STRUKTUR PEKERJAAN BAGI

SEKTOR INDUSTRI KIMPALAN

(Occupational Job Structures for

Welding Industry Sector)

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Ministry of Human Resources, Malaysia

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1. EXECUTIVE SUMMARY

Welding is one of those construction niches that does not get a lot of attention, but is absolutely critical to the completion of any metal structure. The field of welding is not really a totally modern career born in the Industrial Revolution. Pictures of welders and their ancient tools have been discovered in sealed Egyptian tombs. Welding is the process of joining materials through the use of heat with or without pressure. Many people credit developments in the art of welding as enabling many of the technological advances that marked the industrialisation of the world.

The quality and skills of human resource is vital to the success of the Welding Industry sector. So, strengthening collaboration in human resource development among the industry, public sector organisations and the academia is very important to produce quality workers.

In conducting the Occupational Analysis on the Welding sector, information on the Malaysian welding industry sector was gathered through literature research and workshop sessions that were held in an attempt to get a better understanding of the welding industry.

Welding is an industry with great potential. Endowed with strong government support and a substantial human resource, this industry could expand more in the future.

2. CONCEPT AND STRUCTURE OF MALAYSIAN SKILLS CERTIFICATION SYSTEM

2.1 NATIONAL OCCUPATIONAL SKILL STANDARD (NOSS)

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

SKM LEVEL 1: (Operation and Production)	Competent in performing a range of varied work activities most of which are routine and predictable.
SKM LEVEL 2: (Operation & Production)	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.
SKM LEVEL 3: (Supervisory)	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.
DKM LEVEL 4: (Executive)	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.
DLKM LEVEL 5: (Managerial)	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.

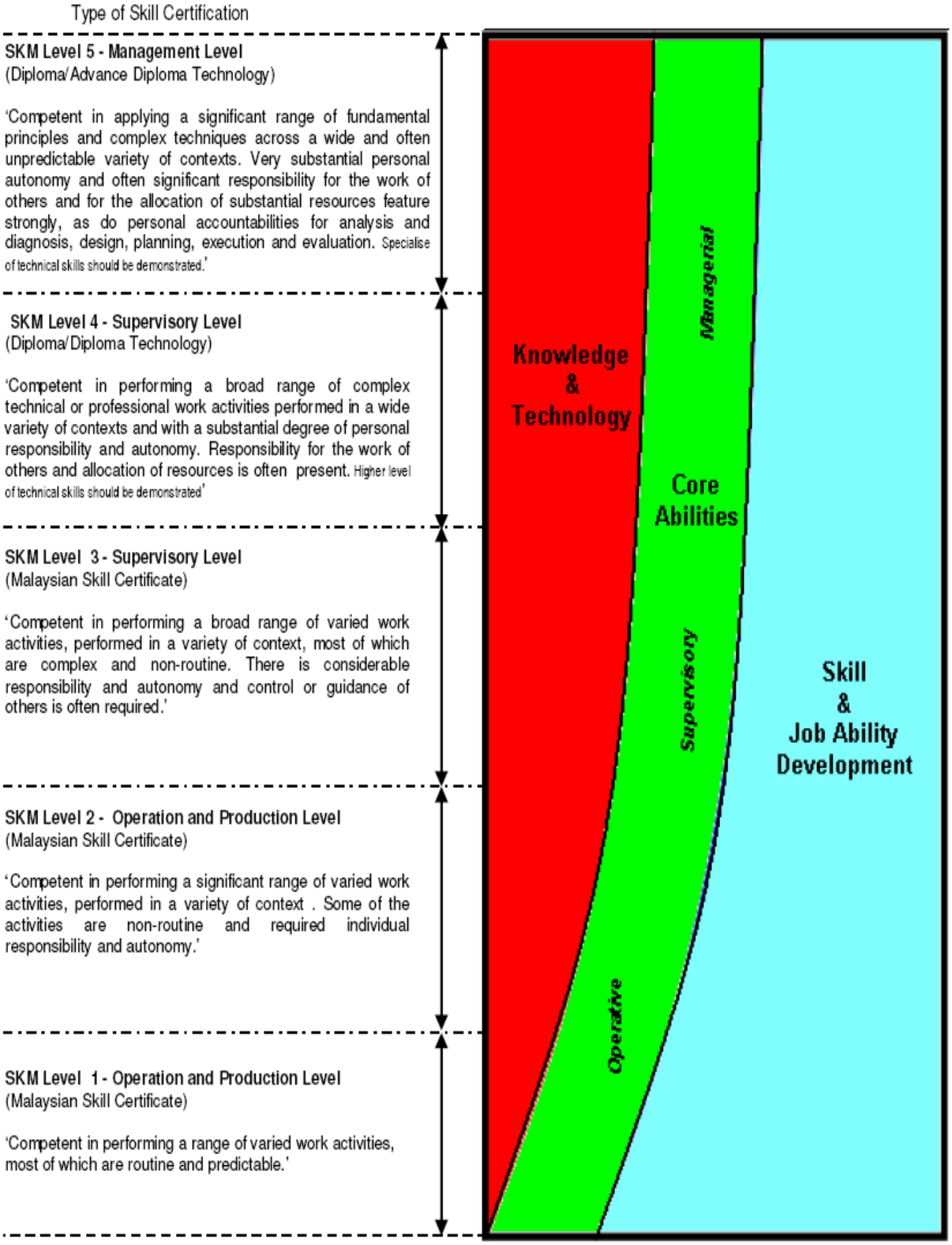

Figure 2.1: Skills Certification Structure

Source: *Department of Skills Development*
Date Reviewed*: 16 January 2009*

2.2 MALAYSIA OCCUPATIONAL SKILLS QUALIFICATION FRAMEWORK (MOSQF)

The Malaysia Occupational Skills Qualification Framework (MOSQF) is a framework that will be a unified system to bind and interlink all the qualifications awarded in Malaysia. The MOSQF will serve as an instrument that develops and classifies qualifications based on a set of criteria that are approved nationally and is at par with international good practices at the level of learning attained by the learners. This includes learning outcomes achieved and thus clarifying levels of learning. The criteria will be used and accepted by all Department of Skills Development (DSD) accredited centres. The MOSQF is developed based on the Malaysian Qualifications Framework (MQF) and also based on frameworks used and referenced by other countries such as England, Wales & Northern Ireland, Australia, New Zealand and Europe. Therefore the MOSQF will enable it to become a translation device to make qualifications more readable and understandable across different countries. The framework was developed in order to improve the current national training system for all parties of interest such as individuals, skills training providers, the Government, associations, professional bodies, the industry and the Malaysian community. The MOSQF has defined eight levels of qualifications in four sectors of education. The four sectors of education are the:

- skills sector
- vocational and technical sector
- life-long learning sector and
- higher education (university) sector

The eight levels of qualifications can be seen in *Figure 2.2: MOSQF – Four (4) Higher Education Sectors & Eight (8) Qualifications Levels*.

The definitions of each of the MOSQF levels are included in *Figure 2.3: Malaysia Occupational Skills Qualification Framework (MOSQF) Levels Description*

<table>
<tr><th rowspan="2">Qualification Levels</th><th colspan="3">Sectors</th><th rowspan="2">Lifelong Learning</th></tr>
<tr><th>Skills</th><th>Vocational and Training</th><th>Higher Education</th></tr>
<tr><td>8</td><td>Malaysian Skills Higher Meister</td><td></td><td>Doctoral Degree</td><td rowspan="11">Accreditation for Prior Experiential Learning (APEL)</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">Malaysian Skills Meister</td><td rowspan="2"></td><td>Master's Degree</td></tr>
<tr><td>Postgraduate Certificate & Diploma</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Malaysian Skills Higher Advanced Diploma</td><td rowspan="2"></td><td>Bachelor's Degree</td></tr>
<tr><td>Graduate Certificate & Diploma</td></tr>
<tr><td>5</td><td>Malaysian Skills Advanced Diploma</td><td>Advanced Diploma</td><td>Advanced Diploma</td></tr>
<tr><td>4</td><td>Malaysian Skills Diploma</td><td>Diploma</td><td>Diploma</td></tr>
<tr><td>3</td><td>Malaysian Skills Certificate 3</td><td rowspan="3">Vocational & Technical Certificate</td><td>Certificate</td></tr>
<tr><td>2</td><td>Malaysian Skills Certificate 2</td><td></td></tr>
<tr><td>1</td><td>Malaysian Skills Certificate 1</td><td></td></tr>
</table>

Figure 2.2: MOSQF – Four (4) Higher Education Sectors & Eight (8) Qualifications Levels

***Source**: MOSQ Division, Department of Skills Development*

***Date Reviewed**: Jun 2008*

MALAYSIA OCCUPATIONAL SKILLS QUALIFICATION FRAMEWORK (MOSQF)

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 **under-standing 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 problem**s. 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**

Level	Level Description
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.

Figure 2.3: Malaysia Occupational Skills Qualification Framework (MOSQF) Levels Description

***Source**: MOSQ Division, Department of Skills Development*
***Date Reviewed**: 2 April 2008*

2.3 EXAMPLES OF FRAMEWORKS IN OTHER COUNTRIES

There are two over-arching frameworks (also called meta-frameworks) in place in Europe. The Bologna Process involves 45 countries across Europe. The **Bologna Framework** (for the European Higher Education Area) is intended to provide a mechanism to relate national qualifications frameworks to each other and to enable international recognition of qualifications and international mobility of learners and graduates in higher education. The **European Qualifications Framework (EQF)** is a common European reference framework which links countries' qualifications together, acting as a translation device to make qualifications more readable and understandable across different countries and systems in Europe. The EQF is fully compatible with the Bologna framework. Both frameworks relate different countries qualifications systems / frameworks to each other. The National Framework of Qualifications remains the most relevant and provides the initial point of reference to learners and employers.

2.4 THE UNITED KINGDOM NATIONAL QUALIFICATIONS FRAMEWORK

The UK National Qualifications Framework (NQF) is also used as a reference for the definitions of each level in the current framework from Level 1 until Level 8. The NQF provides the benchmark of levels against which all UK qualifications are accredited. The NQF is also used internationally as the basis for comparison with other frameworks – particularly in terms of the levels of qualifications awarded. **Education Development International (EDI)** is the body responsible for the framework and awards qualifications that are recognised by employers, universities, governments and professional bodies worldwide. It is an awarding body accredited by the UK regulatory authorities Qualifications & Curriculum Authority / Scottish Qualifications Authority (QCA/ SQA). In addition to overall accreditation as an Awarding Body, EDI is accredited in the UK to offer a range of General and Vocational Qualifications by the Regulatory Authorities.

3. BACKGROUND OF THE WELDING INDUSTRY SECTOR

3.1 PREAMBLE

Welding (joining of two metals) in the early days was the process of fusion of two metal surfaces together by heating them in a forge. Welds made with good forge were really strong and delicate, and very hard to detect the welding mark with the naked eye. Welding is useful for a wide spectrum of industries due to the distinct properties that this process can alone offer.

