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APPLICATION NOTE

DEWATERING OF STORAGE TANKS, AUTOMATIC DRAW WATER CONTROL, AND MANUAL TANK GAUGING

Figure 1

INTRODUCTION

Storage tanks containing hydrocarbon feedstocks, intermediates and finished products will, over time, accumulate a water layer in the tank bottoms, (exceptions are water soluble hydrocarbons such as alcohols and ethers). Standard industry practice is to periodically drain the draw water from storage tanks so that the water does not adversely impact specifications of the hydrocarbon. Water removal also reduces corrosion problems on the floor of the tank.

Manual control of water draw-off can result in free HC product in the discharge. The loss of this free HC product means less product available for sale and increases the cost of wastewater treatment. Additionally, environmental regulation trends (e.g., USA Benzene/NESHAP and SOCMI/HON) may impose large economic penalties for designing water draw conveyance and treatment systems that allow free product in the water draw-off discharge.

Two types of water draw-off control approaches use the AGAR ID-200 Series Interface Detector. Each water draw discharge control strategy has its own advantages and disadvantages.

The control strategies are:

1. Using In-Tank Interface/Concentration Detectors
2. Using Insertion Hydrocarbon/Water Monitors in the Effluent Water Draw-Off Line

AGAR applications specialists can assist in identifying the optimum strategy for controlling draw water discharge.

1. IN-TANK INTERFACE DETECTOR

In-Tank measurement of the hydrocarbon/water interface gives the best results for eliminating the discharge of free hydrocarbons. Usually an AGAR ID-201 probe is inserted into the tank through AGAR's patented seal housing, as shown in Figure 1. Special installation may require the use of the AGAR ID-202 for extended length. Manual tank gauging is performed using the portable AGAR ID-310.

The two probe system can operate under two strategies. A main control/saftey strategy - **System #1** shown in figure 2a and a high-low control strategy - System #2 shown in Figure 2b.

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System #1

When the AGAR ID-201 probe detects free water, the draw water dump valve is opened. As water is drained off the bottom of the tank, the hydrocarbon/water interface begins to drop. When the AGAR ID-201 probe detects the hydrocarbon/water interface, the signal is sent to close the dump valve. Output options to control the dump valve can be 4-20 mA, relay and/or pneumatic. If the hydrocarbon floats, the ID-201 will prevent it from being discharged with the waste water.

Figure 2a shows an upper probe used for control, with the lower probe used for alarm and positive shutdown of the draw water discharge.

SYSTEM 1 CONTROL LOGIC			
	WATER (VALVE OPEN)	*ALARM (VALVE CLOSED)*	*OIL (VALVE CLOSED)*
HIGH	WATER	OIL/WATER	OIL
LOW	WATER	OIL	WATER

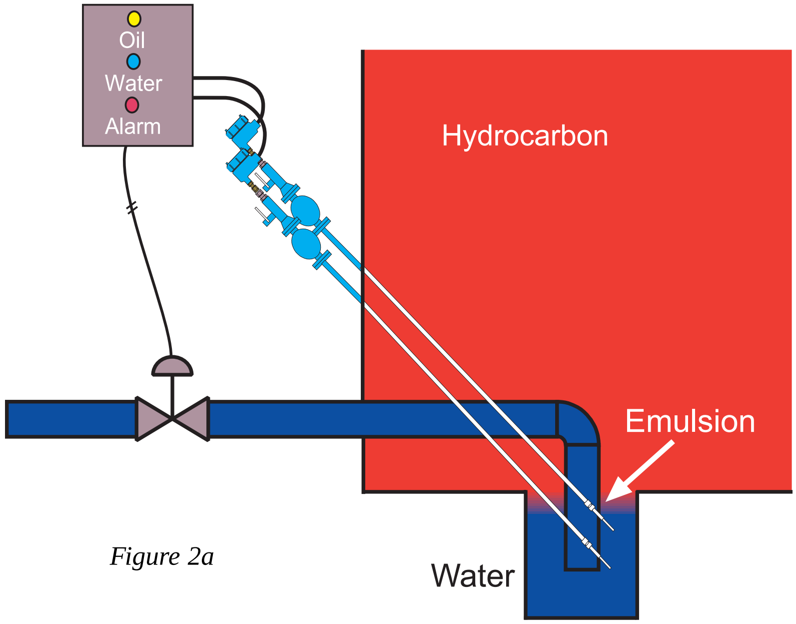

Figure 2a

System #2

Figure 2b shows the high-low control logic in which the valve would close only after both probes have detected hydrocarbon. Figure 2a and 2b also shows how to overcome tank bottom sludge build-up problems by placing the active part of the AGAR ID-201 probe over the sump in the bottom of the tank. (It is nearly impossible for sludge to build-up and cover the probes in this configuration.)

