BMA-System#3 Technical Application Sheet

DESALTER INTERFACE CONTROL

It is all too easy to forget that the primary function of the desalting system is the removal of inorganic chlorides and other water-soluble compounds from crude oil.

One need not be a corrosion specialist to realize that the acids that form from these compounds can do tremendous, long-term damage in the downstream processes of the refinery (as the inspection of crude tower overhead condensers can prove). However, the desalting process has become the focus of attention in areas that are no longer limited to the simple removal of salts and water.

Most critical of these recent areas of concern has been the degree to which the desalting system contributes to the load of volatile organic contaminants (VOCs) at the wastewater system. In fact, the condition of the brine from a modern desalter is frequently under greater scrutiny than the condition of the desalted crude.

There can be no doubt that the operation of the desalting system is an exercise in compromise. A constant balance must be maintained between mixing intensity, wash water quality, chemical demulsifier feed and control of other parameters that can provide optimal salt removal without forming an emulsion so tenacious that it compromises the system's dehydration capabilities. Adding to this balancing act the new legislative demands placed on effluent water quality present the operator with a difficult challenge.

Optimizing the desalting process is a matter of optimizing the individual components and maximizing the efficiency of the electrostatic dehydration stage .By "pushing" the electrostatic process, one seeks to obtain the greatest amount of electrical work possible. The work performed near the grids can provide the dual benefits of enhanced salt removal (secondary mixing) and optimal coalescence.

The question therefore becomes how to maximize the electrical work of the grid.

In the vessel, the structural parameters such as vessel size, grid elevations and feed discharge points are all fixed. The most critical remaining variables then become interface condition and position. In fact, optimal interface control has been proven to have significant impact on both the oil and water quality resulting from the dehydration process. Yet, in spite of the obvious need for such control, the traditional methods of control have operated on a fundamentally flawed assumption: Level.
The very term "level control" indicates the presumption that the interface between oil and water in the desalter exists at a single point (such as that observed between gasoline and water).
Any review of the internal conditions in the desalter vessel via the try-lines or swing-arm will dispel this notion. There is no level, rather the interface consists of a transition zone from oil to water in a continuous change of volume percent. Understanding the true nature of the interface leads to the conclusion that efficient control comes from controlling these water/ oil percentages and not an imaginary level.

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DESIGN of BMA-System#3 for Desalter Interface Control

The **BMA-System#3** represents the first and only interface control system to utilize this under standing of the oil/water interface as the basis for control.
The system consists of a minimum of two (BMA-System#3.2) or a maximum of four (BMA-System#3.4) Agar Energy Absorption Instruments: three designated for service in the vessel and one installed well upstream of the unit in the crude feed line. In the **BMA-System#3** control scheme, these probes provide continuous 4 to 20 mA output signals that are proportional to the % water concentrations at their individual locations inside the desalter.

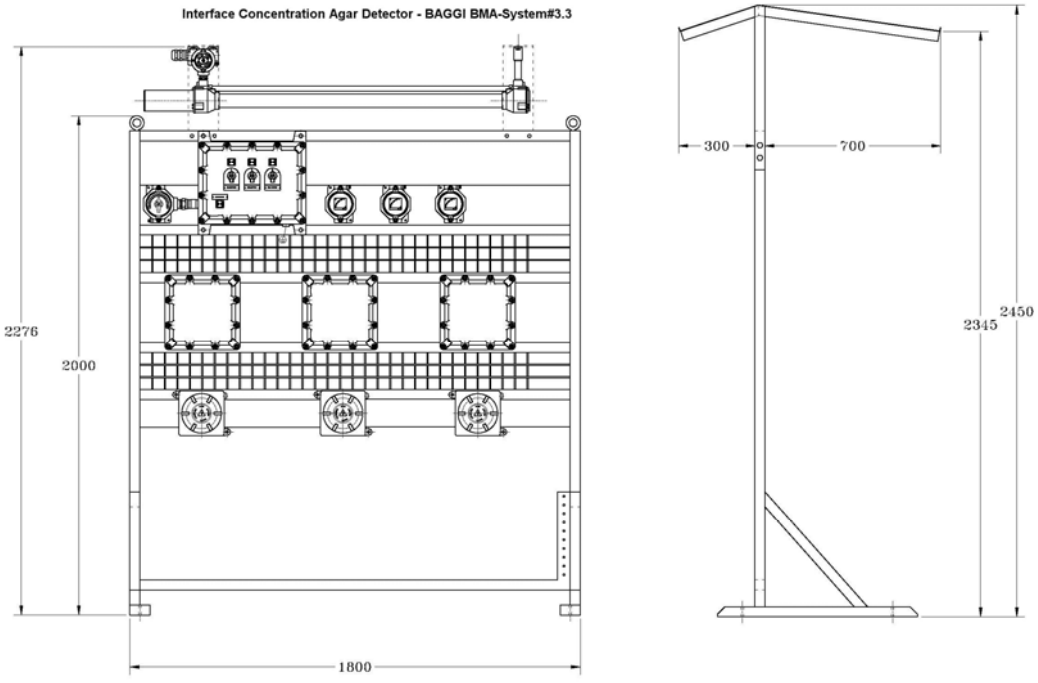
BMA-Probe#1-SYS3 controls the brine outlet valve, using its ability to measure small amounts of oil in water to maintain a very high (and unstable) percentage of water several feet above the bottom of the vessel. This allows suspended oil in the water phase to separate, thus inhibiting oil undercarry as a primary control function. While Probe #1 establishes this lower limit for the emulsion layer - anything that floats on the water phase stops here.

