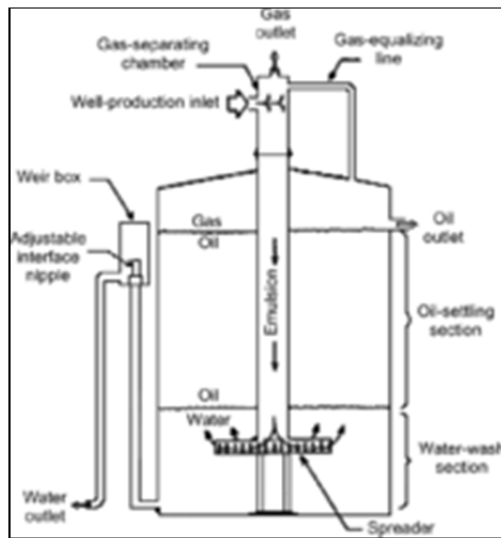


Gunbarrel Sizing for Crude Oil Dehydration

Since the 1860s the oil industry has been dehydrating crude oil in tanks. These tanks were then identified as "Gunbarrels" or "Wash Tanks"... names that prevail even today. For the purpose of this paper we'll call these oil dehydration tanks "Gunbarrels".



A Gunbarrel is a tank that is often taller than it is wide; typically on a 3:2 ratio. It is designed to be from 1/3 to 2/3rds filled with oil. A "water leg" is used to control the depth of the liquids. The raw production containing both water and oil is piped into the bottom and middle of the tank so the oil can rise through the water. The dehydration concept at play here is that "water has an affinity for water, so the water layer strips (absorbs) the water contained in the inlet oil. This water is most often emulsified in the oil as very small water droplets.

The emulsified water droplets have been identified as being from sub-micron to about 500 microns in diameter. Those larger than 30 microns are

considered separable, while those smaller than 30 microns are colloidal and may not settle/separate in the retention time available within any given Gunbarrel. Therefore, chemicals defined as "emulsion breakers" or "demulsifiers" are often added to aid in water droplet size growth.

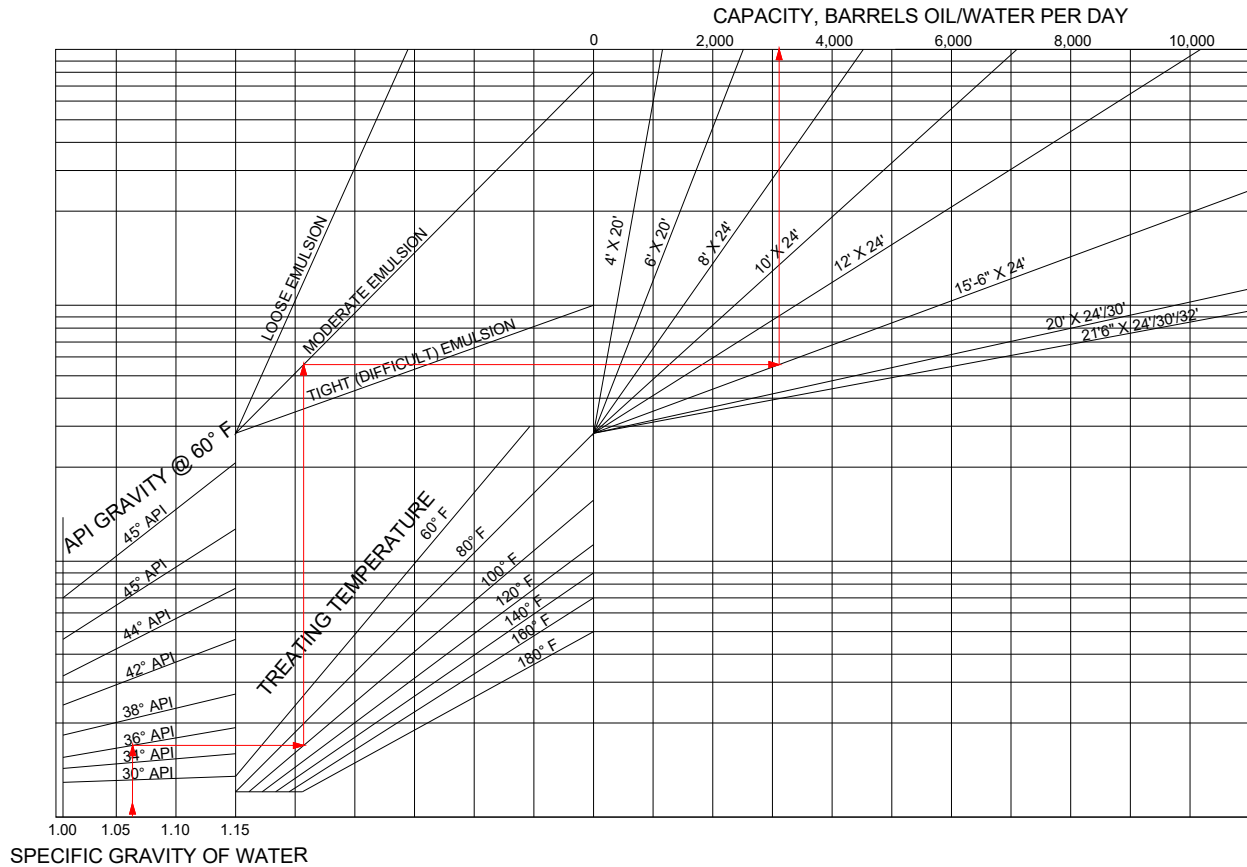
Until the advent of water flooding in the late 1940s the industry produced mostly oil. However, as the popularity of water flooding grew so did the relative volumes of produced water. When water cuts reached 50% Gunbarrel performance suffered. This spawned the use of separation vessels like the Free Water Knockout (aka FWKO) to reduce the bulk water volume influent to Gunbarrels, and heater treaters used to process (dehydrate) crude oil with smaller footprints than the comparatively large Gunbarrel tank.