SYSTEM 2 CONTROL LOGIC					
ID-201 PROBES		VALVE STATUS	LIGHTS		
HIGH	*LOW*		*OIL*	*WATER*	*ALARMM*
WATER	WATER	OPEN	OFF	ON	OFF
OIL	WATER	OPEN	OFF	ON	OFF
OIL	OIL	CLOSED	ON	OFF	OFF
OIL	WATER	CLOSED	ON	OFF	OFF
WATER	WATER	OPEN	OFF	ON	OFF
WATER	OIL	CLOSED	ON	OFF	ON

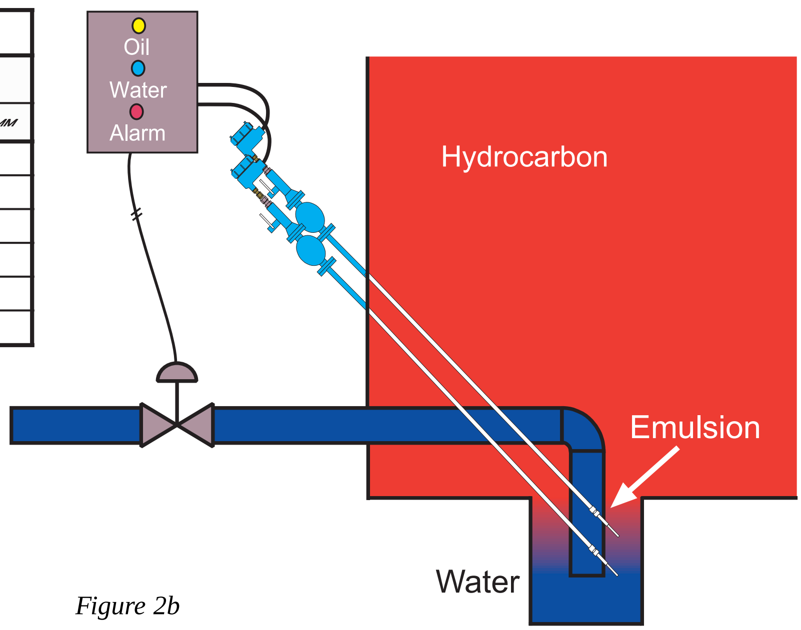

Figure 2b

2. IN-LINE HYDROCARBON/WATER MONITORS

The advantage of this approach is the avoidance of tank penetration, problems with bottom sediments build-up, and eliminating most of the free water in the tank.

However, there are significant disadvantages that should be considered in design and policy decisions:

1. Some hydrocarbon must be discharged with the waste water in order for the monitor to detect it in the external pipe.
2. The drain pipe must be altered to avoid trapping of hydrocarbons.
3. Manual initiation of water draw cycle.

Figure 3 shows how the conventional bent pipe traps hydrocarbon at the end of the dump.

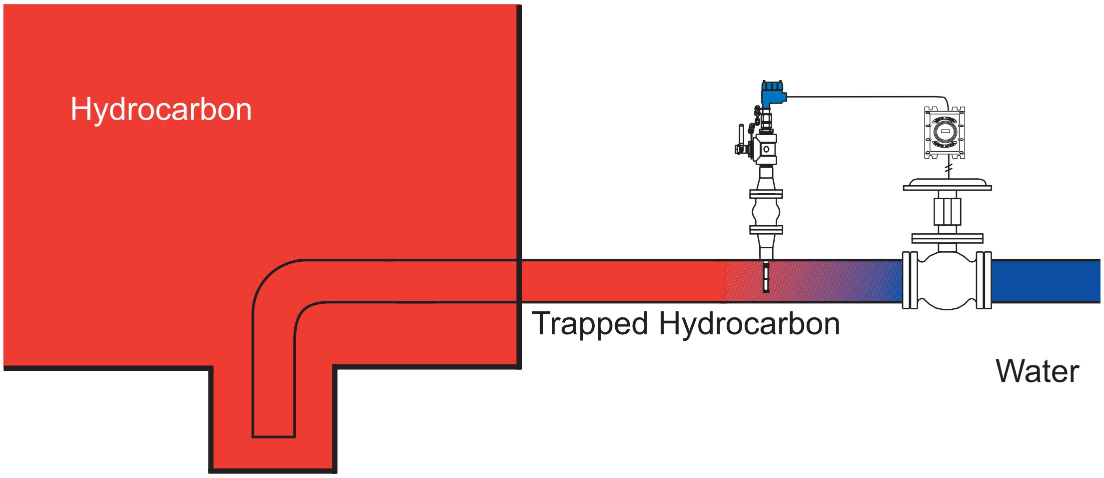

Figure 3

Assume a case where the hydrocarbon and the water have completely “phase separated” to form a clear-cut interface inside the tank. Because hydrocarbon is still present from previous water-draw, the water draw cycle will have to be initiated manualy, water will contiue to drain until the oil/water monitor again detects hydrocarbons. At this point, the oil/water monitor will send a control signal that is used to close the dump valve. However, due to the vortex, this hydrocarbon is trapped in the draw-off line. As water gradually builds up in the tank, the hydrocarbon trapped in the line acts as a seal (being lighter than water). To re-activate the dump valve for a new water draw cycle, the oil/water monitor signal must be overridden for some time to flush the hydrocarbon out of the line before water is again detected.

