
ABB MEASUREMENT & ANALYTICS

Measurement made easy for downstream oil and gas



Expertise in measurement technology

Delivering increased productivity

As a leading supplier to the oil and gas industry, ABB provides the measurement and analytical technology needed to operate downstream refining and petrochemical plants safely, productively and profitably.

With proven high accuracy and reliability, ABB's measurement and analytical products combine high performance with the lowest cost of ownership, giving customers predictable and safe operation.

ABB's global reach means it can provide equipment and expertise wherever it is needed. Customers anywhere in the world can rely on on-time delivery and expert support for their equipment and systems, enabling them to get their installation online as quickly as possible and to keep it running.

ABB and its heritage companies have been leaders in innovation and technology for more than 100 years.

Aztec

Bailey

BOMEM

Bush Beach Engineering
Limited

**FISCHER
& PORTER**

Hartmann & Braun

K-TEK

Kent

LGR
Los Gatos Research
A MEMBER OF THE ABB GROUP

Pressductor®

SENSYCON

Schoppe & Faeser

Spirit
A MEMBER OF THE ABB GROUP

Taylor

TBI-Bailey

TORBAR
FLOWMETERS LTD

TOTALFLOW
MEASUREMENT & CONTROL SYSTEMS

Trusted measurement solutions

Optimizing your production efficiency

World-class measurement and analytical solutions for the oil and gas downstream industry

ABB provides an extensive portfolio of measurement and analytical products for use throughout the downstream chain. From refining through to petrochemical production, ABB's measurement and analytical products provide the accuracy and durability needed to help operators optimize the efficiency and performance of their processes.

With certifications including TÜV, NACE, ATEX, FM, FMC, IECEx, CSA, SAA, GOST, INMETRO, PCEC and KGS, ABB's measurement products provide safe performance in oil, gas, refining and petrochemical operations worldwide.

ABB's portfolio includes sensors, transmitters and related equipment for:

- Process liquid and gas analyzers
- Emission analysis
- Pressure measurement
- Temperature measurement
- Level measurement
- Flow measurement
- Liquid analysis

Did you know?

When a leading chemical company in Mississippi wanted to quickly bring their plant back into operation following Hurricane Katrina, ABB was there to help. Damaged pH analyzers, as well as pressure and temperature transmitters were quickly replaced and repaired to help bring the plant back on-line.



