



Biosolids Treatment

WASTEWATER SYSTEM SOLUTIONS

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**CB&I
STORAGE
SOLUTIONS**

Focused on customer solutions

For years, customers have relied on CB&I Storage Solutions for superior performance and reliable wastewater treatment solutions. We design and build advanced anaerobic digestion systems to stabilize wastewater solids, providing single source responsibility for process design, fabrication, construction, commissioning and operator training of digestion facilities.

Our comprehensive approach can help companies realize the most cost-effective and functional solutions they require for their wastewater systems.



Photo courtesy of Black & Veatch

Egg-shaped digestion systems

Our Egg-Shaped Digesters (ESD™) combine the optimum shape for anaerobic digestion with patented and proprietary design improvements to maximize reliability and minimize operating and maintenance costs. We are the leading supplier of ESD systems in the Western Hemisphere with a proven track record, having supplied more than 90 steel ESD vessels and related systems since 1989.

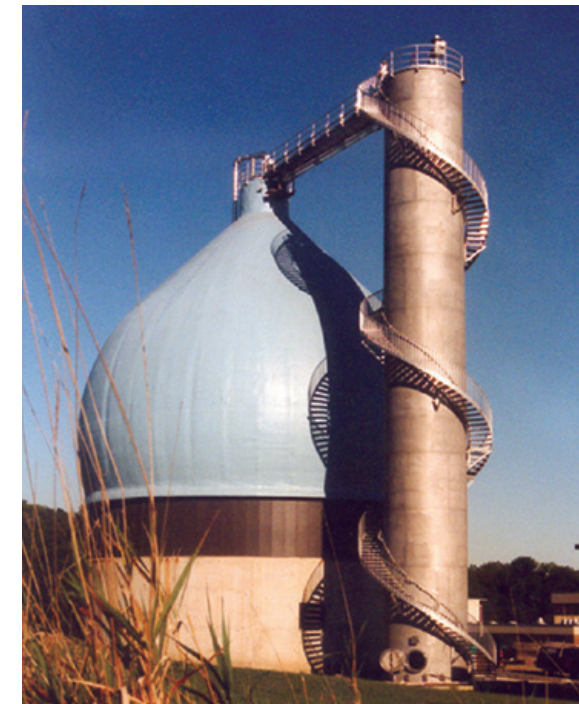
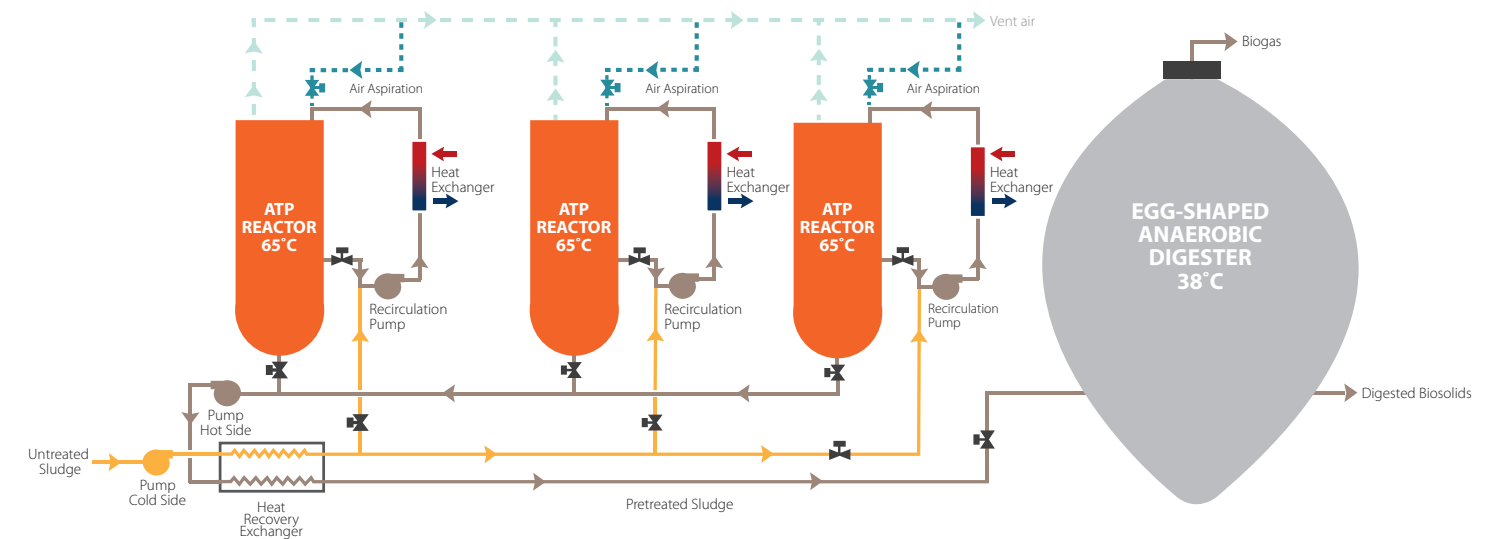
Thermophilic pretreatment systems

