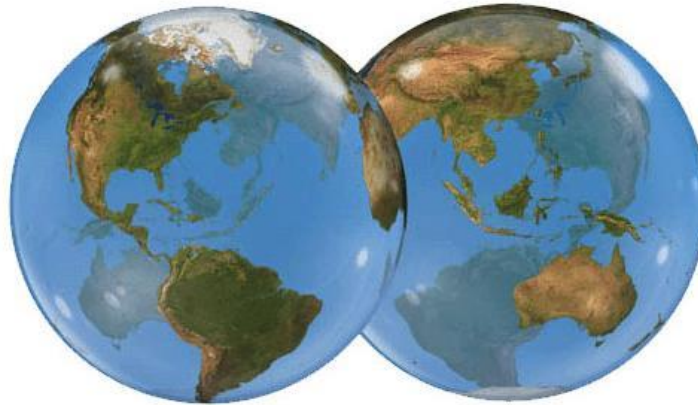


Process & Reuse Water, Wastewater, and Desalination 10th Annual Practical Short Course

College Station, Texas
(October 15 -17, 2014)



HydraKleen[®] Liquid-Solid Separator

Separation Sciences Program
Food Protein Research & Development Center
Texas A&M Engineering Experiment Station
The Texas A&M University System



Presented by
William O. Irvine, P.E.
Engineering Fluid Solutions



Issues

Water Resources

Water Use

Population

Industrial Processes

Environmental Impact

Cost of Production

Sustainability Initiatives

Future Directions



ISSUES

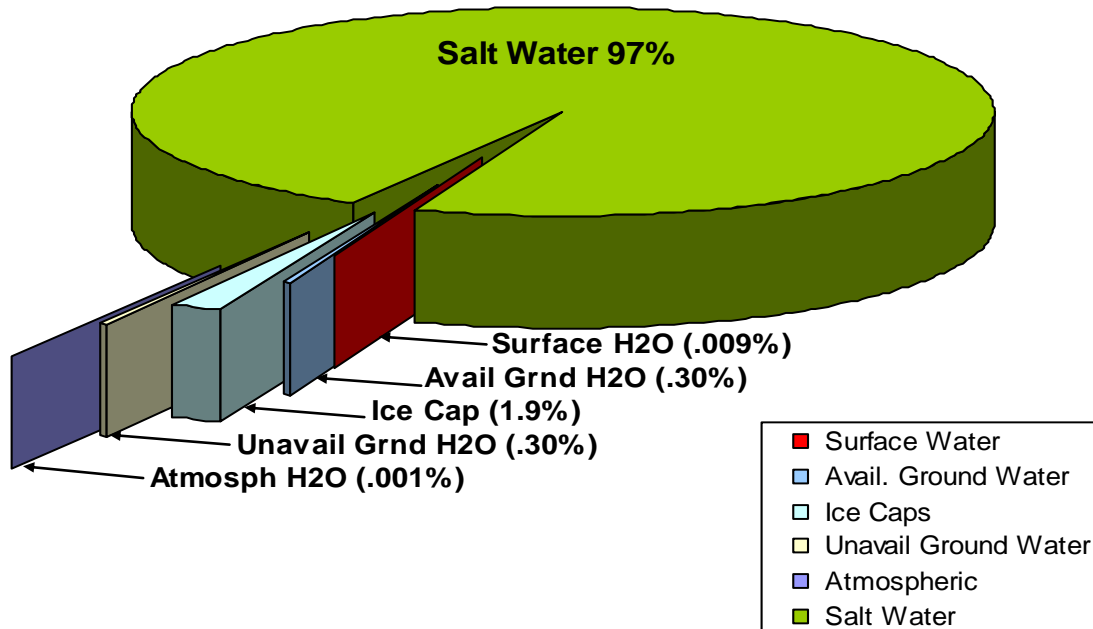
Increasing Population Competing for Limited Water Resources



