AGAR CORPORATION

Process Measurement & Control

APPLICATION NOTE

WATER KNOCK-OUT CONTROLS FOR HEATER-TREATERS AND FREE WATER SEPARATORS

INTRODUCTION

Produced oil contains water in highly variable amounts. Heater-treaters heat the produced fluid to break oil/water emulsions and to reduce the oil viscosity. The water is then typically removed by utilizing gravity to allow the free water to separate from the oil. The water is removed through a dump valve on the bottom of the separator. Oil in the discharged water is a loss of valuable product and causes an increase in water treatment costs.

Control of the water dump valve is complicated by the nature of the produced fluids, such as those from fireflood oil fields. Fireflooding is a method of extracting very viscous oil by burning about 10% of the oil below ground to heat the remaining oil to reduce its viscosity. Water injection is then used to push the oil to the producing well. The produced fluid contains highly variable amounts of water, carbon (from the burnt oil), oil and sand. It is very viscous and severely fouls/coats surfaces.

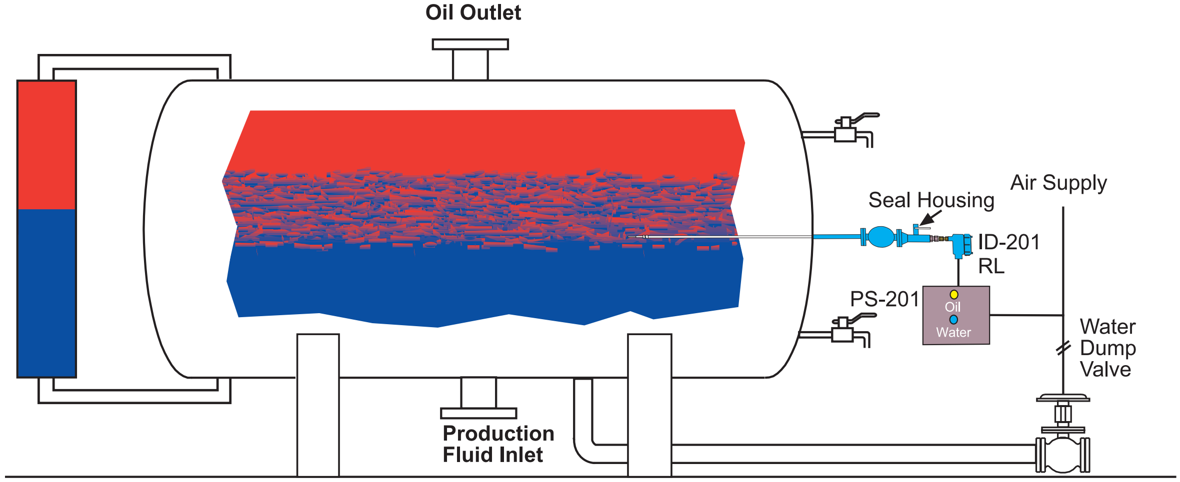
AGAR WATER KNOCK-OUT CONTROL

Both free water knock-out drums and heater-treaters are gravity separators. Water sinks to the bottom, and oil floats to the top because of density differences. The separator must be large enough to allow the water sufficient residence time and laminar conditions that enable the water to settle to the bottom instead of being carried overhead with the oil.

This process is complicated by the presence of complex emulsions that do not give a clear cut oil/water interface.

A typical installation on a separator has an *AGAR ID-201 Interface Detector* inserted horizontally 24 inches above the vessel's water draw-off nozzle through a 1" ball valve and a 1" *AGAR Seal Housing.* The *AGAR ID-201 Interface Detector* controls the on/off dump valve when the water concentration at the *ID-201*'s probe tip exceeds a preset value, such as 80%. The setting for the probe is checked by analysis of samples taken from the seal housing. Additional checks are made by taking samples above and below the seal housing. Since oil/water emulsions containing more than 80% water are not stable, the *AGAR ID-201 Interface Detector* control ensures that only oil-free water is dumped from the vessel and that emulsions build above the probe.

In this installation, an *AGAR ID-201/RL/PN* system solenoid valve directly controls the pneumatic-actuated, fail-closed water dump valve. The presence of 20% or more oil will vent the actuator to close the dump valve. Water content over 80% opens the solenoid valve, supplies air to the dump valve and opens the water valve, thus dumping oil free water. The opening and closing speed of the dump valve is controlled by the air supply valve for opening, and the solenoid's throttling.



INTERFACE DETECTOR INSTALLATION DETAILS

1. Free gas is seen by the *AGAR ID-201* Interface Detector as oil. To avoid false readings, the fluid at the probe must be gas free.

2. The *ID-201* is not affected by coatings because oil coating the antenna has only a small effect on the probe's signal and can easily be eliminated by calibration. Because velocities inside the vessel are low, oil films tend to form to a maximum thickness and remain stable, so routine recalibration is usually not necessary.

3. The *ID-201* is calibrated on-site using the actual crude oil and process water. If fluids other than crude oil and process water are to be used, the AGAR factory should be informed so that any required modifications can be made before shipment to the end user.

4. Normally, changes in crude oil and water characteristics will not affect the *ID-201*. If, however, the water's NaCl content falls below 2000 PPM, the probe will have to be recalibrated.

5. The *ID-201* probe can be adjusted to work within 3 inches of grounded metal. However, Agar recommends that no metal be closer than 12 inches to the tip of the probe.

6. Rapid cycling of the dump valve is usually not a problem because the *ID-201* incorporates a 5% water content hysteresis, and an approximate 3 second delay. However, if rapid valve cycling is a problem and restriction of the drain rate is not acceptable, there are three alternatives: (a) Vertical mounting of the Interface Detector will increase the level change needed to trigger the relay; (b) A time delay relay may be fitted to the *ID-201* to reduce cycling; (c) Two *ID-201s can be used -- a high probe and a low probe*. The dump cycle begins when water covers a high probe and ends when the water drops below the low probe.

NOTES ON INTERFACE FLOAT CHAMBERS AND LEVEL GAUGE GLASSES

Most vessels are fitted with level gauges or float chambers to give a visual indication of the height of the interface in the vessel. These are mounted in bridles that are separate from the vessel so that they can be isolated for maintenance. However, the readings from a gauge glass or a float chamber must be interpreted with caution because:

1. *The connections between the level gauge and the vessel usually are located so that emulsions can not enter*. Instead of accurately being filled with oil, an emulsion layer, and water, the level gauge will be filled with only oil and water layers. Moreover, the narrow tube acts as a separator and shows only clear-cut interfaces.

2. The level bridle is actually a manometer showing a pressure balance between two columns of fluids: one inside the vessel and one outside. *Having the same interface height in the chamber as in the vessel is only coincidence*.

3. Level gauge connections are sometimes located so that the gauge can only fill with water and, over time, oil and emulsion will become trapped at the top of the gauge glass. *This gives a false indication of water height*. Also, the height and density of the trapped oil will affect the water height shown.

4. A change in fluid densities in the vessel will affect the interface height shown in the level gauge. *Temperature differential from the vessel to the gauge, changes in oil density, emulsion composition, or water salinity will all affect the gauge's level*.

5. Particles in the oil can cause a blockage of the small openings in the isolation valves for a level gauge. *This blockage, which prevents the level gauge from functioning, is not detectable unless the level gauge is purged*.

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