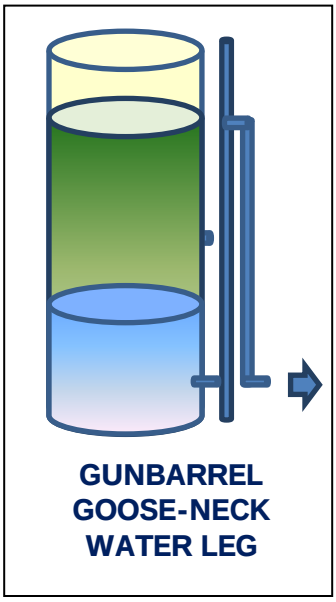
Why Gunbarrels Overflow

And What to do About it

Gunbarrels (aka “wash tanks”) overflow. With oil prices in the $80-100/barrel range, overflowing oil containing tanks, letting crude oil spill out on the ground, is costly, and should be unacceptable! Yet, this happens every day someplace. The purpose of this paper is shed some light on why this happens, and what should be done to prevent it.

Gunbarrels were designed in the “dark ages” of oil patch history, not long after the Drake #1 Well blew out over the crown in Titusville, PA and kicked off the oil industry we know today. Those old gunbarrel tanks were designed to separate very small amounts of water from very large volumes of oil. The water volumes were so small, in fact, that often a 2” goose-neck water leg (aka water siphon) worked fine on most days, but occasionally these gunbarrel tanks overflowed.



GUNBARREL GOOSE-NECK WATER LEG

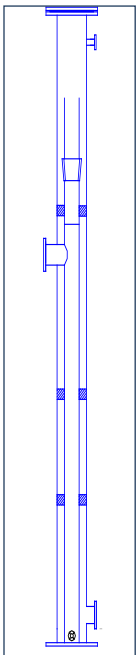
As water volumes increased, water leg sizes also increased. Still, gunbarrels overflowed. It was a mystery! Everything form the full moon to “someone” leaving a water valve closed was blamed for each oil spill.

Finally, it was determined that surges in flow caused the tee in the water leg to flood. That is, when the flow rate of the water into the tank exceeded the capacity of the tee in the water leg the water level inside the water leg built up higher than the tee until it and /or the tank overflowed. When the tank overflowed, it overflowed oil!

In an effort to remedy this, some gunbarrel owners upsized their water legs even more, while others changed out their water leg tees to weir boxes, increasing the size of the water overflow and therefore the ability to absorb surges and mitigate overflows. However, in the vast majority of cases, nothing was done. As years went by, water cuts increased, and overflow events became more prevalent. As water cuts increased, oil volumes and revenue decreased, making it ever-more difficult for oil operators to make wholesale changes to the equipment that had served them so well in the past.

Eventually, clever operators and equipment designers concluded that the problem was the small cross section of the tees normally used. For instance, a 4” tee has a maximum cross section of 4” at its horizontal center line. Since the opening of the tee is the flow area, as it fills to half-full its flow area increases, but it fills beyond half-full, its flow are decreases until it is completely full, and then it floods. With only a few

inches of cross sectional weir area, it is easy to see why small slug of fluid flow would flood the spillover tees in the these small water legs.



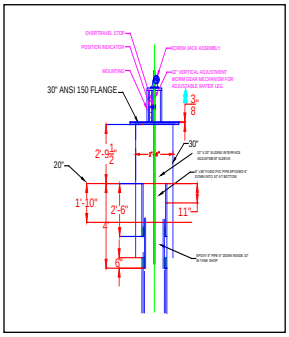
WATER LEG

Recognizing that the cross section of the spillover was the culprit, some designers began experimenting with various designs aimed at increasing the length of the spillover weir. One effective method was to use concentric pipes, allowing the exiting water stream to flow over the circumference of the inside pipe. In this case the 4" pipe used before had a 12.56" weir (4" X 3.1416 = 12.56" circumference). As the circumference is over three times the length as the 4" cross section, it is obvious that at least three times the amount of water can flow over it.

This concentric pipe design eventually found its way into the mainstream of the industry, and is used to day by most knowledgeable equipment designers and manufacturers.

Since oil API gravity only declines gradually over time, the spillover elevation of the water leg could be fixed. However, with the advent of waterflooding in the late 1940s, both produced oil and water specific gravities began to change more often. At this point, the inside spillover pipe was designed to be removable so it could be lengthened or shortened as necessary.

The practice of changing water leg spillover elevations proved to be so time consuming and costly, that designers and manufactures began developing methods of adjusting the spillover height without having to shut down and disassemble the water leg. The "engineered water leg" was born.



The benefits of the engineered water leg far outweigh the cost. Let's see how.

The engineered, externally adjustable water leg is one of the key features of the HWSB™ Skim Tank/Gunbarrel. Each one is offered with an externally adjustable water leg is engineered to assure the owner that their HWSB™/Gunbarrel will NEVER overflow.

Each externally adjustable water leg is designed to maintain the necessary internal levels to provide pipeline oil to sales and high quality injectable water quality, always! And because it works you'll never again find your oil on the ground ... never!
The HWSB™ and its water leg are sized so peak flows and slugs have no effect on the HWSB™ process. All authorized HWSB™ fabricators will deliver these to you with your new HWSB™ Skim Tank/Gunbarrel if you ask them to!! And, since each one has a rapid return on its investment, why wouldn't you ask them to?

Case Study

With oil prices around $80-$100/barrel, the amount of oil inside each HWSB™ represents a sizeable investment on the part of the owner. For instance, a 5' oil pad in a 12' OD HWSB™ represents $10,000 worth of the owner's oil. In order to allow the owner to fine tune the HWSB™ so he keeps only the amount of oil in the vessel that is absolutely necessary. HTC, through its authorized fabricators, has made an externally adjustable water leg available to all HWSB™ owners.

This external adjustment can be made at any time without having to slow down or shut down. The assembly is designed to raise and lower an internal sliding sleeve on the top of the inside spillover pipe, thus raising and lowering the water spillover height of the water leg. The adjustment assembly is sealed gas tight, so there is no environmental impact of this design.

All HWSB™ owners with these adjustable water legs brag about the value of this feature, as it not only lets them put the maximum oil in the sales tanks, it also allows them to fine tune the HWSB™ for the varying treating conditions that often exist between summer and winter, during upsets, and whenever it necessary to move more oil to sales. All of this happens with the turning of a simple jack screw adjustment wheel.

Wherever possible, each HWSB™ is designed so the water leg is positioned near the API access walkway or stairway platform. This is done so the pumper/lease operator can simply climb the stairs and within seconds turn the adjuster wheel on the jack screw. Depending on the gravity of the oil and the water, one inch of jack screw change may mean from three (3) inches to sic (6) inches of oil-water interface level change in the HWSB™. Therefore, the jack screw provides for very fine adjustments with its several revolutions per inch of water leg spillover level change.

Also, it is now easy to move oil out of your HWSB™ using the adjustable water leg adjuster. Simply crank it up and more oil goes to the oil sales tanks. This can be quite useful. For instance, in the summertime when oil dehydrates more rapidly, a thinner layer of oil is necessary to achieve "pipeline" quality oil compared with winter time operations. So, in the summer, with the twist of an adjustment wheel the operator can transfer oil to sales. Then, in the winter, he can crank it down to allow more settling time as the oil gets colder and harder to treat.

While the externally adjustable water leg assembly is not inexpensive, it more than pays for itself by preventing just one shutdown which would be necessary when the levels needed to be adjusted if the HWSB™ was not fitted with the externally adjustable water leg assembly.