BAYUBALI ENGINEERING SDN BHD

STEAM BOILER ENGINEERS GRADE TWO (2) COURSE

	Training Dates:	As per schedule	**Training Venue:**	ALAF, Kuantan, Malaysia.
	Basic Fee:	RM6,000.00 + SST per participant, which includes course materials, meals, refreshments, and an attendance certificate. The fee excludes the examination.		

DURATION

42 hours (Six (6) days)

TARGET GROUP

- Engineers, team leaders/coordinators, operations engineers, maintenance team leaders, and senior operations and maintenance personnel should meet the following minimum education and work experience requirements:
  - **One year** of work experience is required for those with a bachelor's degree in mechanical engineering.
  - **Two years** of work experience is required for those with qualifications other than a bachelor's degree in mechanical engineering.
  - Experience with steam boilers having a heating surface area of more than **500 m²**.
- Experienced professionals who wish to review or expand their understanding of steam boiler systems.
- Engineers intending to take the Steam Boiler Engineer's Certificate of Competency (Grade 2) examination with the Department of Occupational Safety and Health, Malaysia (DOSH).

TARGETED INDUSTRY/INDUSTRIES

Oil & Gas, Petrochemicals, Power Plants, Renewable Energy Plants, Co-Generation Plants, Palm Oil Mills, Refineries, Plywood Industries, Hotels, and all industries utilizing steam for heating and mechanical drives.

CERTIFICATION

This course is approved by the **Department of Occupational Safety and Health (DOSH), Malaysia** for the **Grade 2 Steam Engineer's** examination.

COURSE OVERVIEW

This course provides participants with in-depth knowledge of the responsibilities of personnel involved in the manufacturing, fabrication, and inspection of new steam boiler plant components, as well as new construction activities, as defined by **ASME Section I** and the **Occupational Safety and Health Act 1994 (Amended 2022).**

The training course aims to enhance engineers' understanding of the requirements for the selection, construction, commissioning, operation, inspection, repair, and maintenance of steam boilers. It aligns with **international codes and standards** and **Malaysian laws**, including the **Occupational Safety and Health Act 1994 (Amended 2022)** and its **Regulations**.

This course is **mandatory** for individuals intending to apply for the **Grade 2 Steam Boiler Engineer's License** examination with **DOSH**.

COURSE OUTCOMES

At the end of the course, delegates will be able to:

- Identify the relevant laws, codes, and standards for steam boiler design, installation, fabrication, operation, inspection, repair, and maintenance.
- Calculate the mechanical design of steam boiler main pressure parts, such as drums, tubes, and headers.
- Recognize the major hazards associated with operating and maintaining boilers and steam systems.
- Safely operate steam boilers and steam systems.
- Describe the processes involved in boiler commissioning, operation, troubleshooting, inspection, repair, and maintenance.
- Explain key parameters that affect boiler performance and efficiency.
- Understand the principles of thermodynamics as applied to steam boilers and steam systems.
- Explain the applications of steam in process plants and the power generation sector.
- Describe the basic controls used in boiler operation.
- Identify safety rules for boiler operation, covering industrial combustion phenomena and feed water quality.
- Prepare for the **Steam Engineer's Certificate of Competency (Part 1 & Part 2) Grade 2** examination with the **Department of Occupational Safety and Health, Malaysia (DOSH).**

TRAINING METHODOLOGY

- Lecture
- Pre- and Post-Test
- Site visit
- Classroom discussions
- Short video presentation
- Case study

Note: Participants need to wear the required PPE, such as safety shoes, a jacket, safety glasses, and etc.

COURSE CONTENT

CHAPTER 1 – AN INTRODCUTION TO STEAM BOILERS

- Definition of Steam Boilers
- Purpose of Steam Boilers
- Fundamental of Steam and Water
- Terminology

CHAPTER 2 – LAWS AND STANDARDS (UNDANG-UNDANG DAN PAIWAIAN)

- Occupational Safety and Health Act, 1994 (Act 514) (Amendment 2022)
- Occupation Safety and Health (Plant Requiring Certificate of Fitness), Regulations 2024
- Occupation Safety and Health (Plant Requiring Certificate of Fitness), Regulations 2024: Schedule 8 – Essential Fittings
- Occupational Safety and Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulations 2000.
- Industry Code of Practice for Safe Working in A Confined Space 2010.
- Industry Code of Practice for Management of Occupational Noise Exposure and Hearing Conservation 2019.
- Guidelines on Heat Stress Management at Workplace 2016.
- Guidelines On Ergonomics Risk Assessment at Workplace 2017.
- Plant safety, management, and maintenance policy.
- Steam Engineer's Roles and Responsibilities.
- Boiler House Management.

CHAPTER 3 – BOILER DESIGN

- Applicable Codes and Standards
- Steam Plant Conceptual Design
- Boiler Design
- Boiler fabrication process
- Boiler Components
- Parts, Essential Fittings and Safety Devices

CHAPTER 4 – STEAM BOILER INSTALLATION AND TESTING

- Steam Boiler Installation Procedures
- Cause and Effect Matrix
- Testing and Commissioning
- Refractory Drying Out Procedure
- Alkaline Boiling Out & Post Inspection Procedure
- Steam Blowing
- Steam Test
- Boiler Tuning

CHAPTER 5 – STEAM BOILER OPERATIONS

- Fundamental Operational Responsibilities
- Start-up and Shutdown
- Burner Operation and Interlock System
- Water Level Control System
- Pressure Control System
- Forced Draft Control System
- Furnace Purging
- Blowdown Control System
- Steam Pressure Control System
- Test Gauge Glass
- Emergency Shutdown
- Steam Management
- Boiler Efficiency & Burner Efficiency
- Storage of Idle Boiler
- Steam traps
- Boiler Water Treatment
- Steam Turbine Fundamentals