Until the end of the 19th century, the only welding process was forge welding, which blacksmiths had used for centuries to join metals by heating and pounding them. Arc welding and oxyfuel welding were among the first processes to develop late in the century, and resistance welding followed soon after. Welding technology advanced quickly during the early 20th century as World War I and World War II drove the demand for reliable and inexpensive joining methods.

Following the wars, several modern welding techniques were applied including manual methods like Shielded Metal Arc Welding (SMAW), now one of the most popular welding methods, as well as semi-automatic and automatic processes such as Gas Tungsten Arc Welding (GTAW), Gas Metal Arc Welding (GMAW), Submerged Arc Welding (SAW) , Flux-Cored Arc Welding (FCAW), Resistant Welding/Spot Welding and Electro Slag Welding. Developments continued with the invention of laser beam welding and electron beam welding in the latter half of the century and is being used in Malaysia.

Currently in Malaysia, the Department of Skills Development has accredited the implementation of welding and fabrication technology training programs in local training institutions such as Institut Latihan Perindustrian, Institut Kemahiran Mara, Institut Kemahiran Belia Negara, Pusat GiatMara, technical secondary schools, state training institutions and private colleges. The courses run are such as Welding Engineer and

Assistant Engineer (Fabrication), Steel Structure & Fabrication, Shielded Metal Arc Welding (Carbon Steel & Stainless Steel), Shielded Metal Arc Welding (Carbon Steel & Stainless Steel & Aluminum), Sheet Metal and Gas Metal Arc (Carbon Steel, Stainless Steel & Aluminum).

Today, the welding technology continues to advance. Robotic welding is becoming more commonplace in manufacturing industrial settings, where development of new welding methods to meet industrial needs and to gain greater understanding of weld quality and properties are in progress.

3.2 DEFINITION OF WELDING

Welding is a process of joining two materials that forms a localised coalescence of metals or non-metals by heating the materials to the welding temperature with or without the application of pressure and filler materials.

3.3 WELDING PROCESSES

Some of the several welding processes currently being used in the industry are as the following:

(i) Shielded Metal Arc Welding (SMAW)

Shielded metal arc welding (SMAW), also known as manual metal arc (MMA) welding or informally as stick welding, is a manual arc welding process that uses a consumable electrode coated in flux to lay the weld. An electric current, in the form of either alternating current or direct current from a welding power supply, is used to form an electric arc between the electrode and the metals to be joined. As the weld is laid, the flux coating of the electrode disintegrates, giving off vapors that serve as a shielding gas and providing a layer of slag, both of which protect the solidifying weld area from atmospheric contamination.

Shielded metal arc welding is one of the world's most popular welding processes, accounting for over half of all welding in some countries. Because of its versatility and simplicity, it is particularly dominant in the maintenance and repair industry, and is heavily used in the construction of steel structures and in industrial fabrication. In recent years its use has declined as flux-cored arc welding has expanded in the construction industry and gas metal arc welding has become more popular in industrial environments. However, because of the low equipment cost and wide applicability, the process will likely remain popular, especially among amateurs and small businesses where specialised welding processes are uneconomical and unnecessary.

SMAW is often used to weld carbon steel, low and high alloy steel, stainless steel, cast iron, and ductile iron. While less popular for nonferrous materials, it can be used on nickel and copper and their alloys and, in rare cases, on aluminum.

(ii) Gas Tungsten Arc Welding (GTAW)

Gas tungsten arc welding (GTAW), also known as tungsten inert gas (TIG) welding, is an arc welding process that uses a non consumable tungsten electrode to produce the weld. The weld area is protected from atmospheric contamination by a shielding gas (usually an inert gas such as argon), and a filler metal is normally used, though some welds, known as autogenous welds, do not require it. A constant-current welding power supply produces energy which is conducted across the arc through a column of highly ionized gas and metal vapors known as a plasma.

GTAW is most commonly used to weld thin sections of stainless steel and light metals such as aluminum, magnesium, and copper alloys. The process grants the operator greater control over the weld than competing procedures such as shielded metal arc welding and gas metal arc welding, allowing for stronger, higher

quality welds. However, GTAW is comparatively more complex and difficult to master, and furthermore, it is significantly slower than most other welding techniques. A related process, plasma arc welding, uses a slightly different welding torch to create a more focused welding arc and as a result is often automated.

While the aerospace industry is one of the primary users of gas tungsten arc welding, the process is used in a number of other areas. Many industries use GTAW for welding thin workpieces, especially nonferrous metals. It is used extensively in the manufacture of space vehicles, and is also frequently employed to weld small-diameter, thin-wall tubing such as those used in the bicycle industry. In addition, GTAW is often used to make root or first pass welds for piping of various sizes. In maintenance and repair work, the process is commonly used to repair tools and dies, especially components made of aluminum and magnesium.

(iii) Gas Metal Arc Welding (GMAW)

Gas metal arc welding (GMAW), sometimes referred to by its subtypes metal inert gas (MIG) welding or metal active gas (MAG) welding, is a semi-automatic or automatic arc welding process in which a continuous and consumable wire electrode and a shielding gas are fed through a welding gun. A constant voltage, direct current power source is most commonly used with GMAW, but constant current systems, as well as alternating current, can be used. There are four primary methods of metal transfer in GMAW, called globular, short-circuiting, spray, and pulsed-spray, each of which has distinct properties and corresponding advantages and limitations.

Originally developed for welding aluminum and other non-ferrous materials in the 1940s, GMAW was soon applied to steels because it allowed for lower welding time compared to other welding processes. The cost of inert gas limited its use in steels until

several years later, when the use of semi-inert gases such as carbon dioxide became common. Further developments during the 1950s and 1960s gave the process more versatility and as a result, it became a highly used industrial process. Today, GMAW is the most common industrial welding process, preferred for its versatility, speed and the relative ease of adapting the process to robotic automation. The automobile industry in particular uses GMAW welding almost exclusively. Unlike welding processes that do not employ a shielding gas, such as shielded metal arc welding, it is rarely used outdoors or in other areas of air volatility. A related process, flux cored arc welding, often does not utilise a shielding gas, instead employing a hollow electrode wire that is filled with flux on the inside.

(iv) Flux-cored Arc Welding (FCAW)

Flux-cored arc welding (FCAW) is a semi-automatic or automatic arc welding process. FCAW requires a continuously-fed consumable tubular electrode containing a flux and a constant-voltage or, less commonly, a constant-current welding power supply. An externally supplied shielding gas is sometimes used, but often the flux itself is relied upon to generate the necessary protection from the atmosphere. The process is widely used in construction because of its high welding speed and portability.

FCAW was first developed in the early 1950s as an alternative to shielded metal arc welding (SMAW). The advantage of FCAW over SMAW is the economic aspect and the continuous process of welding without having to stop to change electrodes as opposed to SMAW that will drastically reduce the probability of defects being developed. This helps FCAW to gain prominence over SMAW.

(v) Submerged Arc Welding (SAW)

In submerged arc welding, or SAW, the heat for coalescence is provided by an electric arc struck between the work piece and the consumable electrode. Shielding is provided by a blanket of granular flux, deposited over the area to be welded.

Submerged arc welding (SAW) is a high quality, very high deposition rate welding process. Submerged arc welding being a high deposition rate welding process commonly used to join thick plates.

(vi) Resistance Welding

Resistance welding refers to a group of welding processes such as spot and seam welding that produce coalescence of faying surfaces where heat to form the weld is generated by the resistance of the welding current through the workpieces. Some factors influencing heat or welding temperatures are the proportions of the workpieces, the electrode materials, electrode geometry, electrode pressing force, weld current and weld time, etc. Small pools of molten metal are formed at the point of most electrical resistance (the connecting surfaces) as a high current (100–100 000 A) is passed through the metal. In general, resistance welding methods are efficient and cause little pollution, but their applications are limited to relatively thin materials and the equipment cost can be high.

Resistance Spot Welding (RSW), Resistance Seam Welding (RSEW), and Projection Welding (PW) are commonly used resistance welding processes. Resistance welding uses the application of electric current and mechanical pressure to create a weld between two pieces of metal. Weld electrodes conduct the electric current to the two pieces of metal as they are forged together.

(vii) Plasma Arc Welding

Plasma arc welding (PAW) is an arc welding process similar to gas tungsten arc welding (GTAW). The electric arc is formed between an electrode (which is usually but not always made of sintered tungsten) and the workpiece. The key difference from GTAW is that in PAW, by positioning the electrode within the body of the torch, the plasma arc can be separated from the shielding gas envelope. The plasma is then forced through a fine-bore copper nozzle which constricts the arc and the plasma exits the orifice at high velocities (approaching the speed of sound) and a temperature approaching 20,000 °C. Plasma arc welding is an advancement over the GTAW process. This process uses a non-consumable tungsten electrode and an arc constricted through a fine-bore copper nozzle. PAW can be used to join all metals that are weldable with GTAW (i.e., most commercial metals and alloys). PAW requires relatively expensive and complex equipment as compared to GTAW; proper torch maintenance is critical

The plasma welding process offers two prime benefits: Improved weld quality and increased weld output. Plasma welding offers advanced levels of control, arc stability and weld consistency for high quality welds either in miniature or precision applications.

The plasma process is equally suited to manual and automatic applications. It has been used in a variety of operations ranging from high volume welding of micro components, to precision welding of surgical instruments, to automatic repair of jet engine blades to the manual welding for repair of components in the tool, die and mold industry.

3.4 SKILLED WORKER REQUIREMENT IN THE LOCAL INDUSTRY SECTOR

Based on the statistics obtained from the Electronic Labour Exchange, it can be seen as of November 2008, there is a high demand for those with elementary occupations as many as 59,718 vacancies. Workers from the welding and fabrication sectors can be considered to be under the elementary occupation category.

Occupational Category	Professional	Technician & Associate Professional	Elementary Occupation
Total	18,455	5,911	59,718

Figure 3.1: Malaysia - Vacancies by State and Occupational Category, November 2008

Source: *Ministry of Human Resources, November 2008*

The future is bright for technical students who wish to pursue careers in this industry. The industry has moved very fast due to advances in technology requirements brought about by rapid changes. This has resulted in a technology gap between the requirements of the industry and that being taught in the institutes.

The industry has diversified to support the automotive industry thereby increasing the demand of fabricated and welded parts/components.

DSD's Malaysian Skill Certificate standards have generally not been adopted by the industry to determine and standardise wage levels, leading to wide wage differentials between companies. Wage differentials have contributed to the problem of job hopping. Technical training institutions have difficulties attracting school leavers who possess good academic

qualifications. There is still a lack of technical workforce with high level of engineering background (Malaysian Skills Diploma/Advanced Diploma Level 4 & 5). Interaction between technical institutes and the industry and industry associations remains low. Training institutes do not have significant hands-on training for their students resulting in many graduates not being able to fit into the industry without further in-house training. Response from companies to institutes to undertake on job training (OJT) attachments for the students has also been luke warm.

Technical institutes should offer more programmes with high level skilled (Malaysian Skills Diploma/Advanced Diploma Levels 4 & 5). Regular communication and interaction between DSD, training institutes and the industry should be undertaken through dialogues with Malaysian Industrial Development Authority (MIDA) and associations to exchange information, undertake the planning of curriculum relevant to industry requirements, attachment programmes for hands-on training and other manpower development programmes.