Safe and predictable operation

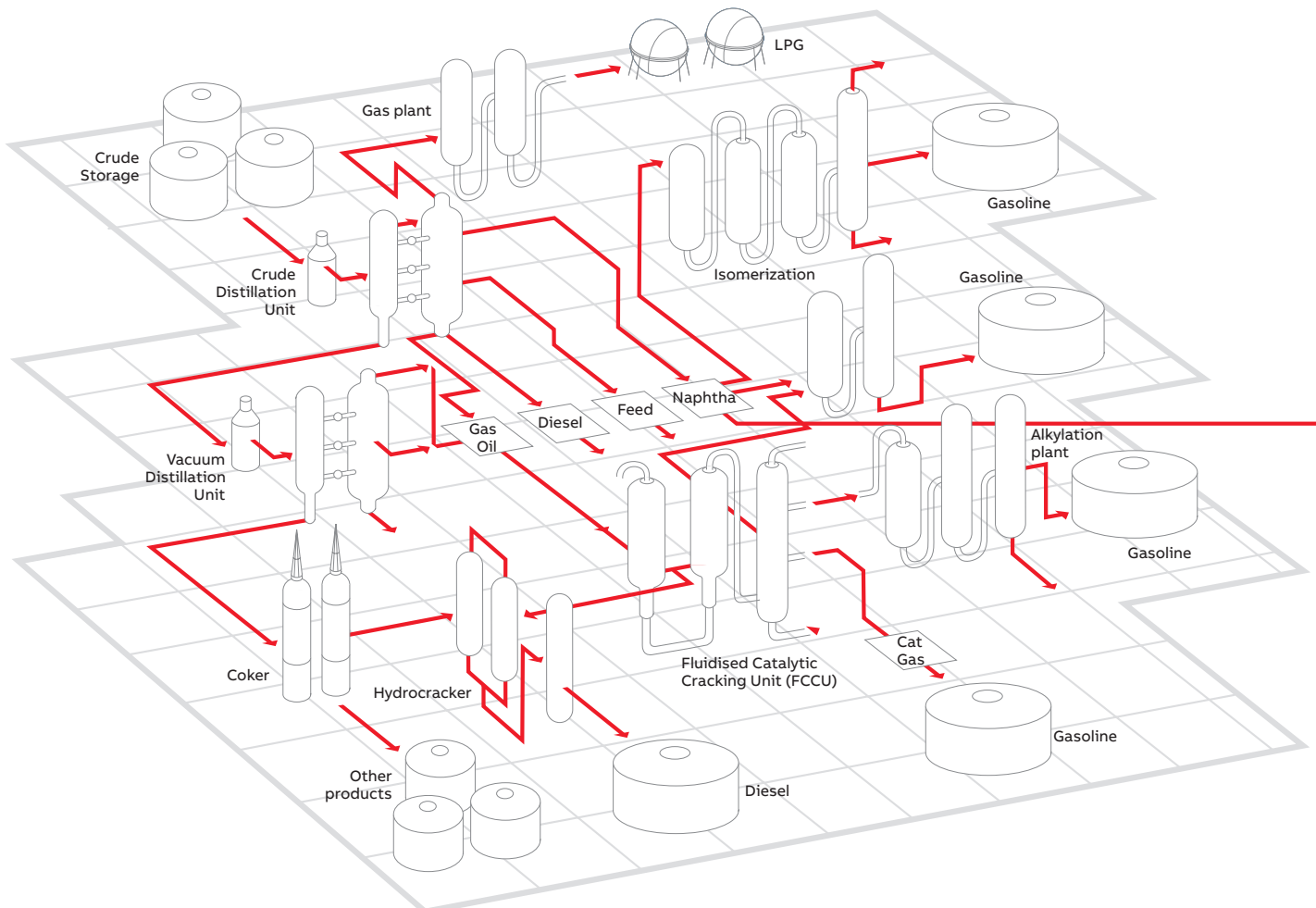
Measurement and analytics for refining

Blending & Crude distillation

Turning crude oil into the vast array of derivative products ranging from fuel oils through to the chemicals used in thousands of everyday products requires the highest levels of control. Whether for distribution, process control or process monitoring, each process in the refining stage requires accurate and reliable measurement for highest levels of productivity, profitability and safety. At the crude distillation stage, ABB's products help to enable the effective separation of crude oil into its key components, ready for the next stage in the process. These components include naphtha, kerosene and light and heavy gas oils.

Hydrotreating & Hydrocracking

Effective hydrotreating, or hydrodesulphurization, is a critical stage which helps to remove contaminants from the crude oil that could affect both equipment and product quality at later stages in the refining process. ABB's equipment at this stage includes process analyzers to help measure process efficiency and enable the effective removal of sulphur and other contaminants. Close control of temperature and cracking severity are major requirements in a hydrocracking process. ABB's temperature sensors and process analyzers help to provide the data needed to produce the optimum conditions for production of jet fuel, diesel, LPG and high octane gasoline fractions.



