evoqua
WATER TECHNOLOGIES

TOW-BRO® SECONDARY CLARIFIER

UNITUBE HEADER FOR TOW-BRO® SLUDGE REMOVERS

UNITUBE HEADER FOR THE TOW-BRO® CLARIFIER — ADVANTAGES

6 REASONS WHY YOU'LL GET MORE FROM YOUR FINAL CLARIFIERS WITH A UNITUBE HEADER

1. **Rapid sludge removal**
   Computer-designed Unitube header assures positive, rapid removal of settled concentrated sludge in one revolution. And you get this efficiency over a full range of flows. This rapid removal means a fresher sludge, less chance for septicity, reduced aeration requirements, prevention of phosphate release.
2. **Maximum solids concentration**
   Because the undisturbed layer on the tank floor is removed first, the necessary pounds of solids required to maintain the process are returned without unnecessary dilution water. Less pumping is required. Aeration basins and solids handling systems can be designed and operated for the minimums since sludge is not diluted and liquid volumes are reduced.
3. **Minimum sludge agitation**
   The header design and gentle removal action reduces the chance for the concentrated settled sludge to resuspend into the upper liquid. There is a minimum of underwater disturbance. Sludge dilution is again avoided.
4. **Balanced hydraulic design**
   Since a sludge blanket settles uniformly over the entire tank bottom, the sludge remover must remove settled solids in proportion to the area covered. The Tow-Bro® sludge remover does this over a wide range of flows and permits low sludge blankets to be maintained for clearer effluents.
5. **Economy**
   Starts with construction. Since tank floors are virtually flat, excavation and forming are simplified. No need for a separate drainline, sloping floors and special hopper designs. Torque requirements (horse-power used) are less than other sludge removal devices since there is no scraping or plowing of the sludge. And the superior sludge quality means lower aeration requirements-another power saver.
6. **Flexible operation and maintenance**
   Compared to the headers used in most other types of sludge removers, the Unitube header used in the Tow-Bro® clarifier is simplicity itself. One valve controls sludge withdrawal by pumping or gravity, an important advantage particularly when change in withdrawal rates is required. Single control allows the final clarifier to be more flexible in meeting changing process conditions. Plugging of orifices is a rare occurrence so frequent demands for unplugging are eliminated. Clogging is nonexistent as compared to other devices. Less maintenance required.

The computer-designed Unitube header provides the ultimate in rapid, uniform removal of final clarifier flocculent sludges. The unique design, proven in hundreds of installations as well as in exhaustive testing programs, assures effective results, simple operation, less maintenance requirements, and substantial construction and energy cost savings.

For tanks over 140 feet

HEADER DESIGN AND ORIFICE SIZE OF THE UNITUBE HEADER

Design

The Unitube header is a rectangular-shaped arm of 1/4 inch plate steel for structural stability which is hot dipped galvanized after fabrication for corrosion resistance. The header is of tapered design with the cross-section decreasing from the center of the tank (where the total sludge volume is the maximum) to the outer tip (where the total volume is least) for a uniform sludge withdrawal velocity. The constant velocities prevent the possibility of sludge build-up in the header or orifice clogging. The header is mounted at an angle of forty-five degrees to physically and hydraulically trap the sludge.

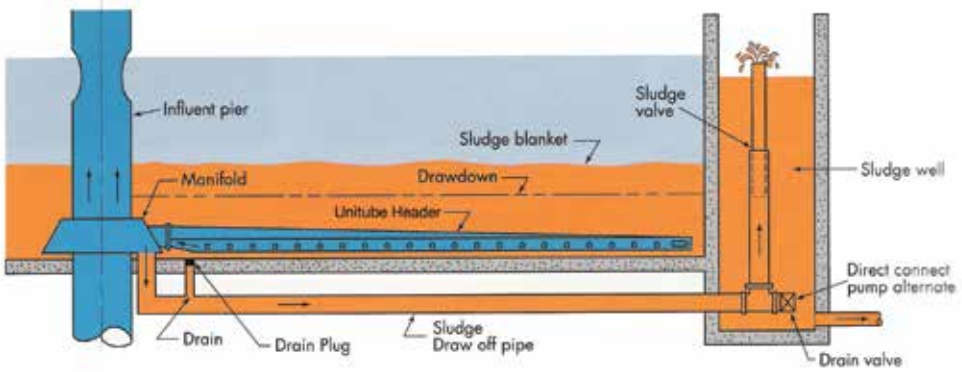
Activated sludge must be refluidized in order to transport it in the sludge conveyance device. A vane fluidizes the sludge into the area of influences of the orifices.

Computer sized and spaced orifices

The peaked top prevents the sludge from collecting on the header and going anaerobic. As the header revolves it cuts into the lower part of the sludge blanket, directing the sludge through the orifices with a minimum of agitation, while assuring maximum solids pick-up.

To assure the desired proportional withdrawal and optimum headloss characteristics, all Unitube headers are designed using a computer to achieve the correct hydraulic and mathematical balances.