In order to produce more skilled workers from these training centres, there should be a set up of a coordination centre providing two-way links with technical institutes and the industry to facilitate sourcing of manpower, a database of all relevant technical institutes and their capabilities including the courses offered to update the industry on manpower availability.

Based on the **2009 Malaysian Budget**, the Government will continue to implement various programmes towards creating a pool of trained and competitive work force. To achieve this objective, a sum of RM47.7 billion is allocated for education and training, accounting for 23% of the total 2009 Budget allocation.

A large sum of funds has been allocated to existing Institut Latihan Perindustrian (ILP), Advanced Technology Training Centre (ADTEC), Institut Kemahiran MARA (IKM), Institut Kemahiran Tinggi MARA (IKTM), Kolej Pelajaran MARA (KPM) and GiatMara projects. The Construction Industry Development Board (CIDB) will take measures to train more

workers in the construction industry and has been instructed to provide at least 100,000 industrial training opportunities in technical fields such as welding, management and safety in 2009.

According to the **Industrial Master Plan 3, 2006-2020, t**he industry faces a shortage of two important groups of the workforce:

- engineers with capabilities in the fields of mechanical, Electrical & Electronic (E&E) and chemical engineering, software development, system integration, food technology, metallurgy, material technology and agriculture technology and
- technicians with expertise in Computer Numerical Control (CNC) machining, **welding and fabrication**, precision casting, machine assembly, integration and testing and servicing and maintenance

With the support and coordination of various institutions of higher learning, research institutes and technical training centres, sufficient human resources with relevant knowledge, competencies and skills will be produced.

Since almost every industry, big or small, uses welding at some stage of production and manufacturing, including the repair and maintenance of equipments, the demand for professional welders is expected to grow. However, with the increase in the number of automated welding systems, job openings for welders may not be as broad as it used to be. But some maintenance, repair and other works in manufacturing cannot be performed solely by automated machines. Most of them have to be operated by man too. In this respect, skilled and certified welders seem to have better employment opportunities, stressing more on the importance of undergoing certification process and skilled technical training.

3.5 INDUSTRIAL COMPETITION AT INTERNATIONAL LEVEL

Workers from this industry have also the potential to be outsourced by foreign companies as local welders use international standards when carrying out their duties. This has also caused some local welders to migrate to other companies that offer better salary and international exposure.

The future issues are cited as the acquisition of the professional knowledge and technologies on latest welding technologies needed for realising the high-speed railway plan and encouraging plans of small and medium-sized companies. The standardisation of welders and industrial procedures, the establishment of welding education systems, and the appointment of a national welding and joining technical centre are cited as the next steps to be taken, and international cooperation is expected in these fields.

The industry is also supported by a wide range of critical engineering services. Malaysian companies have achieved international recognition in terms of capability and quality in a diverse range of activities namely mould and die, metal casting, machining, metal stamping, surface engineering, and metal fabrication.

The Malaysian metal fabrication industry has evolved from supporting traditional resource-based and agro-based industries to the higher value added and technologically more sophisticated sectors such as manufacturing, civil and building construction and onshore and offshore oil and gas.

Metal fabrication is a fairly well established industry in Malaysia with over 2000 companies in operation fabricating products from simple household items to steel structure for skyscrapers and offshore oil drilling platforms. Leading local fabricators have successfully completed many structural metal fabrication projects overseas. Malaysian companies who are

serving this sector must train and qualify welders to meet respective industrial requirements locally.

Continuous and vigorous training must be pursued to qualify and certify welders in accordance to international codes and standards such as American Society of Mechanical Engineers (ASME), American Welding Society (AWS) & European Norm (EN) to be competitive locally and internationally.

4. METHODOLOGY OF OCCUPATIONAL ANALYSIS - WELDING SECTOR

In conducting the Occupational Analysis, a kick off meeting was held primarily to strategise the Plan of Action in accordance with guidelines as presented by DSD in terms of scope of study, time frame and representation by panel of welding experts from both 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 time frame required.

(i) Literature Survey

As outlined by the guidelines, a literature survey on the Welding sector was carried out to get some insight on the scope, policy, programme, activities in the context of the Malaysian scenario. The scope covered under this research includes definitions, current analysis of the sector/sub sector, current status of the Welding industry sector, skilled workers requirement in the local industry and the industrial competition at international level. See References of Literature Survey on page 47.

(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. Companies and experts from the Welding sector were identified and short listed for further communication and contact. The list of experts contacted and confirmed are as in Annex 1.

(iii) Establish Contact with the Welding Sector Experts

A pool of welding experts from the industry and public sector were contacted. The list of experts is in Annex 1.

(iv) Information Gathering

In the process of gathering the information, two methods were adopted, namely; brainstorming and the Developing a Curriculum (DACUM) session. The brainstorming and DACUM session were attended by expert panels who discussed the different sub sectors and areas. The information gathered was then used as input for the occupational analysis of the said industry.

(v) Analysing the Information

Based on the activities done as above, substantial data and information were collected. The data and information were discussed and analysed in several in-house workshops attended by selected key person or experts from the public and industry sector. The presence of the key persons or experts was to help in the development of the Occupational Analysis for this sector.

During this session, attempts to reframe the Welding Sub sector in Malaysia were done using the following framework:

(a) Scope of the Welding sector and its sub sector
(b) Main 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 Occupational Analysis of the Welding sector. The details of the workshops are as below:

Held on the 15th and 16th June, 2008 at the Singgahsana Hotel, Petaling Jaya. The objectives of the workshop were:

- 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 20th and 21st December, 2008 at the Lisbon Hotel, Malacca. The objectives of the workshop were:

- Validation and verification (proofreading) of:
    - Job Titles
    - Career structure
    - Hierarchy structure (Level 1 – 8)
    - Occupational Definition

5. FINDINGS

The findings from the research of the Welding and Fabrication sector's Occupational Analysis can be divided into four categories, which are:

(i) The existing job titles

(ii) Proposed job titles

(iii) The mapping between the proposed job titles to the existing ones

(iv) Leveling & entry level justification

5.1 EXISTING JOB TITLES AND HIERARCHY OF THE WELDING AND FABRICATION SECTOR

Based on the existing job titles in DSD's NOSS Registry, the Welding and Fabrication OA Matrix is divided into two major sectors namely Welding Technology & Fabrication and Arc Welding. A total of 27 job titles are present from Level 1 until Level 5. The entry level for this sector is at Level 1, as a Welder, Welding Inspector and Fabricator. There are 4 sub sectors in the Welding Technology and Fabrication Sector and 1 sub sector with seven areas in the Arc Welding sector. The existing Job Titles and OA Matrix for the existing Welding and Fabrication sub sector are included as follows:

- *Figure 5.1: Existing Welding Technology & Fabrication OA Matrix*
- *Figure 5.2: Existing Arc Welding OA Matrix (1)*
- *Figure 5.3: Existing Arc Welding OA Matrix (2)*

5.2 NEWLY IDENTIFIED SUB SECTORS

The newly identified sub sectors for the Welding and Fabrication sector were obtained through literature research and discussions with industry experts during the development workshop sessions. The discussions were done according to Malaysia's Industrial Plan (IMP3), The Ninth Malaysian Plan (RMK9) and other related national economical plans that aim at boosting Malaysia's global competitiveness.

The OA matrices for these proposed Welding and Fabrication sectors are included in this section. A total of 30 job titles exist in the proposed sub sectors. There are a total of 6 proposed sub sectors. The proposed sub sectors, areas and job titles are based on the current industry and welding & fabrication technology used currently in Malaysia. The detailed job titles and hierarchies are included in this section. Below are the descriptions of each of the different sub sectors:

(i) Fabrication

There are a total of 20 job titles under Fabrication. This industry consists of 3 main sub sectors based on the type of industry:

(a) Fabrication for Small & Medium Enterprise (SME)

SMEs in Malaysia account for more than 90.0% of establishments in the manufacturing sector. The Malaysian Government encourages the further development of SMEs and has put in place measures focusing on enhancing production efficiency and effectiveness, increasing technological capability and competitiveness. Targeted sectors for development include electrical and electronics, transport machinery, and machinery and engineering services.

Fabrication SME focuses on fabrication work in Small Medium Enterprises (SME) and is done on a smaller scale than in the Manufacturing Industry.

(b) Structural Fabrication

Structural fabrication is the use of metal fabrication procedures to produce components for use in a range of applications and industries. Structural fabrication may involve fabrication of

beams, columns, tanks and other components of buildings, oil & gas platforms & off-shore rigs structures and steel bridges.

(c) Pressurised Equipment Fabrication / Manufacturing Industry

This sub sector deals with the fabrication of pressure equipment, such as pressure vessels, tanks, boilers, and pressurised systems.

Most of the areas above have job titles from Level 1 until Level 7, except for the Fabrication SME area that is until level 6 due to the smaller organisation when compared to the organisations that conduct structural & pressurised equipment fabrication. The job titles are specialised according to area from Level 1 until Level 7, because the job scope is different between the areas.

(ii) Welding

The following are the two different sub sectors observed and proposed for the Welding sector which are:

(a) Structural Welding
(b) Pressurised Equipment Fabrication, Piping & Pipeline Fabrication & Manufacturing Welding Industry

The Pressurised Equipment Fabrication, Piping & Pipeline Fabrication & Manufacturing Welding Industry sub sector is further divided into two (2) areas, which are:

- *Pressurised Equipment Fabrication, Piping & Pipeline Fabrication & Manufacturing Welding*

This involves all fabrication work pertaining to the fabrication of pressurised equipment, piping & pipeline. Process plant construction pipeline layout welding involves all fabrication

work pertaining to the structural erection of the process plant, the installation of equipment and piping including the pipeline outside the Plant perimeter. The above projects involve a very high volume of welding

- *Underwater Welding*

Underwater welding can be performed under wet or dry conditions. The most commonly used wet welding technique is shielded metal arc welding (SMAW), also known as manual metal arc (MMA) welding or informally as stick welding. Electrodes for wet welding is of the waterproof type made of mild steel (C/Mn) and their requirements are specified in the AWS E6013 codes and standards. The welding power supply is connected to the welding equipment through cables and hoses. The process is generally limited to low carbon equivalent steels and for repair work.

There are a total of 10 job titles under the Welding sector. All of the sub sectors start at Level 1 as Welder Assistant, whereas, Underwater Welding is a National Competency Standard (NCS). Under the Structural Welding and the Pressurised Equipment Fabrication, Piping & Pipeline Fabrication & Manufacturing Welding Industry, welders can proceed until Level 7, as a Welding Engineer.