Cost of Operation & Maintenance Practices



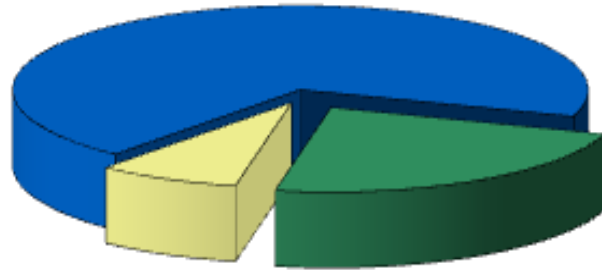
% of Total Global Water



Global Water Sources	Water Volumes (mi ³)	% of Total Fresh Water	% of Total Water
Total Fresh Water	8.40 x 10⁶	100	2.52
Ice Caps	6.37 x 10⁶	76	1.9
Atmospheric	3.1 x 10³	.04	.001
Surface Water	3.02 x 10⁴	0.36	0.009
Total Ground Water	2.0 x 10⁶	24	0.60
Avail. Ground Water	1.0 x 10⁶	12	0.30
Unavail. Ground Water	1.0 x 10⁶	12	0.30
Salt Water	3.25 x 10⁸	3869	97.6
Total Water	3.33 x 10⁸	3964	100

Global Water Use

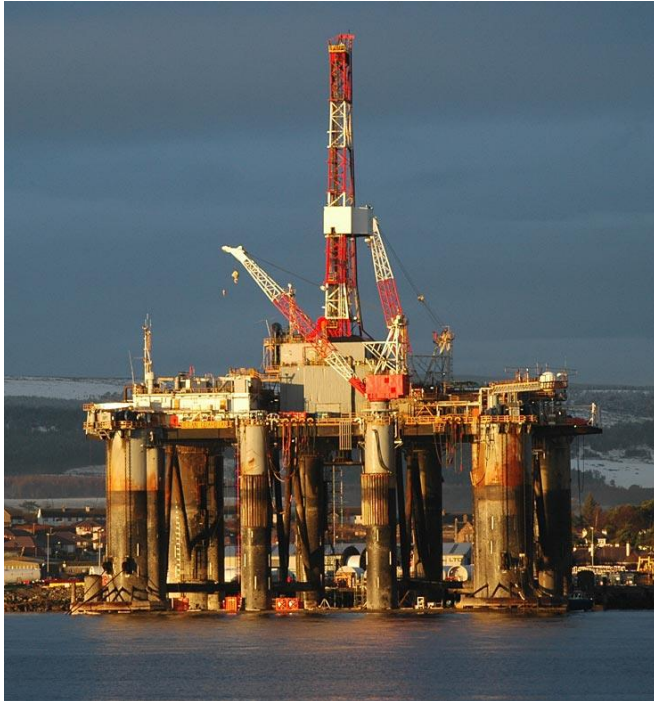
Agricultural Irrigation (69%)



Domestic, Drinking & Municipal (8%)

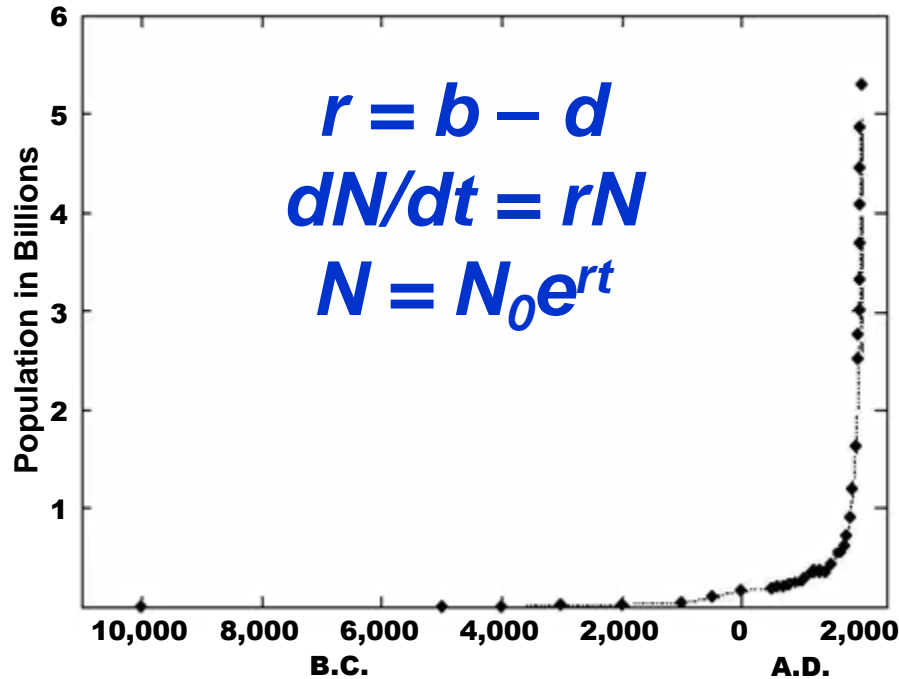
Industrial & Energy (23%)

