MATRIX QUANTUM SDN. BHD. 202201044306 (1490003-X)
Lot 180, Jalan 1A, Kampung Baru Subang,
40150 Shah Alam, Selangor Darul Ehsan.
Tel: 03-58926806 Email: matrixquantum88@gmail.com

TRAINING SCHEDULE & OUTLINE

Course Tittle	**HRSG Operation & Control**
Training Provider	**Matrix Quantum Sdn Bhd**
Duration	**2 Days**
Date	**TBA**
Time	**8.30am – 5.00pm**

About the Training:

Empowering your technical team to master the complexities of HRSG operations. **Focusing** on the precision of control systems and the mitigation of startup failures, this program ensures your facility maintains peak thermal stability and uncompromising asset protection. Unlike general boiler courses, this training dives deep into the high-value components of Heat Recovery, ensuring every PSI of exhaust heat is captured safely and efficiently.

Training Outcomes:

Upon completion of this training, participants will be equipped to immediately implement best practices of:

1) Analyze the unique design characteristics of Heat Recovery Steam Generators (HRSG) and their role in combined cycle power plants.
2) Execute precise Cold, Warm, and Hot startup sequences to minimize thermal stress and fuel consumption.
3) Optimize HRSG Control Systems including Drum Level, Steam Temp, and Swell Management for stable operations.
4) Implement best practices for safe and efficient HRSG shutdown and preservation
5) Identify and mitigate the root causes of typical startup failures and "trip" scenarios.
6) Master HRSG Protection logic, including Drum Level, Furnace Purge, and Temperature interlocks.
7) Manage the "Swell and Shrink" phenomena effectively during load changes and transient periods.
8) Evaluate Heat Transfer efficiency across Economizers, Evaporators, and Superheaters.
9) Formulate emergency response protocols for critical HRSG failures to ensure personnel and asset safety.

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	TIME	DESCRIPTION	REMARK
DAY 1	8.30-8.45	REGISTRATION DAY 1	
	8.45-9.00	INTRODUCTION AND ICE BREAKING	
	9.00-10.30	MODULE 1	
	10.30-11.00	TEA BREAK	
	11.00-12.30	MODULE 2	
	12.30-14.00	LUNCH AND ZOHOR PRAYER BREAK	
	14.00-15.30	MODULE 3	
	15.30-15.45	TEA BREAK	
	15.45-17.15	MODULE 4	
	17.15	ADJOURN DAY 1	
DAY 2	8.30-8.45	REGISTRATION DAY 2	
	8.45-9.00	RECAP OF PREVIOUS DAY LESSONS	
	9.00-10.30	MODULE 5	
	10.30-11.00	TEA BREAK	
	11.00-12.30	MODULE 6	
	12.30-14.00	LUNCH AND ZOHOR PRAYER BREAK	
	14.00-15.30	MODULE 6	
	15.30-15.45	TEA BREAK	
	15.45-17.15	MODULE 7	
	17.15	END OF COURSE	

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MODULE OUTLINE DETAILS

1. MODULE 1 – INTRODUCTION TO HRSG

1) **Introduction**
   comprehensive overview of Heat Recovery Steam Generator (HRSG) technology, its critical role in combined cycle power plants, and modern design configurations.
2) **HRSG In Rankine Cycle**
   Analyzing the integration of the HRSG within the thermodynamic Rankine Cycle to maximize the conversion of gas turbine exhaust into high-pressure steam.
3) **HRSG Principle**
   Examining the fundamental principles of recovering waste heat from gas turbine exhaust gases to produce steam without the need for additional fuel combustion.
4) **Heat Transfer in HRSG**
   Evaluating the mechanisms of convective and conductive heat transfer across the economizer, evaporator, and superheater sections to ensure peak thermal efficiency.
5) **Circulation In HRSG**
   Mastering the dynamics of natural and forced water circulation within the evaporator loops to maintain stable drum levels and prevent tube overheating.

2. MODULE 2 – HRSG MAJOR COMPONENTS

1) **Steam Drum**
   Understanding the steam drum's function as the central reservoir for water-steam separation and its critical role in managing water quality and thermal storage.
2) **Tubes**
   Analyzing the heat transfer efficiency and structural integrity of Economizer, Evaporator, and Superheater tube bundles subjected to high-temperature exhaust gases**.**
3) **Control Valve**
   Mastering the operational precision of feedwater and spray-water control valves in maintaining stable drum levels and steam temperatures during load fluctuations.
4) **Main Stop Valve**
   Examining the critical role of the Main Stop Valve in providing secure isolation and managing the safe release of steam into the distribution header.
5) **Stack Damper**

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Evaluating the strategic use of stack dampers for thermal energy preservation during shutdowns and as a critical tool for controlling gas temperature and heat-up rates during the start-up warm-up sequence.

3. MODULE 3 – HRSG START UP

1) Start Up Preparation

Executing comprehensive pre-start checklists, including valve alignment, instrument verification, and ensuring auxiliary systems are ready for thermal loading.

2) HRSG Firing

Mastering the critical transition from Gas Turbine ignition to HRSG heat-up, focusing on purge requirements and initial temperature ramp-up control.

3) HRSG Loading

4) Managing the controlled increase of steam pressure and temperature while monitoring thermal expansion and drum level stability to prevent equipment stress.

5) HRSG Coupled

Orchestrating the precise synchronization of steam flow with the Steam Turbine or process header to ensure a seamless and stable energy transfer.

4. MODULE 4 – HRSG CONTROLLER

1) Controller Task

Mastering the core functional requirements of the HRSG control system, focusing on the automated management of drum levels, steam temperatures, and pressure set-points to maintain stable equilibrium during transient loads.

2) Typical Controller in HRSG

i. Level Controller

ii. Temperature Controller

5. MODULE 5 – HRSG PROTECTION

1) Major HRSG Protection

Mastering the critical matrix of safety interlocks and automated trip logic, including extreme drum level limits and furnace purge requirements, to safeguard the plant against catastrophic structural and thermal failure.

I. Low Water Level

II. High Water Level

III. Less Steam Flow

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IV. **High Steam Temperature**
V. **Over Pressure**

6. **MODULE 6 – HRSG SHUTDOWN**
   1) **Reduce Firing**
      Managing the controlled reduction of heat input to gradually lower steam production while maintaining thermal equilibrium and preventing rapid cooling stress**.**
   2) **Firing shutdown**
      Executing the precise sequence for extinguishing combustion or cutting off gas turbine exhaust flow to safely initiate the transition to a non-operational state.
   3) **Natural Cooling**
      Monitoring the gradual dissipation of residual heat within the HRSG structure to ensure uniform cooling and protect pressure parts from uneven thermal contraction.
   4) **HRSG Isolation**
      Implementing secure mechanical and electrical isolation protocols to ensure the unit is safely decoupled from the steam header and auxiliary systems for standby or maintenance

7. **MODULE 7 – TYPICAL HRSG START UP FAILURES**
   1) **Low Water Alarm after firing to Low Load**
   2) **High Water Alarm Active after Firing to Low Load**
   3) **Less Of Steam Flow**
   4) **Steam Drum Overpressure**
   5) **High Steam Temperature**