Welding Technology & Fabrication

	Kimpalan Gas (Gas Welding)	Kepingan Logam (Sheet Metal)	Fabrikasi (Fabrication)	Pemeriksaan (Inspection)
L5	H-023-5 Jurutera Kimpalan (Fabrikasi) *(Welding Engineer (Fabrication))* (20-06-97)			
L4	H-023-4 Pembantu Jurutera Kimpalan (Fabrikasi) *(Assistant Welding Engineer (Fabrication))* (20-06-97)			
L3	H-022-3 @ Juruteknik Kimpalan Gas *(Gas Welding Technician)* (12-04-96)	H-070-3 Juruteknik Kepingan Logam *(Sheet Metal Technician)* (10-04-95)	H-200-3 Juruteknik Fabrikasi & Memasang Struktur Keluli *(Steel Structure & Fabrication Technician)* (30-04-97)	H-060-3 @ Pemeriksa Kimpalan Kanan *(Senior Welding Inspector)* (28-11-95)
L2	H-022-2 Jurukimpal Gas *(Gas Welder)* (12-04-96)	H-070-2 Jurubentuk Kepingan Logam *(Sheet Metal Fabricator)* (10-04-95)	H-200-2 Fabrikator & Pemasang Struktur Keluli *(Steel Structure Erector & Fabricator)* (30-09-97)	H-060-2 Pemeriksa Kimpalan *(Welding Inspector)* (28-11-95)
L1	H-022-1 Jurukimpal Gas *(Gas Welder)* (12-04-96)	H-070-1 Jurubentuk Kepingan Logam *(Sheet Metal Fabricator)* (10-04-95)	H-200-1 Fabrikator & Pemasang Struktur Keluli *(Steel Structure Erector & Fabricator)* (30-09-97)	H-060-1 Pemeriksa Kimpalan *(Welding Inspector)* (28-11-95)

Figure 5.1: Existing Welding Technology & Fabrication OA Matrix

Arc Welding

<table>
<tr><td></td><td colspan="4">Kimpalan Arka
(Arc Welding)</td></tr>
<tr><td>L5</td><td colspan="4">H-023-5
Jurutera Kimpalan (Fabrikasi)
(Welding Engineer (Fabrication))
(20-06-97)</td></tr>
<tr><td>L4</td><td colspan="4">H-023-4
Pembantu Jurutera Kimpalan (Fabrikasi)
(Assistant Welding Engineer (Fabrication))
(20-06-97)</td></tr>
<tr><td>L3</td><td>H-024-3
Juruteknik Kimpalan Arka Logam Berperisai(Keluli Karbon & Keluli Tahan Karat)
(Shielded Metal Arc Welding Technician (Carbon Steel & Stainless Steel))
(16-07-98) (P)</td><td>H-026-3
Juruteknik Kimpalan Arka Tungsten Gas & Arka Logam Berperisai(Keluli Karbon & Keluli Tahan Karat)
(Gas Tungsten Arc & Shielded Metal Arc Welding Technician (Carbon Steel & Stainless Steel))
(16-07-98) (P)</td><td>H-025-3
Juruteknik Kimpalan Arka Tungsten Gas (Keluli Karbon & Keluli Tahan Karat & Aluminium)
(Gas Tungsten Arc Welding Technician (Carbon Steel & Stainless Steel & Aluminium)
(16-07-98) (P)</td><td>H-021-3 @
Juruteknik Kimpalan Logam Tanpa Ferus
(Non Ferrous Metal Welding Technician)
(10-04-95)</td></tr>
<tr><td>L2</td><td colspan="2">H-024-2
Jurukimpal Arka Logam Berperisai (Keluli Karbon & Keluli Tahan Karat)
(Shielded Metal Arc Welder (Carbon Steel & Stainless Steel))
(16-07-98) (P)</td><td>H-025-2
Jurukimpal Arka Tungsten Gas(Keluli Karbon & Keluli Tahan Karat)
(Gas Tungsten Arc Welder (Carbon Steel & Stainless Steel))
(16-07-98) (P)</td><td>H-021-2
Jurukimpal Logam Tanpa Ferus
(Non Ferrous Metal Welder)
(10-04-95)</td></tr>
<tr><td>L1</td><td colspan="4">H-024-1
Jurukimpal Arka Logam Berperisai (Keluli Karbon)
(Shielded Metal Arc Welder (Carbon Steel)
(16-07-98) (P)</td></tr>
</table>

Figure 5.2: Existing Arc Welding OA Matrix (1)

Arc Welding

	Kimpalan Arka (Arc Welding)		
L5	H-023-5 Jurutera Kimpalan (Fabrikasi) *(Welding Engineer (Fabrication))* (20-06-97)		
L4	H-023-4 Pembantu Jurutera Kimpalan (Fabrikasi) *(Assistant Welding Engineer (Fabrication))* (20-06-97)		
L3	H-027-3 Juruteknik Kimpalan Arka Logam Gas (Kululi Karbon, Keluli Tahan Karat & Aluminium) *(Gas Metal Arc Welding Technician (Carbon Steel, Stainless Steel & Aluminium))* (08-07-99) (P)	H-028-3 Juruteknik Kimpalan Arka Berteraskan Fluks (Keluli Karbon) *(Flux Cored Arc Welding Tachnician (Carbon Steel)* (08-07-99) (P)	H-029-3 Juruteknik Kimpalan Arka Terbenam (Keluli Karbon) *(Submerged Arc Welding Technician (Carbon Steel))* (08-07-99)(P)
L2	H-027-2 Jurukimpal Arka Logam Gas (Kululi Karbon, Keluli Tahan Karat & Aluminium) *(Gas Metal Arc Welder(Carbon Steel, Stainless Steel & Aluminium))* (08-07-99)(P)		H-029-2 Operator Kimpalan Arka Terbenam (Keluli Karbon) *(Submerged Arc Welding Operator (Carbon Steel))* (08-07-99)(P)
L1	H-024-1 Jurukimpal Arka Logam Berperisai (Keluli Karbon) *(Shielded Metal Arc Welder (Carbon Steel)* (16-07-98)(P)		

Figure 5.3: Existing Arc Welding OA Matrix (2)

SUB SECTOR	FABRICATION Small Medium Enterprise (SME)	STRUCTURAL FABRICATION	PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY
LEVEL 8	*Not Available*	*Not Available*	*Not Available*
LEVEL 7	*Not Available*	MANAGER** (STRUCTURAL FABRICATION)	MANAGER** (PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY)
LEVEL 6	MANAGER** (FABRICATION SME)	ASSISTANT MANAGER** (STRUCTURAL FABRICATION)	ASSISTANT MANAGER** (PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY)
LEVEL 5	ASSISTANT MANAGER** (FABRICATION SME)	SUPERINTENDENT (STRUCTURAL FABRICATION)	SUPERINTENDENT (PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY)
LEVEL 4	QUALITY CONTROLLER (FABRICATION SME)	QUALITY CONTROLLER (STRUCTURAL FABRICATION)	QUALITY CONTROLLER (PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY)
LEVEL 3	SUPERVISOR (FABRICATION SME)	SUPERVISOR (STRUCTURAL FABRICATION)	SUPERVISOR (PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY)
LEVEL 2	FABRICATOR (FABRICATION SME)	FABRICATOR (STRUCTURAL FABRICATION)	FABRICATOR (PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY)
LEVEL 1	GENERAL FITTER	GENERAL FITTER	GENERAL FITTER

***Position will be evaluated by Department of Skills Development*

Figure 5.4: Proposed Fabrication OA Matrix

SUB SECTOR	FABRICATION SMALL MEDIUM ENTERPRISE (SME)
L8	*Not Available*
L7	*Not Available*
L6	MANAGER** (FABRICATION SME)
L5	ASSISTANT MANAGER** (FABRICATION SME)
L4	QUALITY CONTROLLER (FABRICATION SME)
L3	SUPERVISOR (FABRICATION SME)
L2	FABRICATOR (FABRICATION SME)
L1	GENERAL FITTER

***Position will be evaluated by Department of Skills Development*

Figure 5.5: Proposed Fabrication SME OA Matrix

SUB SECTOR	STRUCTURAL FABRICATION
L8	*Not Available*
L7	MANAGER** (STRUCTURAL FABRICATION)
L6	ASSISTANT MANAGER** (STRUCTURAL FABRICATION)
L5	SUPERINTENDENT (STRUCTURAL FABRICATION)
L4	QUALITY CONTROLLER (STRUCTURAL FABRICATION)
L3	SUPERVISOR (STRUCTURAL FABRICATION)
L2	FABRICATOR (STRUCTURAL FABRICATION)
L1	GENERAL FITTER

***Position will be evaluated by Department of Skills Development*

Figure 5.6: Proposed Structural Fabrication OA Matrix

SUB SECTOR	PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY
L8	*Not Available*
L7	MANAGER** (PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY)
L6	ASSISTANT MANAGER** (PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY)
L5	SUPERINTENDENT (PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY)
L4	QUALITY CONTROLLER (PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY)
L3	SUPERVISOR (PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY)
L2	FABRICATOR (PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY)
L1	GENERAL FITTER

***Position will be evaluated by Department of Skills Development*

Figure 5.7: Proposed Pressurised Equipment Fabrication/Manufacturing Industry Fabrication OA Matrix

SUB SECTOR	STRUCTURAL WELDING	PRESSURISED EQUIPMENT FABRICATION, PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING INDUSTRY
AREA		**PRESSURISED EQUIPMENT FABRICATION , PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING**
LEVEL 8	*Not Available*	*Not Available*
LEVEL 7	WELDING ENGINEER** (STRUCTURAL WELDING)	WELDING ENGINEER** (PRESSURISED EQUIPMENT FABRICATION, PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING)
LEVEL 6	ASSISTANT WELDING ENGINEER** (STRUCTURAL WELDING)	ASSISTANT WELDING ENGINEER** (PRESSURISED EQUIPMENT FABRICATION, PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING)
LEVEL 5	SENIOR WELDING INSPECTOR	
LEVEL 4	WELDING INSPECTOR	
LEVEL 3	WELDING SUPERVISOR	
LEVEL 2	WELDER*	
LEVEL 1	WELDER ASSISTANT*	

** Critical Job titles*

***Position will be evaluated by Department of Skills Development*

Figure 5.8: Proposed Welding OA Matrix

SUB SECTOR/ LEVEL	STRUCTURAL WELDING
L8	*Not Available*
L7	WELDING ENGINEER** (STRUCTURAL WELDING)
L6	ASSISTANT WELDING ENGINEER** (STRUCTURAL WELDING)
L5	SENIOR WELDING INSPECTOR
L4	WELDING INSPECTOR
L3	WELDING SUPERVISOR
L2	WELDER*
L1	WELDER ASSISTANT *

**Critical Job titles*

***Position will be evaluated by Department of Skills Development*

Figure 5.9: Proposed Structural Welding OA Matrix

SUB SECTOR/LEVEL	PRESSURISED EQUIPMENT FABRICATION, PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING INDUSTRY
L8	*Not Available*
L7	WELDING ENGINEER** (PRESSURISED EQUIPMENT FABRICATION, PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING INDUSTRY)
L6	ASSISTANT WELDING ENGINEER** (PRESSURISED EQUIPMENT FABRICATION, PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING INDUSTRY)
L5	SENIOR WELDING INSPECTOR
L4	WELDING INSPECTOR
L3	WELDING SUPERVISOR
L2	WELDER*
L1	WELDER ASSISTANT *

**Critical Job titles*

***Position will be evaluated by Department of Skills Development*

Figure 5.10: Proposed Pressurised Equipment Fabrication, Piping & Pipeline Fabrication & Manufacturing Welding Industry OA Matrix

SUB SECTOR	PRESSURISED EQUIPMENT FABRICATION, PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING INDUSTRY
LEVEL / AREA	**UNDERWATER WELDING**
NO LEVEL (NCS)	DIVER WELDER*

** Critical Job Titles*

Figure 5.11: Proposed Underwater Welding OA Matrix

5.3 MAPPING BETWEEN THE PROPOSED SUB SECTORS TO THE EXISTING SUB SECTORS

Due to the current development in the Welding & Fabrication industry, the existing job titles in DSD's Registry of Job Titles for this sector have been reviewed and enhanced. The new proposed job titles reflect workers who are multi skilled while still maintaining the main framework of the Welding and Fabrication sector of the existing job titles. The mapping between the proposed sub sectors to the existing sub sectors are included in this section in an overall view of all the sub sectors; *Figure 5.12: Mapping Between the Proposed Sub Sectors to the Existing Sub Sectors.* There are some issues regarding the mapping as described below:

(i) Leveling

In accordance with JPK's requirement to take into consideration job titles extended from the existing Level 5 up to Level 8, many of the existing leveling has been changed to a higher level than the existing one.

