

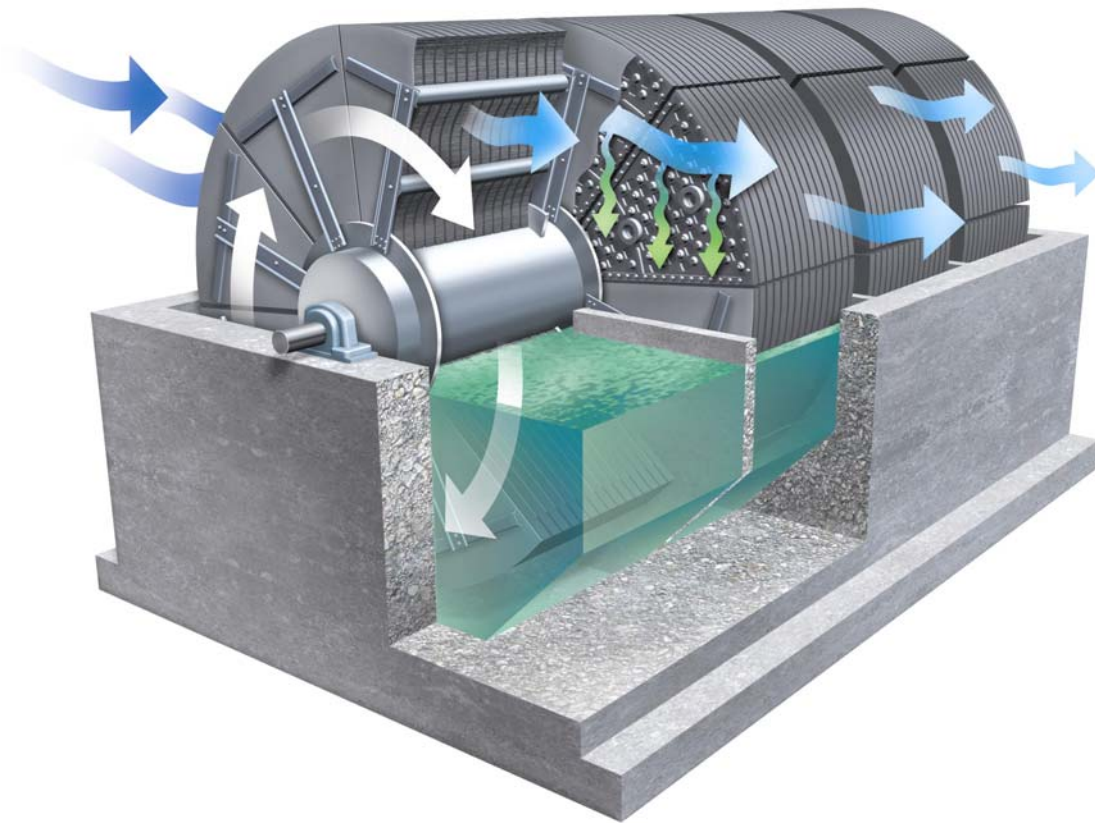
WALKER PROCESS EQUIPMENT

Division of McNish Corporation



Equipment for the Water and Wastewater Industry

Division of McNish Corporation



EnviroDisc™

ROTATING BIOLOGICAL CONTACTOR

ROTATING BIOLOGICAL CONTACTOR SYSTEMS



The Walker Process Rotating Biological Contactor provides a simple and effective method of providing secondary and/or advanced wastewater treatment by a natural biological process.

The widespread use of Rotating Biological Contactors (RBC) began in Europe over four decades ago. Since the first installations in the United States in the early 1970's this wastewater treatment process has gained wide acceptance and has been applied successfully in hundreds of installations. They can be added to upgrade existing wastewater facilities or incorporated into the planning of new facilities. Rotating Biological Contactors are used to treat in a cost effective manner from 5,000 gallons to millions of gallons per day of domestic and industrial wastewaters.