Our ATP™ two-stage digestion system reduces pathogens to meet U.S. EPA requirements for Class A biosolids and improves the stabilization process while reducing total retention within the digestion process.

Gas storage

Gasholders and spheres round out our product offering with economical storage of the methane gas generated from anaerobic digestion.

ATP 2-STAGE DIGESTION SYSTEM



Egg-Shaped Digesters (ESD) facilities

We focus on delivering advanced anaerobic digestion solutions safely, on time and with the highest quality standards. Our advanced EPC approach includes designing and building projects turnkey, self performing the work from concept to commissioning and providing a lump-sum price for the project. For any project, we can provide:

- Design and detail engineering
- Specifications and procurement
- Fabrication
- Project management
- Field construction
- Inspection and testing
- Startup and training



Egg-Shaped Digester systems

Egg-shaped anaerobic digesters have been used throughout North America and Europe for many years. Their optimum shape eliminates dead zones within the vessel to maximize solids stabilization and minimize solids accumulation. Our technical expertise and process improvements enhance the benefits of ESD technology.

The key to the ESD system is the blending of the optimum egg shape with effective and efficient liquid mixing to enhance digester performance. The double curvature shape, reduced operating liquid level surface area and effective mixing eliminate scum and grit build-ups, dead zones and the need to take the egg-shaped digesters out of service for cleaning. This contrasts with conventional digesters, which, even with the use of more complex and energy intensive mixing systems, must be periodically cleaned.

High reliability and superior performance

- Employs leak-tight, all welded steel construction for long life and durability
- Maintains full working volume and consistent residence time
- Accepts high solids concentrations and reduces digester volume
- Features outstanding capability to treat fats, oil and grease

- Applies integrated foam suppression system to control foaming
- Uses no internal moving parts within the digester
- Applies redundant mechanical systems for reliability
- Enhances process control flexibility and minimizes operator attention with automated control system

Low operating and maintenance costs

- Cleaning expenses and downtime are virtually eliminated
- Simple, easy-to-operate, automated control system permits stand-alone operation
- Durable, monolithic Automatic Foamed-In-Place (AFIP™) insulation system minimizes heat loss and reduces energy input
- AFIP insulation protects vessel from atmospheric moisture
- Patented internal discharge system limits maintenance
- Patented jet pump mixing system
 - Eliminates all internal moving parts
 - Decreases foam generation and attendant foam control problems
 - Minimizes energy use and maintenance costs

Low installation costs

- Small footprint minimizes land requirements and costs
- High reliability can eliminate the cost of back-up digesters
- Large space underneath vessel eliminates the need for a separate equipment building
- Internal mixing system is simple and inexpensive
- Steel composition allows economical, fast, all-weather construction
- Economical AFIP insulation is applied on site