BMA-Probe#2-SYS3 monitors the % water content from its position in the oil phase just below the lower grid. This provides real time detection of the rate and extent of emulsion growth (which must, by Probe #1's control, occur in the upward direction). Probe #2's monitoring function allows the operator to avoid downstream upsets by providing an advance warning of such growth, and allows time for corrective measures to prevent grid loss (transformer "trip").

BMA-Probe#3-SYS3 is an in-line monitor of the water content of the crude feed and is typically located as far as possible upstream of the desalter (generally at or near the tank farm). This probe provides the advance warning of contaminated crude feed necessary to avoid the upsets that typically result from tank switching and/or the introduction of slop oil.

BMA-Probe#4-SYS3 monitors the condition of the water phase below the control probe, alarming on the presence of suspended oil that does not readily separate and threatens the condition of the brine effluent. This is of particular value when low-quality sources of wash water (e.g. stripped or straight sour water) are utilized that can upset the separation process and form stable oil-in-water mixtures (reverse emulsions). This probe is also used during mud-wash cycles.

BMA-Evaluation Unit-SYS3
Baggi is able to design the BMA-System#3 with Agar Energy Absorption Instruments for the specific application in the Desalter.
Each Instrument is composed by Insertion Probe and Remote Evaluation Power Supply Unit and could be configurated with own shielded cable and Self-Supporting Skid.



Example
BMA-SYSTEM#3.3 with three (n.3) Agar Energy Absorption Instruments with Self-Supporting Skid BMA-SKID-SYS3 for stand-alone installation

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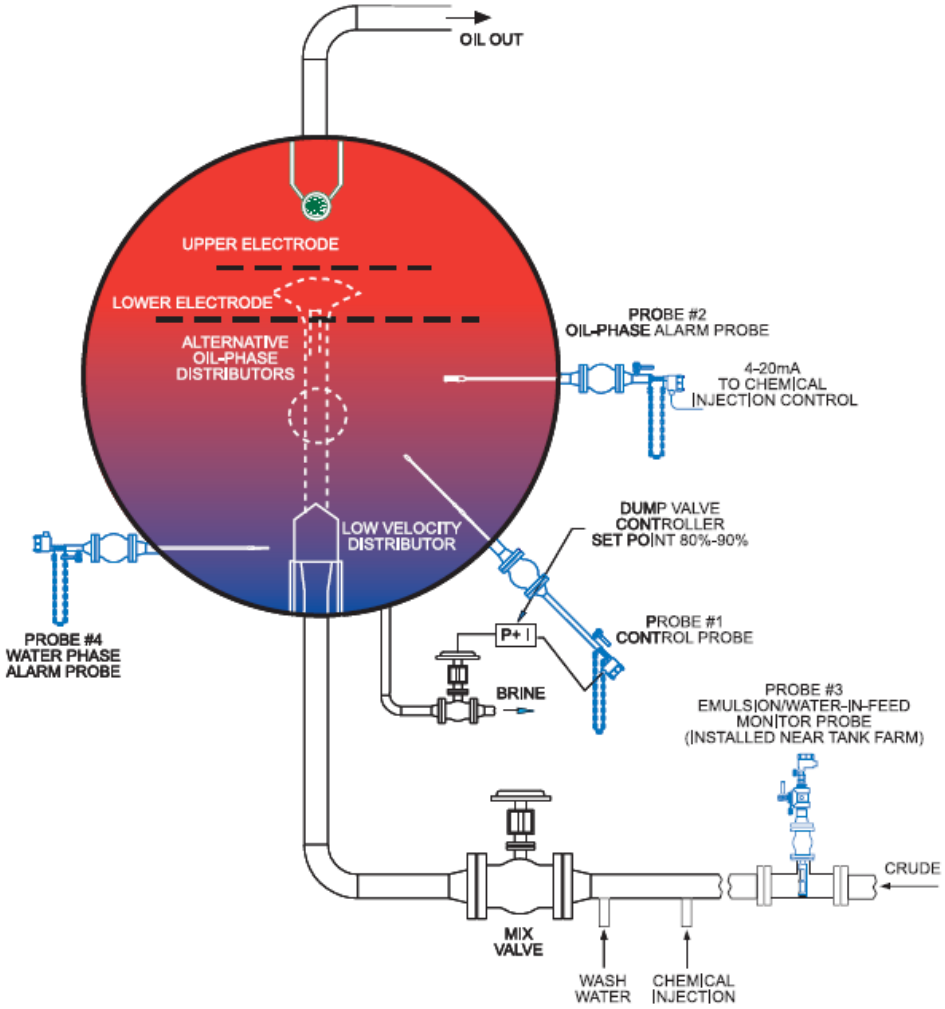
BENEFICT of BMA-System#3 for Desalter Interface Control