- Agricultural Irrigation
- Industrial & Energy
- Domestic, Drinking & Municipal

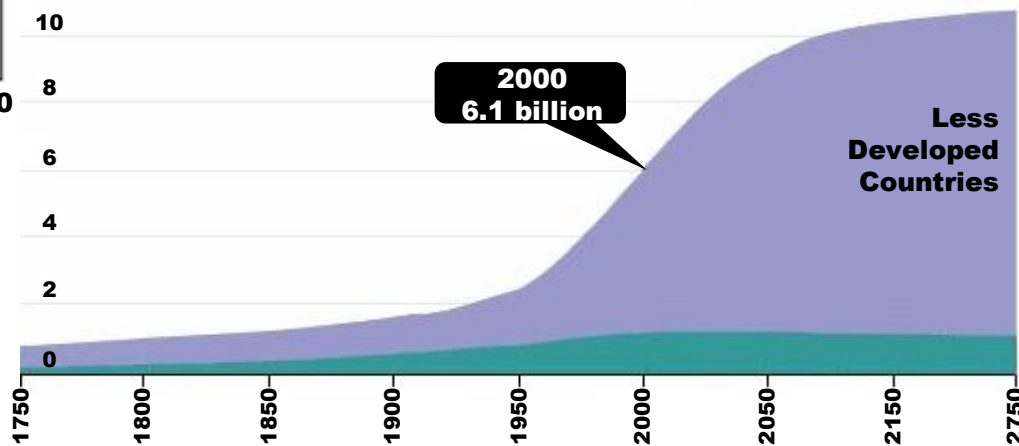
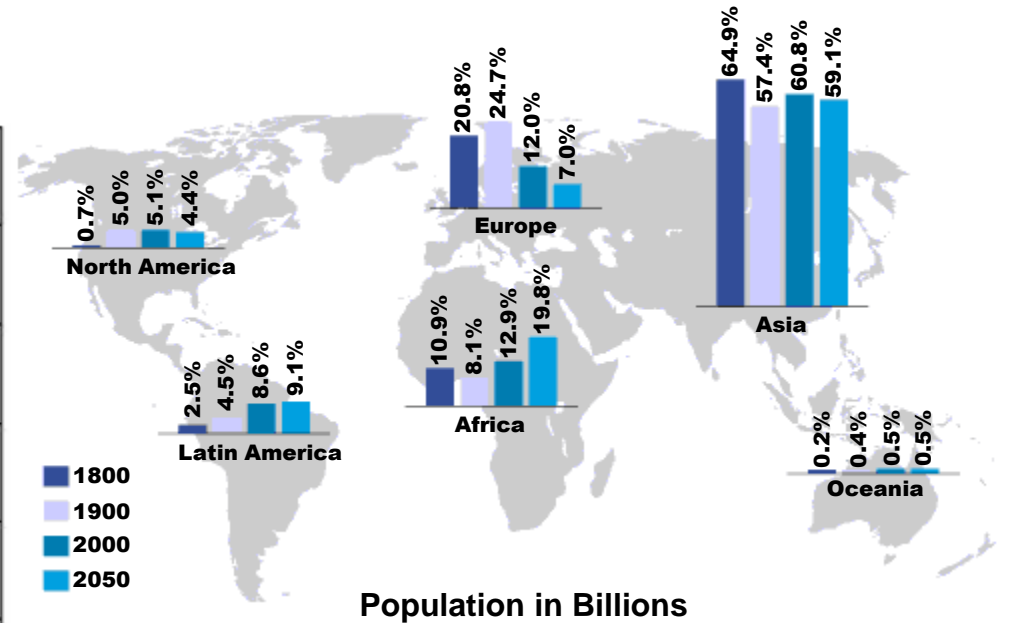


