

# Goliat Metering Systems – A brief summary

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## General

FMC Kongsberg Metering was awarded the contract for supplying the Goliat metering package in January 2011. Delivery date is March 2012. ENI Norge is the operator and Hyundai Heavy Industries (HHI) is the engineering contractor. The platform, based on the Sevan design, will be located 53 km north-west of Hammerfest, not far from the Snøhvit field. The platform will be built by HHI in Ulsan, South Korea. Production start-up is planned for 2013.



FIGURE 1. GOLIAT FIELD AND PLATFORM

## Scope and design

The scope of the metering package is shown in Table 1.

System	Design
<b>Crude Oil Offload Metering (Fiscal)</b>	Skid with: 4 x 12" USM Duty Meters (4 x 2000 m <sup>3</sup> /h = 8000 m <sup>3</sup> /h) 3 x 8" Turbine Master Meters (3 x 800 m <sup>3</sup> /h = 2400 m <sup>3</sup> /h) Connections for 3rd Party Portable Compact Prover (capacity 800 m <sup>3</sup> /h) for annual calibration of Master Meters. Dual pressure and temperature on all meter runs.
<b>Crude Oil Offload Analyser System (Fiscal)</b>	Cabinet with: Automatic sampling, online density and watercut.
<b>Fuel Gas Metering (Fiscal)</b>	Skid with: 1 x 4" USM with bypass pipe. Dual pressure and temperature on all meter runs.
<b>Fuel Gas Analyser System (Fiscal)</b>	Cabinet with: Online gas chromatograph
<b>HP Flare Metering (Fiscal)</b>	1 x 24" Meter Run with single path USM. Dual pressure and temperature.
<b>LP Flare Metering (Fiscal)</b>	1 x 24" Meter Run with single path USM. Dual pressure and temperature.

<b>Gas Injection Metering</b>	Skid with: 1 x 8" Orifice Meter Run. Dual pressure and temperature.
<b>Gas Lift Metering</b>	Skid with: 1 x 4" Cone Meter Run. Dual pressure and temperature.
<b>Test Separator Metering</b>	Meter runs and instrumentation: Cone type flow meters for gas Liquid USM for oil and water Online H <sub>2</sub> S
<b>Metering Control System</b>	FMC FPM207 Flow Computers (API & ISO calculations) FMC Supervisory Computer (Totalizing and stream control) Standard alarming, reporting and trending features.

TABLE 1. GOLIAT SCOPE AND DESIGN

The skids and the liquid analyser systems will be assembled in Larvik by NLI Alfred Andersen. The gas analyser systems will be assembled in Grums, Sweden, by Norsk Analyse.

The Crude Oil Offload Metering skid is the largest and most complex item in the scope. It will be 18x7x6 meter in size with an estimated weight of 100 tonnes and a flow metering capacity of 8000 m<sup>3</sup>/h. It includes electrically actuated inlet and outlet valves as well as pneumatic control valves for flow balancing in addition to the ultrasonic duty meters and master turbine meters.