In control of any process

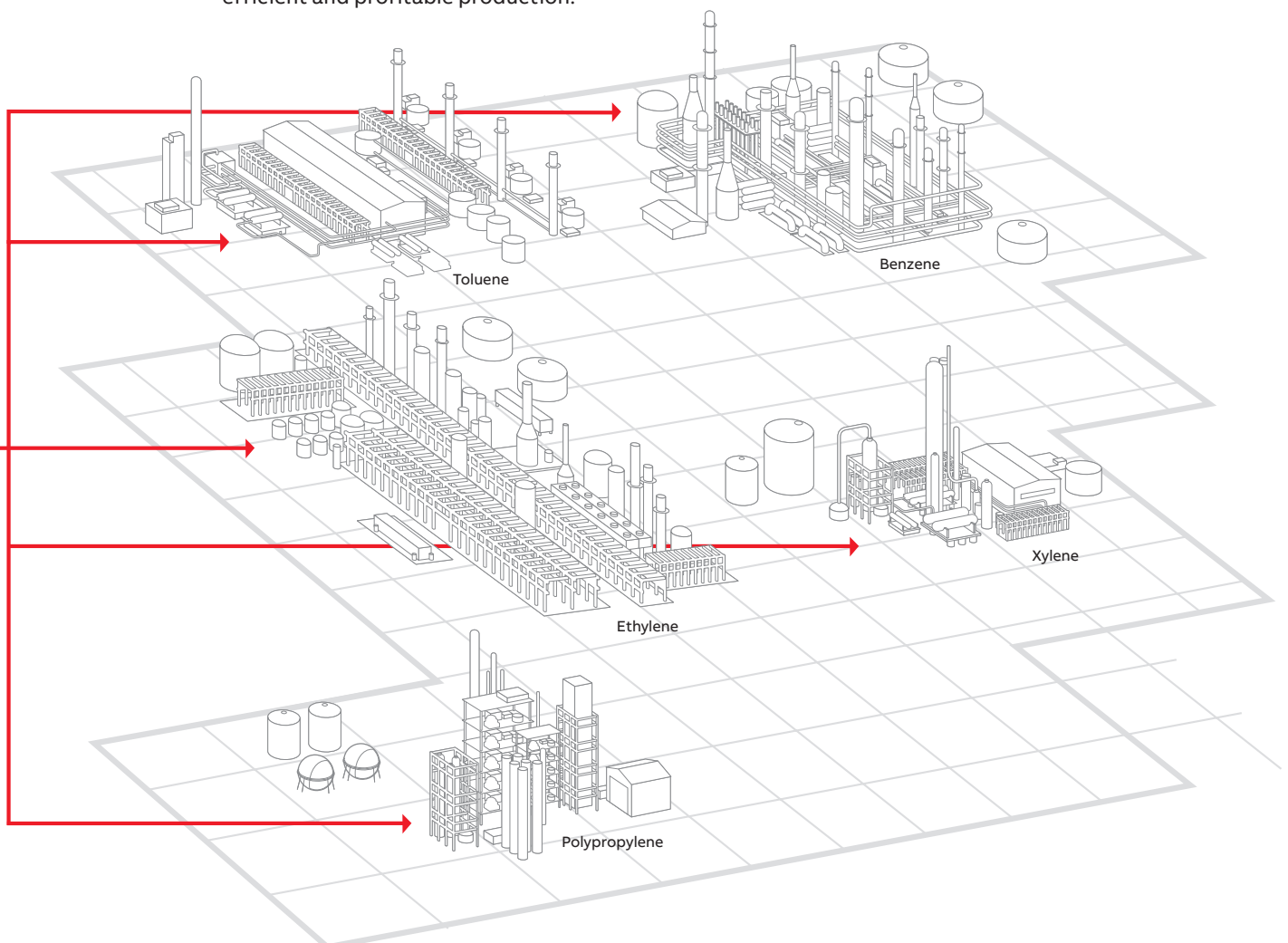
Petrochemical production solutions

Petrochemical production

The production of chemicals from petroleum or natural gas is an essential part of the chemical industry today. Chemicals derived from petrochemical compounds are a key ingredient in products such as detergents, fertilizers, medicines, paints, plastics, synthetic fibers and rubber. Around 200 distinct chemicals are derived from petrochemical production processes, including simple hydrocarbons such as methane and ethane, aromatic hydrocarbons such as benzene and toluene, olefins, including ethylene and propylene, naphthenes and various other derivatives. ABB's measurement and analytical products are widely used throughout petrochemical processes to help achieve and maintain the optimum conditions for safe, efficient and profitable production.

EOEG, TDI and MDI production

Amongst the various petrochemical derivatives, the most significant are ethylene-based products, TDI (Toluene Diisocyanate) and MDI (Methyl Diphenyl Diisocyanate). Together, these chemicals are used in a wide variety of everyday products. ABB's measurement and analytical products play a key role throughout the production of these chemicals, ranging from measuring process flows; managing temperature and pressure conditions and monitoring discharges to the water cycle, through to analyzing and recording fugitive emissions from process plant.



Measurement solutions 1/4

A comprehensive portfolio

Did you know?

For over half a century, ABB has developed, manufactured and installed analyzers for the downstream oil and gas industry. One of the largest analyzer portfolios in the world was designed to improve process performance, productivity, capacity and safety of your processes.