World Population Growth

World Population Distribution by Region, 1800–2050



Source: McEvedy and Jones and United Nations



Source: United Nations Population Division, Briefing Packet, 1998 Revision of World Population Prospects

World Population Calculator

Estimates the current world population based on
US census data and the world growth rate
(updates every second)

FIVE YEARS AGO

(4/20/09)

World Population was:

6,732,135,507

TODAY

(9/23/14)

Current World Population is:

7,136,891,062

World population increases by more than

405 Million

in **FIVE** Years

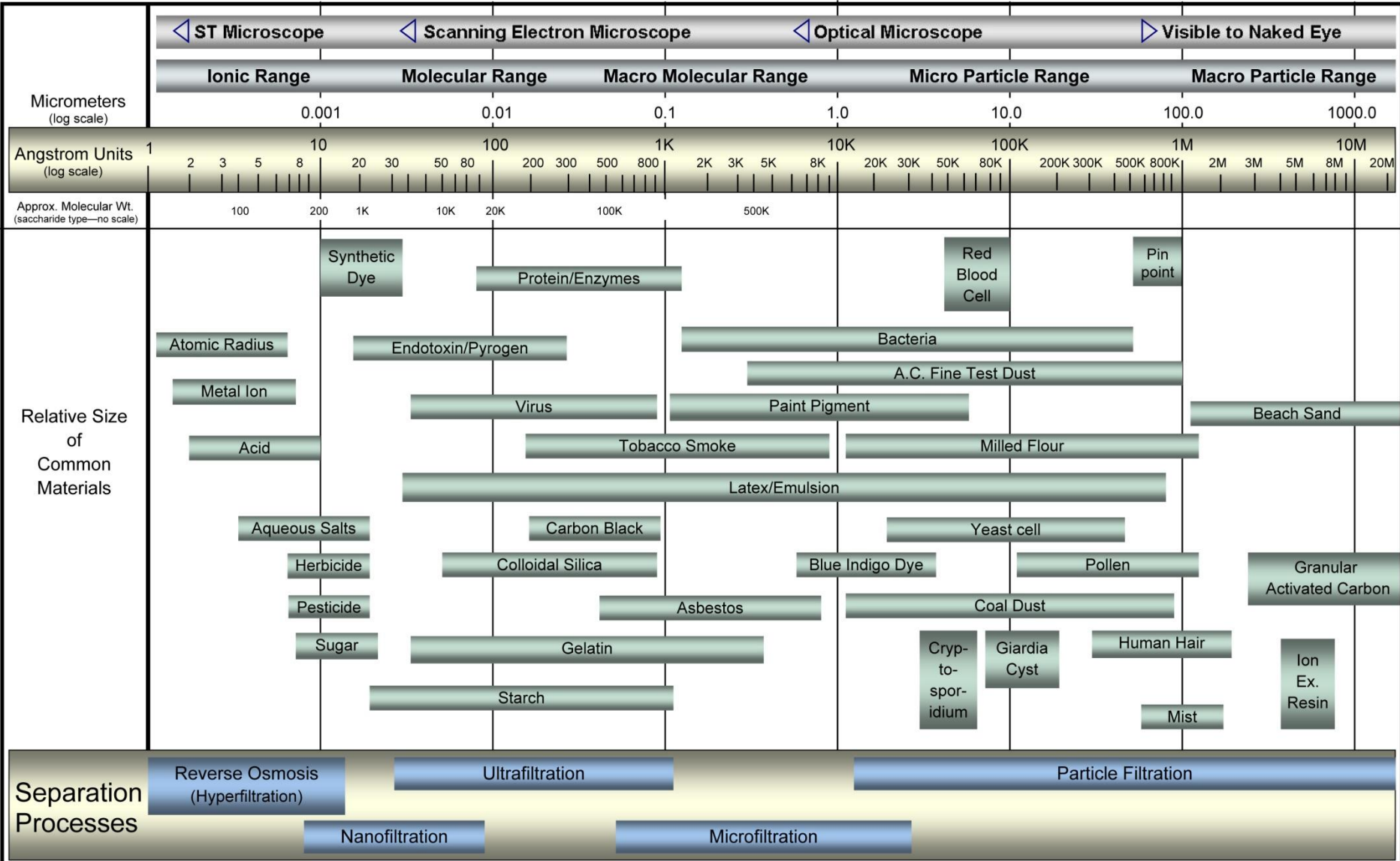
http://www.onlineconversion.com/world_population.htm