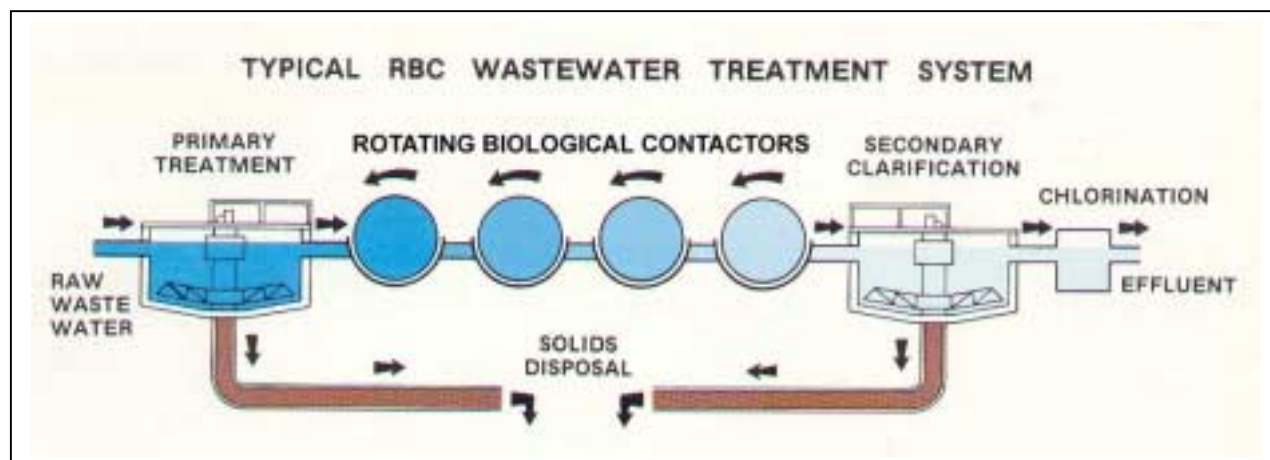
The RBC process provides an extremely high degree of treatment providing effluent qualities as low as 5 mg/l of soluble Biochemical Oxygen Demand (BOD) and 1 mg/l ammonia nitrogen. They are also used for significantly lowering the levels of soluble organics and Chemical Oxygen Demand (COD).

The Walker Process Rotating Biological Contactor offers the user the following benefits:

- Low power requirements
- Low construction and installation costs
- Easily installed under any hydraulic gradient, minimum

Headloss

- Capability to treat high temperature waste - up to 90 degrees F with standard media material
- Eliminates the need for operator control of oxygen and solids return
- Reduced chemical and electrical needs minimize operation costs
- Flexible design allows for units to be shipped fully assembled or knocked down for assembly in existing buildings
- Treatment flexibility with wastewater flow path variations



METHOD OF OPERATION

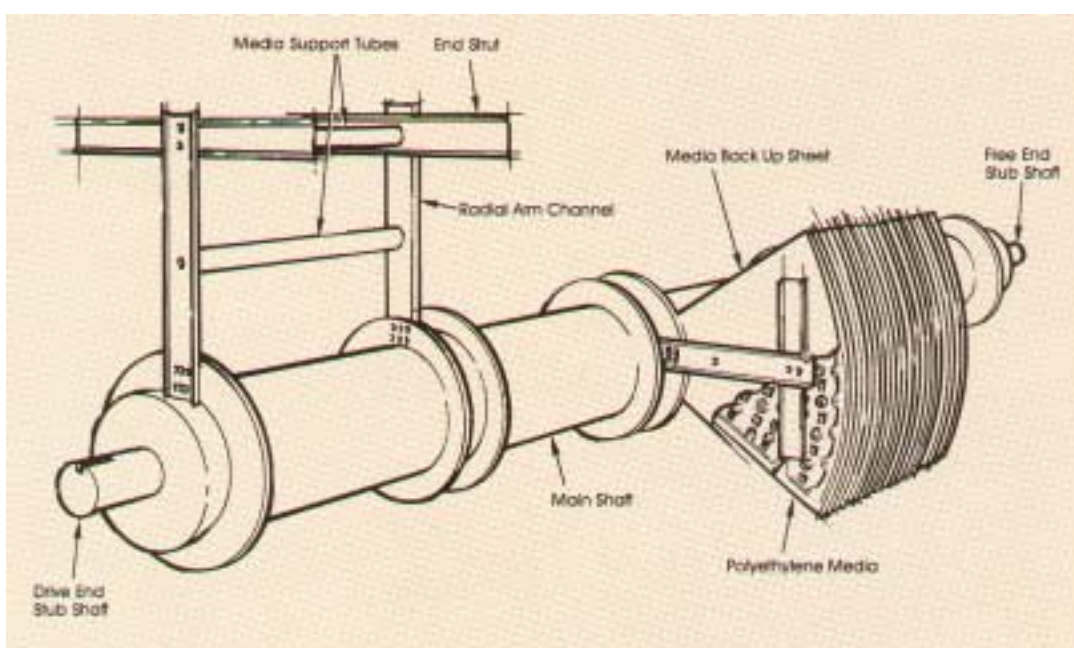
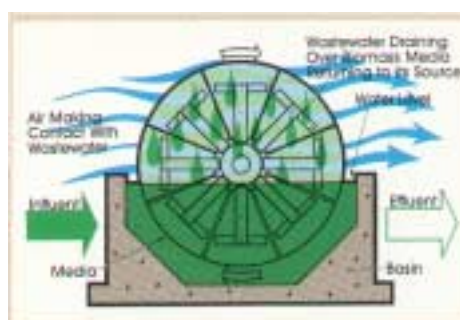
The Walker Process Rotating Biological Contactor consists of a multitude of plastic media sheets in bundles. These bundles are mounted on a shaft by means of a simple, internal radial structure. The vacuum formed plastic media sheets are assembled in a manner which provides intricate flow paths with maximum effective biological surface area. The media is designed to permit ample space between adjacent sheets and to provide sufficient turbulence and oxygenation when moving through the wastewater thus achieving the desired levels of liquid mixing and shear.

