLE TESTING TECHNICIAN (WELDED CONSTRUCTION)**

A Magnetic Particle Testing Technician (Welded Construction) is expected to set up and verify the equipment's settings, prepare Magnetic Particle Testing instructions, perform the testing, interpret and evaluate the results according to designated codes, standards, specifications and procedures.

A Magnetic Particle Testing Technician (Welded Construction) should be able to:

1. Prepare Magnetic Particle Testing Work Instruction according to designated codes, standards, specifications and procedures
2. Provide Magnetic Particle Testing Guidance for personnel at par or below level 2
3. Select and define the limitations and advantages of application of the testing method
4. Set up and verify the equipment's settings
5. Perform and supervise Magnetic Particle Testing activities
6. Perform and supervise all Magnetic Particle Testing tasks at par or below level 2
7. Perform the interpretation and evaluation results according to applicable codes, standards, specifications or procedure
8. Report the results of Magnetic Particle Testing
9. Perform and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 3

### **MAGNETIC PARTICLE TESTING SENIOR TECHNICIAN (WELDED CONSTRUCTION)**

A Magnetic Particle Testing Senior Technician (Welded Construction) is expected to develop and validate the Magnetic Particle testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret testing reports, codes, standards, specification and procedures.

A Magnetic Particle Testing Senior Technician (Welded Construction) should be able to:

1. Verify Magnetic Particle Testing Reports
2. Prepare Magnetic Particle Testing Procedures
3. Validate Magnetic Particle Testing Procedures And Instructions
4. Prepare Magnetic Particle Testing technical proposal
5. Coordinate Magnetic Particle Testing Equipment's Calibration And Validation
6. Conduct Technical Briefings
7. Supervise and coordinate Magnetic Particle Testing Activities
8. Conduct on-the-job training
9. Assume full responsibility for a test facility or examination centre and staff
10. Establish and review editorials for technical correctness
11. Interpret codes, standards, specifications and procedures
12. Perform, coordinate and supervise all Magnetic Particle Testing tasks at all levels

13. Provide Magnetic Particle Testing guidance for personnel at all levels
14. Perform, coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate procedures, equipment and personnel for magnetic particle testing in designated NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify magnetic particle testing procedures that are applicable for a particular magnetic particle testing projects
2. Evaluate and qualify magnetic particle testing equipment and other facilities that are to be used for magnetic particle testing projects
3. Evaluate and qualify magnetic particle testing personnel involved in magnetic particle testing projects
4. Periodic monitoring of magnetic particle testing performance in magnetic particle testing projects
5. Prepare and present progress magnetic particle testing reports performed at various stage to magnetic particle testing projects client
6. Prepare job specifications for senior Technicians, Technicians and Assistant Technicians
7. Witness magnetic particle testing performed by Technicians at the fabrication shops or sites

8. Provide storage area and security for magnetic particle equipment used for inspection at magnetic particle testing project sites
9. Liaise with the authorities (e.g. DOSH, NIOSH) on matters related to magnetic particle testing projects
10. Understand relevant codes and standards that are applicable for a particular magnetic particle testing project



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 5

#### NDT MANAGER

NDT Manager is designated to plan magnetic particle testing requirements, develop magnetic particle testing related quality plan, evaluate magnetic particle testing results for magnetic particle testing projects and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the magnetic particle testing, and ensure that these plans are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage, all of the magnetic particle testing projects requirements of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where magnetic particle testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop magnetic particle testing projects tender specifications that are to be incorporated into the overall bidding documents
4. Develop magnetic particle testing performance test during the construction stage of magnetic particle testing projects
5. Identify requirements for magnetic particle testing for specific magnetic particle testing projects
6. Identifying correct magnetic particle testing methods to be applied in magnetic particle testing projects
7. Establish a sampling size and location for magnetic particle testing projects

8. Evaluate magnetic particle testing during magnetic particle testing projects tender submission
9. Select the most suitable magnetic particle testing service provider as a backup or a sub-contractor to perform inspection during magnetic particle testing projects, based on cost and technical capabilities of the service provider
10. Approved magnetic particle testing procedures that are to be applied in magnetic particle testing projects, in accordance to the applicable codes, standards and specifications
11. Review the results of magnetic particle testing.
12. Recommend further action(s) to be taken based on magnetic particle testing results in magnetic particle testing projects

- Annex 4** : Occupational Definitions in the NDT Sector for **TRANSPORTATION SUB SECTOR**
- Annex 4.3** : Magnetic Particle Testing (MT)
- Annex 4.3.2** : Casting and Forging



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 1

#### MAGNETIC PARTICLE TESTING ASSISTANT TECHNICIAN (CASTING AND FORGING)

A Magnetic Particle Testing Assistant Technician (Casting and Forging) is expected to set up the magnetic particle testing equipment and perform magnetic particle testing on casting and forging according to specific written instructions under the supervision of a level 2 or level 3 personnel.

A Magnetic Particle Testing Assistant Technician (Casting and Forging) should be able to:

1. Perform the magnetic particle testing equipment's inventory and storage control
2. Perform the magnetic particle testing apparatus and equipment's periodic check
3. Set up the magnetic particle testing equipment
4. Perform magnetic particle testing inspection surface area preparation
5. Perform magnetic particle testing
6. Record and classify the magnetic particle on casting and forging results
7. Prepare magnetic particle testing test reports.
8. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

### **Magnetic Particle Testing Level 2**

#### **MAGNETIC PARTICLE TESTING TECHNICIAN (CASTING AND FORGING)**

A Magnetic Particle Testing Technician (Casting and Forging) is expected to prepare the magnetic particle testing instructions, provide magnetic particle testing guidance, perform magnetic particle testing on casting and forging, and carry out magnetic particle defect interpretation and evaluation according to specific written established procedures.

A Magnetic Particle Testing Technician (Casting and Forging) should be able to:

1. Select and define the limitations and advantages of application of the magnetic particle testing technique
2. Prepare magnetic particle testing instructions according to the applicable magnetic particle testing procedures.
3. Perform and coordinate magnetic particle testing equipment's calibration and maintenance
4. Perform and coordinate magnetic particle testing equipment's inventory and storage control
5. Set up and verify magnetic particle testing equipment's settings
6. Perform magnetic particle testing
7. Perform magnetic particle testing interpretation and evaluation according to codes, standards, specifications and procedures
8. Report the results of magnetic particle testing on casting and forging.
9. Perform and supervise all magnetic particle testing tasks at par or below level

10. Provide magnetic particle testing guidance for personnel at par or below level  
2
11. Perform, implement and coordinate established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 3

### **MAGNETIC PARTICLE TESTING SENIOR TECHNICIAN (CASTING AND FORGING)**

A Magnetic Particle Testing Senior Technician (Casting and Forging) is expected to develop and validate the magnetic particle testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret magnetic particle testing report, codes, standards, specification and procedures.

A Magnetic Particle Testing Senior Technician (Casting and Forging) shall be able to:

1. Assume full responsibility for magnetic particle testing facility and staff technical development
2. Develop magnetic particle testing procedures
3. Validate magnetic particle testing procedures from clients/sub-contractors
4. Approve magnetic particle testing procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret magnetic particle testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate magnetic particle testing instructions and procedures
7. Designate and prepare the particular test technique, instructions and procedures for a follow up magnetic particle testing mock-up
8. Provide magnetic particle testing guidance for personnel at par and lower levels

9. Coordinate magnetic particle testing equipment's periodic check and maintenance
10. Coordinate magnetic particle testing equipment's storage, transportation and inventory control
11. Verify magnetic particle testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise ultrasonic testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review the procedures, equipment and personnel for NDT testing for designated projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from clients/sub-contractors
4. Approve NDT procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for a follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT training
11. Conduct appraisal on NDT personnel work performance
12. Carry out audit on NDT equipment and accessories

13. Prepare progress reports of NDT performed at various stages of projects
14. Prepare job specifications for senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan NDT requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the NDT plan, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage, all of the NDT requirements of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT projects tender specification to be incorporated into the overall bidding document
4. Develop NDT performance test during the construction stage
5. Identify specific NDT methods requirements for the project
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspections, based on cost and technical capabilities of the service provider
9. Recommend further action(s) to be taken based on NDT results in the projects
13. Organise project management review meetings

- Annex 4** : Occupational Definitions in the NDT Sector for **TRANSPORTATION SUB SECTOR**
- Annex 4.4** : Liquid Penetrant Testing (PT)
- Annex 4.4.1** : Welded Construction



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 1

#### LIQUID PENETRANT TESTING ASSISTANT TECHNICIAN (WELDED CONSTRUCTION)

A Liquid Penetrant Testing Assistant Technician (Welded Construction) is expected to set up the equipment and perform testing according to specific written instructions under the supervision of a level 2 or level 3 personnel.

A Liquid Penetrant Testing Assistant Technician (Welded Construction) should be able to:

1. Perform the Penetrant Testing Equipment's Periodic Check
2. Perform the Penetrant Testing inventory control and equipment's storage
3. Set up the Penetrant Testing Equipment
4. Perform Penetrant Testing Surface Area Preparation
5. Perform Fluorescent and Visible Penetrant Testing
6. Perform Wet and Dry Penetrant Testing
7. Record and classify the results of the tests
8. Prepare the Penetrant Particle Testing reports
9. Perform and implement established safety and security procedures

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Liquid Penetrant Testing Level 2

### **LIQUID PENETRANT TESTING TECHNICIAN (WELDED CONSTRUCTION)**

A Liquid Penetrant Testing Technician (Welded Construction) is expected to set up and verify the equipment's settings, prepare Penetrant Testing instructions, perform the test, interpret and evaluate the results according to the designated codes, standards, specifications and procedures.

A Liquid Penetrant Testing Technician (Welded Construction) should be able to:

1. Prepare the Penetrant Testing Work instructions according to designated codes, standards, specifications and procedures
2. Provide Penetrant Testing Guidance for personnel at par or below level 2
3. Select and define the limitations and advantages of application of the testing method
4. Set up and verify the equipment's settings
5. Perform and supervise Penetrant Testing activities
6. Perform and supervise all Penetrant Testing tasks at par or below level 2
7. Interpret and evaluate results according to the applicable codes, standards, specifications or procedure
8. Report the results of Penetrant Testing
9. Perform and implement established safety and security procedures



## OCCUPATIONAL DEFINITION

Liquid Penetrant Testing Level 3

### LIQUID PENETRANT TESTING SENIOR TECHNICIAN (WELDED CONSTRUCTION)

A Liquid Penetrant Testing Senior Technician (Welded Construction) is expected to develop and validate the Penetrant testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret testing report, codes, standards, specification and procedures.

A Liquid Penetrant Testing Senior Technician (Welded Construction) be able to:

1. Verify Penetrant Testing Report
2. Prepare Penetrant Testing Procedure
3. Validate Penetrant Testing Procedures And Instruction
4. Prepare Penetrant Testing technical proposal
5. Coordinate Penetrant Testing Equipment Calibration And Validation
6. Conduct Technical Briefings
7. Supervise and coordinate Penetrant Testing Activities
8. Conduct on-the-job Training
9. Assume full responsibility for a test facility or examination centre and staff
10. Establish and review editorials for technical correctness
11. Interpret codes, standards, specifications and procedures
12. Perform, coordinate and supervise all Penetrant Testing tasks at all levels
13. Provide Penetrant Testing guidance for personnel at all levels
14. Perform, coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Liquid Penetrant Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

The NDT Technical Executive is expected to evaluate procedures, equipment and personnel for magnetic particle testing in NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements imposed by clients and the relevant authorities are being duly complied with.