The **BMA-System#3** provides extensive information and control capabilities far beyond simple level control. Through measurement of percent water at specific points in the vessel and crude feed line, the overall behavior of the desalting process can be observed and the results optimized.



The benefits of this control scheme can be summarized as follows:

1. Routine oil undercarry is either significantly reduced or completely eliminated, providing both environmental and economic benefits.

2. The operator is provided with a real time “barometer” of conditions in both the oil and water phases of the vessel as well as the crude feed line.

3. Upsets are detected long before their effects can be felt in the unit, and the alarm outputs offer the option of automating upset response such as increasing or initiating chemical feed(s).

4. Control action that constantly forces emulsion growth toward the electrical grids maximizes electrical work, allowing for optimization/reduction or, in some cases, elimination of chemical feed.

5. By considering the location of an alarm signal, more information is provided as to the source of the upset (wash water quality, wet feed, etc.).

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EQUIPMENT DATA of BMA-System#3 for Desalter Interface Control

Probes (S6DES-SYS3IDP0-BMA00 Series)

overall lenght	Minimum: 12” (1 Ft., 300mm) - Maximum: 120” (10 Ft., 3000mm)
process temperature	Standard 32°F to 300°F (0°C to 149°C) or High-Temp 32°F to 450°F (0°C to 232°C)
ambient temperature	-40°F to 131°F
wetted material	stainless steel, duplex, monel, hastelloy, …
seal housing	included – with drain connection For each Interface Probe, the Seal housing is an accessory that allows the probe to be inserted/retracted even when the vessel is in operation.
process connection	npt or flange
safety chain	included
classification	Intrinsically Safe: Class 1, Div.1, Groups C & D, T3C ATEX: II 1G EEx ia IIB T4(-40ºC<Ta<+70ºC) II 1G EEx ia IIC T5(-40ºC<Ta<+65ºC)

Evaluation Power Supply Units (S6DES-SYS3PSP0-BMA00 Series)

emulsion concentration	0-100% or 0-60% or 0-30% Hydrocarbon/ Water by Volume
ambient temperature	-40°F to 131°F
enclosure	aluminium alloy or stainless steel
power supply	115/240 VAC 50-60 Hz or 12/24 VDC (±20%); Normal Power Consumption 3 Watts Maximum Power Consumption of 250 Watts (including lights)
wiring Connections	Barrier Terminal Block #18 AWG Maximum Diameter
classification	Weatherproof (N4X) NEMA 4X Explosion Proof (N7) NEMA 7 Class 1, Div. 1, Groups C&D Flame-Proof (N7) NEMA 7 ATEX: II 2G Ex d[ia] IIB T6 (-20ºC<Ta<+55ºC)
outputs	Powered 4-20 mA into 400 Ohms Maximum; 4 mA = Oil, or Lowest Water Content Relay and 4-20mA