Orifice size is based on the amount of sludge that each orifice must remove to assure the hydraulic balance required for proportional sludge withdrawal volumes over the entire tank bottom. The orifice size is dependent on both the flow it must accept and the



CROSS SECTION OF TOW-BRO® CLARIFIER WITH UNITUBE HEADER

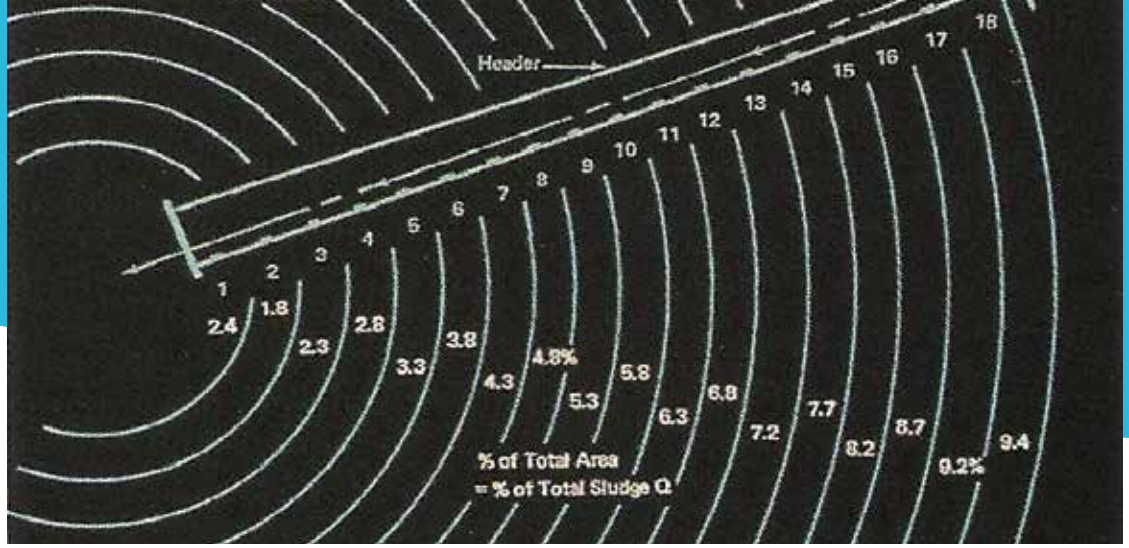
Unitube Header

headloss at that point in the header. The orifice size increases proportionally, with the smallest at the tank center and the largest at the outer periphery. Orifices are spaced no more than thirty inches apart so that the maximum distance the sludge has to travel between orifices is fifteen inches. This spacing eliminates the possibility of concentrated sludge going over the header or by-passing the orifice. The sludge must pass through only the 1/4 inch steel plate, eliminating any clogging.

More than 75 years of experience, plus extensive testing programs, have enabled our engineers to compile a data bank set-up in a computer program to assure precise design parameters for all municipal and industrial sludges.

Higher mass loading capabilities

The uniformly proportional pick-up of the Unitube header over the entire tank floor permits a higher mass loading to be applied as compared to other removal devices. The entire floor area is fully utilized.



HEADER DESIGN AND ORIFICE SIZE OF THE UNITUBE HEADER

Typical Test Runs

The performance of the Unitube header has been demonstrated in over 1000 units in the field and in complete testing programs.

The test shown here, in an operating plant, was designed to demonstrate the accuracy of the computer-designed Unitube header and to compare its actual performance to the theoretical. The results verified header hydraulics and conclusively showed that actual flow withdrawal corresponds with desired withdrawal for uniform sludge pickup from the clarifier floor. And, the desired withdrawal was obtained over the full design flow range of the header.

Test Conclusions

The following conclusions are the result of this study on the Unitube header performance.

1. The actual pickup of sludge from the clarifier floor is in excellent agreement with the desired withdrawal. Proportionately larger volumes of sludge are removed at greater distances from the tank center in accordance with the set geometry.

2. Variations in sludge concentration do not change the performance.

Methods and Apparatus

To accomplish the program it was necessary to directly measure flow and pressure head within the Unitube header. To determine performance under actual operating conditions, measurements were made with the header rotating in settled activated sludge. The method and apparatus used to accomplish these objectives are shown elsewhere on this page.

A dye dilution technique was developed to measure flow within the header. A fluorescent dye (fluorescein) was metered into the end of the header. Sludge flow entering each orifice diluted the dye in proportion to the total flow in the header. By taking samples through the sample tubes between each orifice, the cumulative flow to that point could be calculated from the dye concentration.

Since the probes were located upstream of the corresponding numbered orifice, the flow indicated from the dye dilution was the cumulative flow up to but not including the orifice. For example, the flow indicated from the dye concentration in a sample taken at probe Number 6, is the sum of flows through orifice Numbers 7 to 18.