Product category	Process analysis											
Instrument type	Process analyzer											
Measuring technique	Photometer			Electro-chem. O ₂			Paramagn. O ₂			Thermo-magn. O ₂	Combined	TCD
Product series	EL3060	AO2000	EL3000	PIR3502	PUV3402	AO2000 EL3000	EL3060	AO2000	EL3000	AO2000	ACX	EL3060
Product image												
Product type	<ul style="list-style-type: none"> • Uras26 • Uras26 • Limas11R • Limas11UV • Uras26 • Limas23 • Multiwave IR • Multiwave UV • Option for photometer • Magnos 206 • Magnos 206 • Magnos 206 • Magnos 27 • System solution • Caldos27 • Caldos25 											
Phase												
Solid												
Liquid				•	•							
Gas	•	• • •	• •	•	•	•	•	•	•	•	•	• •
Certification												
Ex II 1G												
Ex II 2G	•	•		•	•		•	•				• •
Ex II 3G	•	• • •	•	•	•		•	•	•	•		• •
Refining												
Blending												
Crude distillation	•	•	•	•	•		•	•	•			
Hydro-cracking	•	•	•	•	•		•	•	•			
Hydro-treating	•	•	•	•			•	•	•			• •
CEMS*	•	• •	• •			•	•	•	•		•	
Petrochem												
EOEG	•	• •	• •	•	•		•	•				
TDI				•	•							
MDI				•	•							
CEMS*	•	• •	• •			•	•	•	•		•	












* Continuous Emissions Monitoring Systems

Measurement solutions 2/4

Serving the downstream chain

Did you know?

ABB has invented many measurement devices to help the downstream oil and gas industry, including the first commercial on-line gas chromatograph, the first SIL2 certified guided-wave radar level transmitter and SIL2 pressure transmitter.

Product category	Process analysis										
Instrument type	Process analyzer										
Measuring technique	TCD		FID	Laser in-situ	FT-IR-Spectrometer			Chromatograph			Vapor pressure
Product series	AO2000	EL3000	AO2000	AO2000	FTPA2000	MB3600	ACF5000	PGC1000	PGC5000	NGC8200	RVP4500 RVP4501 RVP4503 RVP4550
Product image											
Product type	• Caldos25 • Caldos27	• Caldos27	• MultiFID14 • MultiFID14 NMHC	• LS25	• FTPA2000-HP460/360 • FTPA2000-HP260	• MB3600-HP10	• Emission	• PGC1000	• All Purpose • PGC5007	• NGC8206	• RVP
Phase											
Solid						●					
Liquid					●	●	●		●	●	●
Gas	●	●	●	●	●	●	●	●	●	●	●
Certification											
Ex II 1G											
Ex II 2G	●	●		●	●	●		●	●	●	●
Ex II 3G	●	●	●	●					●	●	●
Refining											
Blending				●	●	●	●		●	●	●
Crude distillation				●	●	●	●		●	●	
Hydro-cracking						●	●		●		
Hydro-treating	●	●			●	●	●	●	●		
CEMS*			●	●	●		●				
Petrochem											
EOEG				●	●	●			●		
TDI			●		●	●			●		
MDI			●		●	●			●		
CEMS*			●	●	●		●				














* Continuous Emissions Monitoring Systems

Measurement solutions 3/4

Extensive know-how and global reach

Did you know?

ABB offers Asset Vision Professional, a comprehensive Asset Management tool for PCs, that enables you to cost-effectively manage online and offline device configuration, providing parameter setting functions, online monitoring and tuning, diagnostic alerts, asset monitoring and calibration management.

Product category	Temperature	Pressure		Level			Transmitter					Gauge	
Instrument type	Sensors	Transm.	Sensors	Transm.	Switch								
Measuring technique	PT100 & Thermocouple		Remote seal	Absolute Gauge Differential	Vibrating level	Multipoint	Thermal dispersion	Mech. level	Guided wave radar	Magnetostrictive	Radar	Laser	Magnetic
Product series	Temperature Oil and Gas	TTF300 TTF350		2600T	RS85	MS50	TX	LS	MT5000 MT5100	AT100 AT200	MT5000	LM80 LM200	KM26
Product image													
Phase													
Solid	●	●							●		●	●	
Liquid	●	●	●	●	●	●	●	●	●	●	●	●	●
Gas	●	●	●	●	●	●	●	●	●	●	●		●
Certification													
Ex II 1G	●	●	●	●					●	●	●		
Ex II 2G	●	●	●	●					●	●	●		
Ex II 3G	●	●	●	●					● ¹	● ¹	● ¹	●	
Refining													
Blending	●	●	●	●	●	●	●	●	●	●	●		●
Crude distillation	●	●	●	●	●	●	●	●	●	●	●		●
Hydro-cracking	●	●	●	●	●	●	●	●	●	●	●		●
Hydro-treating	●	●	●	●	●	●	●	●	●	●	●		●
CEMS*													
Petrochem													
EOEG	●	●	●	●	●	●	●	●	●	●	●		●
TDI	●	●	●	●	●	●	●	●	●	●	●		●
MDI	●	●	●	●	●	●	●	●	●	●	●		●
CEMS*													

