

## The Kraken®

### Patented Continuous Flow Vacuum Technology (US #7,380,617)

Do you have a job where you wish you could pull product out of one tank, and pump it directly into a second tank, without having to go to a separate container in between? That's the type of job the Kraken was invented to handle....and the thicker the product, the better the Kraken performs. This whitepaper will explain briefly the Principles of Operation of the Kraken system, and also address issues with the job setup.



*Triton® White Paper*

The Kraken works in tandem with a vacuum source, such as a Triton 2500 diesel-powered trailer unit. A key feature of the Kraken patent is that it synchronizes the flow between the intake (via the vacuum unit) and the discharge (via the Kraken). A Triton 2500 system is generally capable of delivering more product to the Kraken than it is capable of pumping off, so the rate-limiting step is the Kraken output....which is still up to 12,000-14,000 gallons per hour (or up to 70 cubic yards/hour). Automated controls synchronize the vacuum intake so that the Kraken is fed upon demand. The vacuum step conditions the product to allow most effective flow out of the Kraken.



The Kraken is a positive displacement pump containing twin hydraulic cylinders. These cylinders alternate strokes, allowing one cylinder to be loaded while the other is discharged, thus providing continuous output. Generally, each cylinder contains about 6 gallons of product, and the number of strokes at maximum volume control is around 40 per minute...which adds up to 240 gallons per minute discharge, or 14,400 gallons per hour, if the cylinders are fully loaded.

Triton regulates the discharge pressure to a maximum of 250 psi on the product. Thus, it is imperative that the discharge piping or hose be capable of withstanding a surge of 250 psi in the event of a product pluggage in the discharge line. The Kraken's discharge is through a 6"

Class 150 flange, but may be reduced to 4" without loss of throughput. However, the narrower line may increase the risk of pluggage. Normally, continuous running of product prevents any pluggage in the discharge, but it is best to be prepared for the inevitable process upsets. The line and connections must be capable of withstanding at least 250 psi. Most often, 6" dock hose (250# or 300# working pressure) is used. It is generally available in 15' lengths with flanged connections. Triton does not routinely supply this hose, but it is readily available for rental from the pump companies. Composite hose is also available that may be fit for use. The ideal setup is to have hard piping – steel pipe with flanges. Alternatively, plastic piping such as 6" Schedule 80 PVC may be used, provided the connections are designed and installed correctly to meet the pressure requirements. Triton recommends installing a spool piece every hundred feet or so on the discharge line. At those spool points, a pressure gauge can be installed, along with a fitting to allow flushing the line. The flush fitting (pointed toward the direction of flow) allows the line to be cleared during shutdowns. The pressure gauge is used as a diagnostic in the event of any pluggage to determine where in the line the problem is. Triton also recommends a block valve at the discharge of the machine to prevent back pressure towards the hydraulic unit during line flushing. A gate valve is suitable.

At this discharge pressure, the Kraken is capable of moving product several hundred feet vertically and several thousand feet horizontally.

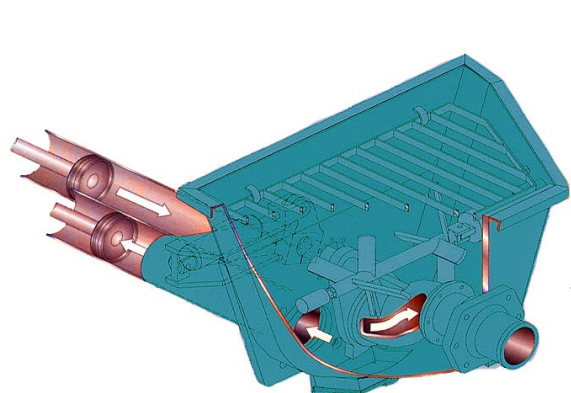
All intake and discharge piping is 6", but can be reduced, depending on application. Consult Triton for the best setup for your situation.

The Kraken has a hopper of approximately 300 gallons that is filled by a vacuum source. Level controls sensors open up a vacuum break on the hopper to stop the intake of product when the level reaches the high setpoint. The Kraken is allowed to pump off until the low setpoint is reached, at which point the vacuum break closes and the vacuum unit delivers more product to the Kraken hopper.

The Kraken has a volume control which determines the stroke frequency. The length of the stroke, and thus the amount of product taken into each pumping cylinder, is fixed. However, very thin products like water may actually backflush into the hopper during the cylinder shift, detracting from production rate. Additionally, dry products like sand may not completely fill the cylinder, also resulting in reduced rate. Maximum rates are obtained on thick slurries and sludges. Our customers have used the Triton vacuum and Kraken system to pump "non-pumpable" products through hard piping more than half a mile. Products pumped with this system include 6-oil and Bunker C fuels, tank bottoms, weathered oil from the BP Deepwater Horizon spill, and other products ranging from peanut butter consistency to thick concrete mix to wet drill cuttings. Solids up to 2" can pass without problem. Quite often, large solids are reduced down as they pass through the system. There is manway access on the hopper to a grid that traps solids larger than 2".

The Kraken also has a water/oil intake port in its hopper, along with an agitator allowing thinning agents to be added just before discharge. The Kraken is not designed to pump completely dry products.

Please contact Triton to discuss your specific application.



Cylinder Operation

Intake



Kraken

Triton 2000

Discharge