EIMCO® Digestion Equipment

Cost-Effective Sludge Stabilization
Sludge Digestion
The anaerobic sludge digestion process accelerates the natural decomposition of sludge, allowing safe, nuisance-free disposal. Over eighty years ago, anaerobic digestion of sludges in covered tanks was proven to be a useful method of solids reduction. Since that time, effective digester mixing has been demonstrated to enhance the anaerobic digestion process. Experience has also shown that inadequate or improper digester mixing causes difficulties such as reduced rates of volatile solids destruction and gas production, rapid scum accumulation, and foaming.

Thickening of the sludges to be anaerobically digested has become a common practice. Combining sludge thickening with adequate digester mixing reduces the volume required for effective digestion and makes the process less subject to upset. Additional factors affecting anaerobic digestion include temperature, volatile acid production, pH, solids concentration, and sludge composition.

Anaerobic Digesters
- Achieve solids stabilization
- Produce a dewaterable sludge
- Reduce the volume of sludge for disposal
- Produce inoffensive sludge for disposal
- Produces a valuable by-product (methane gas)

EIMCO® Digestion Equipment
As the anaerobic digestion process has developed, EIMCO has become a leader in the field, providing technology, engineering and equipment design. EIMCO® equipment described in this brochure is designed to produce the most effective anaerobic digestion systems available. Items offered by EIMCO include:
- Fixed digester covers
- Buoyant digester covers
- Gasholder digester covers
- Sludge mixing systems
- Digester heaters and heat exchangers
- Supernatant removers
- Sight glasses

EIMCO® Digestion Covers
EIMCO provides a variety of digester covers for specific applications. Each EIMCO® digester cover is constructed as a dome-shaped segment of a sphere, offering maximum strength and structural integrity. Thrust rings are installed at the periphery of each cover to absorb all design loads without transmitting excessive forces to the concrete digester wall. During erection, covers are supported by radial beams which add strength to the completed unit but are not considered in structural calculations. The use of radial beams allows EIMCO® covers to be erected quickly and efficiently. The difficulty of painting and protecting truss-type supports is eliminated.

EIMCO® digester cover designs are compatible with all available EIMCO® mixing systems to insure adequate mixing plus odor, scum, and foaming control. A variety of accessories are available with EIMCO® fixed, buoyant, and gasholder digester covers to effectively interface with the consulting engineer’s design. These accessories include manhole covers, large diameter cleanout ports, sample tubes, pressure relief vacuum breakers with flame arresters, gas piping nozzles, gas bonnets for gas draw-off pipes, mixer mountings, sight glasses, and pressure indicators.
The EIMCO® Type F digester cover is the simplest and most economical of all the EIMCO® digester cover designs. A dome-shaped steel structure covers the tank and is supported in a vertical direction by the tank wall. The fixed cover is frequently used as the primary or first stage digester in a two stage system.

Type F covers include arched radial beams attached to a center ring and a thrust ring with a sidesheet extending below liquid level. Fixed covers are supported from structural tubes resting on top of the tank wall. The required number of arched radial beams, sidesheet sections and cover plates varies with the tank diameter. EIMCO® fixed covers are easily insulated to reduce heat loss using commonly available roofing materials. The entire liquid surface beneath a fixed cover is open and can be agitated by a digester mixing system. This is a key element in preventing scum accumulation on the liquid surface of the digester. When a digester mixer is used, a cleanable sight glass viewing port on the digester cover can be added for inspection of the mixer operation.

**Benefits**
- Simple, rugged structural design - Low capital cost
- Constant water level - Allows maximum use of digester volume
- Easy to insulate - Efficient heat retention
- Can be sealed against the tank wall - Combats odors and foaming
- Radial loads absorbed by thrust ring - Wall design is economical, requiring design for vertical loads only
- Self-supporting dome without columns - More effective area with high mixing efficiency
- Simple, quick erection - Low installation cost
- Free water surface - Prevents scum accumulation with mixing
Type GV and Type GS gasholder digester covers are frequently used in the second stage of a two stage system or in a single stage system. EIMCO® gasholder covers use the shell theory design dome structure as on all other EIMCO® digester covers with added sidesheet and ballast for digester gas storage. Submerged ballast blocks are used to maximize cover stability and maintain adequate gas pressure to divert digester gas to supply energy needs. Stored digester gas can be used to reduce wastewater treatment plant energy requirements such as heating and power generation. Special ballasting arrangements are available to increase the gas pressure under the cover to provide the digester heating needs, run auxiliary boilers, generators, gas engines or meet other plant energy requirements.