The NDT Technical Executive should be able to:

1. Evaluate and qualify penetrant testing procedures that are applicable for a particular magnetic particle testing projects
2. Evaluate and qualify penetrant testing equipment and other facilities to be used for magnetic particle testing projects
3. Evaluate and qualify penetrant testing personnel involved in magnetic particle testing projects
4. Periodically monitor of penetrant testing performance in penetrant testing projects
5. Prepare and present progress reports of penetrant testing performed at various stage to the penetrant testing project clients
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness penetrant testing performed by Technicians at the fabrication shops or sites

8. Provide a storage area and security for magnetic particle equipment used for inspection at magnetic particle testing project sites
9. Liaise with the authorities (e.g. DOSH, NIOSH) on matters related to penetrant testing projects
10. Understand the relevant codes and standards that are applicable for a particular penetrant testing project



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 5

#### NDT MANAGER

The NDT Manager is expected to plan penetrant testing requirements, develop penetrant testing related quality plans, evaluate the penetrant testing results for penetrant testing projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the penetrant testing plans, and ensure that these are carried out in a professional and safe manner.

The NDT manager should be able to:

1. Plan, during the design stage, all of the penetrant testing projects requirements for the engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where penetrant testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop penetrant particle testing projects tender specifications that are to be incorporated into the overall bidding document
4. Develop penetrant particle testing performance test during the construction stage of penetrant testing projects
5. Identify the requirements for penetrant testing for specific penetrant testing projects
6. Identifying the correct penetrant testing methods that are to be applied in penetrant testing projects
7. Establishing sampling size and location for penetrant testing projects

8. Evaluate penetrant testing during magnetic particle testing projects tender submission
9. Select the most suitable penetrant testing service provider as a backup or a sub-contractor to perform inspection during magnetic particle testing projects, based on cost and the technical capabilities of the service provider
10. Approve penetrant testing procedures that are to be applied in penetrant testing projects, in accordance with applicable codes, standards and specifications
11. Review the results of magnetic particle testing.
12. Recommend further action(s) to be taken based on magnetic particle testing results in magnetic particle testing projects

- Annex 4** : Occupational Definitions in the NDT Sector for **TRANSPORTATION SUB SECTOR**
- Annex 4.4** : Liquid Penetrant Testing (PT)
- Annex 4.4.2** : Casting and Forging



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 1

#### LIQUID PENETRANT TESTING ASSISTANT TECHNICIAN (CASTING AND FORGING)

A Liquid Penetrant Testing Assistant Technician (Casting and Forging) is expected to set up the penetrant testing equipment and perform penetrant magnetic particle testing on casting and forging according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Liquid Penetrant Testing Assistant Technician (Casting and Forging) should be able to:

1. Perform the penetrant testing equipment's inventory and storage control
2. Perform the penetrant testing apparatus and equipment's periodic check
3. Set up the penetrant testing equipment
4. Perform the penetrant testing inspection surface area preparation
5. Perform penetrant testing
6. Record and classify the penetrant on casting and forging results
7. Prepare penetrant testing test reports.
8. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Liquid Penetrant Testing Level 2

### **LIQUID PENETRANT TESTING TECHNICIAN (CASTING AND FORGING)**

A Penetrant Testing Technician (Casting and Forging) is expected to prepare the penetrant testing instructions, provide penetrant testing guidance, perform penetrant testing on casting and forging, and carry out penetrant defect interpretation and evaluation according to specific written established procedures.

A Penetrant Testing Technician (Casting and Forging) should be able to:

1. Select and define the limitations and advantages of application of the penetrant testing technique
2. Prepare penetrant testing instructions according to applicable penetrant testing procedures.
3. Perform and coordinate the penetrant testing equipment's calibration and maintenance
4. Perform and coordinate the penetrant testing equipment's inventory and storage control
5. Set up and verify the penetrant testing equipment's settings
6. Perform penetrant testing
7. Perform penetrant testing interpretation and evaluation according to codes, standards, specifications and procedures
8. Report the results of penetrant testing on casting and forging.
9. Perform and supervise all penetrant testing tasks at par or below level 2
10. Provide penetrant testing guidance for personnel at par or below level 2
11. Perform, implement and coordinate established safety and security procedures



## **OCCUPATIONAL DEFINITION**

### Liquid Penetrant Testing Level 3

#### **LIQUID PENETRANT TESTING SENIOR TECHNICIAN (CASTING AND FORGING)**

A Liquid Penetrant Testing Senior Technician (Casting and Forging) is expected to develop and validate the penetrant testing instruction and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, and verify and interpret penetrant testing report, codes, standards, specification and procedures.

A Liquid Penetrant Testing Senior Technician (Casting and Forging) should be able to:

1. Assume full responsibility for penetrant testing facility and staff technical development
2. Develop penetrant testing procedures
3. Validate penetrant testing procedures from clients/sub-contractors
4. Approve penetrant testing procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret penetrant testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate penetrant testing instructions and procedures
7. Designate and prepare a particular test technique, instructions and procedures for a follow up penetrant testing mock-up
8. Provide penetrant testing guidance for personnel at par and lower levels
9. Coordinate penetrant testing equipment's periodic check and maintenance

10. Coordinate penetrant testing equipment's storage, transportation and inventory control
11. Verify penetrant testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise penetrant testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Liquid Penetrant Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

An NDT Technical Executive is expected to review procedures, equipment and personnel for NDT testing for designated projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements imposed by clients and the relevant authorities are being duly complied with.

An NDT Technical Executive should be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from clients/sub-contractors
4. Approve NDT procedures that are to be applied for projects in accordance with the applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for a follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT training
11. Conduct appraisal on NDT personnel work performance
12. Carry out audit on NDT equipment and accessories

13. Prepare progress reports of NDT performed at various stages of projects
14. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 5

#### NDT MANAGER

An NDT Manager is expected to plan NDT requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the NDT plan, and ensure that these plans are carried out in a professional and safe manner.

An NDT Manager shall be able to:

1. Plan, during the design stage, all of the NDT requirements for engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT projects tender specification to be incorporated into the overall bidding document
4. Develop NDT performance test during the construction stage
5. Identify specific NDT methods requirements for the project
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspections, based on cost and technical capabilities of the service provider
9. Recommend further action(s) to be taken based on NDT results in the projects
11. Organise project management review meetings

- Annex 4** : Occupational Definitions in the NDT Sector for **TRANSPORTATION SUB SECTOR**
- Annex 4.5** : Eddy Current Testing (ET)
- Annex 4.5.1** : Tubes and Plates



## OCCUPATIONAL DEFINITION

### Eddy Current Testing Level 1

#### EDDY CURRENT TESTING ASSISTANT TECHNICIAN (TUBES AND PLATES)

An Eddy Current Testing Assistant Technician (Tubes and Plates) is expected to set up the equipment and perform testing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

An Eddy Current Testing Assistant Technician (Tubes and Plate) shall be able to:

1. Perform the Eddy Current Testing Equipment's Periodic Check
2. Perform the inventory control and equipment's storage
3. Set up Eddy Current Testing Equipment
4. Perform Eddy Current Testing Surface Area Preparation
5. Perform Conductivity Inspection
6. Perform Surface Inspection
7. Perform Thin Material's Thickness Measurement
8. Perform Bolt Hole Inspection
9. Record and classify the results of the tests
10. Prepare Eddy Current test reports
11. Perform and implement established safety and security procedures

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Eddy Current Testing Level 2

### **EDDY CURRENT TESTING TECHNICIAN (TUBES AND PLATES)**

An Eddy Current Testing Technician (Tubes and Plate) is expected to set up and verify the equipment settings, prepare Eddy Current Testing work instructions, perform testing, and interpret and evaluate results according to the designated codes, standards, specifications and procedures.

An Eddy Current Testing Technician (Tubes and Plates) should be able to:

1. Prepare Eddy Current Testing Work Instruction according to established codes, standards, specifications and procedures
2. Provide Eddy Current Testing Guidance for personnel at par or below level 2
3. Select and define the limitations and advantages of the applications of the testing method
4. Set up and verify the equipment's settings
5. Perform Tubing Inspection
6. Perform and supervise Eddy Current Testing Work
7. Perform Interpretation and evaluation results according to applicable codes, standards, specifications or procedures
8. Report the results of non-destructive tests
9. Perform and implement established safety and security procedures



## OCCUPATIONAL DEFINITION

Eddy Current Testing Level 3

### EDDY CURRENT TESTING SENIOR TECHNICIAN (TUBES AND PLATES)

An Eddy Current Testing Senior Technician (Tubes and Plates) is expected to develop and validate ultrasonic testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up to inspection proposals, and verify and interpret ultrasonic testing reports, codes, standards, specification and procedures.

An Eddy Current Testing Senior Technician (Tubes and Plates) should be able to:

1. Verify Eddy Current Testing Reports
2. Prepare Eddy Current Testing Procedures
3. Validate Eddy Current Testing Procedures And Instructions
4. Prepare Eddy Current Testing technical proposal
5. Coordinate Eddy Current Testing Equipment Calibration And Validation
6. Conduct technical briefings
7. Supervise and coordinate Eddy Current Testing Work Activities
8. Conduct on-the-job training
9. Assume full responsibility for a test facility, examination centre, and staff
10. Establish and review editorials for technical correctness
11. Interpret codes, standards, specifications and procedures
12. Perform, coordinate and supervise Eddy Current Testing at all levels
13. Provide guidance for personnel at all levels
14. Perform, coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Eddy Current Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

An NDT Technical Executive is expected to evaluate procedures, equipment and personnel for eddy current testing for designated NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility for maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by a client and the relevant authorities are being duly complied with.

An NDT Technical Executive should be able to:

1. Evaluate and qualify NDT procedures that are applicable for a particular NDT testing projects
2. Evaluate and qualify NDT equipment and other facilities that are to be used NDT projects
3. Evaluate and qualify NDT personnel that are involved in NDT testing projects
4. Periodic monitoring of NDT testing performance in NDT testing projects
5. Prepare and present progress reports of NDT performed at various stages to the NDT testing projects client
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness NDT testing performed by Technicians at the fabrication shops or sites
8. Provide a storage area and security for NDT equipment used for inspection at NDT testing project sites

9. Liaise with the authorities (e.g AELB, DOSH, NIOSH) on matters related to NDT testing projects
10. Understand the relevant codes and standards that are applicable for a particular NDT testing project



## **OCCUPATIONAL DEFINITION**

### **Eddy Current Testing Level 5**

#### **NDT MANAGER**

An NDT Manager is expected to come up with an NDT testing plan requirement, develop NDT testing related quality plan, evaluate NDT testing results for NDT testing projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the NDT testing, and ensure that these are carried out in a professional and safe manner.

An NDT Manager shall be able to:

1. Plan, during the design stage, all of the NDT testing projects' requirement of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop NDT testing projects tender specifications that are to be incorporated into the overall bidding document
4. Develop NDT testing performance test during the construction stage of NDT testing projects
5. Identify requirements for non-destructive testing for specific NDT testing projects
6. Identifying correct NDT testing methods that are to be applied in NDT testing projects
7. Establish a sampling size and location for NDT testing projects

8. Evaluate non-destructive testing during NDT testing projects tender submission
9. Select the most suitable NDT testing service provider as a backup or a sub-contractor to perform inspection during NDT testing projects, based on cost and technical capabilities of the service provider
10. Approved NDT testing procedures that are to be applied in non-destructive testing projects, in accordance with the applicable codes, standards and specifications
11. Review the results of non-destructive testing in NDT testing projects
12. Recommend further action(s) to be taken based on non-destructive testing results in NDT testing projects

- Annex 5** : Occupational Definitions in the NDT Sector for  
**CONCRETE CONSTRUCTION SUB SECTOR**
- Annex 5.1** : Ultrasonic Testing (UT)
- Annex 5.1.1** : Structural Concrete



## **OCCUPATIONAL DEFINITION**

### Ultrasonic Testing Level 2

#### **ULTRASONIC TESTING TECHNICIAN (STRUCTURAL CONCRETE)**

An Ultrasonic Testing Technician (Structural Concrete) is expected to perform and coordinate inventory control and the equipment's periodic check; prepare the Ultrasonic inspection's written instructions according to the applicable codes, standards, specifications or procedures; set up and verify the equipment, perform and coordinate Ultrasonic inspections according to the designated procedures, select and define the limitations and advantages of the applications of the testing methods, record and interpret test results, and perform and coordinate the established safety and security procedures.