(ii) New existing Job Title, Area or Sub Sector

As there are newly defined job titles, areas and sub sectors, it is not possible to map all of them to existing NOSSes. However, mapping has been done between the proposed job titles to existing NOSSes according to the job scope and responsibility that is felt relevant and can be used as reference.

(iii) Mapping

It can be seen from Figure 5.12 that all the existing sub sectors can be mapped to the proposed sub sectors because the existing sub sectors are divided according to the Welding and Fabrication skills, where as the proposed sub sectors are divided according to the sub sectors in the industry.

Therefore, this means that all the existing Welding & Fabrication sub sectors are an integral part in the new sub sectors as they are used in the different sub sectors in the industry, resulting in multi skilled welders and fabricators.

EXISTING SUB SECTORS / PROPOSED SUB SECTORS		Welding Technology & Fabrication				
		Gas Welding H-022	**Sheet Metal H-070**	**Fabrication H-200**	**Inspection H-060**	**Arc Welding H-021 , H-023, H-024, H-025, H-026,** H-027, H-028, H-029
FABRICATION	**FABRICATION SMALL MEDIUM ENTERPRISE (SME)**					
	STRUCTURAL FABRICATION					
	PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY					
WELDING	**STRUCTURAL WELDING**					
	PRESSURISED EQUIPMENT FABRICATION, PIPING & PIPELINE FABRICATION, MANUFACTURING WELDING INDUSTRY					

Figure 5.12: Mapping between the Proposed Sub Sectors to the Existing Sub sectors

5.4 LEVELING & ENTRY LEVEL JUSTIFICATION

(i) Entry Level at Level 1

Sub sector:

Fabrication (SME), Structural Fabrication, Pressurised Equipment Fabrication / Manufacturing Industry Structural Welding, Pressurised Equipment Fabrication, Piping & Pipeline Fabrication & Manufacturing Welding Industry

Fabrication Small Medium Enterprise (SME)
Not Available
Not Available
Level 6
Level 5
Level 4
Level 3
Level 2
Level 1

Structural Fabrication
Not Available
Level 7
Level 6
Level 5
Level 4
Level 3
Level 2
Level 1

Pressurised Equipment Fabrication / Manufacturing Industry
Not Available
Level 7
Level 6
Level 5
Level 4
Level 3
Level 2
Level 1

Structural Welding
Not Available
Level 7
Level 6
Level 5
Level 4
Level 3
Level 2
Level 1

Pressurised Equipment Fabrication, Piping & Pipeline Fabrication & Manufacturing Welding Industry
Not Available
Level 7
Level 6
Level 5
Level 4
Level 3
Level 2
Level 1

Figure 5.13: Entry Level at Level 1

All the sub sectors above begin at Level 1, because the work of the Fitter and Welder Assistant consists of routine and predictable work.

5.5 OCCUPATIONAL DEFINITION

Under the Welding & Fabrication sector, job titles have been identified and defined. Each job title is given a job definition as specified by the industry. Please refer to **Annex 2** for the job definition.

5.6 CRITICAL JOB TITLES

The critical job titles have been determined based on the analysis and constantly conducted with the panel experts. It must be noted that even though there are three sub sectors in the Welding sector that have critical job titles, the total is still three critical job titles because the job titles at Level 1 and 2 are common for all the three sub sectors.

It can be seen that the critical job titles are Welder Assistant, Welder and Diver Welder. The Welder Assistant and Welder are critical as there is a lack of certified and skilled workers in this position.

Diver welders are currently considered in demand as foreign companies have recognised the local workers to have potential and therefore are interested in employing more diver welders from Malaysia and to conduct underwater welding work in Malaysia. The importance of diver welders is to ensure the maintenance of the many pipelines of the oil & gas industry, especially in the South East Asia region. The job definitions for the critical job titles are included in **Annex 2**. The results of the critical analysis are as below:

SUB SECTOR: WELDING

No.	Job Title	Level
1	Welder Assistant	L1
2	Welder	L2
3	Diver Welder	NCS

Figure 5.14: Table of Critical Job Titles

5.7 NON CRITICAL JOB TITLES

It must be noted that the non critical job titles do not imply that they are not required by the industry but it is used as a reference as to which job title exists in the industry and is not in critical demand as of now.

The job definitions for the non critical job titles are included in Annex 2. The non critical job titles are as below:

(a) SUB SECTOR: FABRICATION

No.	Job Title	Level
1	General Fitter	L1
2	Fabricator (Fabrication SME)	L2
3	Fabricator (Structural Fabrication)	L2
4	Fabricator (Pressurised Equipment Fabrication / Manufacturing Industry)	L2
5	Supervisor (Fabrication SME)	L3
6	Supervisor (Structural Fabrication)	L3
7	Supervisor (Pressurised Equipment Fabrication / Manufacturing Industry)	L3
8	Quality Controller (Fabrication SME)	L4
9	Quality Controller (Structural Fabrication)	L4
10	Quality Controller (Pressurised Equipment Fabrication / Manufacturing Industry)	L4
11	Superintendent(Structural Fabrication)	L5
12	Assistant Manager (Fabrication SME)	L5
13	Superintendent (Pressurised Equipment Fabrication / Manufacturing Industry)	L5
14	Manager (Fabrication SME)	L6
15	Assistant Manager(Structural Fabrication)	L6
16	Assistant Manager (Pressurised Equipment Fabrication / Manufacturing Industry)	L6
17	Manager (Structural Fabrication)	L7
18	Manager (Pressurised Equipment Fabrication / Manufacturing Industry)	L7

Figure 5.15: Table of Non Critical Job Titles (Fabrication)

(b) SUB SECTOR: WELDING

No.	Job Title	Level
1	Welding Supervisor	L3
2	Welding Inspector	L4
3	Senior Welding Inspector	L5

4	Assistant Welding Engineer (Structural Welding)	L6
5	Assistant Welding Engineer (Pressurised Equipment Fabrication / Manufacturing Welding Industry)	L6
6	Welding Engineer (Structural Welding)	L7
7	Welding Engineer (Pressurised Equipment Fabrication / Manufacturing Welding Industry)	L7

Figure 5.16: Table of Critical Job Titles (Welding)

5.8 SUMMARY OF CRITICAL AND NON CRITICAL JOB TITLES

The summary of the critical and non critical job titles can be seen in *Figure 5.17: Critical and Non Critical Schedule*. From the total of 30 job titles from Level 1 until Level 7, there are 27 non critical job titles compared to the 3 critical job titles. From the three critical job titles, one is the diver welder which does not have a particular level, therefore it comes under National Competency Standard (NCS).

SUMMARY OF CRITICAL AND NON CRITICAL JOB TITLES

SUB SECTOR			LEVEL								Total
			NCS	L1	L2	L3	L4	L5	L6	L7	L8	
1	Fabrication	*Critical*	0	0	0	0	0	0	0	0	0	0
		Non-Critical	0	3	3	3	3	3	3	2	0	20
2	Welding	*Critical*	1	1	1	0	0	0	0	0	0	3
		Non-Critical	0	0	0	1	1	1	2	2	0	7
			Critical									**3**
			Non-Critical									**27**
Total			1	4	4	4	4	4	5	4	0	**30**

Figure 5.17: Critical and Non Critical Schedule

6. CONCLUSION AND RECOMMENDATION

As a result of the Welding & Fabrication Sector Occupational Analysis conducted together with expert panel members from various Welding & Fabrication sub sectors and organisations, a total of 30 job titles and 6 main sub sectors have been identified.

Referring to Malaysia's economical plans and vision for the coming years, such as the IMP 3 and RMK 9, a framework of the Welding & Fabrication workforce has been identified. It is hoped that the result of this Occupational Analysis will be able to fulfill the future plans by training Malaysians to be skilled workers in the Welding & Fabrication Industry towards boosting Malaysia's global competitiveness.

Malaysia has made significant strides to take advantage of advancements in the Welding & Fabrication industry to improve efficiency and productivity, thus contributing to the increased overall competitiveness of the economy. Additional measures must also be undertaken to enhance human resource development to provide adequate skilled and knowledgeable manpower to support the knowledge-based economy.

The Welding & Fabrication industry has great potential. Endowed with strong government support and a substantial human resource, this industry could expand by the close cooperation and collaboration between government, welding and fabrication companies & training centres.