Type GV covers use a vertical guide arrangement with the guides attached to the tank wall. Guide devices, spanning from the top to the bottom of the cover sidesheet, are engaged to stabilize the cover and protect the cover from substantial wind loads. Where the sidesheet is exposed to high wind loads, with cover extended beyond the top of the concrete wall, even greater stability is required and
Type GS covers are an option to meet this need. In these designs, a 45° spiral guide track is attached to the cover sidesheet, engaging guide devices located in the digester wall. Any applied wind load or overturning moment simply causes the gasholder cover to spiral downward into the tank while remaining level. This design allows the gasholder cover sidesheet to extend farther above the tank wall while maintaining cover stability.

**Benefits**

- Simple construction - Low capital and installation cost
- Lower ballasting and spiral guides available - Extra stable configuration
- Dome shell design - Flexible cover design
- Cover is designed to move vertically - Allows large liquid level variations
- Gas storage volume - Used for plant energy requirements
- Operates at high pressure - Can divert gas to where it is required to supply plant energy needs
- No trusses to paint or protect - Low maintenance cost
- Easily insulated - Conserves heat in cold climates
EIMCO® Type B and Type BC digester covers are used as the first stage in a two stage digestion system or where gas is stored in some external receptacle. They are used on digesters where it is desirable to vary the liquid level over a wide range during the course of operation. As on all EIMCO® digester covers, a dome-shaped steel structure is designed in accordance with accepted shell design theory. A peripheral buoyant chamber is added and the cover floats directly on the digester contents. Precast concrete ballast blocks are placed on Type B covers to maintain a specified gas pressure. Type BC covers incorporate the ballast as precast panels which form the roof over the buoyant chamber as an economical alternative. A cross-sectional view of the Type B or Type BC cover reveals that the peripheral chamber looks very similar to a catamaran, an extremely stable floating configuration. A major portion of the buoyant volume which keeps the cover afloat is located at the cover periphery. This feature provides the Type B or Type BC cover with excellent resistance to tipping. Slides and anti-rotational guides permit vertical movement without rotation or binding. The domed center portion of the cover provides a free liquid surface to allow vigorous agitation for maximum scum dispersal when mixing is used. Digester gas is forced to the center of the domed cover for collection rather than allowing it to collect at the periphery where it could possibly be vented to the atmosphere causing the cover to tip.

**Benefits**
- Cover is designed to move vertically - Allows large liquid level variations
- Easily constructed and erected - Low installation cost
- No trusses - Easy to paint and protect
- Catamaran cross-section - Insures stability
- Free water surface - Prevents scum accumulation with mixing
- Anti-rotational guides and rollers - Prevents listing or binding
- Gas collected at center of the dome - Prevents tipping of the cover
- Easily insulated - Conserves heat in cold climates
- Buoyant chamber can use precast roof slabs - Lower capital costs

**Type B Buoyant Cover**
HydroSeal® Gasholder Covers for Anaerobic Digesters
Provide 100% Gas Containment

A “Clean” Liquid Seal Eliminates Gas and VOC Emissions, Improves Service Access and Reduces Digester Maintenance

HydroSeal® digester covers are one of the latest EIMCO innovations for anaerobic digestion. A “clean” water seal between the digester tank and cover provides complete gas containment in normal operation and reduces digester maintenance. Because the sideskirt, guides and ballast members are located in the seal water launder there is no direct sludge contact and maintenance access is greatly improved. Rag and sediment accumulation on guide and ballast surfaces is eliminated and in most designs, ballast members remain easily accessible for operating pressure adjustment. HydroSeal® covers are available for new or existing tankage and are fully compatible with all EIMCO® sludge mixers.