* Continuous Emissions Monitoring Systems

¹ Assumed













Measurement solutions 4/4

The ideal partner for downstream projects

Did you know?

More customers buy Distributed Control Systems (DCS) from ABB than from any other vendor**. ABB's measurement products are specifically designed to work seamlessly with an ABB DCS saving you time and money.

**Source: ARC 2010 DCS Worldwide Outlook Study.

Product category	Flow										Liquid	Valve automation	
Instrument type	Flowmeter										Sensors	Positioners	
Measuring technique	Differential pressure				Coriolis	Electro-magnetic	Vortex/Swirl	Thermal mass	Variable Area	pH/ORP			
Product series	Venturi flowmeter	Orifice	Torbar Pitot tube	Wedge Master	Coriolis Master	Process Master FEP	FSV FSS	Sensyflow	VA Master	TB(X)5	TZIDC TZIDC-200	EDP300	
Product image													
Phase													
Solid				●	●	●							
Liquid		●	●	●	●	●	●		●	●	●	●	
Gas	●	●	●	●	●		●	●	●		●	●	
Certification													
Ex II 1G	●		●						●	●	●	●	
Ex II 2G	●	●	●	●	●	●	●	●	●	●	●	●	
Ex II 3G	●	●	●	●	●	●	●	●	●	●			
Refining													
Blending					●	● ²	●	● ³	●		●	●	
Crude distillation		●		●		● ²	●	● ³	●	●	●	●	
Hydro-cracking		●		●	●	● ²	●	● ³	●	● ⁴	●	●	
Hydro-treating		●		●	●	● ²	●		●	●	●	●	
CEMS*			●										
Petrochem													
EOEG		●		●	●	● ²	●	● ³	●		●	●	
TDI		●		●	●	● ²	●	● ³	●		●	●	
MDI		●		●	●	● ²	●	● ³	●		●	●	
CEMS*			●										

* Continuous Emissions Monitoring Systems
² For all conductive liquid measurements up to 180 °C
³ For all dry gas measurements with low pressures
⁴ Sour water application, quench tower, waster water

Accurate and reliable measurement

Exceeding your expectations

01 ABB's 266 series gives accurate, reliable pressure measurement

02 CoriolisMaster mass flowmeters are ideal for liquid mass flow applications

Eliminating the effects of plugged impulse lines

Pressure transmitters are used to measure pressure through to level and flow. With hundreds of transmitters often installed in inaccessible locations, any problem could mean that a process's performance is based on incorrect information, which could have long term consequences on costs and quality.

The challenge of blocked impulse lines

With pressure transmitters rarely directly connected to the processes being measured, blocked impulse lines are a common problem. The small diameter pressure lines are prone to plugging caused by products freezing or solidifying. With no direct impact on the transmitter itself, the problem is often difficult to trace.

The solution is a transmitter with plugged impulse line detection functionality

ABB's 266 pressure transmitters feature plugged impulse line detection (PILD). Many of the basic diagnosis functions are accessible via the local HMI (Human Machine Interface). Any functions that cannot be handled via the HMI can be accessed via ABB's AssetVision software, which runs on a laptop connected to the transmitter. Operators are guided through a simple process which assesses the background noise, allows testing of the PILD condition and enables adjustment of parameters. The software can be used to 'train' the transmitter to the process, enabling the background noise algorithm to adapt to the specific process conditions during installation. Using this information, it can detect the variations in process conditions that indicate a plugged impulse line.