EXCESSIVE COSTS

in

**Conventional
Industrial Process
Treatments**

Filtration and Separation Spectrum



1 micron (1 x 10⁻⁶ meters) = 4 x 10⁻⁵ inches (0.00004 inch)

1 Angstrom unit = 10⁻¹⁰ meters = 10⁻⁴ micrometers (microns)



ENGINEERING FLUID SOLUTIONS, LLC

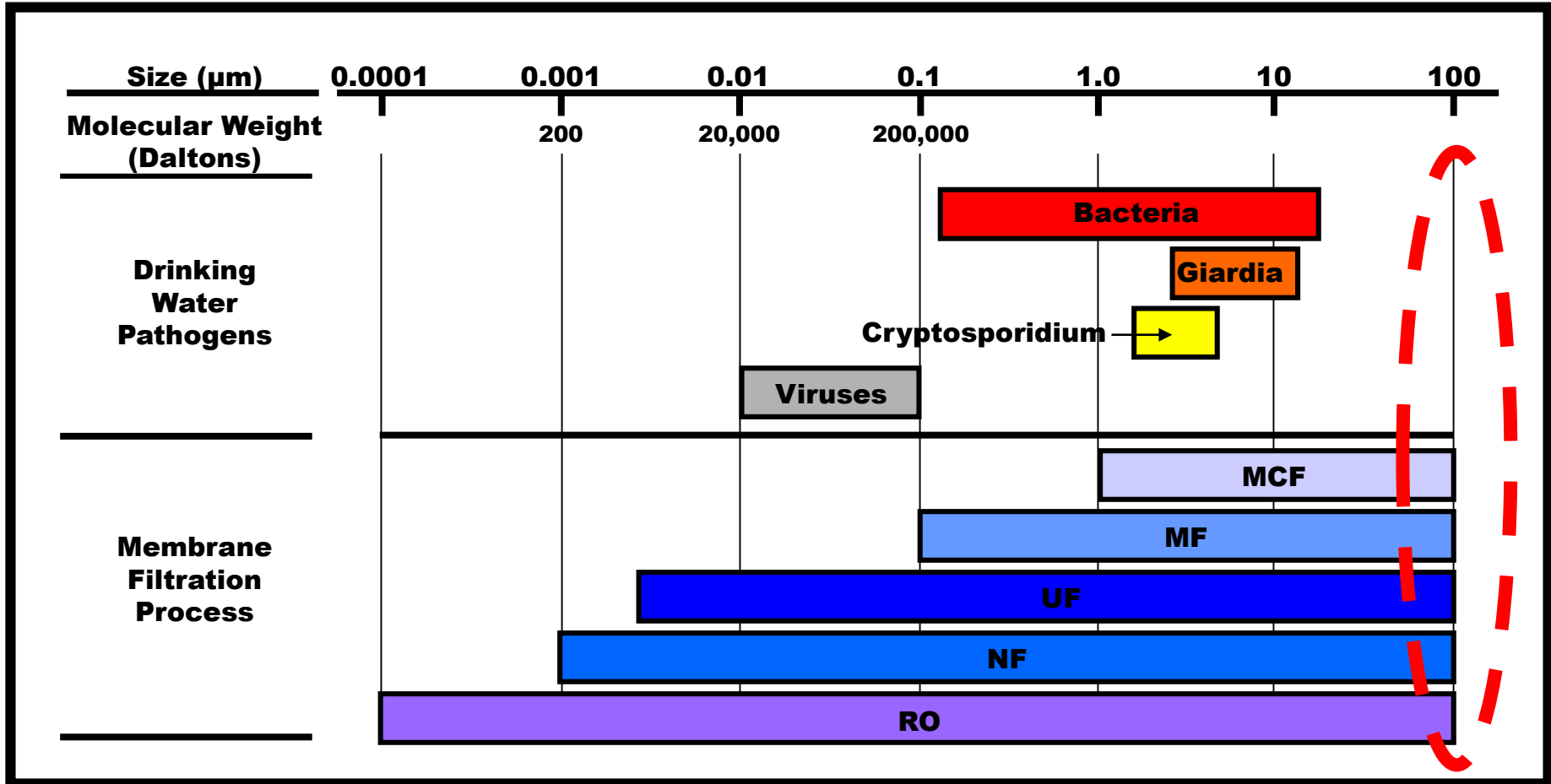
1851 East 68th Avenue, Denver, CO 80229

Ph: 303.463.5357

Fax: 303.987.1547

e-mail: info@efsfilter.com

Filtration Regime



Impact Summary

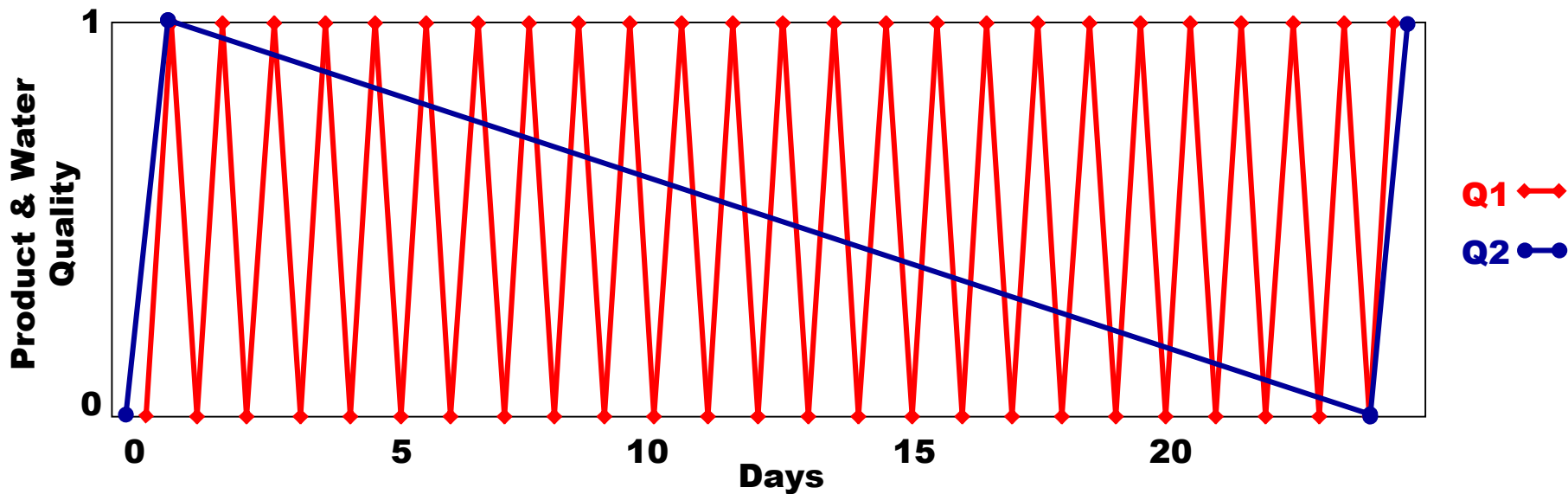


Impact Summary (\$\$\$)