There is no assurance that there will be sufficient water in the tank to flush all hydrocarbon out of the water draw-off line. Thus, the pipe must be designed in such a way as to eliminate the trapping of hydrocarbon. A small upward inclination is desirable, with a vortex breaker at the intake. The latter avoids vortexing and the suction of hydrocarbon with water when the dump valve is fully open. Figure 4 shows hydrocarbon being discharged with the water because of the vortex action.

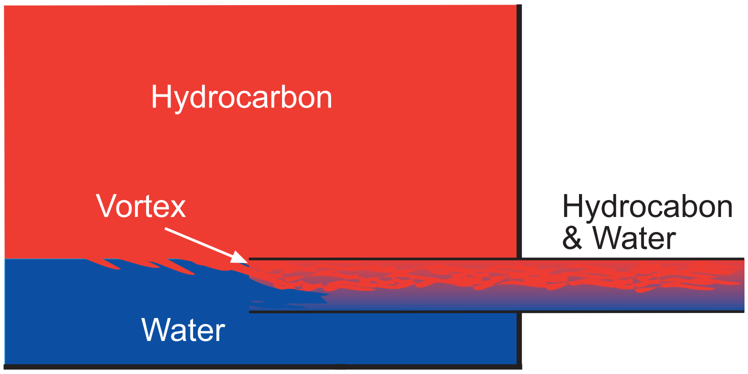

Figure 4

Figure 5 shows the correct installation with a slotted discharge pipe. Note that the cross-section of the slot must be at least ten times larger than the cross-section of the pipe. Similarly, the pipe can be perforated with many holes, whose total cross-section area exceeds the pipe's area by a factor of ten

If the hydrocarbon is highly viscous, special care must be taken to compensate for hydrocarbon fouling that will stick to pipe walls and the AGAR OW-100 probe. The amount of dumped hydrocarbons will thus depend on the oil's viscosity and the flushing action of the effluent water. Calibration adjustments to the oil/water monitor will negate the effects of fouling.

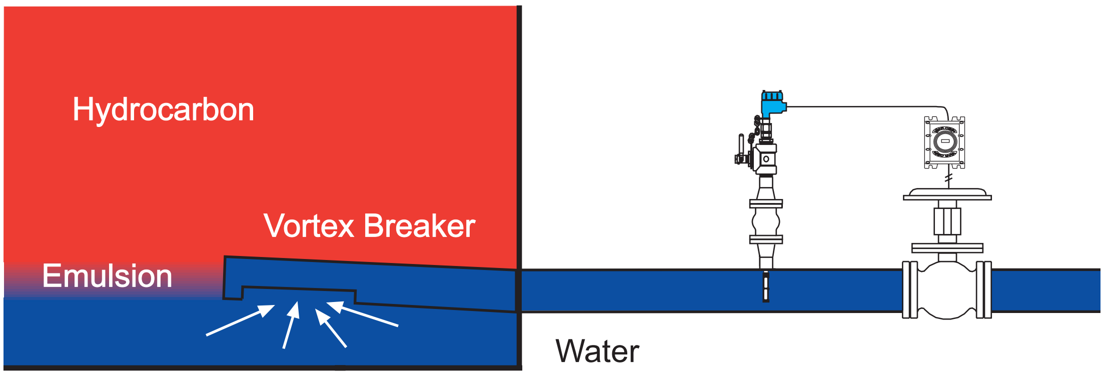

Figure 5

MANUAL TANK GAUGING

Manual gauging is used in storage tanks that are not expected to have a water draw. Also, manual gauging is used for shipping tanks such as barges, tankers and trailers. The AGAR ID-310 Portable Emulsion Profiler is used for these applications where a portable device is more practical than a permanent system.

Some storage tanks contain dehydrated hydrocarbon products that are not expected to contain water or emulsions. Typically, plant quality control measurements are sufficient to ensure the dehydrated product meets specifications, or there are other factors that make water an unlikely contaminant. Routine interface measurements are not needed in this case.

For these tanks, the AGAR ID-310 is a rugged and accurate choice for manually measuring liquid depth as a check of the on-line level instrumentation. However, AGAR recommends a interface measurement system for all permanent storage tanks where there is a routine water draw or the possibility of water from an upset condition.

Hydrocarbon feedstock and product shipping is a step where it is desirable to check for water content in received shipments. This is especially important for over water shipment by barge and tanker. A measurement of the water level in a barge or tanker compartment prior to the beginning of pumping from the vessel can avoid unexpected water entering a manufacturing process or paying for water instead of hydrocarbon in accepting delivery.