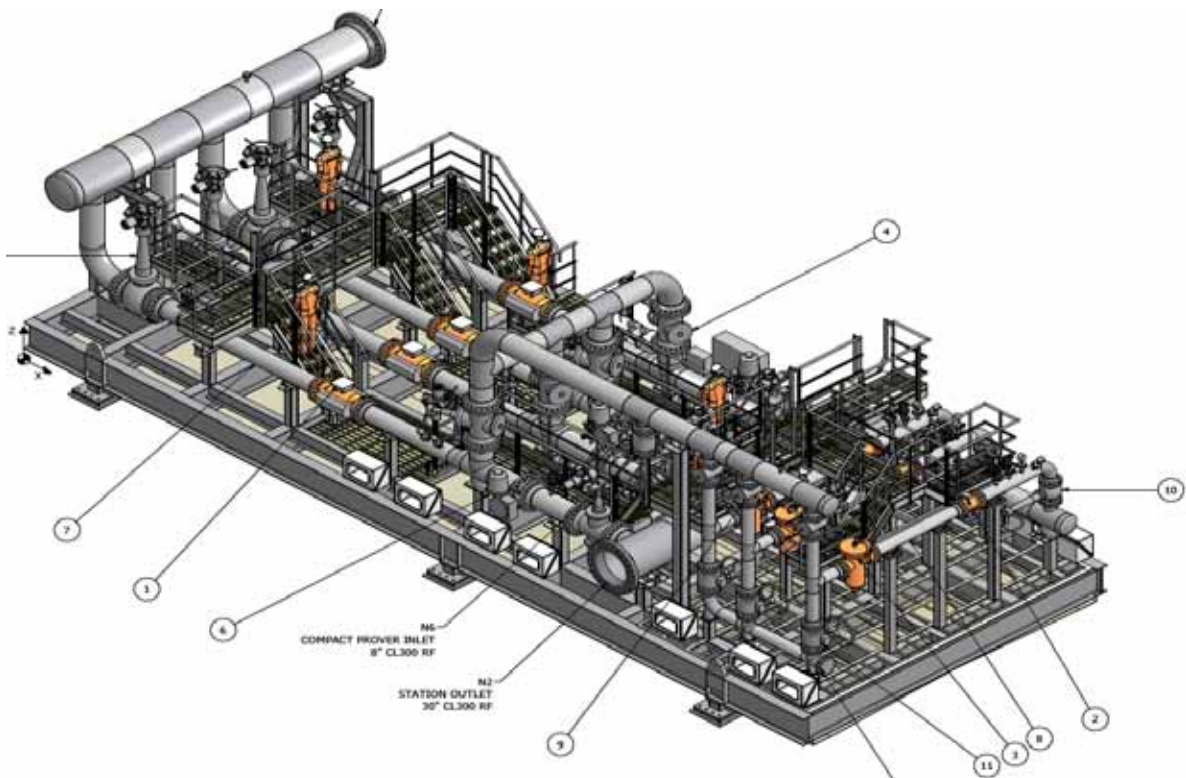


FIGURE 2. GOLIAT 33JX001 CRUDE OIL OFFLOAD METERING SKID

A schematic of the metering system on Goliat is shown in figure 3.