The RBC is immersed in wastewater to a depth that submerges approximately 40% of the media. When the RBC is rotated at a normal operating speed of 1-1/2 RPM the media is alternately exposed to the air and wastewater. Once exposed to wastewater a biological growth begins to develop on the plastic media, using

the contaminants in the effluent as their food source. As the RBC rotates, the media with biomass growth will continuously come out of the wastewater with each rotation of the shaft. When the media lifts from the effluent in the treatment basin, some of the wastewater is carried out on the media. The wastewater immediately begins draining over the media back to its source. This draining action provides a thin film of liquid which permits high exchange rates of oxygen from the atmosphere to the liquid. It also allows for the release of gaseous by-products of the biogrowth to the air.

As long as neither food nor oxygen become limiting factors the biogrowth continues to grow. Through several mechanisms, predominantly the shearing action from the rotation of the RBC shaft, the biogrowth is continuously being sloughed off on a gradual basis from the media. As the sloughing of the biogrowth occurs new organisms grow to replace it.

The sloughed biomass becomes suspended solids and eventually sludge in a clarifier. Since the biomass attached to the media represents 99% of the system's biogrowth, the recycling of sludge is not required. Once the effluent is treated by the RBC, it flows to a secondary clarifier for suspended solids removal and discharged to the receiving water source.



METHOD OF OPERATION



BIOMASS MEDIA

The biomass media bundles are a multitude of thin individual wedge-shaped sheets of high molecular weight polyethylene. The media is vacuum thermoformed with a pattern of truncated pyramids and conical spacers that provide maximum surface and drainage area while contributing to the rigidity of the sheet. The conical spacers allow for a clog free flow path between the sheets of media. This configuration creates an open media system that allows for excellent contact of wastewater and oxygen with the biomass. The media bundles are fully removable from their supporting members without having to raise or remove the entire shaft assembly.



MEDIA SUPPORT STRUCTURE & SHAFT

The media support structure consists of dual support tubes that are mounted to the radial structure. The radial structure is attached directly to mounting rings that are welded to the main shaft of the RBC. Dual support tubes pass through the media with operational loading being distributed throughout the plastic media at acceptable levels rather than being concentrated. For added strength the media has a support tube-reinforcing collar molded in it.

The shaft is a fabricated carbon steel cylinder that is coated with coal tar epoxy for corrosion resistance. The use of a cylindrical shape eliminates the stress risers that occur when square or other angular shapes are rotated.



SHAFT BEARING

The main shaft uses heavy-duty, self-aligning, pillow-block roller bearings. They are designed for high humidity, slow speed operation with a B-10 life of over twenty years of operating loads and speeds. The drive end of the shaft is equipped with an expansion type bearing to allow for expansion and contraction of the shaft while the free end has a non-expansion type bearing. The bearings are equipped with spring loaded bearing lip seals which are designed to maintain contact with the shaft if misalignment should occur.