<table>
<thead>
<tr>
<th>Feature / Function</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate launder and “clean” seal liquid with no annular gap</td>
<td>Positive Seal</td>
</tr>
<tr>
<td></td>
<td>100% gas containment.</td>
</tr>
<tr>
<td></td>
<td>Effective odor and VOC emissions control.</td>
</tr>
<tr>
<td></td>
<td>Clean environment, no rags, sediment or debris accumulation on side sheet or ballast.</td>
</tr>
<tr>
<td></td>
<td>Aesthetically pleasing.</td>
</tr>
<tr>
<td></td>
<td>Easy, low-cost installation.</td>
</tr>
<tr>
<td></td>
<td>Accessible for ease of maintenance.</td>
</tr>
<tr>
<td>No components come in contact with sludge</td>
<td>Corrosion resistant.</td>
</tr>
<tr>
<td></td>
<td>Long, trouble-free life, easier inspection.</td>
</tr>
<tr>
<td>Side sheet operates independent of sludge storage in clean area</td>
<td>Variable sludge storage capabilities.</td>
</tr>
<tr>
<td></td>
<td>Lower equipment cost.</td>
</tr>
<tr>
<td></td>
<td>Will not become coated with dried sludge, rags, etc.</td>
</tr>
<tr>
<td></td>
<td>Length dependent only on gas storage needs.</td>
</tr>
<tr>
<td>Guide system contained in clean area</td>
<td>Accessible for inspection.</td>
</tr>
<tr>
<td></td>
<td>Easier maintenance.</td>
</tr>
<tr>
<td></td>
<td>Greater stability.</td>
</tr>
<tr>
<td></td>
<td>Increased life.</td>
</tr>
</tbody>
</table>
Effective anaerobic digestion is highly dependent upon efficient mixing. When tank contents are not vigorously mixed, stratification occurs and the tank volume is not effectively utilized. Most wastewater treatment facilities incorporate thorough and complete mixing to insure uniform temperature, and solids distribution and microorganism contact with incoming sludge. High-rate digestion processes effectively handle high solids loadings with shortened detention time through the proper application of digester mixing. EIMCO® EIMIX® sludge mixers minimize scum formation, distribute heat throughout the digester, completely mix the digester contents, and evenly distribute volatile acids and nutrients. Several types of sludge mixers are available to pump large volumes of sludge through draft tubes. These mixers act as low head, high volume sludge pumps, utilizing explosion proof motors to drive specially designed, vertical sludge mixing propellers. Use of a reversing motor enables these mixers to operate in either direction, maximizing system flexibility. EIMCO uses the unique EIMIX® sludge mixer propeller that prevents fouling and is capable of pumping upward or downward with equal efficiency. The sludge mixer upper bearing is located well above liquid level, next to the motor, and the lower bearing is located adjacent to the propeller. Using this configuration, bearing span is increased and overhung loads are negligible resulting in extended bearing life. The entire EIMIX® mixing assembly is removable without dewatering or depressurizing the digester. Pumping capacity varies with mixer motor horsepower (from 5 to 20 HP) and ranges up to 23,000 gallons per minute.

EIMCO® Type EDT Mixer

External Draft Tube (EDT) mixers are self contained units which provide a tangential flow pattern within the digester. They are the most efficient system available for high rate digestion. Maximum energy input occurs at the periphery of the tank near the surface to enhance surface turbulence and prevent scum accumulation. Easy access for maintenance is achieved by mounting the mixer outside of the tank. Removal of the drive assembly for maintenance is achieved without losing digester gas or dewatering the tank.

Conventional Propeller

A conventional three-bladed weedless marine type propeller, as shown above in a sludge mixing application, clearly demonstrates its propensity for fouling. Mixing efficiency is severely reduced and mechanical problems, such as motor overload and bearing damage, is greatly increased. Maintenance was required for cleaning at least once every two weeks.

