



APPLICATION NOTE Oil & Gas

Fiscal metering of a dry natural gas mixture

- AGA9-compliant metering skids for billing of gas supplied to a processing facility
- Full scope of software and hardware supply with ultrasonic CT flowmeters, analyzer house with chromatographs, analyzer management system, flow computers, etc.
- All from one source incl. engineering, testing, commissioning and training services

1. Background

A national oil company operates several oil fields in the Middle East. To maximise the values of the hydrocarbons produced and to reduce gas flaring, the gas that is separated from the oil and produced water is further processed to achieve grid quality natural gas. In this way, large quantities of natural gas can be recovered, resulting in additional revenue.

2. Measurement requirements

The raw gas from the separator is basically dry natural gas (methane) with a negligible amount of water and traces of nitrogen, CO₂, propane, butane and other organic compounds, as well as a significant amount of hydrogen sulphur (H₂S). The high H₂S content makes the raw gas "sour" and requires amine treatment.

The subsequent transport of the desulphurised gas to the gas processing plant requires fiscal metering. The oil company therefore needed a gas metering skid consisting of custody transfer (CT) flowmeters, pressure and temperature transmitters, as well as gas chromatographs, a water dew point analyzer and a fully equipped metering control system with certified flow computers, data acquisition system and PLCs.

Process parameters

Case / stream	Case 1: HT winter	Case 2: HT summer	Case 3: LT winter	Case 4: LT summer
Temperature (°C/°F)	56.7 / 134	77 / 170.6	55.7 / 132.26	76.4 / 169.5
Pressure (barg/psig)	52.8 / 765.8	52.8 / 765.8	52.8 / 765.8	52.8 / 765.8
Molecular weight (kg/kgmole)	25.55	26.8	25.71	26.7
Mass density (kg/m ³)	62.4	60.1	63.5	60.1
Viscosity (cP)	0.014	0.015	0.014	0.015
Volumetric flow rate (MMscf/d)	3...136.5	3...141.1	3...148.2	3...152.5
Mass flow (kg/h)	3825...174036	4011...188676	3849...190155	4003...203492



3. KROHNE solution

With a long track record in oil and gas projects and an experienced team of local service engineers in the Middle East, KROHNE met all the customer's requirements and won the EPC tender package. The dry gas metering solution comprised of a gas metering skid, an analyzer shelter with different gas analysing units, a metering control cabinet and various related services.

Dry gas metering skid

For fiscal metering KROHNE supplied two metering lines with ALTOSONIC V12 ultrasonic gas flowmeters (12", Cl 600) in a Z configuration, with one flowmeter as duty meter and the other one as check meter. The Z-crossover allows the duty meters to be periodically verified against the master meter. An additional ALTOSONIC V12 was provided as a spare.

As per AGA9, 10D/5D straight length meter spools were considered for each metering stream. The multi-path flowmeters had been wet calibrated with natural gas at a third-party calibration lab prior to delivery. The metering skids are equipped with motor operated ball valves at the inlet, outlet and the cross-over of the streams as well as pressure transmitters, temperature sensors and all the necessary tubing, fittings and electrical equipment.



Dry gas metering skid with the ALTOSONIC V12 ultrasonic flowmeter

Analyzer house and shelter

The metering skid was accompanied by a fully assembled, configured and tested analyzer house and shelter for gas quality measurements. The galvanised steel analyzer unit was equipped with third-party equipment as per customer requirements, such as:

- a gas chromatograph for various components (in mol-%): methane, ethane, propane, butane, pentane, hexane, heptane, octane, nonane, nitrogen, CO₂
- a dew point analyzer for moisture measurement
- HVAC equipment and gas detection for the Fire & Gas (F&G) system
- other equipment inside and outside the housing, e.g. a sampling conditioning cabinet

The analyzer solution was delivered integrated with the CalSys solution for analyzer management and data acquisition (AMADAS). This enables fully automated analyzer validation procedures to determine the performance, availability and maintainability of the various process analyzers. The project also included the integration and monitoring of the various existing online analyzers for oxygen, chlorine, total dissolved solids (TDS), pH, ORP and H₂S.