DRIVE SYSTEM

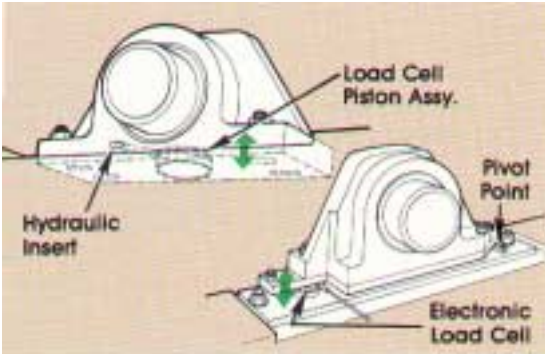
The drive unit for the Walker Process Rotating Biological Contactor was designed in cooperation with the gear reducer manufacturer for reliable and energy efficient operation. The drive system is mounted directly on the stub end of the shaft for ease of installation and maintenance. By mounting the drive directly on the shaft adjustable bases are not required. The drive motor is directly coupled to the gear reducer eliminating belts and sheaves. A two-piece weatherproof corrosion resistant casing fully encloses the drive system and is specially designed for operation in high humidity areas.

OPTIONAL EQUIPMENT



FIBERGLASS ENCLOSURES

The fiberglass enclosures are custom designed for use with RBC assemblies and feature modular interlocking construction for ease of assembly in the field. Because of their design interlocking sections allow for partial ventilation of the RBC shafts. Access doors and inspection ports are included with the enclosures. The enclosures can also be provided with insulation for use in colder climates.



BEARING LOAD CELLS

Two types of bearing load cells are available for weighing the RBC shaft while it is operating. Either type monitors the growth of the biomass forming on the shaft assembly. The far left illustration shows the hydraulic cell type. It is filled with a quick disconnect for use with a portable hydraulic pump and gauge system for periodic inspection. The near left illustration shows an electronic load cell system for automatic and continuous monitoring of biomass weight.



HIGH DENSITY MEDIA

When the RBC is used for nitrification and/or low BOD environments the media spacing may be reduced. Both the nitrifying and carbonaceous organisms develop in a less dense growth so less space between the media is required. The use of high-density media decreases the space between each sheet while increasing the surface area of the RBC. The overall length of the RBC shaft is not affected.

PROCESSES

BOD & COD REDUCTION

Influent BOD can be easily reduced using the rotating biological contactor process. Levels of soluble BOD can be lowered to 5 mg/l. Processes with properly designed basins and staging can achieve 90% or more COD reduction.

NITRIFICATION

When the proper influent environmental conditions exist within the wastewater such as alkalinity, temperature, low BOD, and pH, the reduction of ammonia nitrogen can be easily achieved. Ammonia nitrogen values can be reduced to values less than 1.0 mg/l.

AIR STRIPPING OF CHEMICALS

Since the Rotating Biological Contactor process is less susceptible to upset from toxic and hydraulic shock, its applications extend beyond the treatment of typical domestic and industrial wastes. RBCs can be used for air stripping and biological degradation of materials found in wastewater or contaminated groundwater. RBCs have been used successfully to remove acetone, cyanide, ammonia, chlorinated compounds, organic solvents, as well as many other materials from wastewater.

DESIGN CONSIDERATIONS

Proper evaluation and application of an RBC system requires careful consideration of many factors that affect system sizing and performance. The first step in properly designing a system is to determine the basic wastewater characteristics and effluent requirements. Design can be completed with the following parameters:

INFLUENT TO RBC SYSTEM

	GPD
Flow, daily average	GPD
Flow, peak two hour duration	GPD
Flow, minimum.	GPD
Total BOD ₅	mg/l
Soluble BOD ₅	mg/l
TSS.	mg/l
*TKN	mg/l
*NH ₃ N	mg/l
*Alkalinity (CaCO ₃)	mg/l
Temperature/summer	°F
Temperature/winter.	°F
Ph	

**When ammonia nitrogen reduction is required.*

EFFLUENT

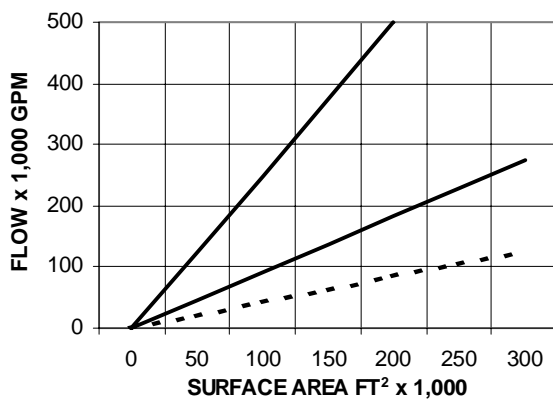
Total BOD ₅	mg/l
Soluble BOD ₅	mg/l
*NH ₃ N/summer	mg/l
*NH ₃ N/winter	mg/l

In evaluating these parameters, the designer will also rationally apply loading values, temperature corrections, staging and other design considerations to arrive at the proper RBC system size and arrangement.