An Ultrasonic Testing Technician (Structural Concrete) should be able to:

1. Perform and coordinate the Ultrasonic inspection equipment's periodic check,
2. Prepare the Ultrasonic inspection's instructions according to applicable codes, standards, specifications or procedures,
3. Setup and verify the Ultrasonic inspection's equipment settings,
4. Perform and coordinate the Ultrasonic inspection's work activities, as per the given procedures,
5. Select and define the limitations and advantages of application of the testing methods,
6. Record Ultrasonic inspection test results, and
7. Perform and coordinate established safety and security procedure



## **OCCUPATIONAL DEFINITION**

Ultrasonic Testing Level 3

### **ULTRASONIC TESTING SENIOR TECHNICIAN (STRUCTURAL CONCRETE)**

An Ultrasonic Testing Senior Technician is expected to coordinate and supervise the Ultrasonic inspections of the equipment's maintenance, coordinate and supervise Ultrasonic inspection activities, verify test reports, prepare and validate Ultrasonic inspection procedures and instructions; conduct technical briefings and on-the-job training; interpret codes, standards, specifications and procedures; and coordinate and implement safety and security procedures.

An Ultrasonic Testing Senior Technician should be able to:

1. Coordinate the Ultrasonic inspection equipment's periodic check and maintenance,
2. Coordinate and supervise Ultrasonic inspection's activities,
3. Verify the Ultrasonic inspection's testing report,
4. Prepare the Ultrasonic inspection's testing procedure,
5. Validate the Ultrasonic inspection's testing procedures and instructions,
6. Provide Ultrasonic inspection's guidance for personnel at all levels,
7. Conduct technical briefings,
8. Conduct on-the-job training,
9. Coordinate and supervise Ultrasonic inspection activities at all levels,
10. Interpret Ultrasonic testing codes, standards, specifications and procedures,
11. Coordinate and implement established safety and security procedures.



## **OCCUPATIONAL DEFINITION**

Ultrasonic Testing Level 4

### **NDT TECHNICAL EXECUTIVE (STRUCTURAL CONCRETE)**

The NDT Technical Executive Structural Concrete is expected to evaluate and qualify procedures, equipment and personnel for common NDT concrete testing methods in designated NDT concrete inspection projects; witness performance testing and prepare progress reports; assume the responsibility in maintaining constant contact with clients and the relevant authorities and also ensuring that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

In particular, NDT Technical Executive Structural Concrete shall be able to:

1. Evaluate and qualify all NDT Structural Concrete procedures that are applicable for a particular NDT Structural Concrete inspection projects;
2. Evaluate and qualify all five common NDT Structural Concrete testing equipment and other facilities that are used for NDT Structural Concrete inspection projects;
3. Evaluate and qualify NDT Structural Concrete personnel involved in NDT Structural Concrete inspection projects;
4. Periodically monitor NDT Structural Concrete performance;
5. Prepare and present progress reports of NDT Structural Concrete tests performed at various stages to NDT Structural Concrete projects to clients;
6. Prepare job specifications for Senior Technicians and Technicians;
7. Witness NDT Structural Concrete performed by NDT Structural concrete workers at the fabrication shops;

8. Provide a drawing for storage area for the industrial radiography source that are being used for inspection at radiography testing project sites;
9. Liaise with the relevant authorities on matters related to NDT Structural concrete testing projects; and
10. Understand the relevant codes and standards that are applicable to all five common NDT Structural concrete testing methods.



## **OCCUPATIONAL DEFINITION**

Ultrasonic Testing Level 5

### **NDT MANAGER (STRUCTURAL CONCRETE)**

The NDT Manager Structural Concrete is expected to plan, during the design stage of all common NDT Structural Concrete testing projects for the requirement of engineering components parts and systems that are to be inspected; propose NDT Structural concrete project; develop NDT Structural concrete testing related quality plan, evaluate NDT Structural concrete testing results for NDT Structural concrete projects and provide further recommendations based on these results. They are also expected to assume the responsibility for organising the implementation of all common NDT Structural concrete methods and ensure that these are carried out in a professional and safe manner, with the NDT Structural concrete personnel providing the appropriate guidance to all levels.

The NDT Manager Structural Concrete should be able to:

1. Propose NDT Structural concrete projects;
2. Plan, during the design stage of all common NDT Structural concrete testing projects, all of the required engineering components, parts and system to be inspected;
3. Develop a quality plan (stages where NDT Structural concrete projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages);
4. Develop NDT Structural concrete testing projects tender specifications that are to be incorporated into the overall bidding documents;

5. Develop all five common NDT Structural concrete testing performance test during the construction stage of the NDT Structural concrete testing projects;
6. Identify the requirements for NDT concrete testing for specific NDT Structural concrete testing projects;
7. Identifying the correct NDT Structural concrete testing methods that are to be applied in NDT Structural concrete projects;
8. Establish a sampling size and location for NDT Structural concrete testing projects;
9. Evaluate NDT Structural concrete testing during NDT Structural concrete testing projects tender submission;
10. Select the most suitable NDT Structural concrete testing service provider as a backup or a sub-contractor to perform inspections during NDT Structural concrete testing projects based on cost and technical capabilities of the service provider, and
11. Approve NDT Structural concrete testing procedures that are to be applied in the NDT Structural concrete testing projects in accordance with the applicable code standard and specification;
12. Review the action(s) to be taken based on NDT Structural concrete testing results in NDT Structural concrete projects; and
13. Provide guidance for all levels NDT Structural concrete personnel.

- Annex 5** : Occupational Definitions in the NDT Sector for  
**CONCRETE CONSTRUCTION SUB SECTOR**
- Annex 5.2** : Radiographic Testing (RT)
- Annex 5.2.1** : Structural Concrete



## **OCCUPATIONAL DEFINITION**

### **Radiographic Testing Level 2**

#### **RADIOGRAPHIC TESTING TECHNICIAN (STRUCTURAL CONCRETE)**

The Radiography Testing Technician (Structural Concrete) is expected to perform and coordinate inventory control and the equipment's periodic check; perform and coordinate the equipment's transport and storage; prepare radiography testing written instructions according to applicable codes, standards, specifications or procedures; set up and verify the equipments, perform and coordinate radiography testing, conduct film interpretation and evaluation; and perform and coordinate established radiation safety and security procedures.

The Radiography Testing Technician (Structural Concrete) should be able to:

1. Perform and coordinate radiography testing inventory control and the equipment's periodic check,
2. Perform and coordinate radiography testing equipment's transportation and storage,
3. Prepare radiography testing instruction according to applicable codes, standards, specifications or procedures,
4. Setup and verify radiography testing equipment's settings,
5. Perform and coordinate radiography testing work activities at par or below level 2,
6. Select and define the limitations and advantages of the applications of the testing methods,
7. Provide radiography testing guidance for personnel at par or below level 2,
8. Record and classify radiography testing concrete test results

9. Prepare radiography concrete test report, film interpretation and evaluation results according to applicable codes, standards, specifications or procedures, and,
10. Perform and implement established safety and security procedures.



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 3

### **RADIOGRAPHIC TESTING SENIOR TECHNICIAN (STRUCTURAL CONCRETE)**

The Radiography Testing Senior Technician (Structural Concrete) is expected to coordinate the radiography testing equipment's maintenance; storage, transportation and inventory control; coordinate radiography testing activities; verify test reports, prepare and validate radiography testing procedures and instructions; conduct technical briefings and on-the-job training; interpret codes, standards, specifications and procedures; and coordinate and implement established safety and security procedures.

The Radiography Testing Senior Technician (Structural Concrete) should be able to:

1. Coordinate radiography testing equipment's periodic check and maintenance,
2. Coordinate radiography testing equipment's storage, transportation and inventory control,
3. Verify radiography testing reports,
4. Prepare radiography testing procedures,
5. Establish and review editorials for technical correctness,
6. Validate radiography testing procedures and instructions,
7. Provide radiography testing guidance for personnel at all levels,
8. Designate and prepare a particular test method, instructions and procedures for a follow up radiography testing proposal,
9. Conduct technical briefings,
10. Conduct on-the-job training,
11. Coordinate and supervise radiography testing activities at all levels,

12. Interpret radiography testing codes, standards, specifications and procedures,
13. Coordinate and implement established safety and security procedures.  
Prepare radiography concrete test report, film interpretation and evaluation results according to applicable codes, standards, specifications or procedures, and,
14. Perform and implement established safety and security procedures.



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Testing Level 4

### **NDT TECHNICAL EXECUTIVE (STRUCTURAL CONCRETE)**

The NDT Technical Executive Structural Concrete is expected to evaluate and qualify procedures, equipment and personnel for common NDT concrete testing methods in designated NDT concrete inspection projects; witness performance testing and prepare progress reports; assume the responsibility in maintaining constant contact with clients and the relevant authorities and also ensuring that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

In particular, NDT Technical Executive Structural Concrete shall be able to:

1. Evaluate and qualify all NDT Structural Concrete procedures that are applicable for a particular NDT Structural Concrete inspection projects;
2. Evaluate and qualify all five common NDT Structural Concrete testing equipment and other facilities that are used for NDT Structural Concrete inspection projects;
3. Evaluate and qualify NDT Structural Concrete personnel involved in NDT Structural Concrete inspection projects;
4. Periodically monitor NDT Structural Concrete performance;
5. Prepare and present progress reports of NDT Structural Concrete tests performed at various stages to NDT Structural Concrete projects to clients;
6. Prepare job specifications for Senior Technicians and Technicians;
7. Witness NDT Structural Concrete performed by NDT Structural concrete workers at the fabrication shops;

8. Provide a drawing for storage area for the industrial radiography source that are being used for inspection at radiography testing project sites;
9. Liaise with the relevant authorities on matters related to NDT Structural concrete testing projects; and
10. Understand the relevant codes and standards that are applicable to all five common NDT Structural concrete testing methods.



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 5

### **NDT MANAGER (STRUCTURAL CONCRETE)**

An NDT Manager Structural Concrete is expected to plan, during the design stage of all common NDT Structural Concrete testing projects for the requirement of engineering components parts and systems that are to be inspected; propose NDT Structural concrete project; develop NDT Structural concrete testing related quality plan, evaluate NDT Structural concrete testing results for NDT Structural concrete projects and provide further recommendations based on these results. They are also expected to assume the responsibility for organising the implementation of all common NDT Structural concrete methods and ensure that these are carried out in a professional and safe manner, with the NDT Structural concrete personnel providing the appropriate guidance to all levels.

The NDT Manager Structural Concrete should be able to:

1. Propose NDT Structural concrete projects;
2. Plan, during the design stage of all common NDT Structural concrete testing projects, all of the required engineering components, parts and system to be inspected;
3. Develop a quality plan (stages where NDT Structural concrete projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages);
4. Develop NDT Structural concrete testing projects tender specifications that are to be incorporated into the overall bidding documents;

5. Develop all five common NDT Structural concrete testing performance test during the construction stage of the NDT Structural concrete testing projects;
6. Identify the requirements for NDT concrete testing for specific NDT Structural concrete testing projects;
7. Identifying the correct NDT Structural concrete testing methods that are to be applied in NDT Structural concrete projects;
8. Establish a sampling size and location for NDT Structural concrete testing projects;
9. Evaluate NDT Structural concrete testing during NDT Structural concrete testing projects tender submission;
10. Select the most suitable NDT Structural concrete testing service provider as a backup or a sub-contractor to perform inspections during NDT Structural concrete testing projects based on cost and technical capabilities of the service provider, and
11. Approve NDT Structural concrete testing procedures that are to be applied in the NDT Structural concrete testing projects in accordance with the applicable code standard and specification;
12. Review the action(s) to be taken based on NDT Structural concrete testing results in NDT Structural concrete projects; and
13. Provide guidance for all levels NDT Structural concrete personnel.

