

# **RT-FLEX & WIN GD Diesel Engines Operation and Maintenance**

## **4-DAY Training Course**

### **1. OVERALL AIM**

A Training Course designed for Engineer Officers who are to be recruited in one of the nine (9) ships of Minerva Marine fitted with a Wartsila RT-Flex or Win GD (*Winterthur Gas & Diesel*) diesel engine. The overall aim of the course is to increase the awareness of the participants to the concept, key components, operation and maintenance on the above camshaft-less, pressurized fuel and servo oil common rail, Tier II, electronic engines.



### **2. LEARNING OBJECTIVES**

To help the Engineer Officers understand:

- the RT-Flex mechanical features including the fuel and servo oil pumps, and the function of ICU (Injection Control Unit), CLU (Cylinder Lubrication Unit) and VCU (Valve Control Unit).
- the electronically controlled and load-dependent high-pressure, common rail systems for fuel injection and exhaust valves operation.

- the Control System including the WECS 9520 and the UNIC Control System, the Variable Injection Timing and the Variable Exhaust Opening/Closing.
- the function of the Flex Lube Cylinder Lubrication System and the feed rate adjustment, the importance of Service Letters issued by the maker and measures to be taken in emergency occasions.

### 3. TRAINING FACILITIES

The Training Course will take place at the ATHINA Maritime Learning and Development Center by making use of the K-Sim Engine Simulator (Class A) and Desk-Top (Class C) Simulators.

Class A (ENG)	A full mission simulator capable of simulating all machinery operations in the engine control room and machinery spaces.
Class C (ENG)	A limited task marine simulator capable of simulating some machinery operations in the engine control room and machinery spaces.

For the simulated training, an engine model Wartsila 12 RT – Flex 82 (C), two-stroke, low speed, 12 cylinder configuration, turbocharged, reversible with cylinder bore 820 mm, piston stroke 2646 mm, CSR 54.24 MW with 102 RPM corresponding speed.



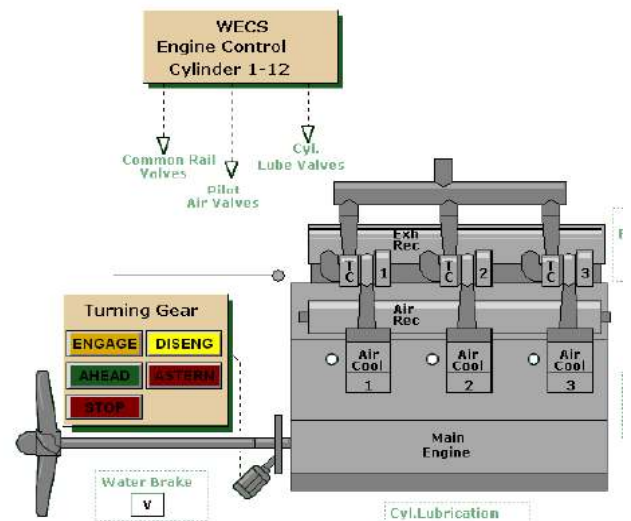
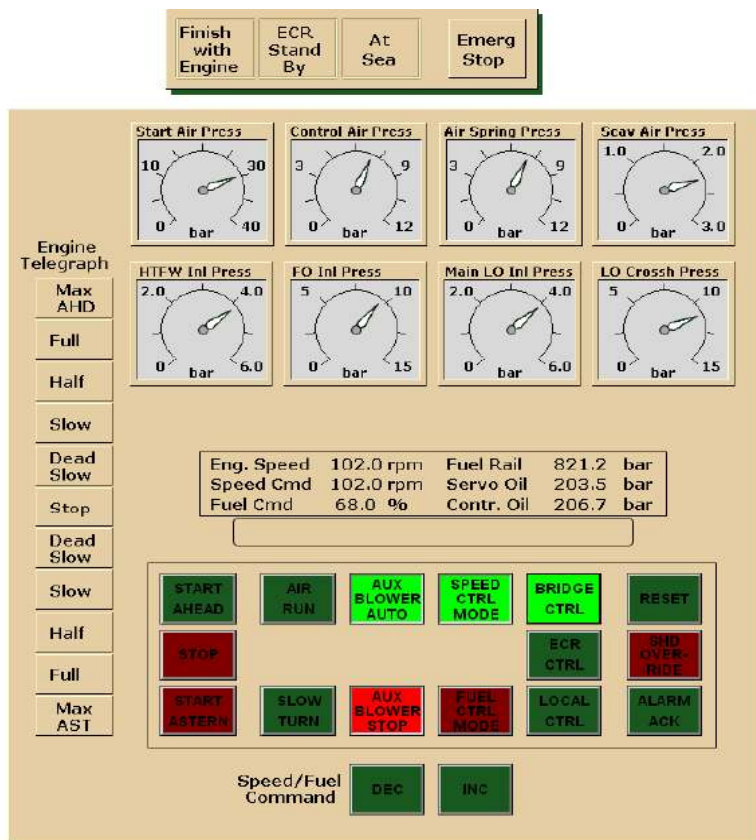
***RT-Flex 68T-B, Minerva Nounou, (17.647 KW – 94 RPM)***

