

ENERGY
ENVIRONMENT
ECONOMYINTELLIGENT COMBUSTION CONTROL FOR
WÄRTSILÄ TWO-STROKE RT-flex AND W-X ENGINES**KEY BENEFITS OF INTELLIGENT
COMBUSTION CONTROL**

- Optimized fuel consumption over whole load range
- Reduced maintenance costs and downtime
- Fully automated balancing
- Real-time data
- Reduced workload for crew and technical department
- Maximized availability and reliability through a safer, finely balanced engine operation

Today's shipping business is faced with the requirement to reduce fuel oil consumption throughout the fleet's operating profiles. Similarly, operational reliability and vessel availability must be ensured, maintenance costs need to be reduced, and emissions legislation has to be complied with.

Wärtsilä's Intelligent Combustion Control system (ICC) supports to achieve all these goals. It enables the ship's engines to operate reliably and in accordance with their original shop test performance. This is done automatically on board, in real time and regardless of the fuel in use or ambient conditions.

The ICC system automatically balances compression and firing pressures in all cylinders, resulting in equal exploitation of each unit and reduced torsional vibrations of the complete engine. The system also protects the engine against potential manual operating errors.



■ ■ ■ The advantages of the system become even more significant when the fuel has to be changed while in SO_x Emission Control Areas, and always when different fuel qualities are used for cost or availability reasons.

Compared to an engine where the Fuel Quality Setting (FQS) is not adjusted properly, the measured reduction in fuel oil consumption with an activated ICC is up to 2.5 g/kWh over the whole engine load range. When ICC is active the specific fuel oil consumption is reduced which results in a decrease of CO₂ emissions.

ENGINE CONTROL FUNCTION

The ICC is a engine control function, which adjusts the peak firing pressure of the

engine according to the given design criteria. The firing and compression pressures of all cylinders are balanced by adjusting the injection timing and exhaust valve closing within their allowed operating range. All modifications of engine control parameters made in the ICC system are compliant with the vessel's IMO certificate.

The ICC system also limits the pressure rise (compression/ combustion ratio) of the engine as an included safety function. This reduces the wear of engine components, minimizes the risk of overloads, and helps to avoid manual adjustment flaws in case of open loop control.

Thanks to the ICC system, the engine is always operated according to its design criteria, as safely and as efficiently as possible.

INSTALLATION REFERENCE

After the completion of rigorous testing, the ICC system was installed on two vessels powered by Wärtsilä 7RT-flex96C and 12RT-flex96C engines. The complete installation took place during port time, and the ICC system was commissioned during a short voyage between European ports without influencing the vessel's schedule. Commissioning included functionality and performance testing.

Compared to the original setting with standard Open Loop Control and FQS=0, a fuel oil consumption reduction was observed for each operating point (figure 1). This was achieved mainly with the adjustment to the permitted peak firing pressure at each speed

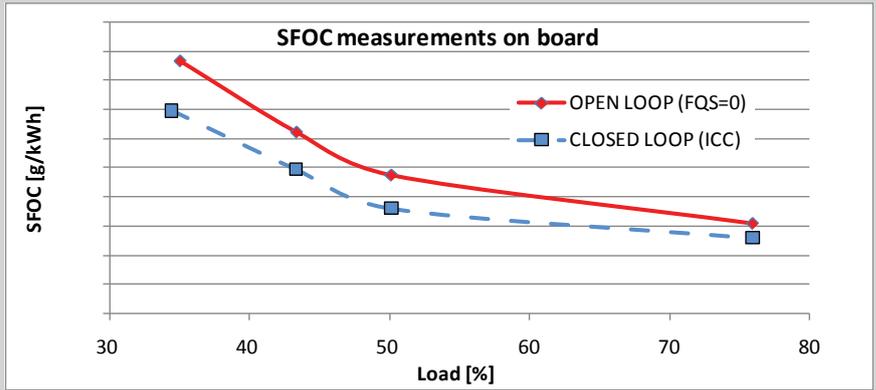


Figure 1: SFOC measurement on board.