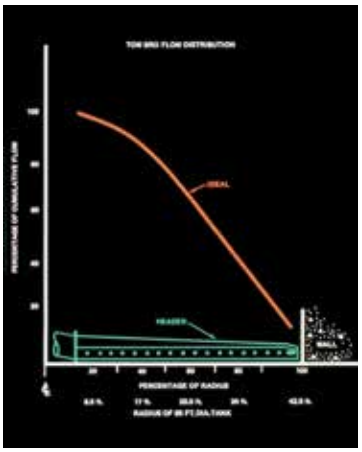
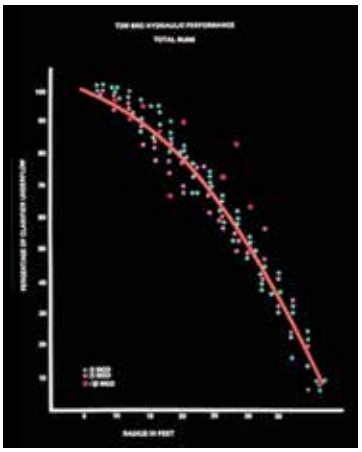


Illustration shows percentage cumulative flow within the header plotted against the tank radius. Ideal withdrawal distribution for a given orifice spacing is also indicated.



The measure flows fall within an experimentally acceptable range of values around the theoretically ideal distribution. Most individual runs show exceptional agreement with the ideal flow distribution.

Installation of sample probes in header.

Update your clarifier with a Unitube header

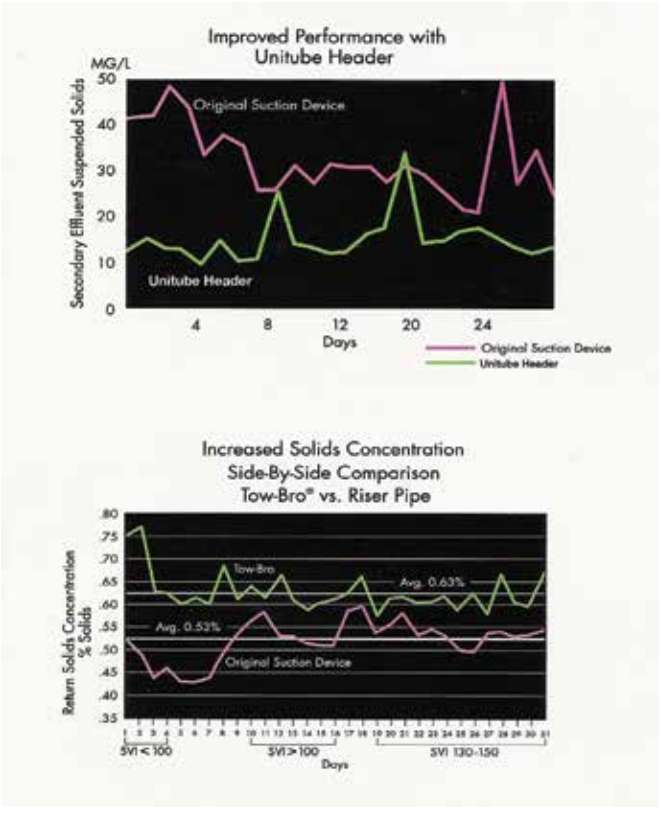
You can improve the performance of your present activated sludge clarifiers by retrofitting existing scraper or riser pipe mechanisms with a Unitube header. Steep floor slopes and special hopper designs with rake type mechanisms are not required and operating torque loads are reduced so existing sludge pipes, drives and bridges can be reused.

The highest solids concentrations possible, faster removal rates, lower operating torques, and greater operator flexibility assured by the Tow-Bro® Unitube header means greater capacity, clearer effluent, lower costs and quicker response time to changes in the biological system.

Evoqua Water Technologies has long been the industry leader in processes and equipment for effective sludge removal. The background of more than 75 years of experience can be used to solve problems associated with activated sludge clarifiers such as improper inlet location, inlet jetting, clogged collection pipes, high sludge blankets, high rotational speeds, inaccessible flow adjustment devices, low return solids, concentrations, rising solids and vortexing in shallow sludge boxes causing sludge pumps to cavitate. To find our more about how to put Evoqua to work for you, contact us.

DESCRIPTION OF CLARIFIER TESTED

Tow-Bro® clarifier, center effluent troughs, half bridge drive with full diameter walkway, one header.	
Diameter	85 feet
Side water depth	12 feet
Header rotation	27 min/rev
Effluent flow	
Average	4.6 MGD
Minimum	2.3 MGD
Maximum	10.6 MGD
Underflow	
Average	2.3 MGD
Minimum	1.5 MGD
Maximum	6.0 MGD
Sludge velocity through header	
Average	1.63 FPS
Minimum	1.06 FPS
Maximum	4.25 FPS



Envirex®
an EVOQUA brand

EVOQUA
WATER TECHNOLOGIES

210 Sixth Avenue, Suite 3300, Pittsburgh, PA 15222

+1 (866) 926-8420 (toll-free) **+1 (978) 614-7233** (toll) **www.evoqua.com**