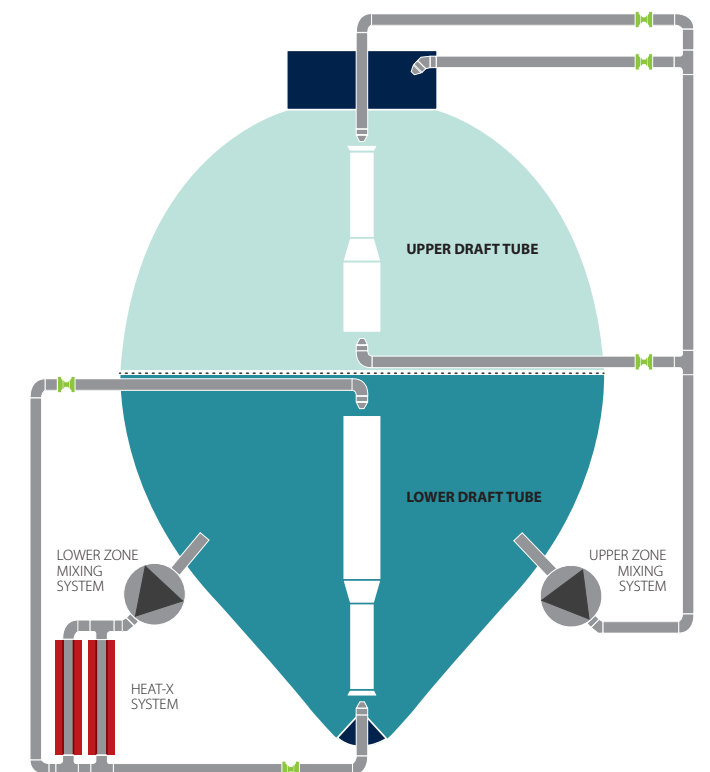
Good neighbor

- Leak-tight, all-welded steel containment significantly reduces odor emissions
- Compact plant with small footprint minimizes community impact
- AFIP insulation provides attractive appearance

Superior safety and security

- Includes patented internal discharge system
- Removes risk of routine gas releases
- Eliminates confined space work areas

JET PUMP DUAL ZONE MIXING SYSTEM



ATP Class A System

The ATP thermophilic pretreatment system operates under nearly anoxic conditions resulting in acidified, hydrolyzed and homogenized sludge. This thermal conditioning, when combined with anaerobic digestion, provides U.S. EPA certified Class A-pathogen reduction.

ATP's nominal Hydraulic Residence Time (HRT) is one day, followed by 12 to 15 days of mesophilic anaerobic digestion. The ATP system has been used for more than 100 installations throughout North America and Europe. Representative pathogen reduction performance data is provided below.

	U.S. 40 CFR PART 503	ATP
Salmonella	<3 MPN/4 grams	<1 MPBN/4 grams
Helminth Eggs	<1/4 grams	<1/4 grams
Enterovirus	<1PFU/4 grams	<1PFU/4 grams

Superior performance

- Certified U.S. EPA Class A process
- Greater solids destruction
- Increased digester capacity
- Enhanced gas production
- Improved dewaterability
- Minimized odor
- Demonstrated Nocardia destruction

Low operating costs

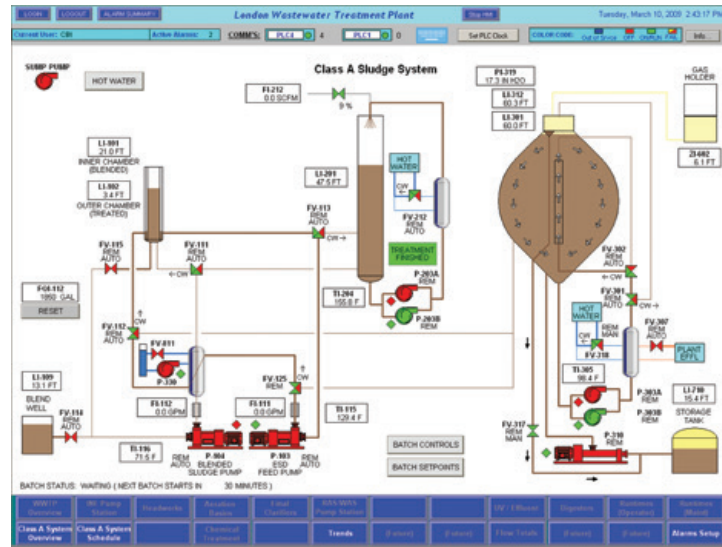
- Heat recovery reduces heating requirements
- Digester heating system is eliminated
- Automated control system supports stand-alone operation

High reliability

- Minimal moving parts in vessel
- Fully redundant mixing systems
- Aspirated air injection
- Atmospheric operation

Flexible application

- New or existing installations
- Upgrades for both conventional and Egg-Shaped Digester facilities
- Batch or continuous feed options available
- Single vessel design for small facilities
- Multiple vessel design for larger facilities



Gas Storage

Whether the need is for high-pressure or low-pressure storage, we provide a variety of gasholder solutions to meet any requirement.