Minimizing flow measurement errors using Coriolis mass flowmeters

Achieving optimum process efficiency in downstream refining applications requires accurate, dependable liquid and gas flow measurement. It is especially important to be able to identify sources of product loss or measurement discrepancies that could affect profitability or legislative compliance.

The challenge to measure accurately while avoiding potential errors

Volumetric flowmeters have been the preferred method for continuous flow measurement in downstream refining applications. For these flowmeters to deliver an accurate calculated mass or standard volumetric rate, it is necessary to factor in standard or normalized temperature and pressure conditions, which can introduce potential errors. This is undesirable in applications such as mass balance, where accurate measurement is crucial for precise catalyst determination, calculating product yields and assessing plant performance.

The solution is the CoriolisMaster flowmeter series – accurate measurement unaffected by temperature and pressure

Coriolis mass flowmeters are increasingly being used for high accuracy applications, as they are unaffected by temperature and pressure. As well as their high accuracy and wide turn-down, they also offer long term benefits through increased process efficiency, production cost savings and reduced cost of ownership. Coriolis mass flowmeters are ideal for liquid mass flow measurement applications throughout the downstream refining chain.

01



02



03 The TB(X)564 pH sensor is ideal for harsh environments

04 ABB offers a wide choice of level transmitters and gauges

pH measurement of overhead crude condensed water

Crude distillation units separate crude oil into a number of fractions.

The challenge of dealing with acidic water

Non-hydrocarbon contaminants and water vapor concentrate in the upper part of the column and the overheads system. Vapors from the top of the column pass to a condenser and then to a vessel that separates gas and hydrocarbons from the water. The contaminants tend to collect in the separated water, turning it acidic. Left untreated, the acidic water can damage piping, condensers and the upper portion of the column. To minimize corrosion, neutralization chemicals are added to the top of the tower, using the pH of the water from the separator to guide the dosing rate. Residual hydrocarbons mixed with the condensed water can plug the porous reference junction used in most pH electrodes and hydrogen sulfide (H₂S) can also poison pH electrodes, reducing sensor life.

The solution against hydrocarbon plugging

ABB's TB(X)564 high-pressure hot tap retractable pH sensor is ideal for these applications. Rated up to 20 bar at 140 °C, with the option of a wooden reference junction, the TB(X)5 offers added protection against hydrocarbon plugging. Sensor life can also be prolonged by installing a sample conditioning system to cool the condensed water.

Effective interface level control in caustic wash processes

Alkylation is the reaction of propylene or butylene with isobutane to form alkylate. Sulphuric or hydrofluoric acid is used as the catalyst in the alkylation process. Alkylation plants include a reactor, an acid separator and a caustic/water wash. After the reactor, the mixture passes to the acid separator, where the hydrocarbon and acid catalyst are separated. The mixture is 'washed' with caustic and water to neutralize the acid and remove residual esters, caustic and salts.

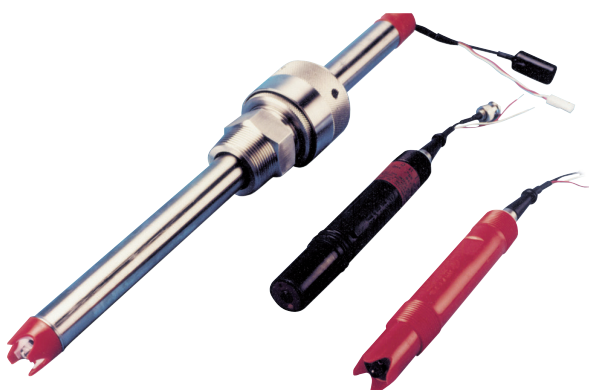
The challenge to prevent corrosion

Accurate interface level measurement is needed during washing to prevent corrosion and fouling of downstream processes and to help achieve the optimum hydrocarbon mixture. Excessive levels will cause the caustic to carry into downstream processes, impairing process efficiency and product quality. If levels are too low, then hydrocarbon carryunder may occur, reducing the mixture quality. Many level measurement technologies can encounter problems if the interface level becomes too small or there are sticky solids which can leave residue on the devices.

The solution enables accurate interface level control

ABB's level measurement instruments can solve these problems and enable accurate interface level control in caustic wash processes. Options include guided wave radar and magnetostrictive transmitters, mechanical and vibrating level switches and magnetic gauges.