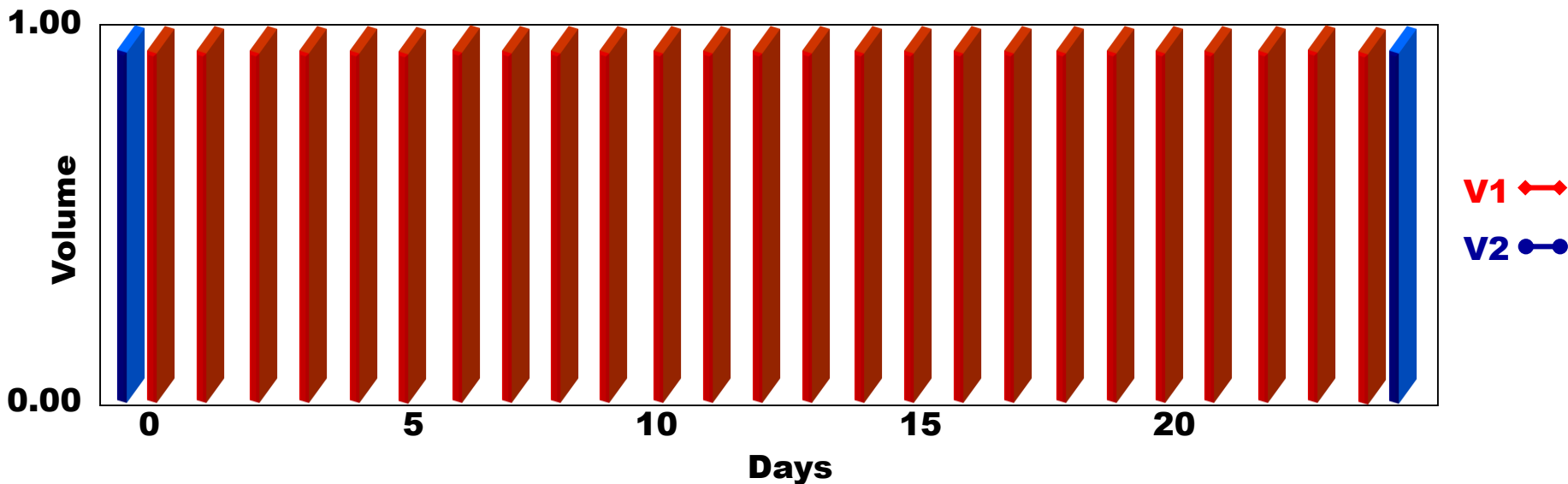
1. Onsite Waste Treatment
2. Municipal Waste Treatment
3. Environmental Burden
4. Administration and Inventory Costs Consumable Media
5. Purchasing Consumable Media
6. Maintaining Conventional Filtration Equipment
7. Disposing Filtration Media
8. Municipal Water Supply
9. Purchasing, Administration & Inventory of Chemical Additives
10. Facility Maintenance Labor in Refreshing Process Tanks
11. Lost Opportunity with Zero Product Throughput
12. Compromised Product Quality with Return Claims from Foreign Material
13. Internal Product Rework from Foreign Material
14. Carryout and Carryover to Downstream Industrial Cleaning Processes
15. Energy Expense in Reheating & Cooling Process Liquids



Normalized Quality vs Days



Cumulative Water Volume & Chemical Used



Sustainability Initiative



www.hydrakleen.com



Automatic Liquid-Solid Separator

HYDRAKLEEN®

Automatic Liquid-Solid Separator

- ☾ **Saves Water, Chemicals & Energy**
- ☾ **Advances Reuse & Reclamation**
- ☾ **Increases Product Throughput**
- ☾ **Improves Product Quality**

- ☾ **Promotes Sustainable Growth**
- ☾ **Reduces Operation & Maintenance Costs**
- ☾ **Reduces Waste Treatment**
- ☾ **Eliminates Consumable Media**