Analyzer house and shelter with gas analyzers for sour gas analysis



Metering control system

KROHNE also supplied a supervisory control system cabinet, which provides control of the metering skids and allows validation of the installed field instrumentation. It includes supervisory station computers, an AMADAS server, field signal and data transfer equipment, a PLC and two SUMMIT 8800 flow computers.

Based on the readings from the ALTOSONIC V12 and the signals from pressure and temperature transmitters, the SUMMIT 8800 calculates the standard volume flow rate of dry gas for billing purposes. For this purpose, the multi-stream flow computers are equipped with two I/O boards and one communication board. The dual pulse signal of the flowmeters is used as the primary measurement signal by the SUMMIT 8800.

The flow computers receive backup measurement signals and diagnostic data via the serial RS-485 Modbus connection of the ALTOSONIC V12. The flowmeter features two serial RS-485 Modbus RTU ports which are connected to both flow computers. The Modbus connection of the flow computer is also used for speed of sound comparison calculated as per AGA10. The readings of the pressure and temperature measurements are transferred via 4...20 mA to the analogue input of the flow computer.



ALTOSONIC V12 for fiscal metering of sour gas

4. Customer benefits

KROHNE's range of solutions enables the gas producer to implement an AGA-compliant fiscal metering. Based on the ALTOSONIC V12 flowmeter, the metering skids generate accurate billing data for transparent transactions between the sour gas treatment facility and the gas processing plant. It also enables the management of several analyzers and chromatographs to monitor gas moisture and composition prior to dehydration and further processing. Thanks to the CalSys analyzer management solution, the operator can effectively monitor the performance of its quality measurement instruments (QMI) to carry out targeted maintenance of their gas chromatographs, process analyzers and gas detectors. It also enables production management to keep track of asset KPIs to ensure a maximum uptime of the analytical equipment.

The customer benefited from the full scope of supply, including software and hardware components as well as the solution-related services conducted by KROHNE's local service engineers. These ranged from the initial design drawings and calculations to engineering, manufacturing and welding of pipework to comprehensive quality assessments and non-destructive examination (NDE) to calibration and acceptance testing to installation, commissioning and training.

5. Solutions and products used

Custody transfer metering system for gases

- Metering solution for dry gases and gas mixtures
- Comprising flow metering skid, metering control cabinets, sampling and analyzer systems, and all supervisory and validation software
- Compliance with international and local standards e.g. OIML R137, AGA9, MI-002



ALTOSONIC V12

- Ultrasonic flowmeter for custody transfer (CT) measurement of gases
- CT: OIML R137 (class 0.5), MI-002, AGA9 etc.
- Flange: DN100...1600 / 4...64"; max. PN450 / ASME Cl 2500



Metering houses and shelters

- Turnkey housing solution for the installation of electronic systems and cabinets on-site
- Integrated HVAC system where required



CalSys analyzer management software

- Solution for analyzer management and data acquisition (AMADAS)
- Effective performance monitoring of quality measurement instruments (QMI)
- Automated analyzer validation and statistical process control
- Complies with international standards and methods (ASTM D3764, ASTM D6299, OP 97-30425 etc.)
- Increased availability of gas chromatographs and critical process analyzers



Supervisory control cabinets

- Complete solution for process control
- Provides control of the metering system, including validation of field instrumentation
- Installed in a safe area (e.g. in a control room)



Flow computing

- Solution for the visualisation of measurements based on the SUMMIT 8800 flow computer
- Graphical representation of all measurements
- Fully pre-configured and tested according to customer requirements



SUMMIT 8800

- Flow computer for custody transfer (CT) measurement
- Compliant with all main international standards, such as OIML, ISO, API, AGA, GOST
- Cost effective solution due to modular hard- and software design



Contact

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Do you require technical advice for your application?
application@krohne.com

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