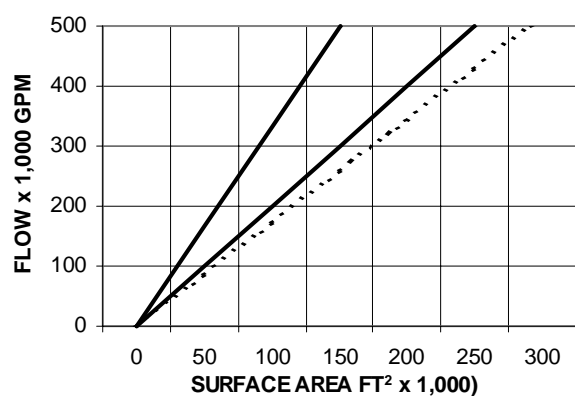
For purposes of allowing the designer to gain a rough approximation of the RBC system for his application, Walker Process has developed sizing charts for determining surface area required for various BOD₅ and NH₃N loadings. These are preliminary design values, of course, and the designer should contact his local Walker Process Sales Representative for specific information. Walker Process engineers will assist the designer and will perform a careful analysis of each particular application and provide specific information suitable for that application. Proper shaft arrangement, staging and exact design application can significantly affect the surface area from the charts. Consult Walker Process for flows or influent loadings beyond the limits of the curves.

SIZING CHARTS

NH₃N REMOVAL
FOR EFFLUENT NH₃N OF 4 MG/L



BOD REMOVAL
FOR EFFLUENT SBOD OF 15 MG/L



TEMPERATURE CORRECTION TABLE

TEMP. (°F)	TEMP CORR. FACTOR
45	0.56
50	0.78
55	1.00

TEMPERATURE CORRECTION TABLE

TEMP. (°F)	TEMP CORR. FACTOR
45	0.73
50	0.87
55	1.00

FOOTNOTES

- Charts are based on 100 GPD/capita
- Temperature correction must be applied to values from charts below temperatures of 55° F
- Effluent total BOD is 30 mg/l with soluble BOD of 15 mg/l
- Normally, and for purposes of approximation, standard density media is applied for BOD removal and high-density media for NH₃N removal.
- Standard shafts normally utilize 100,000 ft.² (standard density) and 150,000 ft.² (high density) maximum media surface area per shaft. For total surface areas beyond these values apply multiple shafts.
- NH₃N removal chart assumes SBOD level is reduced to about 15 mg/l.
- For purposes of approximation, add surface areas obtained from the charts for combined BOD and NH₃N removal. In actual practice this is generally conservative.
- Flow rates may have to be adjusted prior to entering the charts if the peak to average ratio exceeds 2.5.
- Consult Walker Process for values not listed in the charts, for specific design applications, and staging arrangements

EXAMPLES

Example 1: (BOD removal only)

Flow = 0.28 MGD

SBOD 100 mg/l (RBC Influent)

TBOD 30 mg/l (effluent)

Winter min. wastewater temperature = 45° F

From chart: 140,000 ft.² is required.

Applying temperature correction:

$$\frac{140,000}{0.73} = 191,800 \text{ ft.}^2$$

Use two standard density shafts @ 100,000 ft.² each; 200,000 ft.² total; two parallel tanks.