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LIST OF PANEL EXPERTS OF THE WELDING SECTOR OCCUPATIONAL ANALYSIS DEVELOPMENT

NO	NAME	POSITION	ORGANISATION	EXPERTISE
1	ENCIK ISMAIL ABU BAKAR	FLAWLESS MANAGER	SHELL PD	WELDING INSPECTION MAINTENANCE ON STRUCTURAL, PRESSURISED EQUIPMENT, PIPING AND TANKAGE
2	ENCIK CHIN KIK MIN (HARRIS)	MANAGER	TTS SDN. BHD.	WELDING MECHANICAL ENGINEERING
3	ENCIK KN. DHANAPALAN	QA MANAGER	VICKERS HONSKINS (M) SDN. BHD	WELDING MECHANICAL ENGINEERING
4	ENCIK ABDUL AZIZ DAWAM	LECTURER	UNIVERSITI KUALA LUMPUR	WELDING & FABRICATION
5	ENCIK AZHAR MAHMUD	LECTURER	UNIVERSITI KUALA LUMPUR	WELDING/JOINING

LIST OF FACILITATORS OF THE WELDING SECTOR OCCUPATIONAL ANALYSIS DEVELOPMENT

DR. AMIRON BIN ISMAIL

FACILITATOR

PRITEC ACADEMY

EN. FAHISZAM BIN SAAD

CO-FACILITATOR

PRITEC ACADEMY

PN. EVARINA BINTI AMIRON

CO-FACILITATOR

PRITEC ACADEMY

EN. MOHD ZAMRI BIN ZAKARIA

SECRETARIAT

PRITEC ACADEMY

CIK NOR ZURIANI BINTI MOHD ZAINI

SECRETARIAT

PRITEC ACADEMY

CIK ROZIAH BINTI ISMAIL

SECRETARIAT

PRITEC ACADEMY

LIST OF WELDING INDUSTRY EXPERTS OF THE SKILL DEVELOPMENT ADVISORY COMMITTEE (SDAC)

NO	NAME	POSITION	ORGANISATION	EXPERTISE
1	ENCIK AWALDIN BIN MOHD ARIF	MANAGING DIRECTOR	INDUSTRIAL TESTING & ENGINEERING	QA/QC, WELDING, , NDT COROSION, STRUCTURAL, PRESSURE VESSED, PIPING, TANKAGE & BOILER
2	DR. SAMSUDIN BIN BANI	HEAD PROGRAMME (JTIP)	SIRIM BERHAD	WELDING
3	ENCIK DAWOT BIN HUSSIN	PRINCIPAL TECHNOLOGIST & WEKDING INSPECTOR	SIRIM BERHAD	WELDING
4	ENCIK ABDUL GHANI BIN ISMAIL	PRINCIPAL ENGINEER	PETRONAS PENAPISAN MELAKA SDN. BHD	QA/QC, WELDING, NDT, PRESSURE VESSEL, PIPING, CORROSION, RBI, TANKAGE & BOILER

FABRICATION SME

LEVEL 1

GENERAL FITTER

A GENERAL FITTER IS DESIGNATED TO PREPARE MATERIAL, PERFORM MARKING ON WORK SPECIMEN, PERFORM CUTTING, FITTING, ASSEMBLY, CLEANING WORK AND HOUSEKEEPING.

In particular the person will:

1. Perform marking on work specimen according to drawing
2. Perform cutting of specimen according to work piece specification
3. Perform chipping & cleaning for finished work piece
4. Perform fitting and assembly on work piece
5. Assist fabricator in carrying out various fabrication work
6. Carry out housekeeping in work area

FABRICATION SME

LEVEL 2

FABRICATOR

A FABRICATOR IS DESIGNATED TO FABRICATE A WIDE VARIETY OF METAL STRUCTURES, REPAIR METAL SURFACES AND CARRY OUT REQUISITION OF EQUIPMENT AND SUPPLIES.

In particular the person will:

1. Fabricate a wide variety of metal structure from approved drawings and blueprints
2. Prepare written materials (e.g. work orders, requisitions, drawings, sketches, etc.) for the purpose of documenting activities
3. Repair metal surfaces to ensure that items are in proper working condition
4. Request equipment and supplies for the purpose of maintaining inventory and ensuring availability of required items
5. Perform drawing interpretation
6. Perform calculation for dimensional work
7. Perform marking on work piece according to complex work piece drawing
8. Perform cutting to complex dimension according to work piece drawing
9. Perform complex fit-up & assembly
10. Perform tack welding on work piece according to work specification and drawing

FABRICATION SME

LEVEL 3

SUPERVISOR

A FABRICATION SME SUPERVISOR IS DESIGNATED TO ORGANISE FABRICATION ACTIVITIES, CONDUCT SAFETY BRIEFING, PREPARE MAINTENANCE SCHEDULE, COORDINATE NON-DESTRUCTIVE TESTING (NDT) AND DESTRUCTIVE TEST (DT) WITH EXTERNAL COMPANY AND SUPERVISE PERSONNEL IN THE WORKSHOP.

In particular the person will:

1. Work closely with the fabrication superintendent to meet production and project schedules
2. Interpret shop fabrication drawings and cut lists according to project specification
3. Organise fabrication activities
4. Conduct job & safety briefing to fabricator
5. Supervise fabrication personnel in the workshop
6. Prepare maintenance schedule for tools & equipment
7. Coordinate testing after welding with NDT and DT company

FABRICATION SME

LEVEL 4

QUALITY CONTROLLER

A FABRICATION QUALITY CONTROLLER IS DESIGNATED TO PERFORM WORK SPECIFICATION REVIEW, FIT-UP INSPECTION, WORK IN PROGRESS MONITORING AND PREPARE RECOMMENDATION FOR ACCEPTANCE & REJECTION OF A PROJECT.

In particular the person will:

1. Liaise with a diverse workforce as well as vendors, customers and engineers and coordinate fabrication schedules
2. Ensure fabrications are performed in compliance to work specifications and drawing
3. Provide assurance to the project in terms of delivery of technical integrity, quality assurance and quality control in all welding and fabrication matters
4. Perform drawing & work specification interpretation
5. Perform work specification review
6. Perform fit-up inspection in accordance with project specification
7. Perform visual and dimensional check in accordance with project specification
8. Perform progress monitoring on testing and inspection work
9. Perform recommendation for acceptance & rejection criteria for a project

FABRICATION SME

LEVEL 5

ASSISTANT MANAGER

AN ASSISTANT FABRICATION MANAGER IS DESIGNATED TO ESTABLISH OPERATION UNIT'S OBJECTIVES, POLICIES, PROCEDURES, FORMULATE FINANCIAL PLANS, ESTABLISH STANDARDS & DESIGN AND ASSIST IN MANAGING THE FABRICATION YARD OPERATION.

In particular the person will:

1. Establish operation unit's objectives, policies and procedures covering the phases of fabrication yard operations
2. Formulate financial plans and capital expenditure of fabrication yard operations
3. Establish standards and design to measure fabrication yard operations' performance relative to sales, profit and return on investment
4. Perform approval on drawing & work specification
5. Perform supervision on fabrication superintendent work
6. Monitor fabrication work progress
7. Prepare project budget and planning
8. Assist manager in performing managerial function in accordance with company policies and procedures
9. Perform marketing activities

FABRICATION SME

LEVEL 6

MANAGER

A FABRICATION MANAGER IS DESIGNATED TO PLAN, APPROVE PROJECT SPECIFICATION, DIRECT OPERATIONS, MONITOR PROJECT IMPLEMENTATION AND PERFORM MANAGERIAL DUTIES OF FABRICATION YARD ACTIVITIES.

In particular the person will:

1. Plan and direct operations and administration of fabrication yard activities
2. Analyse the business operation, including market and customer trends, product and competitive developments, profit margins and capital spending requirements
3. Ensure compliance of local laws and government procedures
4. Monitor project in accordance with work planning & scheduling
5. Perform approval on contract document, procurement & project costing
6. Perform approval on project design in accordance with project specification and requirement
7. Perform managerial function in accordance with company policies and procedures
8. Prepare marketing plan

STRUCTURAL FABRICATION

LEVEL 1

GENERAL FITTER

A GENERAL FITTER IS DESIGNATED TO PREPARE MATERIAL, PERFORM MARKING ON WORK SPECIMEN, PERFORM CUTTING, FITTING, ASSEMBLY, CLEANING WORK AND HOUSEKEEPING.

In particular the person will:

1. Perform marking on work specimen according to drawing
2. Perform cutting of specimen according to work piece specification
3. Perform chipping & cleaning for finished work piece
4. Perform fitting and assembly on work piece
5. Assist fabricator in carrying out various fabrication work
6. Carry out housekeeping in work area

STRUCTURAL FABRICATION

LEVEL 2

FABRICATOR

A STRUCTURAL FABRICATOR IS DESIGNATED TO FABRICATE A WIDE VARIETY OF METAL STRUCTURES, REPAIR METAL SURFACES, PERFORM CALCULATION, MARKING, CUTTING AND TACK WELDING ON WORK PIECE, FIT-UP & ASSEMBLY OF WORK PIECE AND CARRY OUT HOUSEKEEPING IN WORK AREA.

In particular the person will:

1. Fabricate a wide variety of metal structures according to oral directions, sketches, drawings and blueprints
2. Prepare written materials (e.g. work orders, requisitions, drawings, sketches, etc.) according to standard operating procedure
3. Repair metal surfaces according to product requirement
4. Perform drawing interpretation
5. Perform calculation for dimensional work
6. Perform marking on work piece according to complex product specification
7. Perform cutting according to complex product specification
8. Perform fit-up & assembly for work piece
9. Perform tack welding on work piece according to codes and standard
10. Monitor supplies for the purpose of maintaining inventory and ensuring availability of required items
11. Carry out housekeeping in work area

STRUCTURAL FABRICATION

LEVEL 3

SUPERVISOR

A STRUCTURAL FABRICATION SUPERVISOR IS DESIGNATED TO SUPERVISE FABRICATION ACTIVITIES, COORDINATE FABRICATION PERSONNEL IN THE WORKSHOP WITH EXTERNAL COMPANY AND COORDINATE NON-DESTRUCTIVE TESTING (NDT) AND DESTRUCTIVE TEST (DT) WITH EXTERNAL COMPANY.

In particular the person will:

1. Work closely with the fabrication superintendent to meet production and project schedules
2. Interpret shop fabrication drawings and cut lists according to project specification
3. Liaise with civil work contractors in regards to on-site installation and assembly activities
4. Conduct job & safety briefing to fabricator
5. Supervise fabrication activities in accordance with project specification
6. Supervise fabrication personnel in the workshop
7. Coordinate NDT and DT with external company

STRUCTURAL FABRICATION

LEVEL 4

QUALITY CONTROLLER

A STRUCTURAL FABRICATION QUALITY CONTROLLER IS DESIGNATED TO MONITOR THE FABRICATION OF STRUCTURAL STEEL, PERFORM WORK SPECIFICATION REVIEWS, FIT-UP INSPECTION OF FABRICATION WORK, MONITOR WORK IN PROGRESS, VISUAL AND DIMENSIONAL INSPECTION, RECOMMENDATION FOR ACCEPTANCE & REJECTION CRITERIA AND UPDATE FABRICATION DATA.

In particular the person will:

1. Liaise with a diverse workforce as well as vendors, customers and engineers and coordinate production schedules
2. Prepare Inspection Test Plan (ITP) in accordance with contractual project requirement and client's specification
3. Monitor the fabrication of structural steel are perform in compliance to codes and standards
4. Foster a good working relationship with the contractors and sub contractors
5. Perform drawing & work specification interpretation
6. Perform work specification review
7. Perform fit-up inspection according to project specification
8. Monitor work in progress fabrication
9. Perform visual and dimensional inspection as per project specification
10. Perform recommendation for acceptance & rejection criteria on project
11. Compile & update fabrication data in accordance with contractual project requirement such as Manufacturing Data Record (MDR)

STRUCTURAL FABRICATION
LEVEL 5

SUPERINTENDENT

A STRUCTURAL FABRICATION SUPERINTENDENT IS DESIGNATED TO COORDINATE PRODUCTION SCHEDULES, ANALYSE METAL FABRICATION SPECIFICATION AND REQUIREMENT AND MONITOR ALL FABRICATION ACTIVITIES.