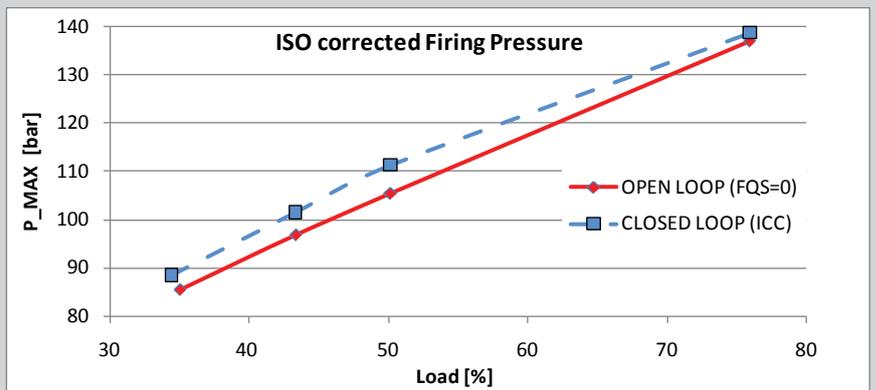


Figure 2: ISO corrected firing pressure.

The compression and firing pressures are adjusted with ICC for each engine speed / load operating point.

/ load point with activated Closed Loop Control (figure 2). Meanwhile ICC has been installed on over 150 engines with very good operation results.

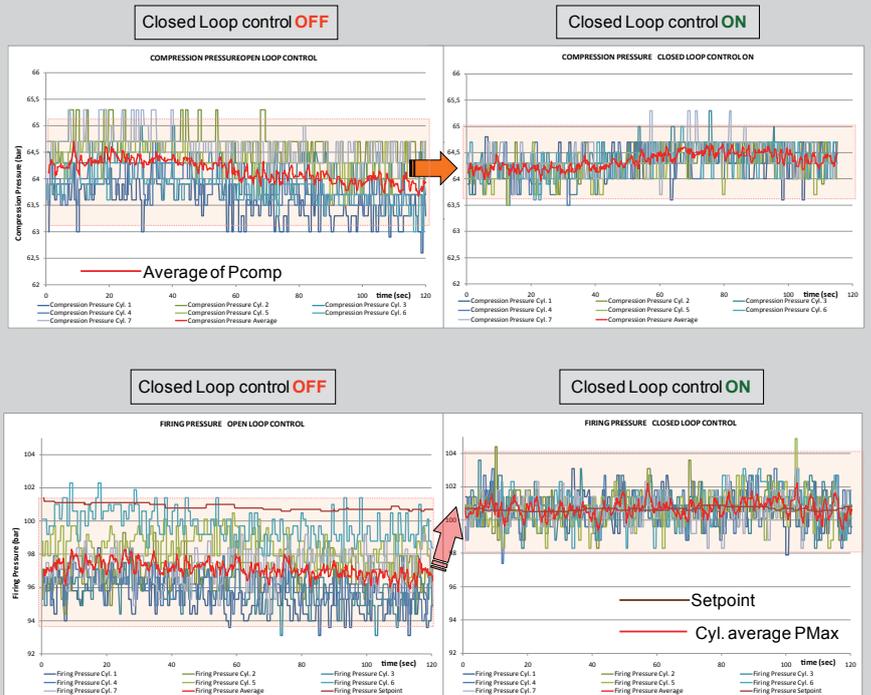


Figure 3: Activation of ICC (Wärtsilä 7RT-flex96C).

Compression and firing pressure deviations between cylinders are clearly reduced.



THE WÄRTSILÄ ICC SOLUTION PROVIDES SAFER OPERATION WITH REDUCED COSTS

Optimized engine operation

- Fuel savings up to 2.5 g/kWh
- Automated FQS setting

Balanced mechanical and thermal load distribution

- Automated adjustment of compression and firing pressures
- Reduced wear and ageing of sensitive engine components
- Prevention of mechanical and thermal overload (high-peak pressures)
- Avoidance of unfavourable manual FQS adjustment

CONCLUSION

ICC ensures that the engine is operated according to its design criteria, as safely and as efficiently as possible. The reduction in fuel oil consumption with an activated ICC is up to 2.5 g/kWh over the whole engine load range. The equal exploitation of each cylinder unit of the engine by the balancing of compression and firing pressure reduces potential overload and abnormal wear rates of engine components. The ICC system helps to reduce the work load of the crew as all adaptations and adjustments are done automatically while also considering fuel quality and ambient conditions.