CHEPTER 6 – COMBUSTION OF FUELS

- Introduction of Combustion
- Types of Combustion
- Excess Air
- Flue Gas Analysis
- Combustion efficiency
- General Considerations Regarding Safety
- Steam Soot Blower
- Atomizer For Fuel Oils
- Types of Fuel
- Emission Controls

CHAPTER 7 – STEAM BOILER INSPECTION, MAINTENANCE AND REPAIR

Chapter 7.1 – Materials, Creep and Fatigue, Corrosion and Controls

- Classification of Materials
- Imperfection in Solids or Metals
- Mechanical Properties of Metals
- Tension Tests
- Plastic and Elastic Deformations
- Material’s hardness
- Mechanisms of Strengthening in Metals
- Metal Failures
- Heat Treatment of Steels
- Heat Treatment (Annealing) of Ferrous Alloys
- Corrosion and its Controls

Chapter 7.2 - Welding Process

- Welding procedures
- Types of welding process
- Pre-heating
- Post weld heat treatment
- Test specimens
- Welding positions

Chapter 7.3 – Non-Destructive Testing (NDT)

- Advantages of Non-Destructive Testing (NDT)
- NDT Methods
  - Radiographic Testing (RT)
  - Ultrasonic Testing (UT)
  - Magnetic Particle Testing (MPI)
  - Eddy Current Testing
  - Dye-Penetrant Testing (DPI)
  - Visual Testing (VT)

Chapter 7.4 – Welding Mechanical Failures (Welding Defects)

- Welding Defects
- External Welding Defects
- Internal Welding Defects

Chapter 7.5 – Boiler Defects and Potential Root Cause

- Typical Boiler Damages and Defects
- Boiler Defects
- Waterside Failure Mechanisms
- Fireside Failure Mechanisms
- General Failure Mechanisms

Chapter 7.6 - Steam Boiler Maintenance, Inspection and Repair

- Maintenance Objectives
- Safety Checklist for Inspection
- Boiler Maintenance Programs
- Maintenance Checks
- Steam Boiler Repairs

TRAINING AND EXAMINATION REQUIREMENTS

General Requirements

- Must be a **Malaysian citizen**.
- Have adequate working experience in Occupational Safety and Health.
- Must not have been charged or found guilty of any offenses under Act 514 or its Regulations.
- Certified medically fit by an Occupational Health Doctor (OHD).
- Attend a **Steam Boiler Engineer Grade 2 Course** conducted by a DOSH-approved training provider.
- Submit a registration application within one (1) year after passing the Steam Engineer exam.

Educational & Work Experience Requirements

Option 1:

- Hold at least a **bachelor's degree in mechanical engineering** recognized by **MQA**, and
- Have **one (1) year** of work experience related to steam boiler operation (**must be verified by the employer**).

OR

Option 2:

- Hold at least a **bachelor's degree in engineering (other than Mechanical Engineering)** recognized by **MQA**, and
- Have **two (2) years** of work experience related to steam boiler operation (**must be verified by the employer**).

ABOUT THE INSTRUCTOR



Ir. Mohd Normarzuki bin Ya'acob graduated with a Bachelor's (Honors) in Mechanical Engineering from the University of Malaya. He is a registered Professional Engineer with a Practicing Certificate (Mechanical) from the Board of Engineers, Malaysia (BEM), a Corporate Member of The Institution of Engineers, Malaysia (IEM) and a Professional Technologist from the Malaysia Board of Technologist (MBOT). Additionally, he holds certification as a First Grade Engineer (Steam Boiler and Internal Combustion Engine) from the Department of Occupational Safety and Health (DOSH).

His professional journey includes significant roles at various companies, including Equator Engineering Sdn Bhd, Tenaga Nasional Berhad, Petronas Gas Berhad (Gas Processing Plant 5/6 and Centralized Utilities Facility), and Qatar Petroleum (where he served as the Head of Short Technical Training). Presently, he serves as the Managing Director at Bayubali Engineering Sdn Bhd.

Throughout his career. Mohd Normarzuki has gained extensive field experience in steam boiler operation, troubleshooting, inspection, maintenance, and repair. He possesses expertise in project management, design, selection, specification, installation, maintenance, operation, plant optimization, and troubleshooting of utility facilities in the oil and gas industry.

He is also a co-author of the book "An Introduction to Steam Machinery," published by the University of Malaya Publisher.

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TRAINING TIME TABLE

STEAM ENGINEER GRADE 2 COURSE

TIME	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6
08:30 - 10:30	Intoduction to Steam Boiler	Steam Boiler Installation and Testing	Boiler Operation	Boiler Operation	Combustion of Fuels	Welding Mechanical Failures (Welding Defects)
10:30 - 10:45	**Morning Tea Break**					
10:45 - 13:00	Laws and Standards	Steam Boiler Installation and Testing	Boiler Operation	Boiler Operation	Materials, Creep and Fatigue, Corrosion and Controls	Boiler Defects and Potential Root Cause
13:00 - 14:00	**Lunch & Prayer**					
14:00 - 15:30	Boiler Design	Steam Boiler Installation and Testing Boiler Operation	Boiler Operation	Boiler Operation	Welding Process	Steam Boiler Maintenance
15:30 - 15:45	**Afternoon Tea Break**					
15:45 - 17:30	Boiler Design (Practical)	Boiler Operation	Boiler Operation	Combustion of Fuels	Non-Destructive Testing	Mock Up Test or Site Visit

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