In particular the person will:

1. Coordinate production schedules in accordance with project planning such as KPI, project milestone, look ahead planning etc.
2. Analyse project specification and requirement from engineering drawings to shop machinery and fabrication work
3. Monitor all fabrication activities
4. Organise project according to project specification
5. Administer project costing, procurement, contract document & project inventory
6. Perform interview of new technical staff
7. Analyse project drawing and work specification

STRUCTURAL FABRICATION
LEVEL 6

ASSISTANT MANAGER

A STRUCTURAL FABRICATION ASSISTANT MANAGER IS DESIGNATED TO APPROVE DRAWING & WORK SPECIFICATION, MONITOR FABRICATION WORK PROGRESS, PREPARE PROJECT BUDGET AND ASSIST THE MANAGER IN THE OVERALL ADMINISTRATION OF FABRICATION YARD.

In particular the person will:

1. Assist in establishing operation unit's objectives, policies and procedures covering the phases of fabrication yard operations
2. Assist to formulate financial plans and capital expenditure of fabrication yard
3. Assist in establishing standards to measure fabrication yard operations performance in relation to sales and return on investment
4. Approve drawing & work specification in accordance with project specification
5. Monitor fabrication work progress according to project schedule
6. Prepare manpower requirement plan
7. Prepare project budget in accordance with project requirement and specification
8. Assist manager in the overall administration of fabrication yard

STRUCTURAL FABRICATION
LEVEL 7

MANAGER

A STRUCTURAL FABRICATION MANAGER IS DESIGNATED TO PLAN AND DIRECT OPERATIONS AND ADMINISTRATION OF FABRICATION YARD ACTIVITIES, IMPLEMENT PROJECT WORK PLANNING & SCHEDULING AND PERFORM MANAGERIAL FUNCTION.

In particular the person will:

1. Plan and direct operations and administration of fabrication yard activities
2. Obtain statutory approval on project and work procedure
3. Ensure compliance with the local laws and government procedures, acts and regulation
4. Implement project work planning & scheduling in accordance with project specification
5. Perform approval on contract document, procurement and project costing
6. Approve project design review in accordance with project specification
7. Verify manpower requirement plan according to standard operating procedure
8. Perform managerial function in accordance with company policies and procedures

PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY

LEVEL 1

GENERAL FITTER

A GENERAL FITTER IS DESIGNATED TO PREPARE MATERIAL, PERFORM MARKING ON WORK SPECIMEN, PERFORM CUTTING, FITTING, ASSEMBLY, CLEANING WORK AND HOUSEKEEPING.

In particular the person will:

1. Perform marking on work specimen according to drawing
2. Perform cutting of specimen according to work piece specification
3. Perform chipping & cleaning for finished work piece
4. Perform fitting and assembly on work piece
5. Assist fabricator in carrying out various fabrication work
6. Carry out housekeeping in work area

PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY

LEVEL 2

FABRICATOR

A GENERAL FABRICATOR IS DESIGNATED TO FABRICATE A WIDE VARIETY OF PRESSURISED EQUIPMENT FROM APPROVED DRAWINGS AND PERFORM FABRICATION WORK SUCH AS CULTING, FIT-UP AND ASSEMBLY, TACK WELDING AND CLEANING OF FINISHED WORK.

In particular the person will:

1. Fabricate a wide variety of pressurised equipment from approved drawings
2. Perform fabrication work in accordance to work specification
3. Perform drawing interpretation
4. Perform calculation for dimensional work and marking on work piece
5. Perform cutting to intricate dimension in accordance with requirement
6. Perform complex fit-up & assembly in accordance with requirement
7. Perform tack welding on work piece in accordance with requirement

PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY

LEVEL 3

SUPERVISOR

A PRESSURISED EQUIPMENT FABRICATION SUPERVISOR IS DESIGNATED TO PERFORM SUPERVISORY SKILLS, ORGANISE FABRICATION ACTIVITIES, CONDUCT JOB & SAFETY BRIEFING TO FABRICATOR, SUPERVISE FABRICATION PERSONNEL, PREPARE MAINTENANCE SCHEDULE AND COORDINATE NON DESTRUCTIVE TESTING (NDT) AND DESTRUCTIVE TESTING (DT) OF FINISHED PRODUCT.

In particular the person will:

1. Collaborate with the fabrication superintendent to meet production and project schedules
2. Interpret shop fabrication drawings and cut lists according to project specification
3. Liaise with civil external parties in regards to on-site installation and assembly activities
4. Organise fabrication activities
5. Conduct job & safety briefing to fabricator
6. Administer fabrication personnel in the workshop
7. Prepare maintenance schedule for tools & equipment
8. Coordinate Non Destructive Testing (NDT) and Destructive Test (DT) for finished product
9. Perform supervisory function in accordance with company standard

PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY
LEVEL 4

QUALITY CONTROLLER

A PRESSURISED EQUIPMENT FABRICATION QUALITY CONTROLLER IS DESIGNATED TO COORDINATE PRODUCTION SCHEDULES, PERFORM DOCUMENTS REVIEWS, ANALYSIS OF FIT-UP INSPECTION, MONITOR WORK IN PROGRESS, VISUAL AND DIMENSIONAL INSPECTION, PREPARE RECOMMENDATION OF ACCEPTANCE & REJECTION CRITERIA AND UPDATE FABRICATION DATA.

In particular the person will:

1. Communicate with a diverse workforce as well as vendors, customers and engineers and coordinate production schedules and foster a good working relationship with the contractors and sub contractors
2. Prepare Inspection Test Plan (ITP) in accordance with contractual project requirement and client's specification
3. Ensure fabrication of pressurised equipment are in compliance to codes and standards
4. Provide assurance to the project in terms of delivery of technical integrity, quality assurance and quality control in all welding and fabrication matters
5. Responsible for documents reviews, analysis and input
6. Perform drawing & work specification interpretation
7. Perform work specification review
8. Perform fit-up inspection of fabrication work
9. Perform visual and dimensional inspection in accordance with project specification
10. Prepare recommendation of acceptance & rejection criteria
11. Compile & update fabrication data in accordance with contractual requirements such as Manufacturing Data Record (MDR)

PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY

LEVEL 5

FABRICATION SUPERINTENDENT

A PRESSURISED EQUIPMENT FABRICATION SUPERINTENDENT IS DESIGNATED TO COORDINATE PRODUCTION SCHEDULES, AND MONITOR OVERALL PROCESS OF PRESSURE EQUIPMENT FABRICATION FROM ENGINEERING DRAWINGS TO SHOP MACHINERY.

In particular the person will:

1. Coordinate production schedules and reviewing work scheduling in accordance with project specification such as K.P.I, milestones and look ahead planning etc.
2. Monitor pressurised equipment fabrication process from engineering drawings to shop machinery.
3. Coordinate costing, procurement, contract documents and project inventory
4. Review drawing and work specification of fabrication work
5. Supervise QC personnel and interview new technical staff
6. Organise project according to project specification

PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY

LEVEL 6

ASSISTANT FABRICATION MANAGER

AN ASSISTANT FABRICATION MANAGER IS DESIGNATED TO ASSIST IN ESTABLISHING OPERATION UNIT'S OBJECTIVES, POLICIES AND PROCEDURES COVERING THE PHASES OF PRESSURISED EQUIPMENT WORKSHOP OPERATIONS AND ALSO ASSIST MANAGER IN CARRYING OUT MANAGERIAL DUTIES.

In particular the person will:

1. Establish operation unit's objectives, policies and procedures of workshop operations
2. Assist to formulate financial plans and capital expenditure of workshop operations.
3. Establish standards to measure pressure equipment workshop operations performance relative to sales, profit and return on investment objectives
4. Approve drawing & work specification according to project specification
5. Prepare project budgeting and planning as per project requirement
6. Assist manager in carrying out managerial duties in accordance with company policies and procedures
7. Perform marketing activities

PRESSURISED EQUIPMENT FABRICATION / MANUFACTURING INDUSTRY
LEVEL 7

FABRICATION MANAGER

A FABRICATION MANAGER IS DESIGNATED TO PLAN AND DIRECT OPERATIONS AND ADMINISTRATION OF PRESSURISED EQUIPMENT WORKSHOP ACTIVITIES, MANAGE PROJECT IMPLEMENTATION, APPROVE PROCUREMENT & PROJECT COSTING, PERFORM DESIGN REVIEWING, CONTRACT APPROVAL AND PERFORM MANAGERIAL DUTIES.

In particular the person will:

1. Plan and direct fabrication operations of pressurised equipment workshop activities
2. Analyse business operation including market and customer trends, product and competitive developments, profit margins and capital spending requirements
3. Approve contract document, procurement & project costing
4. Review design of fabrication job
5. Perform managerial function in accordance with company policies and procedures

STRUCTURAL WELDING
LEVEL 1

WELDER ASSISTANT

A WELDER ASSISTANT IS DESIGNATED TO PREPARE MATERIAL AND PERFORM MARKING ON WORK SPECIMEN, PERFORM CUTTING, FITTING, ASSEMBLY, TACKING ACCORDING TO DRAWING, PREPARE WORK SPECIMEN AND CARRY OUT CLEANING WORK AND HOUSEKEEPING.

In particular the person will:

1. Perform marking on work piece according to drawing specification
2. Perform cutting to dimension according to drawing specification
3. Perform chipping & cleaning on finished work piece
4. Perform fit-up & assembly on work piece
5. Perform tack welding on work piece according to standard

STRUCTURAL WELDING
LEVEL 2

WELDER

A WELDER IS DESIGNATED TO PERFORM A WIDE VARIETY OF WELDING WORK, SUCH AS WELDING AFTER FIT – UP AND ASSEMBLY, CARRY OUT INITIAL VISUAL INSPECTION AFTER COMPLETION OF WELDS, ENSURE WELDING EQUIPMENT IS IN GOOD WORKING CONDITION AND CARRY OUT HOUSEKEEPING ACTIVITIES.

In particular the person will:

1. Perform welding after fit – up and assembly
2. Perform initial visual inspection after completion of welds
3. Ensure welding equipment is in proper working condition
4. Perform welding equipment set up
5. Set up complex work piece as per project requirement – to remove
6. Perform current adjustment prior to welding
7. Perform welding on complex position
8. Perform chipping & cleaning
9. Perform visual inspection on finished work piece
10. Perform cleaning work and housekeeping

LEVEL 3

WELDING SUPERVISOR

A WELDING SUPERVISOR IS DESIGNATED TO PERFORM COMPLEX WELDING WORK, IMPLEMENT VARIOUS JOINT DESIGNS AND CONFIGURATION, CARRY OUT SET WELD SEQUENCES, PERFORM AUDIT ON WELDERS TO ENSURE PROCEDURES ARE FOLLOWED AND PERFORM SUPERVISORY FUNCTION.

In particular the person will:

1. Obtain and interpret Welding Procedure Specification (WPS)
2. Organise and monitor welding activities according to procedures
3. Perform various welding technique which include SMAW, GTAW, GMAW, FCAW, SAW, as well as Plasma Cutting
4. Implement various joint designs and configuration
5. Carry out set weld sequences
6. Perform audit on welders in accordance with standard operating procedure
7. Carry out inspection on finished work piece for defect and non compliance weld
8. Coordinate Non-Destructive Testing (NDT) and Destructive Test (DT) for finished product
9. Perform supervisory function

STRUCTURAL WELDING

LEVEL 4

WELDING INSPECTOR

A WELDING INSPECTOR IS DESIGNATED TO PERFORM WELDING INSPECTION AT JOB SITE, ENSURE THAT QUALITY PLANS PROCEDURES ARE IMPLEMENTED AND ALL QUALITY RECORDS MAINTAINED.