EIMIX® Propeller

An EIMIX® propeller was installed in place of the marine type propeller. After three years of continuous operation, the EIMIX® propeller was removed from the draft tube and is shown in the above photo. These photos testify to the superior ability of the EIMIX® propeller to eliminate accumulation of materials while retaining high operating efficiency with low maintenance.
**EIMCO® Type RDT Mixer**

Removable Draft Tube (RDT) mixers are mounted on the digester cover with the draft tubes and drive assemblies both being easily removable. For maximum mixing capability, several RDT mixers can be distributed around the cover on large digesters. Flow can be directed upward or downward with periodic reversing of direction.

Types RDT-V and RDT-L mixers incorporate telescoping extensions at the bottom of the draft tube. With type RDT-L, flow is pumped downward through the draft tube toward the digester bottom. In large diameter digester applications, an RDT mixer can be installed at the center of the digester tank to operate in conjunction with the EDT mixers at the tank periphery to give additional scum breaking and mixing capacity.

**Benefits**

- Rotating equipment and draft tubes are supplied as a unit - Easy installation
- Forward and reverse operation - Alters flow and increases system flexibility
- Specially designed propeller - Eliminates accumulation of debris
- Machined, lower mechanical oil seals - Decreases maintenance costs
- Large diameter draft tube propeller - Provides low head loss and effective utilization of mixing energy
- Heat exchange jackets - Effective digester heating for low cost
- Mixers are located at the tank periphery and / or on the digester cover - More effective sludge mixing and easy access
- Strong surface agitation - Effective scum break-up
- Can be worked on while the digester remains in service - Easier maintenance
- High degree of mixing intensity - Eliminates short circuiting and increases the active digester volume

**EIMCO® EIMIX® Mixing Propeller**

The propeller is designed specifically to eliminate accumulation of stringy and fibrous material on the propeller which can cause bearing and seal damage and drive motor overload. Flow is directed away from the hub by the specially designed propeller blade which also permits operation in either upward or downward flow without changing the pumping rate.
**Digester Heater**

EIMCO® Type DH digester heaters supply the hot water necessary to maintain proper digester temperature. Extra heating capacity can be supplied to heat building with hot water systems, or supply hot water wherever else it might be required. Digester gas burners and controls feature an automatic switch-over to auxiliary fuels such as natural gas or oil when digester gas is not of adequate supply. Maximum use is made of available digester gas prior to the burning of any auxiliary fuel. The boiler employed in the DH unit is of a forced draft design. It is the most efficient available, extracting the most heating capacity from the available fuel.

**Heat Exchanger**

EIMCO® Type HX concentric tube heat exchangers can be used in conjunction with a Type DH digester heater as a package or supplied separately. The Type HX heat exchanger is a simple, rugged piece of equipment employing counter current flow to transfer the maximum amount of heat from hot water to sludge. A tube-in-tube design is employed using heavy duty, removable cast iron return bends for long life and ease of maintenance.

**Supernatant Remover**

Withdrawal of supernatant at various levels in the digester can be accomplished by use of an EIMCO® supernatant remover. A rotatable drawoff pipe is manually operated through a vertical zone up to 20 feet in diameter by an external worm gear assembly. Location of the drawoff pipe inlet is easily noted by a pointer. The EIMCO® cleanable sight glass, allows the operator a visual inspection of the removal process.
Cleanable Sight Glass
The Type K-2 sight glass is used for right angle flow applications. Sludge is clearly visible through a pyrex glass pipe-section to permit observation and inspection of contents without withdrawing samples. The Type K-3 sight glass is used in straight through flow applications. A light shines through two tempered glass windows on opposite sides of an inner chamber.

Both Type K-2 and Type K-3 sight glasses have internal neoprene wipers and cleaning rod handles with provision for dispensing cleaning solvent on the inside of the glass. To allow inspection through the digester cover, the EIMCO® 8” x 16” weldable sight glass can be used. The assembly can also be provided with a solvent dispenser when required.
Global Sales, Service and Full Equipment Life-Cycle Support

For a complete listing of office locations, visit www.glv.com or contact our US office at 1.801.526.2000