- Annex 5** : Occupational Definitions in the NDT Sector for  
**CONCRETE CONSTRUCTION SUB SECTOR**
- Annex 5.3** : Concrete Evaluation Testing (CET)
- Annex 5.3.1** : Structural Concrete



## **OCCUPATIONAL DEFINITION**

Concrete Evaluation Testing Level 2

### **CONCRETE EVALUATION TESTING TECHNICIAN (STRUCTURAL CONCRETE)**

A Concrete Evaluation Testing Technician (Structural Concrete) is expected to perform the CET equipment's periodic check; prepare the CET area; setup the ultrasonic testing equipment; prepare the CET instructions according to applicable codes, standards, specifications or procedures; perform tests according to work procedures/instructions; select and define the limitations and advantages of the application of the testing methods; record and classify the CET results of the tests; prepare the CET reports; and perform and implement established work safety and security procedures.

A Concrete Evaluation Testing Technician (Structural Concrete) should be able to:

1. Perform the CET equipment's periodic check;
2. Prepare the CET area;
3. Setup the CET equipment;
4. Prepare the CET instructions according to applicable codes, standards, specifications or procedures;
5. Perform tests according to work procedures/instructions;
6. Select and define the limitations and advantages of the applications of the testing methods;
7. Record and classify the CET results of the tests;
8. Prepare the CET reports;
9. Perform and implement established work safety and security procedures



## **OCCUPATIONAL DEFINITION**

Concrete Evaluation Testing Level 3

### **CONCRETE EVALUATION TESTING SENIOR TECHNICIAN (STRUCTURAL CONCRETE)**

A Concrete Evaluation Testing Senior Technician (Structural Concrete) is expected to perform the CET equipment's periodic check; prepare the CET area; setup the ultrasonic testing equipment; prepare the CET instructions according to applicable codes, standards, specifications or procedures; perform tests according to work procedures/instructions; select and define the limitations and advantages of the application of the testing methods; record and classify the CET results of the tests; prepare the CET reports; and perform and implement established work safety and security procedures.

A Concrete Evaluation Testing Senior Technician (Structural Concrete) should be able to:

1. Prepare and validate the CET procedures and instructions;
2. Supervise CET work;
3. Liaise with the respective authorities' representatives;
4. Understand and interpret work instruction/work order;
5. Prepare CET test reports;
6. Carry out site inspections;
7. Submit site difficulty feedbacks;
8. Adhere to established safety and security procedures;
9. Follow standard operating procedures;
10. Conduct technical briefings



## **OCCUPATIONAL DEFINITION**

Concrete Evaluation Testing Level 4

### **NDT TECHNICAL EXECUTIVE (STRUCTURAL CONCRETE)**

An NDT Technical Executive Structural Concrete is expected to evaluate and qualify procedures, equipment and personnel for common NDT concrete testing methods in designated NDT concrete inspection projects; witness performance testing and prepare progress reports; assume the responsibility in maintaining constant contact with clients and the relevant authorities and also ensuring that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

In particular, NDT Technical Executive Structural Concrete shall be able to:

1. Evaluate and qualify all NDT Structural Concrete procedures that are applicable for a particular NDT Structural Concrete inspection projects;
2. Evaluate and qualify all five common NDT Structural Concrete testing equipment and other facilities that are used for NDT Structural Concrete inspection projects;
3. Evaluate and qualify NDT Structural Concrete personnel involved in NDT Structural Concrete inspection projects;
4. Periodically monitor NDT Structural Concrete performance;
5. Prepare and present progress reports of NDT Structural Concrete tests performed at various stages to NDT Structural Concrete projects to clients;
6. Prepare job specifications for Senior Technicians and Technicians;
7. Witness NDT Structural Concrete performed by NDT Structural concrete workers at the fabrication shops;

8. Provide a drawing for storage area for the industrial radiography source that are being used for inspection at radiography testing project sites;
9. Liaise with the relevant authorities on matters related to NDT Structural concrete testing projects; and
10. Understand the relevant codes and standards that are applicable to all five common NDT Structural concrete testing methods.



## **OCCUPATIONAL DEFINITION**

Concrete Evaluation Testing Level 5

### **NDT MANAGER (STRUCTURAL CONCRETE)**

An NDT Manager Structural Concrete is expected to plan, during the design stage of all common NDT Structural Concrete testing projects for the requirement of engineering components parts and systems that are to be inspected; propose NDT Structural concrete project; develop NDT Structural concrete testing related quality plan, evaluate NDT Structural concrete testing results for NDT Structural concrete projects and provide further recommendations based on these results. They are also expected to assume the responsibility for organising the implementation of all common NDT Structural concrete methods and ensure that these are carried out in a professional and safe manner, with the NDT Structural concrete personnel providing the appropriate guidance to all levels.

An NDT Manager Structural Concrete should be able to:

1. Propose NDT Structural concrete projects;
2. Plan, during the design stage of all common NDT Structural concrete testing projects, all of the required engineering components, parts and system to be inspected;
3. Develop a quality plan (stages where NDT Structural concrete projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages);
4. Develop NDT Structural concrete testing projects tender specifications that are to be incorporated into the overall bidding documents;

5. Develop all five common NDT Structural concrete testing performance test during the construction stage of the NDT Structural concrete testing projects;
6. Identify the requirements for NDT concrete testing for specific NDT Structural concrete testing projects;
7. Identifying the correct NDT Structural concrete testing methods that are to be applied in NDT Structural concrete projects;
8. Establish a sampling size and location for NDT Structural concrete testing projects;
9. Evaluate NDT Structural concrete testing during NDT Structural concrete testing projects tender submission;
10. Select the most suitable NDT Structural concrete testing service provider as a backup or a sub-contractor to perform inspections during NDT Structural concrete testing projects based on cost and technical capabilities of the service provider, and
11. Approve NDT Structural concrete testing procedures that are to be applied in the NDT Structural concrete testing projects in accordance with the applicable code standard and specification;
12. Review the action(s) to be taken based on NDT Structural concrete testing results in NDT Structural concrete projects; and
13. Provide guidance for all levels NDT Structural concrete personnel.

- Annex 6** : Occupational Definitions in the NDT Sector for **NUCLEAR POWER SUB SECTOR**
- Annex 6.1** : Radiography Testing (RT)
- Annex 6.1.1** : Welded Construction



## OCCUPATIONAL DEFINITION

### Radiography Testing Level 1

#### RADIOGRAPHY TESTING ASSISTANT TECHNICIAN (WELDED CONSTRUCTION)

A Radiography Testing Assistant Technician (Welded Construction) is expected to set up the equipment and perform radiography testing and film processing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Radiography Testing Assistant Technician (Welded Construction) should be able to:

1. Perform the x-ray and gamma radiography testing equipment's periodic check
2. Perform the x-ray and gamma ray radiography testing equipment's storage
3. Transport x-ray and gamma ray radiography testing equipment
4. Perform x-ray and gamma ray radiography testing inventory control
5. Prepare the x-ray and gamma ray radiography testing area
6. Setup the x-ray and gamma ray radiography testing equipment
7. Perform the x-ray and gamma ray radiography testing
8. Carry out automatic and manual film processing preparations
9. Perform automatic and manual film processing
10. Record and classify the x-ray and gamma ray radiography testing welded construction results of the tests
11. Prepare x-ray and gamma ray radiography testing test reports.
12. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## OCCUPATIONAL DEFINITION

Radiography Testing Level 2

### RADIOGRAPHY TESTING TECHNICIAN (WELDED CONSTRUCTION)

A Radiography Testing Technician (Welded Construction) is expected to set up and verify the equipment, perform and coordinate radiography testing, film interpretation and evaluation, and prepare radiography testing written instructions according to applicable codes, standards specifications or procedures.

A Radiography Testing Technician (Welded Construction) should be able to:

1. Perform and coordinate x-ray and gamma ray radiography testing inventory control and the equipment's periodic check
2. Perform and coordinate x-ray and gamma ray radiography testing equipment's transportation and storage
3. Prepare x-ray and gamma ray radiography testing instruction according to applicable codes, standards, specifications or procedures
4. Setup and verify x-ray and gamma ray radiography testing equipment's settings
5. Perform and coordinate x-ray and gamma ray Radiography Testing Work activities at par or below level 2
6. Select and define the limitations and advantages of the applications of the testing methods
7. Provide x-ray and gamma ray radiography testing guidance for personnel at par or below level 2.
8. Perform radiographic film interpretation on welded construction items in accordance to applied codes, standards & specifications.

9. Record and classify the x-ray and gamma ray radiography welded construction results of the tests
10. Prepare x-ray and gamma ray radiography test report, film Interpretation and evaluation results according to applicable codes, standards, specifications or procedures
11. Perform and implement established safety and security procedures.



## **OCCUPATIONAL DEFINITION**

### **Radiography Testing Level 3**

#### **RADIOGRAPHY TESTING SENIOR TECHNICIAN (WELDED CONSTRUCTION)**

A Radiography Testing Senior Technician (Welded Construction) is expected to coordinate radiography testing equipment's maintenance, storage, transportation and inventory control, coordinate radiography testing activities, verify test reports, prepare and validate radiography testing procedures and instructions, conduct technical briefings and on-the-job training, and interpret codes, standards, specifications and procedures.

A Radiography Testing Senior Technician (Welded Construction) should be able to:

1. Coordinate x-ray and gamma ray radiography testing equipment's periodic check and maintenance
2. Coordinate x-ray and gamma ray radiography testing equipment's storage, transportation and inventory control
3. Verify x-ray and gamma ray radiography testing reports
4. Prepare x-ray and gamma ray radiography testing procedures
5. Establish and review editorials for technical correctness
6. Validate x-ray and gamma ray radiography testing procedures and instructions
7. Provide x-ray and gamma ray radiography testing guidance for personnel at all levels
8. Designate and prepare the particular test methods, instructions and procedures for follow up x-ray and gamma ray radiography testing proposal
9. Conduct technical briefings

10. Conduct on-the-job training
11. Coordinate and supervise x-ray and gamma ray radiography testing activities at all levels
12. Interpret x-ray and gamma ray radiography testing codes, standards, specifications and procedures
13. Coordinate and implement established safety and security procedures.



## **OCCUPATIONAL DEFINITION**

### **Radiography Testing Level 4**

#### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate procedures, equipment and personnel for radiography testing in NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify radiography testing procedures that are applicable for a particular radiography testing projects
2. Evaluate and qualify radiography testing equipment and other facilities that are to be used for radiography testing projects
3. Evaluate and qualify radiography testing personnel involved in radiography testing projects
4. Periodically monitor radiography testing performance in radiography testing
5. Prepare and present progress reports of radiography testing performed at various stages to radiography testing projects client
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness radiography testing performed by Technicians at the fabrication shops
8. Provide storage area for industrial radiography source used for inspection at radiography testing project sites

9. Liaise with the authorities (e.g. AELB, DOSH, NIOSH) on matters related to radiography testing projects
10. Understand the relevant codes and standards that are applicable for particular radiography testing projects



## OCCUPATIONAL DEFINITION

### Radiography Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan radiography testing requirements, develop radiography testing related quality plan, evaluate radiography testing results for radiography testing projects, and provide further recommendations based on these results. They are expected to assume the responsibility for organising the implementation of the radiography testing plan, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage of the radiography testing projects, all of the required engineering components, parts and systems to be inspected
2. Develop quality plan (stages where radiography testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop radiography testing projects tender specifications that are to be incorporated into the overall bidding documents
4. Develop radiography testing performance test during the construction stage of radiography testing projects
5. Identify the requirements for radiography testing for specific radiography testing projects
6. Identifying the correct radiography testing methods that are to be applied in radiography testing projects
7. Establish a sampling size and location for radiography testing projects

8. Evaluate radiography testing during radiography testing projects tender submission
9. Select the most suitable radiography testing service provider as a backup or a sub-contractor to perform inspection during radiography testing projects, based on cost and the technical capabilities of the service provider
10. Approve radiography testing procedures that are to be applied in radiography testing projects in accordance with applicable code standards and specifications
11. Review results of radiography testing in radiography testing projects
12. Recommend further action(s) to be taken based on radiography testing results in radiography testing projects

- Annex 6** : Occupational Definitions in the NDT Sector for **NUCLEAR POWER SUB SECTOR**
- Annex 6.1** : Radiography Testing (RT)
- Annex 6.1.2** : Casting and Forging



## **OCCUPATIONAL DEFINITION**

### **Radiographic Testing Level 1**

#### **RADIOGRAPHIC TESTING ASSISTANT TECHNICIAN (CASTING AND FORGING)**

A Radiographic Testing Assistant Technician (Casting and Forging) is expected to set up the equipment and perform radiographic testing on casting and forging, and film processing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Radiographic Testing Assistant Technician (Casting and Forging) should be able to:

1. Perform the x-ray and gamma radiography testing equipment's periodic check
2. Perform x-ray and gamma ray radiographic testing equipment's storage
3. Transport the x-ray and gamma ray radiographic testing equipment
4. Perform the x-ray and gamma ray radiographic testing inventory control
5. Prepare the x-ray and gamma ray radiographic testing area
6. Setup the x-ray and gamma ray radiographic testing equipment
7. Perform x-ray and gamma ray radiographic testing
8. Perform automatic and manual film processing preparations
9. Perform automatic and manual film processing
10. Record and classify the x-ray and gamma ray radiographic testing casting and forging results of the tests
11. Prepare x-ray and gamma ray radiographic testing test reports.
12. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 2

### **RADIOGRAPHIC TESTING TECHNICIAN (CASTING AND FORGING)**

A Radiographic Testing Technician (Casting and Forging) is expected to set up and verify the equipment and perform and coordinate radiographic testing, film interpretation and evaluation, prepare radiographic testing on casting and forging written instructions according to applicable codes, standards specifications or procedures.