Example 2: (BOD and NH₃N removal)

Flow 0.45 MGD

SBOD = 50 mg/l (RBC Influent)

NH₃N = 12 mg/l (RBC Influent)

TBOD 30 mg/l (effluent)

NH₃N = 4 mg/l (effluent)

Winter min. wastewater temperature = 45° F

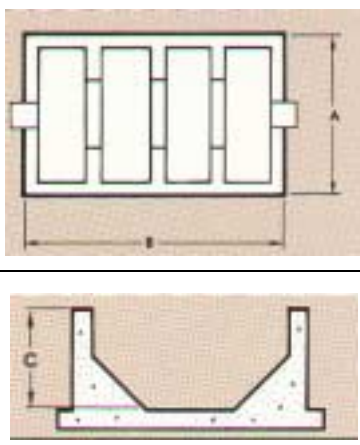
From charts and applying correction factors:

$$\text{For BOD removal: } \frac{130,000}{0.73} = 178,000 \text{ ft.}^2$$

$$\text{For NH}_3\text{N removal: } \frac{180,000}{0.56} = 321,000 \text{ ft.}^2$$

Use two standard density shafts @ 100,000 ft.² each; two high-density shafts @ 150,000 ft.² each; 500,000 ft.² total; two parallel tanks.

DIMENSIONAL DATA

MODEL	Media Area*	Tank Width A	Tank Width B	Tank Width C	Shaft Weight Less Biomass	Motor HP	
A-10	11,000	13'-0"	6'-7"	6'-6"	6,500	1	
B-15	16,500	13'-0"	7'-10"	6'-6"	7,500	1-1/2	
B-20	22,000	13'-0"	9'-1"	6'-6"	8,250	1-1/2	
C-25	27,500	13'-0"	10'-4"	6'-6"	9,250	2	
C-30	33,000	13'-0"	11'-7"	6'-6"	10,000	2	
D-37	42,000	13'-0"	13'-4"	6'-6"	11,250	3	
D-45	51,000	13'-0"	15'-6"	6'-6"	12,500	3	
E-53	60,000	13'-0"	17'-4"	6'-6"	14,500	3	
E-62	70,000	13'-0"	19'-7"	6'-6"	16,500	5	
E-69	79,000	13'-0"	21'-4"	6'-6"	17,500	5	
F-77	88,000	13'-0"	23'-6"	6'-6"	20,500	5	
F-89	100,000	13'-0"	26'-4"	6'-6"	22,500	5	

Dimensions subject to change without notice.

*Areas shown are standard density media. Increase by 50% for high-density media.

TYPICAL APPLICATIONS

MUNICIPAL APPLICATIONS

The Rotating Biological Contactor has gained wide acceptance as the principal secondary treatment process for new facilities. They are also used as polishing systems to upgrade existing treatment plants to conform to existing discharge regulations. RBC's are particularly suitable to municipal applications due to the high degree of performance they deliver with relatively low energy requirements. Because of the modular configuration of the equipment more units can be easily added when additional plant capacity is required.

LAND DEVELOPMENT APPLICATIONS

The Rotating Biological Contactor process is well suited for use in land development applications such as subdivisions, apartment complexes, nursing homes, mobile home parks and campgrounds. The simplicity of operation and high treatment efficiency of RBC's make them an ideal choice for new installations or for the expansion of existing plants.

INDUSTRIAL APPLICATIONS

The reduction of high BOD and COD levels found-in wastewater prior to discharge is essential to the efficient and profitable operation of manufacturers in the processing industries. Rotating Biological Contactors have been used successfully in food processing plants such as dairies, cheese producers, large bakeries, wineries, distilleries and poultry processing. They have also been used in applications treating wastewater from petroleum refining facilities, steel mill blast furnace blowdown, and chemical plant effluent.

OTHER WALKER PROCESS EQUIPMENT PRODUCTS

GRIT REMOVAL

HydroSeparator
Rolling Grit
Grit Washer

BIOLOGICAL PROCESS

EnviroDisc® RBC - Rotating
Biological Contactor
Rotary Distributors

SKIMMING

HeliSkim
RotoDip Skimmer
Grease Prep - Skimmings &
Grease Preparation Systems

SEDIMENTATION & THICKENING

Circular Collectors & Thickeners
Bridge Supported
Pier Supported
Plow Type, Spiral Flights, MultiDraw,
SightWell
UniMix Flocculating Clarifiers
Spur Gear Drives
Rectangular Collector Mechanisms
HeliThickener

SOLIDS CONTACT CLARIFIERS

MC ClariFlow
RollFlow™ Clarifier

SLUDGE DIGESTION

Covers – Fixed, Floating,
GasHolder, Combination
Cover
GasLifter Circulator-Mixer
HeatX – Heat Exchanger,
Boiler, Combination Units

RollAer - For Aerobic
Digestion

WATER TREATMENT

Paddle Flocculators

InstoMix Flash Mixer
Cascade Tray Aerators

Walker Process Equipment

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