



NORSK ANALYSE



VOC/NMVOC Emission Monitoring System

VOC/NMVOC EMISSION MONITORING SYSTEM

Quantification of VOC and NMVOC emissions from oil tankers and gas carriers

During the loading, storage and transportation of crude oil and liquid hydrocarbon products, volatile organic compounds (VOCs) boil-off from the cargo.

In a vapour recovery unit (VRU), heavier VOC fractions can be condensed into liquid VOC (LVOC) and reused as fuel in engines or boilers. Non-condensable surplus gas, including inert gas and low-energy VOCs, may be released into the atmosphere.

Non-methane volatile organic compounds (NMVOCs) reacts with nitrogen oxides, contribute to ground-level ozone and smog. This may adversely affect human health, vegetation and the environment as greenhouse gas.

MARPOL Annex VI, Regulation 15, establishes requirements for the control of NMVOC emissions from tankers. Emissions can be reduced through vapour recovery systems and improved operational practices, including optimised cargo tank pressure and reduced vessel roll and pitch.

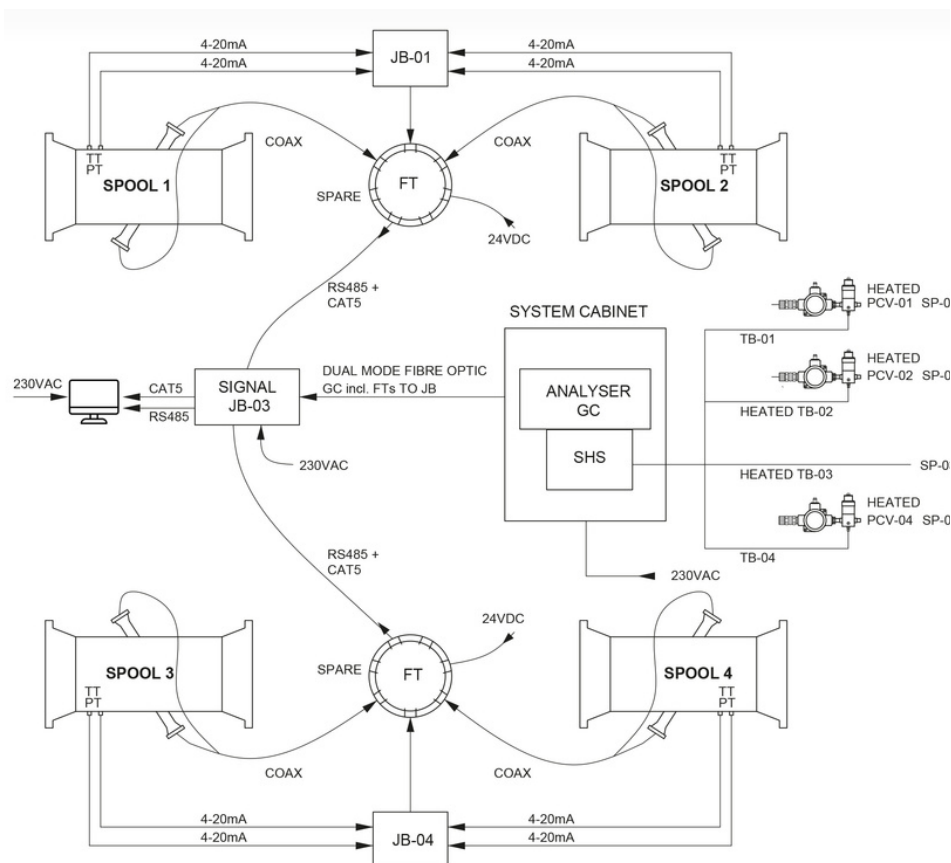
The Norsk Analyse NMVOC Emission Monitoring System continuously measures gas volume flow and the concentrations of air, CO₂ and C1–C6+ hydrocarbons throughout the vapour recovery system, including SVOC, LVOC and mast riser streams.

The system provides:

- Gas volume flow and composition
- Energy content and Wobbe Index
- Calculated mass emissions of inert gas, methane and NMVOC
- Reliable data for emission reporting and operational optimisation

Continuous monitoring enables improved emission control and supports more efficient onboard operating practices.





- Sample probe SP-01 (with Vapour LNG) goes to Spool 1, SVOC to RISER
- Sample probe SP-02 (with Vapour LVOC) goes to Spool 2, SVOC to BOILER
- Sample probe SP-03 (with VOC) goes to Spool 3, VOC to RISER
- Sample probe SP-04 (with SVOC) goes to Spool 4, VOC to VRU

By measuring flow, pressure and temperature, and analysing the gas composition, the system provides full control of:

- VRU efficiency
- LVOC energy content for fuel blending
- SVOC Wobbe Index for boiler applications
- NMVOC emissions from the mast riser
- Analyser system with sample conditioning, stream switching and a field-mounted process gas chromatograph housed in an SS316L stainless steel cabinet

The main system components are:

- Carbon steel spool pieces with gas sampling probes and ultrasonic flow measurement
- Calculation unit for data processing, emission log storage and communication
- Industrial computer for remote operation, monitoring and maintenance

System and analyser cabinet units

Installed in Ex Zone 1

- Spool piece with all necessary flanges and nozzles for:
 - Ultrasonic flow meter
 - Temperature and pressure transmitters
 - Sample probe for analyser system
- Heat traced sample tubing (transporting sample from spool piece to analyser cabinet)
- Dedicated automated analyser system cabinet with:
 - Sample handling system
 - Flow indicators with alarm limits
 - Compact gas chromatograph for component analysis of inert gas and VOC mixture
 - Oxygen analyser to prevent O₂ leaks into inert system
 - All necessary utility gases, carrier and calibration gas
 - Interface and signal converter

Installed in Safe Area

- Calculation unit for data processing
- Remote operator and maintenance interface unit
- System connection to ship's network (technical LAN)

Analyser cabinet installed in deck trunks according to:

- IACS E10
- IEC 60092-504

Dry instrument air and 230 VAC power to be provided by ship.

Technical Specifications

Spool piece

- Material: Carbon steel
- Total length including flanges: 1500 mm
- Wall thickness: 9.5 mm
- Ship owner to specify flange standard
- Mechanical connections downstream for transmitters, gas sample and by-pass sample return, gas chromatograph flange: ½" NPTF socket
- Mounting bracket for junction box

Pressure transmitter

- Measures absolute pressure
- Measuring range: 0 to 2 barA

Flow transmitter

- Type: USM Gas flowmeter
- Measuring range: 0 to 16000 m³/h
- Transducer configuration: 180 degrees
- Communication: Modbus TCP/IP

Temperature transmitter

- Immersion depth: Close to center of spool piece ($\approx \frac{1}{2} \times \text{diameter}$)
- Measuring range: 0 to 40°C

Gas components [measuring range vol %]

- Nitrogen and oxygen [0 to 100]
- Carbon dioxide [0 to 15]
- Methane [0 to 20]
- Ethane [0 to 20]
- Propane [0 to 30]
- Isobutane [0 to 30]
- n-Butane [0 to 30]
- Isopentane [0 to 10]
- n-Pentane [0 to 10]
- Hexane+ [0 to 5] (including hydrocarbons up to C₉)
- Cycle time: 2 to 3 minutes

Specifications are subject to change without notice.