A Radiographic Testing Technician (Casting and Forging) should be able to:

1. Perform and coordinate x-ray and gamma ray radiographic testing inventory control and the equipment's periodic check
2. Perform and coordinate x-ray and gamma ray radiographic testing equipment's transportation and storage
3. Prepare x-ray and gamma ray radiographic testing instructions according to the applicable Radiographic Testing Procedures
4. Setup and verify x-ray and gamma ray radiographic testing equipment settings
5. Perform and coordinate x-ray and gamma ray radiographic testing work activities at par or below level 2
6. Select and define the limitations and advantages of application of the testing methods
7. Provide x-ray and gamma ray radiographic testing guidance for personnel at par or below level 2

8. Perform radiographic film interpretation on casting and forging items in accordance to codes, standards & applied specifications
9. Prepare x-ray and gamma ray radiographic testing report, film interpretation and evaluation results according to applicable codes, standards, specifications or procedures
10. Record and classify the x-ray and gamma ray radiographic casting and forging results of the tests
11. Monitor x-ray and gamma ray equipment maintenance, storage, inventory, transportation and etc.
12. Perform and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 3

### **RADIOGRAPHIC TESTING SENIOR TECHNICIAN (CASTING AND FORGING)**

A Radiographic Testing Senior Technician (Casting and Forging) is expected to coordinate the radiographic testing equipment's maintenance, storage, transportation and inventory control, coordinate radiographic testing activities, verify test reports, prepare and validate radiographic testing procedures and instructions, conduct technical briefings and on-the-job training, and interpret codes, standards, specifications and procedures.

A Radiographic Testing Senior Technician (Casting and Forging) should be able to:

1. Assume full responsibility for radiographic testing facility and staff technical development.
2. Develop radiographic testing procedures
3. Validate radiographic testing procedures from clients/sub-contractors
4. Approve radiographic testing procedure that are to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret radiographic testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate radiographic testing instructions and procedures
7. Designate and prepare a particular test technique, instructions and procedures for a follow up radiographic testing mock-up
8. Provide radiographic testing guidance for personnel at par and lower levels
9. Coordinate radiographic testing equipment's periodic check and maintenance

10. Coordinate radiographic testing equipment's storage, transportation and inventory control
11. Verify radiographic testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise radiographic testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Radiographic Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review the procedures, equipment and personnel for NDT testing in designated projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive shall be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from clients/sub-contractors
4. Approve NDT procedures that are to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for a follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT trainings
11. Conduct appraisal on NDT personnel's work performance
12. Carry out audit on NDT equipment and accessories

13. Prepare progress NDT reports performed on/at various stages of projects
14. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g AELB, DOSH) on NDT matters related in the projects



## OCCUPATIONAL DEFINITION

### Radiographic Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan NDT requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are expected to assume the responsibility for organising the implementation of the NDT plan, and ensure that these are carried out in a professional and safe manner.

A NDT Manager shall be able to:

1. Plan, during the design stage of NDT requirements, all of the required engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT projects tender specifications to be incorporated into the overall bidding document
4. Develop NDT performance test during the construction stage
5. Identify specific NDT methods requirements for the project
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspection, based on cost and technical capabilities of the service provider
9. Recommend further action(s) to be taken based on NDT results in the projects

10. Organise project management review meetings

- Annex 6** : Occupational Definitions in the NDT Sector for **NUCLEAR POWER SUB SECTOR**
- Annex 6.2** : Ultrasonic Testing (UT)
- Annex 6.2.1** : Welded Construction



## OCCUPATIONAL DEFINITION

### Ultrasonic Testing Level 1

#### ULTRASONIC TESTING ASSISTANT TECHNICIAN (WELDED CONSTRUCTION)

An Ultrasonic Testing Assistant Technician (Welded Construction) is expected to set up the ultrasonic testing equipment and to perform the ultrasonic testing on welded construction according to specific written instructions under the supervision of a level 2 or level 3 personnel,

An Ultrasonic Testing Assistant Technician (Welded Construction) should be able to:

1. Perform the ultrasonic testing equipment's inventory and storage control
2. Perform the ultrasonic testing apparatus and equipment's periodic check
3. Set up the ultrasonic testing equipment
4. Perform ultrasonic testing Inspection surface area preparation
5. Perform thickness measurement ultrasonic testing
6. Perform lamination ultrasonic testing
7. Record and classify the ultrasonic testing on welded construction results
8. Prepare ultrasonic testing test report.
9. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Ultrasonic Testing Level 2

### **ULTRASONIC TESTING TECHNICIAN (WELDED CONSTRUCTION)**

An Ultrasonic Testing Technician (Welded Construction) is expected to prepare the ultrasonic testing instruction, provide ultrasonic testing guidance, perform ultrasonic testing on welded construction, carry out ultrasonic flaw interpretation and evaluation according to specific written established procedures.

An Ultrasonic Testing Technician (Welded Construction) should be able to:

1. Select and define the limitations and advantages of the applications of the ultrasonic testing technique
2. Prepare the ultrasonic testing instructions according to the applicable ultrasonic testing procedures.
3. Perform and coordinate the ultrasonic testing equipment's calibration and maintenance
4. Perform and coordinate ultrasonic testing equipment's inventory and storage control
5. Set up and verify the ultrasonic testing equipment's settings
6. Perform groove plates ultrasonic testing
7. Perform pipe ultrasonic testing
8. Perform nozzle ultrasonic testing
9. Perform TKY joint ultrasonic testing
10. Perform ultrasonic testing interpretation and evaluation according to codes, standards, specifications and procedures
11. Report the results of ultrasonic testing on welded construction.

12. Perform and supervise all ultrasonic testing tasks at par or below level 2
13. Provide ultrasonic testing guidance for personnel at par or below level 2
14. Perform, implement and coordinate established safety and security procedures



## OCCUPATIONAL DEFINITION

Ultrasonic Testing level 3

### ULTRASONIC TESTING SENIOR TECHNICIAN (WELDED CONSTRUCTION)

An Ultrasonic Senior Technician (Welded Construction) is expected to develop and validate ultrasonic testing instructions and procedures, conduct technical briefings and on-the-job training, prepare follow up inspection proposal, verify and interpret ultrasonic testing reports, codes, standards, specification and procedures.

An Ultrasonic Senior Technician (Welded Construction) should be able to:

1. Assume full responsibility for Ultrasonic testing facility and staff technical development
2. Develop Ultrasonic testing procedures
3. Validate Ultrasonic testing procedures from clients/sub-contractors
4. Approve Ultrasonic testing procedure that are to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret Ultrasonic testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate Ultrasonic testing instructions and procedures
7. Designate and prepare the particular test technique, instructions and procedures for a follow up Ultrasonic testing mock-up
8. Provide Ultrasonic testing guidance for personnel at par and lower levels
9. Coordinate Ultrasonic testing equipment's periodic check and maintenance
10. Coordinate Ultrasonic testing equipment's storage, transportation and inventory control
11. Verify Ultrasonic testing reports

12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise Ultrasonic testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

### Ultrasonic Testing Level 4

#### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review procedures, equipment and personnel for NDT testing in designated projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility in maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive shall be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from client/sub-contractors
4. Approve NDT procedures that are to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for a follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT trainings
11. Conduct appraisal on NDT personnel's work performance
12. Carry out audit on NDT equipment and accessories

13. Prepare progress reports of NDT performed at various stages of projects
14. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## CCUPATIONAL DEFINITION

### Ultrasonic Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan NDT requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are expected to assume the responsibility for organising the implementation of the NDT plan and ensure that these are carried out in a professional and safe manner.

A NDT Manager shall be able to:

1. Plan, during the design stage of all NDT requirements, all of the required engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT project's tender specifications that are to be incorporated into the overall bidding document
4. Develop NDT performance test during the construction stage
5. Identify the specific NDT methods requirements for the project
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspection, based on cost and the technical capabilities of the service provider
9. Recommend further action(s) to be taken based on NDT results in the projects

10. Organise project management review meetings

- Annex 6** : Occupational Definitions in the NDT Sector for **NUCLEAR POWER SUB SECTOR**
- Annex 6.2** : Ultrasonic Testing (UT)
- Annex 6.2.2** : Casting and Forging



## OCCUPATIONAL DEFINITION

### Ultrasonic Testing Level 1

#### ULTRASONIC TESTING ASSISTANT TECHNICIAN (CASTING AND FORGING)

An Ultrasonic Testing Assistant Technician (Casting and Forging) is expected to set up ultrasonic testing equipment and perform ultrasonic testing on casting and forging according to specific written instructions under the supervision of a level 2 or level 3 personnel,

An Ultrasonic Testing Assistant Technician (Casting and Forging) should be able to:

1. Perform ultrasonic testing equipment's inventory and storage control
2. Perform ultrasonic testing apparatus and equipment's periodic check
3. Set up the ultrasonic testing equipment
4. Perform the ultrasonic testing inspection surface area preparation
5. Perform the thickness measurement ultrasonic testing
6. Perform ultrasonic testing using longitudinal wave probe
7. Record and classify the ultrasonic testing on casting and forging results
8. Prepare ultrasonic testing test reports.
9. Perform and implement established safety and security procedures.

***NOTE:** Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Ultrasonic Testing Level 2

### **ULTRASONIC TESTING TECHNICIAN (CASTING AND FORGING)**

An Ultrasonic Testing Technician (Casting and Forging) is expected to prepare the ultrasonic testing instructions, provide ultrasonic testing guidance, perform ultrasonic testing on casting and forging, carry out ultrasonic flaw interpretations and evaluations according to specific written established procedures.

An Ultrasonic Testing Technician (Casting and Forging) should be able to:

1. Select and define the limitations and advantages of the application of the ultrasonic testing technique
2. Prepare ultrasonic testing instructions according to applicable ultrasonic testing procedures.
3. Perform and coordinate ultrasonic testing equipment's calibration and maintenance
4. Perform and coordinate ultrasonic testing equipment's inventory and storage control
5. Set up and verify ultrasonic testing equipment's settings
6. Perform ultrasonic testing using longitudinal and shear wave probe
7. Perform ultrasonic testing interpretation and evaluation according to codes, standards, specifications and procedures
8. Report the results of ultrasonic testing on casting and forging.
9. Perform and supervise all ultrasonic testing tasks at par or below level 2
10. Provide ultrasonic testing guidance for personnel at par or below level 2

11. Perform, implement and coordinate established safety and security procedures



## OCCUPATIONAL DEFINITION

Ultrasonic Testing Level 3

### ULTRASONIC TESTING SENIOR TECHNICIAN (CASTING AND FORGING)

An Ultrasonic Senior Technician (Casting and Forging) is expected to develop and validate the ultrasonic testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, verify and interpret ultrasonic testing reports, codes, standards, specifications and procedures.