Certifications

CSA Canadian Standards Association

ATEX European Committee for Electrical Standardization

GOST-R Russian Approval for Hazardous Areas and Accuracy

JRIIS Japanese Research Institute of Industrial Safety

Service

Fat	Factory Acceptance Test (in Baggi Factory – Italy)
Documentation Customer	Vendor/Inspection Book as per Standard Baggi and/or Specification (data sheets, manual, material certification, pressure test, electrical test, factory acceptance test, dimensional drawing, electrical drawing, ..)
Packing	on request also for export
Commissioning	start-up on site, training, calibration, … worldwide assistance
Spare part	on request

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Accessories for specific design & customer's configuration

Self-Supporting Skid for stand-alone installation (S6DES-SYS3SKID-BMA01)
Dimensions: 2000 x 1800 x 800 mm (H x W x D) without roof mounted
Material: stainless steel
All components (if ordered) are identified by stainless steel Tag and pre-mounted and tested in BAGGI-Factory (Intrinsically Safe Cable is used)
This configuration allow to guarantee the electrical connection for each component of the system; only the probes and own cable has to be connected on-site

Sun-Shield / Roof for Environmental protection (S6DES-SYS3SKID-BMA02)
The Skid is available also with Sun-Shield for Environmental protection (roof) in stainless steel
Dimensions 2450 x 1800 x 800 mm (H x W x D) Skid with roof mounted

Main Power Supply Switch (S6DES-SYS3SKID-BMA03)
Power supply 24vdc, 110Vac or 220Vac (to be specified)
ATEX II2G Exd IIC T6 IP65 (-20°C<Ta<+60°C)
Housing material: cast iron (other available on request)

Power Control Unit (S6DES-SYS3SKID-BMA04)
Power supply 24vdc, 110Vac or 220Vac (to be specified)
ATEX II2G Exd IIB T5 IP65 (-20°C<Ta<+55°C)
housing material: aluminium alloy or stainless steel 430 x 415 x 180 mm (W x H x D) typical
n.1 led for on/off local indication from main power supply swtich
n.2 to 5 led for each Interface Detector and own Evaluation Power Supply Unit switch
n.2 to 5 power switch for each Interface Detector and own Evaluation Power Supply Unit
This configuration allow to switch-on/off each interface detector on-site in separate time; in this way the operator, during the commissioning and/or maintenance, will be able to operate for each detector without interrupt the others in easy way

Light On-Site (S6DES-SYS3SKID-BMA05)
Power supply 110Vac or 220Vac (to be specified)
ATEX II2G Exd IIB T6 IP65 (-20°C<Ta<+40°C)
Housing material: cust iron Light 1x 36W - Connection: 3/4 G

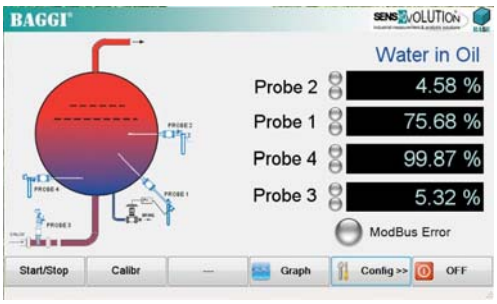
Analogue Outputs Junction Box (S6DES-SYS3SKID-BMA06)
ATEX II2G Exd IIC T6 IP65 (-20°C<Ta<+60°C)
Housing material: aluminium Process electrical connection: 1/2" npt-f

Power Supply Junction Box (S6DES-SYS3SKID-BMA07)
ATEX II2G Exd IIC T6 IP65 (-20°C<Ta<+60°C)
Housing material: aluminium Process electrical connection: 1/2" npt-f

Digital Display (S6DES-SYS300DD-BMA01)
Hart Protocol (0-100% or 0-60% Hydrocarbon/water Vol.)
ATEX EEx d IIC T5/T6 (-40°C<Ta<+70/+85°C) Flame Proof
Housing material: aluminium alloy with light gray (RAL 4002) baked epoxy finish
Input range 4-20mA (from Interface Detector Evaluation Power Supply Unit)
Output with Hart communication protocol (only for Digital Display Setting)

Shielded Cable (S6DES-SYS3CAVO-BMA01)
Intrinsically Safe Type 3x18AWG (3 x 1mm^2)
For each Interface Probe the cable length has to be calculate to allow the mechanical extraction from the Desalter.

Evaluation Smart Unit Base
(S6DES-SYS3BASE-BMA01)
Unit with digital display and keypad to monitor and control the BMA-System#3 on-site



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