AGAR CORPORATION

Process Measurement & Control Solutions

WATER KNOCK-OUT CONTROLS for HEATER-TREATERS & 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 then 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 heavy oil fields using steam flood. Steam injection is used to push the oil to the producing well. The produced fluid contains highly variable amounts of water, oil and sand. It is very viscous, forms stabilized emulsions, and severely fouls/coats instrumentation.

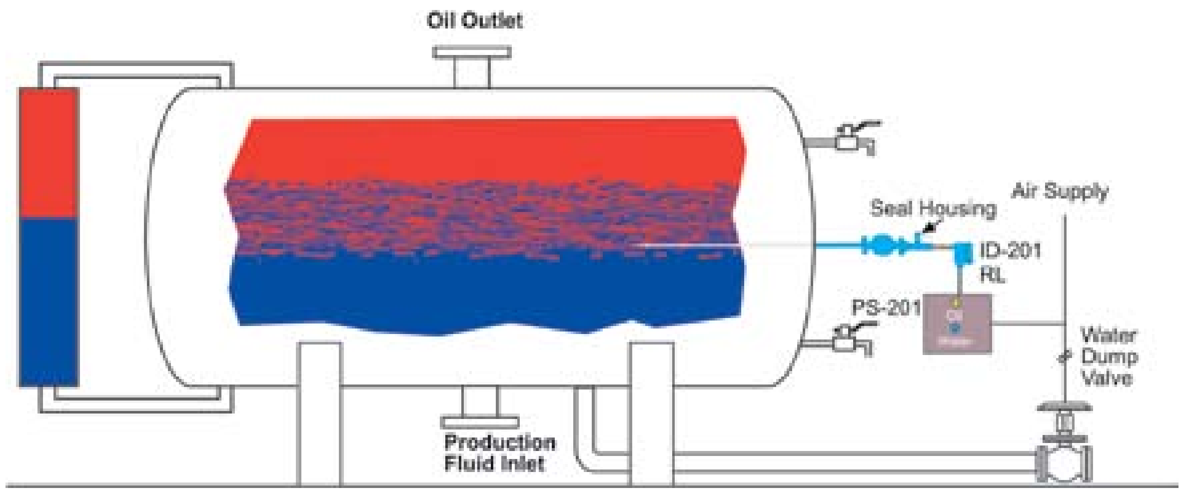
AGAR WATER KNOCK-OUT CONTROL

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 2" ball valve and an *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 the installation shown below, 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 when closing the valve.



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's antenna must be gas free.

2. The ID-201 is not affected by coatings because it operates at high frequency and can "see" through normal coating build-up. 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 oil and process water. If fluids other than 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 oil and water characteristics will not affect the ID-201. If, however, the water's NaCl content falls below 2000 PPM, the probe may have to be recalibrated.

5. The ID-201 probe can be adjusted to work within one inch of grounded metal. However, Agar recommends that no metal be closer than six 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 three second delay. However, if rapid valve cycling is a problem and restriction of the drain rate is not acceptable, there are two alternatives: (a) A time-delay relay may be fitted to the ID-201 to reduce cycling; and (b) 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 (System 2).

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 a coincidence.

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