An Ultrasonic Senior Technician (Casting and Forging) should be able to:

1. Assume full responsibility for ultrasonic testing facility and staff technical development
2. Develop ultrasonic testing procedures
3. Validate ultrasonic testing procedures from clients/sub-contractors
4. Approve ultrasonic testing procedures that are to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret ultrasonic testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate Ultrasonic testing instructions and procedures
7. Designate and prepare the particular test technique, instructions and procedures for a follow up Ultrasonic testing mock-up
8. Provide ultrasonic testing guidance for personnel at par or lower levels
9. Coordinate ultrasonic testing equipment's periodic check and maintenance
10. Coordinate ultrasonic testing equipment's storage, transportation and inventory control
11. Verify ultrasonic testing reports

12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise ultrasonic testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Ultrasonic Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review procedures, equipment and personnel for NDT testing in the projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from client/sub-contractors
4. Approve NDT procedures to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for a follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT trainings
11. Conduct appraisal on NDT personnel's work performance
12. Carry out audit on NDT equipment and accessories

13. Prepare progress report of NDT performed at various stages of projects
14. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Ultrasonic Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan NDT requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are expected to assume the responsibility for organising the implementation of the NDT plan, and ensuring that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage, all of the NDT requirements of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT project's tender specifications that are to be incorporated into the overall bidding document
4. Develop NDT performance test during the construction stage
5. Identify specific NDT methods requirements for the project
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspection, based on cost and technical capabilities of the service provider
9. Recommend further action(s) to be taken based on NDT results in the projects

## 11. Organise project management review meetings

- Annex 6** : Occupational Definitions in the NDT Sector for **NUCLEAR POWER SUB SECTOR**
- Annex 6.3** : Magnetic Particle Testing (MT)
- Annex 6.3.1** : Welded Construction



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 1

#### MAGNETIC PARTICLE TESTING ASSISTANT TECHNICIAN (WELDED CONSTRUCTION)

A Magnetic Particle Testing Assistant Technician (Welded Construction) is expected to set up the equipment and perform testing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Magnetic Particle Testing Assistant Technician (Welded Construction) should be able to:

1. Perform Magnetic Particle Testing Equipment's Periodic Check
2. Perform Magnetic Particle inventory control and equipment's storage
3. Set up Magnetic Particle Testing Equipment
4. Perform Magnetic Particle Testing Surface Area Preparation
5. Perform Fluorescent and Visible Magnetic Particle Testing
6. Perform Wet and Dry Magnetic Particle Testing
7. Record and classify the results of the tests
8. Prepare Magnetic Particle Testing test report
9. Perform and implement established safety and security procedures

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 2

### **MAGNETIC PARTICLE TESTING TECHNICIAN (WELDED CONSTRUCTION)**

A Magnetic Particle Testing Technician (Welded Construction) is expected to set up and verify equipment settings, prepare Magnetic Particle Testing instructions, perform testing, interpretations and evaluation results according to codes, standards, specifications and procedures.

A Magnetic Particle Testing Technician (Welded Construction) should be able to:

1. Prepare Magnetic Particle Testing Work Instruction according to codes, standards, specifications and procedures
2. Provide Magnetic Particle Testing Guidance for personnel at par or below level 2
3. Select and define the limitations and advantages of application of the testing method
4. Set up and verify the equipment's settings
5. Perform and supervise Magnetic Particle Testing activities
6. Perform and supervise all Magnetic Particle Testing tasks at par or below level 2
7. Perform the interpretation and evaluation of the results according to applicable codes, standards, specifications or procedure
8. Report the results of Magnetic Particle Testing
9. Perform and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 3

### **MAGNETIC PARTICLE TESTING SENIOR TECHNICIAN (WELDED CONSTRUCTION)**

A Magnetic Particle Testing Senior Technician (Welded Construction) is expected to develop and validate Magnetic Particle testing instructions and procedures, conduct technical briefings and on-the-job training, to prepare follow up inspection proposal, to verify and interpret testing reports, codes, standards, specification and procedures.

A Magnetic Particle Testing Senior Technician (Welded Construction) should be able to:

1. Verify Magnetic Particle Testing Reports
2. Prepare Magnetic Particle Testing Procedures
3. Validate Magnetic Particle Testing Procedures And Instructions
4. Prepare Magnetic Particle Testing technical proposal
5. Coordinate Magnetic Particle Testing Equipment Calibration And Validation
6. Conduct technical briefings
7. Supervise and coordinate Magnetic Particle Testing Activities
8. Conduct on-the-job training
9. Assume full responsibility for a test facility, examination centre, and staff
10. Establish and review editorials for technical correctness
11. Interpret codes, standards, specifications and procedures
12. Perform, coordinate and supervise all Magnetic Particle Testing tasks at all levels
13. Provide Magnetic Particle Testing guidance for personnel at all levels

14. Perform, coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Magnetic Particle Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate procedures, equipment and personnel for magnetic particle testing in NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all legal requirements imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify magnetic particle testing procedures that are applicable for a designated magnetic particle testing project
2. Evaluate and qualify magnetic particle testing equipment and other facilities that are to be used for magnetic particle testing projects
3. Evaluate and qualify magnetic particle testing personnel involved in magnetic particle testing projects
4. Periodic monitoring of magnetic particle testing performance in magnetic particle testing projects
5. Prepare and present progress report of magnetic particle testing performed at various stages to magnetic particle testing projects client
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness magnetic particle testing performed by Technicians at the fabrication shops or sites

8. Provide a storage area and security for magnetic particle equipment used for inspections at magnetic particle testing project sites
9. Liaise with the authorities (e.g. DOSH, NIOSH) on matters related to magnetic particle testing projects
10. Understand the relevant codes and standards that are applicable for designated magnetic particle testing projects



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan magnetic particle testing requirements, develop magnetic particle testing related quality plan, evaluate magnetic particle testing results for magnetic particle testing projects, and provide further recommendations based on these results. They are expected to assume the responsibility for organizing the implementation of the magnetic particle testing plans, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage of magnetic particle testing projects for the requirement of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where magnetic particle testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop magnetic particle testing projects tender specifications that are to be incorporated into the overall bidding document
4. Develop magnetic particle testing performance test during the construction stage of magnetic particle testing projects
5. Identify requirements for magnetic particle testing for specific magnetic particle testing projects
6. Identifying correct magnetic particle testing methods that are to be applied in magnetic particle testing projects
7. Establish a sampling size and location for magnetic particle testing projects

8. Evaluate magnetic particle testing during magnetic particle testing projects tender submission
9. Select the most suitable magnetic particle testing service provider as a backup or a sub-contractor to perform inspection during magnetic particle testing projects, based on cost and technical capabilities of the service provider
10. Approved magnetic particle testing procedures that are to be applied in magnetic particle testing projects in accordance with the applicable codes, standards and specifications
11. Review the results of magnetic particle testing.
12. Recommend further action(s) to be taken based on magnetic particle testing results in magnetic particle testing projects

- Annex 6** : Occupational Definitions in the NDT Sector for **NUCLEAR POWER SUB SECTOR**
- Annex 6.3** : Magnetic Particle Testing (MT)
- Annex 6.3.2** : Casting and Forging



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 1

#### MAGNETIC PARTICLE TESTING ASSISTANT TECHNICIAN (CASTING AND FORGING)

A Magnetic Particle Testing Assistant Technician (Casting and Forging) is expected to set up magnetic particle testing equipment and perform magnetic particle testing on casting and forging according to specific written instructions under the supervision of a level 2 or level 3 personnel.

A Magnetic Particle Testing Assistant Technician (Casting and Forging) should be able to:

1. Perform the magnetic particle testing equipment's inventory and storage control
2. Perform the magnetic particle testing apparatus and equipment's periodic check
3. Set up the magnetic particle testing equipment
4. Perform magnetic particle testing inspection surface area preparation
5. Perform magnetic particle testing
6. Record and classify the magnetic particle on casting and forging results
7. Prepare magnetic particle testing test report.
8. Perform and implement established safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 2

#### MAGNETIC PARTICLE TESTING TECHNICIAN (CASTING AND FORGING)

A Magnetic Particle Testing Technician (Casting and Forging) is expected to prepare the magnetic particle testing instructions, provide magnetic particle testing guidance, perform magnetic particle testing on casting and forging, and carry out magnetic particle defect interpretation and evaluation according to specific written established procedures.

A Magnetic Particle Testing Technician (Casting and Forging) should be able to:

1. Select and define the limitations and advantages of application of the magnetic particle testing technique
2. Prepare the magnetic particle testing instructions according to applicable magnetic particle testing procedures.
3. Perform and coordinate magnetic particle testing equipment's calibration and maintenance
4. Perform and coordinate magnetic particle testing equipment's inventory and storage control
5. Set up and verify magnetic particle testing equipment's settings
6. Perform magnetic particle testing
7. Perform magnetic particle testing interpretation and evaluation according to codes, standards, specifications and procedures
8. Report the results of magnetic particle testing on casting and forging.
9. Perform and supervise all magnetic particle testing tasks at par or below level

10. Provide magnetic particle testing guidance for personnel at par or below level 2
11. Perform, implement and coordinate established safety and security procedures



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 3

#### MAGNETIC PARTICLE TESTING SENIOR TECHNICIAN (CASTING AND FORGING)

A Magnetic Particle Testing Senior Technician (Casting and Forging) Senior Technician is expected to develop and validate magnetic particle testing instructions and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, verify and interpret magnetic particle testing reports, codes, standards, specifications and procedures.

A Magnetic Particle Testing Senior Technician (Casting and Forging) should be able to:

1. Assume full responsibility for magnetic particle testing facility and staff technical development
2. Develop magnetic particle testing procedures
3. Validate magnetic particle testing procedures from clients/sub-contractors
4. Approve magnetic particle testing procedures that are to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret magnetic particle testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate magnetic particle testing instructions and procedures
7. Designate and prepare the particular test technique, instructions and procedures for a follow up magnetic particle testing mock-up
8. Provide magnetic particle testing guidance for personnel at par and lower levels

9. Coordinate magnetic particle testing equipment's periodic check and maintenance
10. Coordinate magnetic particle testing equipment's storage, transportation and inventory control
11. Verify magnetic particle testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise ultrasonic testing activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## OCCUPATIONAL DEFINITION

Magnetic Particle Testing Level 4

### NDT TECHNICAL EXECUTIVE

A NDT Technical Executive is expected to review procedures, equipment and personnel for NDT testing in the projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from clients/sub-contractors
4. Approve NDT procedures that are to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for a follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT trainings
11. Conduct appraisal on NDT personnel work performance
12. Carry out audit on NDT equipment and accessories
13. Prepare progress NDT reports performed on/at various stages of projects

14. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Magnetic Particle Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan NDT requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendations based on these results. They are expected to assume the responsibility for organising the implementation of the NDT plan, and ensuring that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage, all of the NDT requirements regarding engineering components, parts and systems to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT projects tender specifications that are to be incorporated into the overall bidding document
4. Develop NDT performance test during the construction stage
5. Identify specific NDT methods requirements for the project
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspection, based on cost and the technical capabilities of the service provider
9. Recommend further action(s) to be taken, based on NDT results in the projects
12. Organise project management review meetings

- Annex 6** : Occupational Definitions in the NDT Sector for **NUCLEAR POWER SUB SECTOR**
- Annex 6.4** : Liquid Penetrant Testing (PT)
- Annex 6.4.1** : Welded Construction



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 1

#### LIQUID PENETRANT TESTING ASSISTANT TECHNICIAN (WELDED CONSTRUCTION)

A Liquid Penetrant Testing Assistant Technician (Welded Construction) is expected to set up the equipment and perform testing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Liquid Penetrant Testing Assistant Technician (Welded Construction) should be able to:

1. Perform Penetrant Testing Equipment's Periodic Check
2. Perform Penetrant Testing inventory control and equipment's storage
3. Set up the Penetrant Testing Equipment
4. Perform Penetrant Testing Surface Area Preparation
5. Perform Fluorescent and Visible Penetrant Testing
6. Perform Wet and Dry Penetrant Testing
7. Record and classify the results of the tests
8. Prepare Penetrant Testing test reports
9. Perform and implement established safety and security procedures

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Liquid Penetrant Testing Level 2

### **LIQUID PENETRANT TESTING TECHNICIAN (WELDED CONSTRUCTION)**

A Liquid Penetrant Testing Technician (Welded Construction) is expected to set up and verify equipment settings, prepare Penetrant Testing instructions, perform testing, interpretation and evaluation of the results according to established codes, standards, specifications and procedures.