High-pressure gas storage

Hortonsphere® pressure vessels provide large volumes of product gas storage in a small area. These vessels:

- Holds more gas in a smaller footprint compared with low-pressure storage
- Allows for variable discharge pressure for downstream usage
- Provides lower capital cost than large-volume, low-pressure gas storage

Low-pressure gas storage

Two types of low-pressure gas storage are available, dry seal and wet seal. Compared with high-pressure storage, these systems provide consistent gas pressure to meet the needs of downstream usage and operate with minimal mechanical operating equipment.

Dry seal gas storage

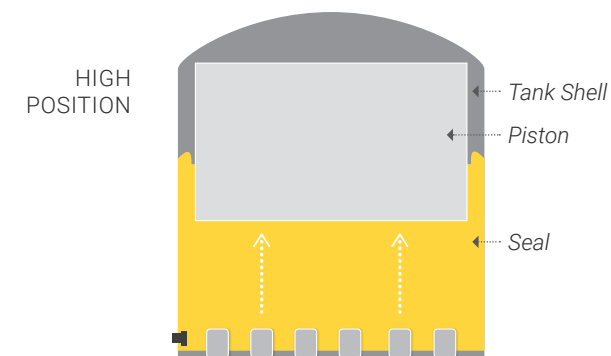
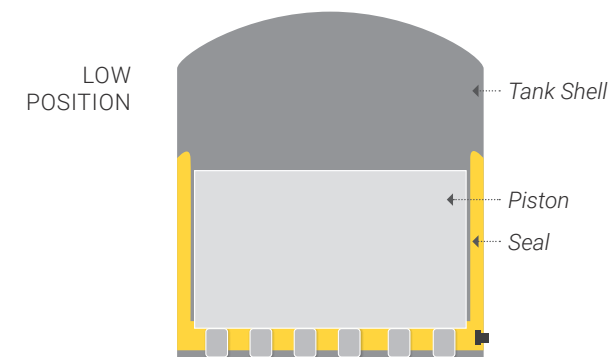
- Increases gas storage volume compared with a wet seal design for a given tank volume
- Reduces odor emissions
- Provides weather protected piston and seal



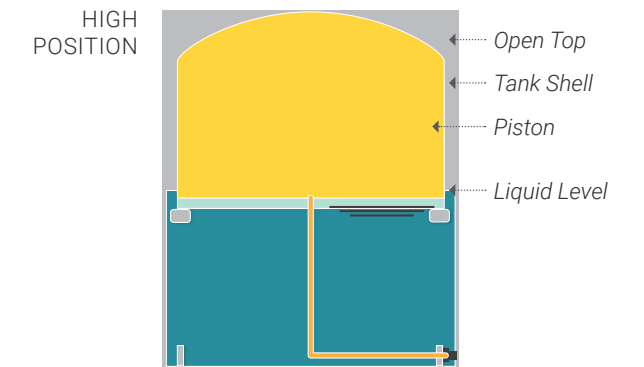
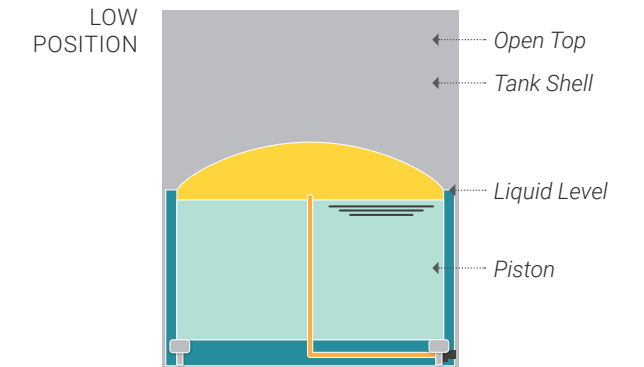
Wet seal gas storage

- Accepts multiple liquids for the wet seal
- Allows for sludge and gas storage within a single vessel
- Operates on either constant or variable liquid level
- Reduces capital expenditure due to size and output requirements

DRY SEAL GASHOLDER



WET SEAL GASHOLDER





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McDermott's storage business, CB&I Storage Solutions, is the world's leading designer and builder of storage facilities, tanks and terminals. With more than 59,000 structures completed throughout our 130-year history, CB&I Storage Solutions has the global expertise and strategically located operations to provide our customers world-class storage solutions for even the most complex energy infrastructure projects.

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