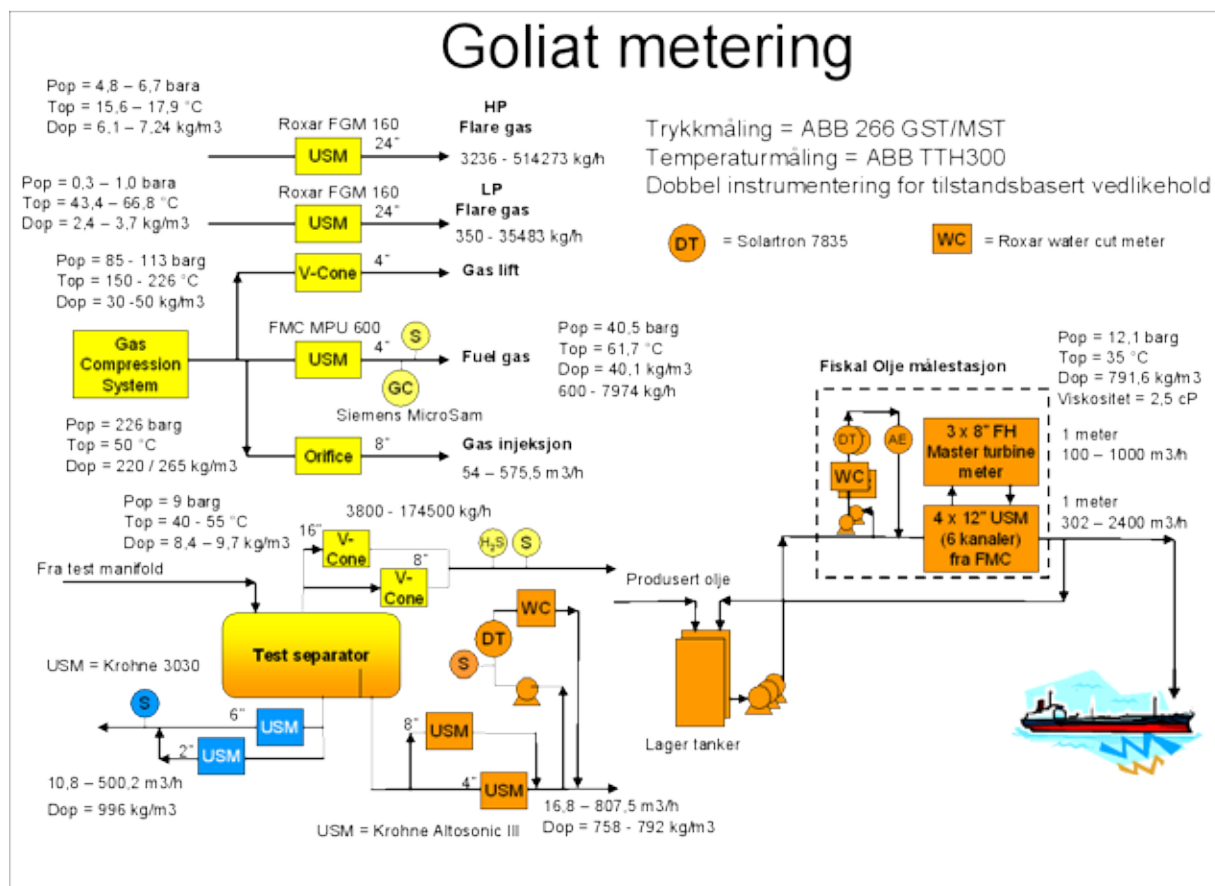


FIGURE 3. GOLIAT METERING

## Main flow meters and instrumentation

All instrumentation for the metering systems is based on well proven technology from suppliers familiar with NORSOK and NPD requirements. FMC Technologies is entering the Norwegian market with their Ultra6 liquid ultrasonic flow meters. The Ultra6 flow meters are being used as duty meters on the Crude Oil Offload Metering skid and were tested successfully to NPD and API requirements at FMC's accredited flow calibration facility in Erie, Pennsylvania, in September this year. The makes and model of the flow meters and main instrumentation is shown in Table 2 together with calibration schedule and status per November 2011.

System	Meters	Model / Make	Calibration	Status
Crude Oil Offload Metering	4 x Liquid Ultrasonic Flow Meters (Duty)	FMC Ultra-6, 12-inch, 6-path, pulse output	Accredited flow calibration (5 x 5), Erie, Pennsylvania, USA	Completed September 2011
	3 x Liquid Turbine Flow Meters (Master)	Faure Herman TZN200-1000, 8-inch, pulse output	Accredited flow calibration (6 x 5), Faure Herman, France	Completed August 2011
Crude Oil Offload Analyzer System	1 x Grab Sampler with 12-litre ProMix receiver	Grab Sampler Proserv/Autocontrol Proserv ProMix SS-100-1200 Receiver	N/A	

	2 x Densitometer	Solartron 7835	Accredited UKAS calibration, UK	
	2 x Water-in-Oil	Roxar WCM	Factory test, Stavanger, Norway	
<b>Fuel Gas Metering</b>	1 x Gas Ultrasonic Flow Meters (Duty)	FMC MPU 600, 4-inch, 3-path, pulse output	Accredited flow calibration (5 x 5), Force, Denmark	Completed November 2011
<b>Fuel Gas Analyser System</b>	1 x Gas Chromatograph	Siemens MicroSam, Natural Gas GC, 10 components	NORSOK I-104 and ISO 10723, Karlsruhe, Germany	Completed August 2011
<b>HP Flare Metering</b>	1 x Gas Ultrasonic	Fluenta FGM 160, 24-inch, single path, serial comm.	Dry (Zero) Factory Calibration, Bergen, Norway	Completed October 2011
<b>LP Flare Metering</b>	1 x Gas Ultrasonic	Fluenta FGM 160, 24-inch, single path, serial comm.	Dry (Zero) Factory Calibration, Bergen, Norway	Completed October 2011
<b>Pressure for all systems</b>	Pressure Indicating transmitters	ABB 266	Factory calibration	
<b>Temperature for all systems</b>	Temperature indicating transm.	ABB TH300, direct mounted	Factory calibration	
<b>Gas Injection Metering</b>	1 x Orifice	Autek / EPS, 8-inch single chamber orifice	Dimensional control	
<b>Gas Lift Metering</b>	1 x Cone Meter	McCrometer, 4-inch V-Cone	Accredited calibration at CEESI Colorado	
<b>Test Separator Gas Metering</b>	2 x Cone Meter 1 x Online H <sub>2</sub> S	McCrometer, 16-inch and 8-inch V-Cone Norsk Analyse / Ametek 933	Accredited calibration at CEESI Colorado	
<b>Test Separator Oil Metering</b>	2 x Liquid USM 1 x Densitometer 1 x Water-in-Oil	Krohne Altosonic III Solartron 7835 Roxar WCM	Accredited calibration at Trapil	
<b>Test Separator Water Metering</b>	2 x Liquid USM	Krohne UFM3030	Factory calibration	

TABLE 2. GOLIAT INSTRUMENTATION