A Liquid Penetrant Testing Technician (Welded Construction) should be able to:

1. Prepare Penetrant Testing Work Instruction according to codes, standards, specifications and procedures
2. Provide Penetrant Testing Guidance for personnel at par or below level 2
3. Select and define the limitations and advantages of application of the testing method
4. Set up and verify the equipment's settings
5. Perform and supervise Penetrant Testing activities
6. Perform and supervise all the Penetrant Testing tasks at par or below level 2
7. Perform interpretation and evaluation of the results according to the applicable codes, standards, specifications or procedure
8. Report the results of Penetrant Testing
9. Perform and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Liquid Penetrant Testing Level 3

### **LIQUID PENETRANT TESTING SENIOR TECHNICIAN (WELDED CONSTRUCTION)**

A Liquid Penetrant Testing Assistant Senior Technician (Welded Construction) is expected to develop and validate the Penetrant testing instruction and procedures, conduct technical briefings and on-the-job training, prepare a follow up inspection proposal, verify and interpret testing report, codes, standards, specification and procedures.

A Liquid Penetrant Testing Assistant Senior Technician (Welded Construction) should be able to:

1. Verify Penetrant Testing Reports
2. Prepare Penetrant Testing Procedures
3. Validate Penetrant Testing Procedures And Instructions
4. Prepare Penetrant Testing technical proposal
5. Coordinate Penetrant Testing Equipment Calibration And Validation
6. Conduct technical briefings
7. Supervise and coordinate Penetrant Testing Activities
8. Conduct on-the-job training
9. Assume full responsibility for a test facility, examination centre, and staff
10. Establish and review editorials for technical correctness
11. Interpret codes, standards, specifications and procedures
12. Perform, coordinate and supervise all Penetrant Testing tasks at all levels
13. Provide Penetrant Testing guidance for personnel at all levels

14. Perform, coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Liquid Penetrant Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive) is expected to evaluate procedures, equipment and personnel for magnetic particle testing in NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify penetrant testing procedures that are applicable for a particular magnetic particle testing projects
2. Evaluate and qualify penetrant testing equipment and other facilities that are to be used for magnetic particle testing projects
3. Evaluate and qualify penetrant testing personnel involved in magnetic particle testing projects
4. Periodic monitoring of penetrant testing performance in penetrant testing projects
5. Prepare and present progress penetrant testing report performed on at various stage to penetrant testing projects client
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness penetrant testing performed by Technicians at the fabrication shops or sites

8. Provide a storage area and security for penetrant testing equipment used for inspection at penetrant testing project sites
9. Liaise with the authorities (e.g. DOSH, NIOSH) on matters related to penetrant testing projects
10. Understand the relevant codes and standards that are applicable for particular penetrant testing projects



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan penetrant testing requirements, develop penetrant testing related quality plan, evaluate penetrant testing results for penetrant testing projects, and provide further recommendations based on these results. They are expected to assume the responsibility for organising the implementation of the penetrant testing plans, and ensure that these are carried out in a professional and safe manner.

A NDT Manager should be able to:

1. Plan, during the design stage, all penetrant testing project's requirement for engineering components, parts and systems that needs to be inspected
2. Develop quality plan (stages where penetrant testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop penetrant particle testing projects tender specification that are to be incorporated into the overall bidding document
4. Develop penetrant particle testing performance testing during the construction stage of penetrant testing projects
5. Identify the requirements for penetrant testing for specific penetrant testing projects
6. Identifying correct penetrant testing methods that are to be applied in penetrant testing projects
7. Establish a sampling size and location for penetrant testing projects

8. Evaluate the penetrant testing during penetrant testing projects tender submission
9. Select the most suitable penetrant testing service provider as a backup or a sub-contractor to perform inspection during penetrant testing projects, based on cost and technical capabilities of the service provider
10. Approve penetrant testing procedures that are to be applied in penetrant testing projects in accordance with the applicable code's standards and specifications
11. Review the results of magnetic particle testing.
12. Recommend further action(s) to be taken based on penetrant testing results in penetrant testing projects

- Annex 6** : Occupational Definitions in the NDT Sector for **NUCLEAR POWER SUB SECTOR**
- Annex 6.4** : Liquid Penetrant Testing (PT)
- Annex 6.4.2** : Casting and Forging



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 1

#### LIQUID PENETRANT TESTING ASSISTANT TECHNICIAN (CASTING AND FORGING)

A Liquid Penetrant Testing Assistant Technician (Casting and Forging) is expected to set up the penetrant testing equipment and perform penetrant magnetic particle testing on casting and forging according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Liquid Penetrant Testing Assistant Technician (Casting and Forging) should be able to:

1. Perform the penetrant testing equipment's inventory and storage control
2. Perform the penetrant testing apparatus and equipment's periodic check
3. Set up the penetrant testing equipment
4. Perform penetrant testing inspection surface area preparation
5. Perform penetrant testing
6. Record and classify the penetrant on casting and forging results
7. Prepare penetrant testing test reports.
8. Perform and implement established safety and security procedures.

***NOTE:** Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

### Liquid Penetrant Testing Level 2

#### **LIQUID PENETRANT TESTING TECHNICIAN (CASTING AND FORGING)**

A Penetrant Testing Technician (Casting and Forging) is expected to prepare the penetrant testing instruction and provide penetrant testing guidance; perform penetrant testing on casting and forging; carry out penetrant defect interpretations and evaluations according to specific written established procedures.

A Penetrant Testing Technician (Casting and Forging) should be able to:

1. Select and define the limitations and advantages of the application of the penetrant testing technique
2. Prepare penetrant testing Instruction according to applicable penetrant testing procedures.
3. Perform and coordinate penetrant testing equipment's calibration and maintenance
4. Perform and coordinate penetrant testing equipment's inventory and storage control
5. Set up and verify the penetrant testing equipment's settings
6. Perform penetrant testing
7. Perform penetrant testing's interpretation and evaluation according to codes, standards, specifications and procedures
8. Report the results of penetrant testing on casting and forging.
9. Perform and supervise all penetrant testing tasks at par or below level 2
10. Provide penetrant testing guidance for personnel at par or below level 2

11. Perform, implement and coordinate established safety and security procedures



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 3

#### LIQUID PENETRANT TESTING SENIOR TECHNICIAN (CASTING AND FORGING)

A Liquid Penetrant Testing Senior Technician (Casting and Forging) Senior Technician is expected to develop and validate the penetrant testing instructions and procedures, conduct technical briefings and on-the-job training, prepare follow up inspection proposal, verify and interpret penetrant testing reports, codes, standards, specifications and procedures.

A Liquid Penetrant Testing Senior Technician (Casting and Forging) Senior Technician should be able to:

1. Assume full responsibility for penetrant testing facility and staff technical development
2. Develop penetrant testing procedures
3. Validate penetrant testing procedures from client/sub-contractors
4. Approve penetrant testing procedures that are to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret penetrant testing codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate penetrant testing instructions and procedures
7. Designate and prepare a particular test's technique, instructions and procedures for a follow up penetrant testing mock-up
8. Provide penetrant testing guidance for personnel at and below certain levels
9. Coordinate the penetrant testing equipment's periodic check and maintenance

10. Coordinate the penetrant testing equipment's storage, transportation and inventory control
11. Verify penetrant testing reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise penetrant testing activities at and below certain levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Liquid Penetrant Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to review procedures, equipment and personnel for NDT testing in designated projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensuring that all of the legal requirements that are imposed by clients and the relevant authorities are being duly complied with.

A NDT Technical Executive shall be able to:

1. Assume full responsibility for NDT facility and staff development
2. Review NDT procedures
3. Validate NDT procedures from clients/sub-contractors
4. Approve NDT procedures that are to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret NDT codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate NDT procedures
7. Review test techniques, instructions and procedures for follow up NDT mock-up (performance test)
8. Review NDT reports
9. Conduct technical meetings
10. Conduct NDT trainings
11. Conduct appraisal on NDT personnel's work performance
12. Carry out audit on NDT equipment and accessories

13. Prepare progress report of NDT performed at various stages of projects
14. Prepare job specifications for senior Technicians, Technicians and Assistant Technicians
15. Liaise with the authorities (e.g. AELB, DOSH) on NDT matters related to the projects



## OCCUPATIONAL DEFINITION

### Liquid Penetrant Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan NDT requirements, develop NDT related quality plan, evaluate NDT results for NDT projects, and provide further recommendation based on these results. They are expected to assume the responsibility for organising the implementation of the NDT plans, and ensuring that these are carried out in a professional and safe manner.

A NDT Manager shall be able to:

1. Plan, during the design stage, all of the NDT requirements of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT projects work to be applied and witnessed by customers-construction, operation, maintenance and assessment stages)
3. Develop NDT projects tender specification to be incorporated into the overall bidding document
4. Develop NDT performance test during the construction stage
5. Identify specific NDT method's requirements for the project
6. Establish NDT work distribution, sampling size and location for the projects
7. Evaluate NDT documents for tender submission
8. Select the most suitable NDT service provider as a backup or a sub-contractor to perform NDT inspection, based on cost and technical capabilities of the service provider
9. Recommend further action(s) to be taken based on NDT results in the projects

13. Organise project management review meetings

- Annex 6** : Occupational Definitions in the NDT Sector for **NUCLEAR POWER SUB SECTOR**
- Annex 6.5** : Eddy Current Testing (ET)
- Annex 6.5.1** : Tubes and Plates



## OCCUPATIONAL DEFINITION

### Eddy Current Testing Level 1

#### EDDY CURRENT TESTING ASSISTANT TECHNICIAN (TUBES AND PLATES)

An Eddy Current Testing Assistant Technician (Tubes and Plates) is expected to set up the equipment and perform the testing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

An Eddy Current Testing Assistant Technician (Tubes and Plates) should be able to:

1. Perform Eddy Current Testing Equipment Periodic Check
2. Perform inventory control and equipment's storage
3. Set up Eddy Current Testing Equipment
4. Perform Eddy Current Testing Surface Area Preparation
5. Perform Conductivity Inspections
6. Perform Surface Inspection
7. Perform Thin Material's Thickness Measurement
8. Perform Bolt Hole Inspections
9. Record and classify the results of the tests
10. Prepare Eddy Current test reports
11. Perform and implement established safety and security procedures

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Eddy Current Testing Level 2

### **EDDY CURRENT TESTING TECHNICIAN (TUBES AND PLATES)**

An Eddy Current Testing Technician (Tubes and Plates) is expected to set up and verify the equipment's settings and prepare the Eddy Current Testing Work Instruction, perform testing, and interpret and evaluate the results according to the codes, standards, specifications and procedures.

An Eddy Current Testing Technician (Tubes and Plates) should be able to:

1. Prepare Eddy Current Testing Work instruction according to codes, standards, specifications and procedures
2. Provide Eddy Current Testing Guidance for personnel at par or below level 2
3. Select and define the limitations and advantages of the application of the testing method
4. Set up and verify the equipment's settings
5. Perform Tubing Inspection
6. Perform and supervise Eddy Current Testing Work
7. Perform interpretation and evaluation results according to applicable codes, standards, specifications or procedures
8. Report the results of non-destructive tests
9. Perform and implement established safety and security procedures



## OCCUPATIONAL DEFINITION

Eddy Current Testing Level 3

### EDDY CURRENT TESTING TECHNICIAN (TUBES AND PLATES)

An Eddy Current Testing Senior Technician (Tubes and Plates) is expected to develop and validate ultrasonic testing instructions and procedures, conduct technical briefing and on-the-job training, prepare a follow up inspection proposal, and verify and interpret ultrasonic testing report, codes, standards, specifications and procedures.