In particular the person will:

1. Perform welding inspection at job site
2. Ensure welding specifications are followed correctly in accordance to codes and standards
3. Ensure that quality plans and procedures are implemented and all quality records maintained
4. Perform drawing & work specification interpretation
5. Perform Welding Procedure Specification (WPS) review
6. Perform fit-up inspection
7. Monitor welding / pre-heating work in progress
8. Perform recommendation for acceptance & rejection
9. Recommend accepted work for Non-Destructive Testing (NDT) and Destructive Test (DT)
10. Compile & update welder's data
11. Witness welding procedure qualification test & welder performance test in accordance with Standard Operating Procedure

STRUCTURAL WELDING

LEVEL 5

SENIOR WELDING INSPECTOR

A SENIOR WELDING INSPECTOR IS DESIGNATED TO APPROVE AND PERFORM INSPECTION ON PROJECTS IN PROGRESS, CONDUCT PREPARATION AND IMPLEMENTATION OF PROJECT QUALITY PLAN, APPROVE DRAWING AND WORK SPECIFICATION, PREPARE WELDING PROCEDURES SPECIFICATION AND RECOMMEND NON-DESTRUCTIVE TESTING AND DESTRUCTIVE TEST. HE WILL INTERPRET AND ANALYSE NON-DESTRUCTIVE TESTING AND DESTRUCTIVE TEST RESULTS & SUPERVISE WELDING INSPECTOR'S WORK.

In particular the person will:

1. Approve and perform inspection for oil and gas piping project and mechanical structure
2. Responsible for preparation and implementation of project
3. Prepare Welding Procedure Specification (WPS), Non-Destructive Testing (NDT) and Destructive Test (DT) requirement
4. Analyse Non-Destructive Testing (NDT) and Destructive Test (DT) results
5. Perform liaison with third party companies and authorities
6. Approve drawing & work specification
7. Perform supervision on welding inspector's work
8. Monitor, compile & update welder's performance record

STRUCTURAL WELDING
LEVEL 6

ASSISTANT WELDING ENGINEER

AN ASSISTANT WELDING ENGINEER IS DESIGNATED TO OVERSEE THE FABRICATION OF STRUCTURAL STEEL, ORGANISE & MANAGE PROJECT, PROJECT INVENTORY, PROJECT COSTING & CONTRACT DOCUMENT.

In particular the person will:

1. Communicate with a diverse workforce as well as vendors, customers and engineers and coordinate production schedules.
2. Monitor the fabrication of steel structures
3. Be responsible for providing assurance to the project in terms of delivery technical integrity and quality of a welding work
4. Be responsible for fostering good working relationship with the contractor and subcontractors
5. Review work scheduling
6. Organise & manage project
7. Manage inventory and costing

STRUCTURAL WELDING
LEVEL 7

WELDING ENGINEER

A STRUCTURAL WELDING ENGINEER IS DESIGNATED TO PLAN, CONTROL OPERATIONS AND ADMINISTERS WELDING ACTIVITIES. IN ADDITION, HE WILL ALSO ANALYSE AND APPROVE PROJECT DESIGN, APPROVE CONTRACT DOCUMENT, PROJECT COSTING, PROCUREMENT AND PERFORM MANAGERIAL DUTIES.

In particular the person will:

1. Plan and direct operations on welding activities.
2. Analyse business operation, including market and customer trends, product and competitive developments, profit margins and capital investment requirements.
3. Directs and participates in the process of acquiring, scheduling and completing work.
4. Present the plans and request for approval.
5. Ensure the financial information generated by fabrication yard reflects the financial position of the operation.
6. Approve contract document
7. Approve procurement & costing
8. Perform contract review & approval
9. Perform design review & approval

PRESSURISED EQUIPMENT FABRICATION , PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING

LEVEL 1

WELDER ASSISTANT

A WELDER ASSISTANT IS DESIGNATED TO PREPARE MATERIAL AND PERFORM MARKING ON WORK SPECIMEN, PERFORM CUTTING, FITTING, ASSEMBLY, TACKING ACCORDING TO DRAWING, PREPARE WORK SPECIMEN AND CARRY OUT CLEANING WORK AND HOUSEKEEPING.

In particular the person will:

1. Perform marking on work piece according to drawing specification
2. Perform cutting to dimension according to drawing specification
3. Perform chipping & cleaning on finished work piece
4. Perform fit-up & assembly on work piece
5. Perform tack welding on work piece according to standard

PRESSURISED EQUIPMENT FABRICATION , PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING

LEVEL 2

WELDER

A WELDER IS DESIGNATED TO PERFORM A WIDE VARIETY OF WELDING WORK, SUCH AS WELDING AFTER FIT – UP AND ASSEMBLY, CARRY OUT INITIAL VISUAL INSPECTION AFTER COMPLETION OF WELDS, ENSURE WELDING EQUIPMENT IS IN GOOD WORKING CONDITION AND CARRY OUT HOUSEKEEPING ACTIVITIES.

In particular the person will:

1. Perform welding after fit – up and assembly
2. Perform initial visual inspection after completion of welds
3. Ensure welding equipment is in proper working condition
4. Perform welding equipment set up
5. Set up work piece as per project requirement – to remove.
6. Perform current adjustment prior to welding
7. Perform welding on complex position
8. Perform chipping & cleaning
9. Perform visual inspection on finished work piece
10. Perform cleaning work and housekeeping

PRESSURISED EQUIPMENT FABRICATION , PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING

LEVEL 3

WELDING SUPERVISOR

A WELDING SUPERVISOR IS DESIGNATED TO PERFORM COMPLEX WELDING WORK, IMPLEMENTS VARIOUS JOINT DESIGNS AND CONFIGURATION, CARRY OUT SET WELD SEQUENCES, PERFORM AUDIT ON WELDERS TO ENSURE PROCEDURES ARE FOLLOWED AND PERFORM SUPERVISORY FUNCTION.

In particular the person will:

1. Obtain and interpret Welding Procedure Specification (WPS)
2. Organise and monitor welding activities according to procedures
3. Perform various welding technique which include SMAW, GTAW, GMAW, FCAW, SAW, as well as Plasma Cutting
4. Implement various joint designs and configuration
5. Carry out set weld sequences
6. Perform audit on welders in accordance with standard operating procedure
7. Carry out inspection on finished work piece for defect and non compliance weld
8. Coordinate Non-Destructive Testing (NDT) and Destructive Test (DT) for finished product
9. Perform supervisory function

PRESSURISED EQUIPMENT FABRICATION, PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING

LEVEL 4

WELDING INSPECTOR

A WELDING INSPECTOR IS DESIGNATED TO PERFORM WELDING INSPECTION AT JOB SITE, ENSURE THAT QUALITY PLANS PROCEDURES ARE IMPLEMENTED AND ALL QUALITY RECORDS MAINTAINED.

In particular the person will:

1. Perform welding inspection at job site
2. Ensure welding specifications are followed correctly in accordance to codes and standards
3. Ensure that quality plans and procedures are implemented and all quality records maintained
4. Perform drawing & work specification interpretation
5. Perform Welding Procedure Specification (WPS) review
6. Perform fit-up inspection
7. Monitor welding / pre-heating work in progress
8. Perform recommendation for acceptance & rejection
9. Recommend accepted work for Non-Destructive Testing (NDT) and Destructive Testing (DT)
10. Compile & update welder's data
11. Witness pressure test, welding procedure qualification test & welder performance test in accordance with Standard Operating Procedure

PRESSURISED EQUIPMENT FABRICATION , PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING

LEVEL 5

SENIOR WELDING INSPECTOR

A SENIOR WELDING INSPECTOR IS DESIGNATED TO APPROVE AND PERFORM INSPECTION ON PROJECTS IN PROGRESS, CONDUCT PREPARATION AND IMPLEMENTATION OF PROJECT QUALITY PLAN, APPROVE DRAWING AND WORK SPECIFICATION, PREPARE WELDING PROCEDURES SPECIFICATION AND RECOMMEND NON-DESTRUCTIVE TESTING AND DESTRUCTIVE TEST. HE WILL INTERPRET AND ANALYSE NON-DESTRUCTIVE TESTING AND DESTRUCTIVE TEST RESULTS & SUPERVISE WELDING INSPECTOR'S WORK.

In particular the person will:

1. Approve and perform inspection for oil and gas piping project and mechanical structure
2. Responsible for preparation and implementation of project
3. Prepare Welding Procedure Specification (WPS), Non-Destructive Testing (NDT) and Destructive Test (DT) requirement
4. Analyse Non-Destructive Testing (NDT) and Destructive Test (DT) results
5. Perform liaison with third party companies and authorities
6. Approve drawing & work specification
7. Perform supervision on welding inspector's work
8. Monitor, compile & update welder's performance record

PRESSURISED EQUIPMENT FABRICATION , PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING

LEVEL 6

ASSISTANT WELDING ENGINEER

AN ASSISTANT WELDING ENGINEER IS DESIGNATED TO MONITOR THE FABRICATION OF PRESSURISED EQUIPMENT**,** ORGANISE PROJECT, PROJECT INVENTORY AND PROJECT COSTING.

In particular the person will:

1. Liaise with a diverse workforce as well as vendors, customers and engineers and coordinate fabrication schedules
2. Monitor the fabrication of pressurised equipment
3. Provide assurance to the project in terms of delivery, technical integrity and quality of welding work
4. Organise project according to specification
5. Manage project inventory, project costing & contract document according to project requirement
6. Foster a good working relationship with the contractor and subcontractors
7. Assist manager in performing managerial function in accordance with company policies and procedures

PRESSURISED EQUIPMENT FABRICATION , PIPING & PIPELINE FABRICATION & MANUFACTURING WELDING

LEVEL 7

WELDING ENGINEER

A WELDING ENGINEER IS DESIGNATED TO PLAN AND DIRECT OPERATIONS AND ADMINISTERS WELDING OF PRESSURISED EQUIPMENT ACTIVITIES, MANAGE PROJECT SCHEDULING, APPROVE CONTRACT DOCUMENT, PROJECT PROCUREMENT AND PROJECT COSTING, ANALYSE AND APPROVE PROJECT DESIGN AND PERFORM MANAGERIAL DUTIES.

In particular the person will:

1. Plan and direct operations welding and pressurised equipment activities
2. Perform & manage project work planning & scheduling
3. Carry out approval on contract document, project procurement and project costing according to Standard Operating Procedure
4. Analyse and approve project design
5. Verify manpower recruitment according to project need and company requirement
6. Perform managerial function in accordance with company policies and procedures

NATIONAL COMPETENCY STANDARD

UNDERWATER WELDING

* Please refer to existing Occupational Definition stated by the Department of Skills Development