03



04



Enhanced performance, reduced emissions

Proven measurement and analyzer technology

01 ABB's analyzers deliver close control for ethylene cracking

02 ABB's NIR analyzers provide real-time data for blending

Process gas analysis in ethylene cracking processes

Ethylene is a common ingredient in key chemicals including polystyrene, polyethylene and alpha-olefins, as well as ethylene glycol, vinyl chloride resin and acetic acid. Ethylene cracking plants crack feedstock chemicals in a rapid process at high temperatures around 850 °C. The effluent gases leaving the cracking furnace enter a quench pot, where they are cooled with water, before being fed to a fractionator where they are separated into specific chemicals, including ethylene.

The challenge to closely control the cracking process

Close control of the cracking process is crucial. If the feedstock is over-cracked, excessive coke can form in the furnace, causing it to deactivate. If the feed is under-cracked, the quantity of olefins produced will be reduced.

The solution is monitoring the right cracking severity

ABB's process gas analyzers provide the data needed to achieve the right cracking severity. Flue gas measurement using ABB zirconia oxygen probes allows combustion optimization through correct air/fuel ratios. Measuring the output gases from the process at various points and measuring the naphtha feedstock quality with an FT-NIR analyzer can help to enable the feedstock being cracked at the correct severity. Furnace decoking uses ABB's NDIR (non-dispersive infrared) analyzers to monitor carbon dioxide in the effluent gas during burn-off, with levels rising and then falling to zero as the coke is removed.

Optimized gasoline and diesel blending with NIR analyzers

Gasoline and diesel blending is a complex process, demanding fuel quality and legislative targets to be met while producing the product at the lowest possible cost. To meet these targets, various properties are measured and controlled including RON (Research Octane Number), MON (Motor Octane Number), RVP (Reid Vapour Pressure), aromatics, benzene, olefins, ASTM D86 distillation points and oxygenates.

The challenge of slow response times

These measurements have traditionally been obtained either by interrupting the blend to obtain laboratory test results or by using several on-line analyzers, such as octane engines and gas chromatograph and distillation analyzers. Problems include the high capital and operating costs of multiple analyzers, slow response times and poor repeatability, lost product and reduced blender throughput, and increased inventory as well as storage costs.

The solution allows for real-time measuring results

ABB's FT-NIR analyzers for on-line gasoline and diesel blending enable rapid multi-stream and multi-property analysis of gasoline and diesel blending components and final product streams. By accurately measuring in real-time, the analyzers provide the data needed to optimize the blend, minimize product re-blends and quality giveaway, and allow the use of lower-cost feedstocks while meeting final product quality targets.

01



02



03 ABB's photometers provide fast, accurate on-line gas analysis

04 ABB supplies a wide choice of gas and water analysis equipment

Controlling TDI and MDI emissions – maximizing process safety

Toluene diisocyanate (TDI) and Methylene diphenyl diisocyanate (MDI) are widely used in polyurethane manufacture. Categorized as volatile organic compounds (VOCs), both can cause irritation to skin and eyes when diffused into air. A key ingredient in the manufacture of TDI and MDI is phosgene, a highly toxic chemical. Emissions of phosgene, plus other harmful chemicals involved in TDI/MDI production, need to be closely monitored to help comply with environmental, safety and quality requirements.

The challenge of safe TDI and MDI production

TDI and MDI production includes multiple stages, spanning feedstock input through to scrubbing and recovery of key intermediates. To help maximize process safety and efficiency, the chemical reactions at each stage need to be closed regulated. This requires measurement of both direct process emissions and ambient conditions where emissions may arise from fugitive leaks or malfunctioning equipment.

The solution to achieve process safety and product quality

ABB's Multiwave Process Photometers provide on-line measurements of gas or liquid components for process control, product quality control, safety, catalyst protection and area monitoring. They can be deployed throughout the TDI/MDI production process to analyze everything from feedstock purity through to phosgene and solvent recovery. The photometers offer fast, continuous analysis for accurate feedback control, whilst dynamic sample temperature compensation provides a stable reading.

03



Meeting global environmental emissions standards

Accurate monitoring of emissions from refining and petrochemical sites is becoming increasingly important to meet strict global environmental standards. Such monitoring needs to include not only emissions of chemical substances released from the processes, but also the pollutant by-products from combustion processes such as sulphur and nitrogen dioxides. Equal attention needs to be paid to waterborne emissions that could detrimentally affect aquatic life, if discharged into the water cycle.