An Eddy Current Testing Senior Technician (Tubes and Plates) should be able to:

1. Verify Eddy Current Testing Reports
2. Prepare Eddy Current Testing Procedures
3. Validate Eddy Current Testing Procedures And Instruction
4. Prepare Eddy Current Testing technical proposal
5. Coordinate Eddy Current Testing Equipment Calibration And Validation
6. Conduct technical briefings
7. Supervise and coordinate Eddy Current Testing Work Activities
8. Conduct on-the-job training
9. Assume full responsibility for a test facility, examination centre, and staff
10. Establish and review editorials for technical correctness
11. Interpret codes, standards, specifications and procedures
12. Perform, coordinate and supervise Eddy Current Testing at all levels
13. Provide guidance for personnel at all levels
14. Perform, coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Eddy Current Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate procedures, equipment and personnel for eddy current testing in designated NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility of maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by the clients and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify NDT procedures that are applicable for a particular NDT testing projects
2. Evaluate and qualify NDT equipment and other facilities that are to be used NDT projects
3. Evaluate and qualify NDT personnel involved in NDT testing projects
4. Periodic monitoring of NDT testing performance in NDT testing projects
5. Prepare and present progress reports of NDT performed at various stages to NDT testing project's client
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness NDT testing performed by Technicians at the fabrication shops or sites
8. Provide a storage area and security for NDT equipment used for inspection at NDT testing project sites

9. Liaise with the authorities (e.g. AELB, DOSH, NIOSH) on matters related to NDT testing projects
10. Understand the relevant codes and standards that are applicable for particular NDT testing projects



## OCCUPATIONAL DEFINITION

### Eddy Current Testing Level 5

#### NDT MANAGER

A NDT Manager is expected to plan non-destructive testing requirements, develop NDT testing related quality plan, evaluate NDT testing results for NDT testing projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organising the implementation of the NDT testing plan, and ensure that these are carried out in a professional and safe manner.

A NDT Manager shall be able to:

1. Plan, during the design stage, all NDT testing projects for the requirement of engineering components, parts and system to be inspected
2. Develop quality plan (stages where NDT testing projects work to be applied and witnessed by customers-construction, operations and maintenance and operation and assessment stages)
3. Develop NDT testing projects tender specification that are to be incorporated into the overall bidding document
4. Develop NDT testing performance test during the construction stage of NDT testing projects
5. Identify the requirements for non-destructive testing for specific NDT testing projects
6. Identifying the correct NDT testing methods that are to be applied in NDT testing projects
7. Establish a sampling size and location for NDT testing projects
8. Evaluate non-destructive testing during NDT testing projects tender submission

9. Select the most suitable NDT testing service provider as a backup or a sub-contractor to perform inspection during NDT testing projects, based on cost and technical capabilities of the service provider
10. Approve NDT testing procedures that are to be applied in non-destructive testing projects in accordance with applicable code standards and specifications
11. Review the results of non-destructive testing in NDT testing projects
12. Recommend further action(s) to be taken based on non-destructive testing results in NDT testing projects

- Annex 6** : Occupational Definitions in the NDT Sector for **NUCLEAR POWER SUB SECTOR**
- Annex 6.6** : Visual Testing (VT)
- Annex 6.6.1** : Engineering Components



## OCCUPATIONAL DEFINITION

### Visual Testing Level 1

#### VISUAL TESTING ASSISTANT TECHNICIAN (ENGINEERING COMPONENTS)

A Visual Testing Assistant Technician (Engineering Components) is expected to set up the equipment and perform visual inspections and image processing according to specific written instructions under the supervision of a level 2 or level 3 personnel,

A Visual Testing Assistant Technician (Engineering Components) shall be able to:

1. Perform the visual inspection equipment's periodic check
2. Perform the visual inspection equipment's storage
3. Transport the visual inspection equipment
4. Perform visual inspection inventory control
5. Prepare visual inspection area
6. Setup visual inspection equipment
7. Perform visual inspection testing
8. Prepare image recording, storing and retrieving
9. Perform image recording, storing and retrieving
10. Record and classify test result of visual inspection
11. Prepare visual inspection test report
12. Perform and implement safety and security procedures.

*NOTE: Level 1 certified personnel should not be responsible for the choice of test method or technique to be used, nor for the assessment of test results.*



## **OCCUPATIONAL DEFINITION**

Visual Testing Level 2

### **VISUAL TESTING TECHNICIAN (ENGINEERING COMPONENTS)**

A Visual Testing Technician (Engineering Components) is expected to set up and verify the equipment, perform and coordinate visual inspection, film interpretation and evaluation, prepare visual inspection written instructions according to the applicable codes, standards specifications or procedures.

A Visual Testing Technician (Engineering Components) should be able to:

1. Perform and coordinate the x-ray and gamma ray visual inspection inventory control and equipment's periodic check
2. Perform and coordinate visual inspection equipment's transportation and storage
3. Prepare visual inspection instructions according to the applicable visual inspection procedures
4. Setup and verify the visual inspection equipment's settings
5. Perform and coordinate visual inspection work activities at par or below level 2
6. Select and define the limitations and advantages of the applications of the inspection methods
7. Provide visual inspection guidance for personnel at par or below level 2
8. Interpret the test result according to the codes, standards & specifications being applied
9. Prepare visual inspection reports, interpretation and evaluation of the test results according to applicable codes, standards, specifications or procedures

10. Record and classify the visual inspection results
11. Monitor visual inspection equipment's maintenance, storage, inventory, transportation and etc
12. Perform and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Visual Testing Level 3

### **VISUAL TESTING TECHNICIAN (ENGINEERING COMPONENTS)**

A Visual Testing Senior Technician (Engineering Components) is expected to coordinate visual inspection equipment's maintenance, storage, transportation and inventory control, coordinate visual inspection activities, verify test reports, prepare and validate visual inspection procedures and instructions, conduct technical briefings and on-the-job training, and interpret codes, standards, specifications and procedures.

A Visual Testing Senior Technician shall be able to:

1. Assume full responsibility for visual inspection facility and staff technical development
2. Develop visual inspection procedures
3. Validate visual inspection procedures from clients/sub-contractors
4. Approve visual inspection procedures that are to be applied for projects in accordance with applicable codes, standards and specifications
5. Interpret visual inspection codes, standards, specifications and procedures
6. Establish and review editorials for technical correctness, and validate visual inspection instructions and procedures
7. Designate and prepare a particular test technique, instructions and procedures for a follow up visual inspection mock-up
8. Provide visual inspection guidance for personnel at par and lower levels
9. Coordinate visual inspection equipment's periodic check and maintenance
10. Coordinate visual inspection equipment's storage, transportation and inventory control

11. Verify visual inspection reports
12. Conduct technical briefings
13. Conduct on-the-job training
14. Coordinate and supervise visual inspection activities at par and lower levels
15. Coordinate and implement established safety and security procedures



## **OCCUPATIONAL DEFINITION**

Visual Testing Level 4

### **NDT TECHNICAL EXECUTIVE**

A NDT Technical Executive is expected to evaluate procedures, equipment and personnel for eddy current testing for designated NDT inspection projects. They are also expected to witness performance testing and prepare progress reports. They are expected to assume the responsibility for maintaining constant contact with clients and the relevant authorities, and also ensure that all of the legal requirements that are imposed by a client and the relevant authorities are being duly complied with.

A NDT Technical Executive should be able to:

1. Evaluate and qualify NDT procedures that are applicable for a particular NDT testing projects
2. Evaluate and qualify NDT equipment and other facilities that are to be used NDT projects
3. Evaluate and qualify NDT personnel that are involved in NDT testing projects
4. Periodic monitoring of NDT testing performance in NDT testing projects
5. Prepare and present progress reports of NDT performed at various stages to the NDT testing projects client
6. Prepare job specifications for Senior Technicians, Technicians and Assistant Technicians
7. Witness NDT testing performed by Technicians at the fabrication shops or sites
8. Provide a storage area and security for NDT equipment used for inspection at NDT testing project sites

9. Liaise with the authorities (e.g AELB, DOSH, NIOSH) on matters related to NDT testing projects
10. Understand the relevant codes and standards that are applicable for a particular NDT testing project



## OCCUPATIONAL DEFINITION

Visual Testing Level 5

### NDT MANAGER

A NDT Manager is expected to come up with an NDT testing plan requirement, develop NDT testing related quality plan, evaluate NDT testing results for NDT testing projects, and provide further recommendations based on these results. They are also expected to assume the responsibility for organizing the implementation of the NDT testing, and ensure that these are carried out in a professional and safe manner.

A NDT Manager shall be able to:

1. Plan, during the design stage, all of the NDT testing projects' requirement of engineering components, parts and systems that are to be inspected
2. Develop quality plan (stages where NDT testing projects work to be applied and witnessed by customers-construction, operation and maintenance and operation and assessment stages)
3. Develop NDT testing projects tender specifications that are to be incorporated into the overall bidding document
4. Develop NDT testing performance test during the construction stage of NDT testing projects
5. Identify requirements for non-destructive testing for specific NDT testing projects
6. Identifying correct NDT testing methods that are to be applied in NDT testing projects
7. Establish a sampling size and location for NDT testing projects

8. Evaluate non-destructive testing during NDT testing projects tender submission
9. Select the most suitable NDT testing service provider as a backup or a sub-contractor to perform inspection during NDT testing projects, based on cost and technical capabilities of the service provider
10. Approved NDT testing procedures that are to be applied in non-destructive testing projects, in accordance with the applicable codes, standards and specifications
11. Review the results of non-destructive testing in NDT testing projects
12. Recommend further action(s) to be taken based on non-destructive testing results in NDT testing projects

## LIST OF ABBREVIATIONS

|        |  |
|--------|--|
| DACUM  | Developing a Curriculum                                    |
| JPK    | Jabatan Pembangunan Kemahiran                              |
| AELB   | Atomic Energy Licensing Board                              |
| MLVK   | Majlis Latihan Vokasional Kebangsaan                       |
| MINT   | Malaysian Institute for Nuclear Technology Research        |
| ANM    | Agensi Nuklear Malaysia                                    |
| NITTCB | National Industrial Trade Training and Certification Board |
| DCA    | Department of Civil Aviation                               |
| DOSH   | Department Occupational Safety and Health                  |
| NDT    | Non Destructive Testing                                    |
| RT     | Radiographic Testing                                       |
| UT     | Ultrasonic Testing   |
| MT     | Magnetic Particle Testing                                  |
| PT     | Liquid Penetrant Testing                                   |
| ET     | Eddy Current Testing                                       |
| OA     | Occupational Analysis                                      |
| MSNT   | Malaysian Society for Non Destructive Testing              |
| NOSS   | National Occupational Skill Standard                       |
| RCA    | Regional Cooperative Agreement                             |
| PAUT   | Phase Array Ultrasonic Testing                             |
| AE     | Acoustic Emission Testing                                  |
| LRUT   | Long Range Ultrasonic Testing                              |
| TOFD   | Time of Flight Diffraction Testing                         |
| MAS    | Malaysian Airlines   |
| AIROD  | Aircraft Inspection Repair and Overhaul Depot              |
| QCS    | Qualification and Certification Scheme                     |
| ASNT   | American Society for Non-Destructive Testing               |
| NVTC   | National Vocational Training Council                       |
| ICNDT  | International Committee for NDT                            |
| IAEA   | International Atomic Energy Agency                         |
| ISO    | International Standardisation Organisation                 |

|        |   |
|--------|---|
| APCNDT | Asia- Pacific Committee for NDT                         |
| MRA    | Mutual Recognition Agreement                            |
| ILB    | Industrial Lead Body                                    |
| DSD    | Department of Skill Development                         |
| MOSTI  | Ministry of Science, Technology and Innovation          |
| NCB    | National Certification Body                             |
| SIRIM  | Standards and Industrial Research Institute of Malaysia |
| ICT    | Information and Communication Technology                |