#### 4. SCHEDULE

		<b>WARTSILA RT-FLEX</b>
<b>DAY 1</b>	09:00 – 11:00	The RT-FLEX Common Rail System with Electronic Control of Fuel Injection and Exhaust Valve Actuation  Mechanical Components (Fuel Supply Units, Fuel Pumps, Actuators, Servo Oil Supply Pumps)
	<i>11:00 – 11:20</i>	<i>Coffee Break</i>
	11:20 – 13:00	Cylinder Lubrication Rail Valves, Fuel Fast Nozzles, Exhaust Valves
	<i>13:00 – 13:50</i>	<i>Lunch Break</i>
	13:50 – 15:00	ICC Sensors, Gear Wheel Angle Sensors  TDC and BTC sensors
	<i>15:00 – 15:20</i>	<i>Coffee Break</i>
	15:20 – 16:30	Engine Control Diagram

		<b>WARTSILA RT-FLEX</b>
<b>DAY 2</b>	09:00 – 11:00	Hydraulic and Pneumatic Components (ICU Cross-section and working principles, VCU working principles)
	<i>11:00 – 11:20</i>	<i>Coffee Break</i>
	11:20 – 13:00	Starting Air System  Engine Control System (WECS) for controlling fuel delivery from common rail to individual cylinders – Volumetric Injection Control  AMS, Engine Safety System
	<i>13:00 – 13:50</i>	<i>Lunch Break</i>
	13:50 – 15:00	Kongsberg Automation and NABDESCO FCM-20 Module
	<i>15:00 – 15:20</i>	<i>Coffee Break</i>
	15:20 – 16:30	Manual Control Panel VIT Nozzle Control System

<b>WARTSILA RT-FLEX</b>		
<b>DAY 3</b>	09:00 – 11:00	Flex View Operator Service Operator
	11:00 – 11:20	Coffee Break
	11:20 – 13:00	Simulation – Exercises Familiarization Ready to Start and Full Load Operation
	13:00 – 13:50	Lunch Break
	13:50 – 15:00	Power Charge Over from Shaft Generator to DGs and speed reduction from ECR and Local Stand
	15:00 – 15:20	Coffee Break
	15:20 – 16:30	Troubleshooting



		<b>WIN GD Diesel Engine</b>
<b>DAY 4</b>	09:00 – 11:00	<p>The W-X type of engine (*)</p> <p>Control System UNIC – Flex</p> <p>UNIC – Flex Hardware Modules</p> <ul style="list-style-type: none"> <li>· Cylinder Control Modules 20 (CCM) for opening the starting valves at the correct crank angle to release starting air.</li> <li>· Main Control Module (MCM)</li> <li>· Input Output Module (IOM)</li> <li>· Electronic Governor</li> </ul> <p>Remote Control System, Safety System Speed Measuring Pick-up Sensors</p>
	11:00 – 11:20	<i>Coffee Break</i>
	11:20 – 13:00	Module Identification Bus System
	13:00 – 13:50	<i>Lunch Break</i>
	13:50 – 15:00	Flex–Lub Cylinder Lubrication System – Feed Rate Adjustment Local Display Unit - LDU-20
	15:00 – 15:20	<i>Coffee Break</i>
	15:20 – 16:30	Practice on PC Simulator

(\*) A Win GD W5X72 main engine is fitted to M. Evropi and M. Kalypso.