The widespread use of Gunbarrels waned in the last half of the 20th century. As popularity decreased, some of the basics of Gunbarrel use was lost to the generations of oilfield workers who came and went in the many boom-bust cycles typical of the industry. Today few people know how to size a Gunbarrel!

The 21st century ushered in a new era of high volume oil production on the heels of horizontal completions and multi-stage frac jobs which results in high rate oil production with comparatively low water cuts. This has spawned a renewed interest in the use of Gunbarrels.

What follows is a sizing nomograph that has stood the test of time.

GUNBARREL PROCESS CAPACITY



EXAMPLE

In this example the crude is 36 degree API. The water is 1.065 specific gravity. The oil is made up of a moderate emulsion of water. The planned treating temperature is 120°F. Starting at the bottom of the nomograph we find the specific gravity of the water, and move straight up to the API Gravity of the crude. Then we move right to the 120°F temperature, and from that intersection straight up to the “Moderate Emulsion” intersect point. We then move right to the size Gunbarrel needed to process the desired volume. In this case we are producing 2950 BOPD, so we proceed right to a tank size intersect that can process the desired volume; the 15’-6” x 24’ Gunbarrel.

CONCLUSION

This paper documents a method for the proper sizing of a Gunbarrel or Wash Tank.

ABOUT BREAKTHROUGH ENGENUITY’S OWNER/INVENTOR



Bill Ball is the founder and owner of Breakthrough Engenuity LLC. He has had a distinguished career in the field of oilfield separation, and has a comprehensive list of related patents. Bill’s hands-on oilfield experience and career portfolio make him



one of the industry's leading separation authorities today. After his university studies he launched his career in a 1,000,000 b/d waterflood operation where he was responsible for the evaluation and performance improvement of all surface facilities. He spent most of his work days crawling through the process equipment of the day, gaining knowledge, and making improvements wherever possible.

This hands-on experience was the foundation Bill needed to improve, develop, and advance the technologies necessary to improve process equipment efficiencies across the board. In the early years Bill learned what works, and what doesn't! In the decades since his accumulated separation knowledge and experience led to his many patents, each of which speaks for itself.

The result is a unique approach; one where, "Engineering meets ingenuity!"

Bill's efforts continue to innovate improvements like the patent pending combination free water knockout- heater treater in one vessel. It's called "KOTREAT®". Each new KOTREAT® eliminates the time and expense of installing two separate vessels. And, through the use of highly efficient internals, KOTREAT® is a game changer when it comes to performance.

Another example of ingenious innovation is the MorOil™ system. MorOil™ is a patent pending system designed to condense the valuable C4+ hydrocarbon liquids from produced natural gas streams to generate a new producer stream of cash flow in the form of saleable, highly valued NGLs.

And yet another is the L-POD® System. This patented system brings the subject of crude oil dehydration into the 21st century. Using the most advanced components L-POD® reduces the BS&W concentration of crude oils to below the 0.1% level (that's 99.9% oil purity!).

These are just a few of Breakthrough Engenuity's unique contributions.

Today, Breakthrough Engenuity is one of the industry's leading low-cost engineering and design firms. We specialize developing designs for the industry's most efficient high and low pressure, two and three-phase heated and unheated separators, as well as providing general engineering services for most other oilfield process needs.

Now, more than ever, Breakthrough Engenuity can be found in every sector of the oil and gas industry, adding cash flow to operators and efficiency to their operations. We're a full service engineering firm. We pledge to meet and exceed every client expectation.

CONTACT US

If all else fails, or if you just have a question, don't hesitate to call Bill Ball at Breakthrough Engenuity for assistance. You can reach Bill at the office at 918-298-6841, or on his cell phone at 918-231-9698.