The challenge of reliable emissions control

Refining and petrochemical plant operators need to comply with a range of legislative and regulatory emissions requirements, covering exhaust gases and fugitive emissions through to discharges to the water cycle. Failure to meet any of these could result in a process or even an entire plant being shut down, incurring highly expensive delays and lost production.

The solution is a wide choice of gas and water analysis equipment

ABB supplies one of the largest process, emissions and laboratory analyzer portfolios, offering real-time analysis of the chemical composition and physical properties of a process sample or stream. Options include individual products through to complete skid-mounted or cabin-based systems, for measurement of both chemical and combustion gas emissions. This range is backed up by a comprehensive range of liquid analysis products and systems, covering a wide range of parameters including pH, conductivity, chlorine and ammonia.

04



Services for measurement and analytics

Performance optimization

Dedicated to optimizing plant productivity and performance, ABB's certified services enable improved utilization and performance of automation equipment, processes and personnel. ABB provides support from the planning phase through to commissioning and full lifecycle servicing, in accordance with international industry standards, enabling the utmost safety and environmental protection.

ABB's performance optimization services:

Productized life cycle services

- Start-up: dimensioning, installation, commissioning
- Operate and maintain: maintenance, calibration, spare parts and repairs, support and remote services, training and eLearning
- Rebuild or replace: retrofits, upgrades,
- Migration planning, replace and recycling

Service agreements

- Flexible service agreements
- Globally supported, locally delivered
- Tailored from basic service agreements to Full Service[®] contracts according to customer's needs

Did you know?

When a superior technical solution is needed for a problem, ABB can help. Take ABB's HF Alkylation process acid analyzer for accurate measurement of hydrofluoric acid and acid soluble oils, for example. Developed with one of ABB's leading customers, the analyzer is now helping refineries worldwide to achieve enhanced personnel safety, process control, corrosion monitoring and catalyst efficiency.



Offering integrated automation

Delivering value added solutions

Main Automation Contractor and Main Electrical Contractor

ABB minimizes customers' risks by providing integrated products and solutions as the Main Automation Contractor (MAC) and the Main Electrical Contractor (MEC). Solutions for downstream refining and petrochemical automation include a full range of instruments and field devices, combined with applications such as pump optimization, emergency shutdown (ESD), compressor efficiency monitoring, and abnormal situation management.

- Faster schedule: engineering, commissioning and start-up time reduced
- Best use of technology: truly integrated solutions for long-term benefits

Benefit from ABB's integrated automation offering

- Lower costs: 20% project cost saving potentials due to reduced spending on engineering, start-up and maintenance
- Lower project risk due to a single integrated team with global reach and resource
- Reduced expediting and inspection due to a single source supplier

Did you know?

ABB's experience integrating measurement and control solutions eliminates the need to work with multiple suppliers. As an industry leader in automation, we enable optimal project delivery, meet demanding cost and schedule requirements, and manage risk.

ABB's integrated automation solutions

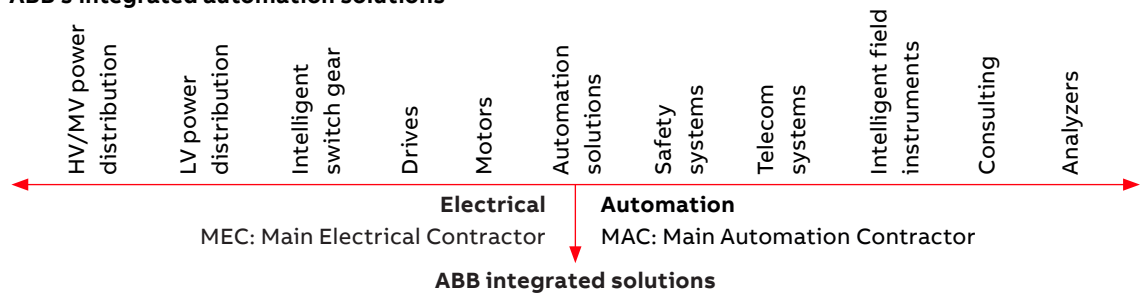


ABB Measurement & Analytics

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For more product information, visit:
www.abb.com/measurement