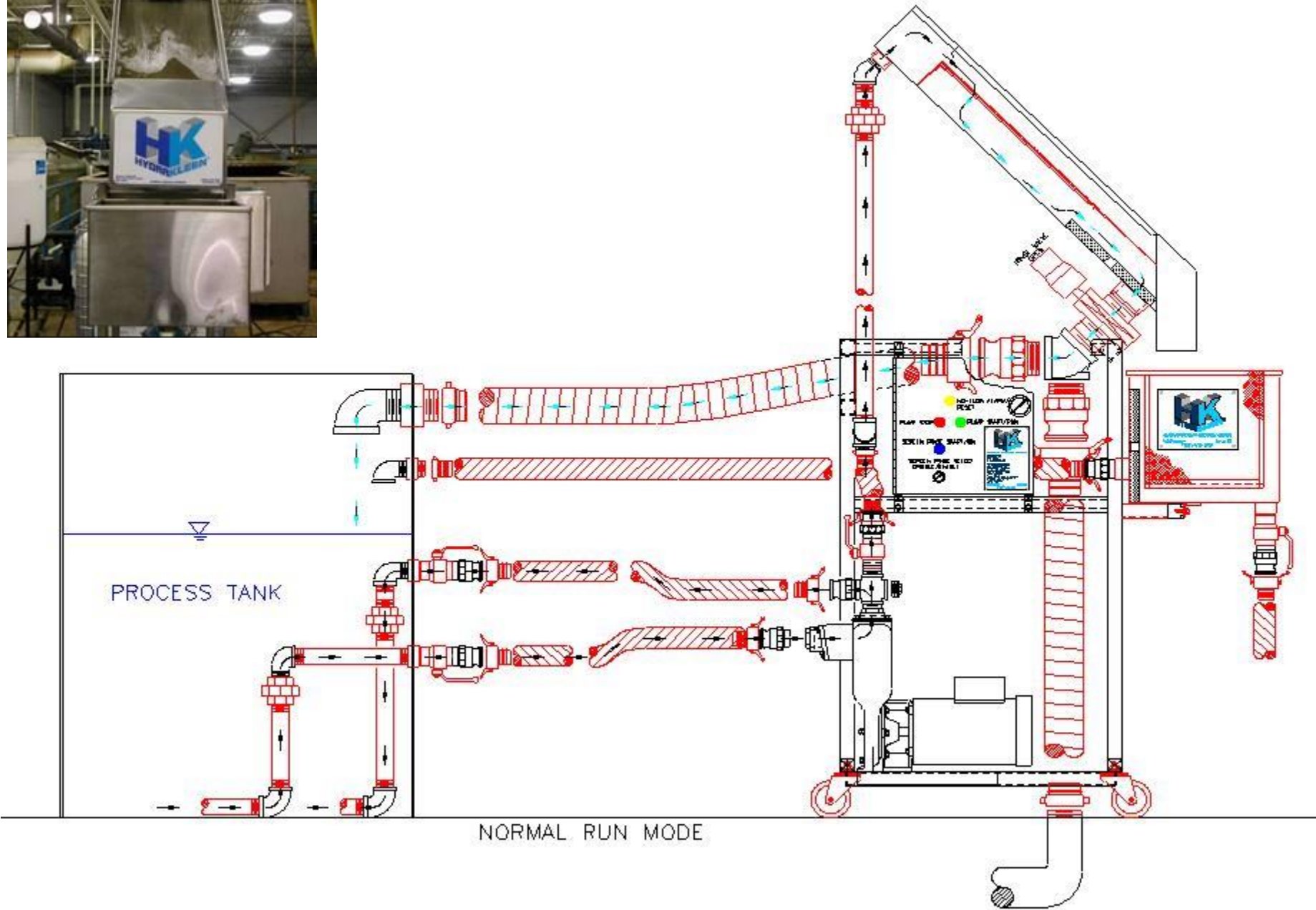
HYDRAKLEEN's

Four Modes of Operation

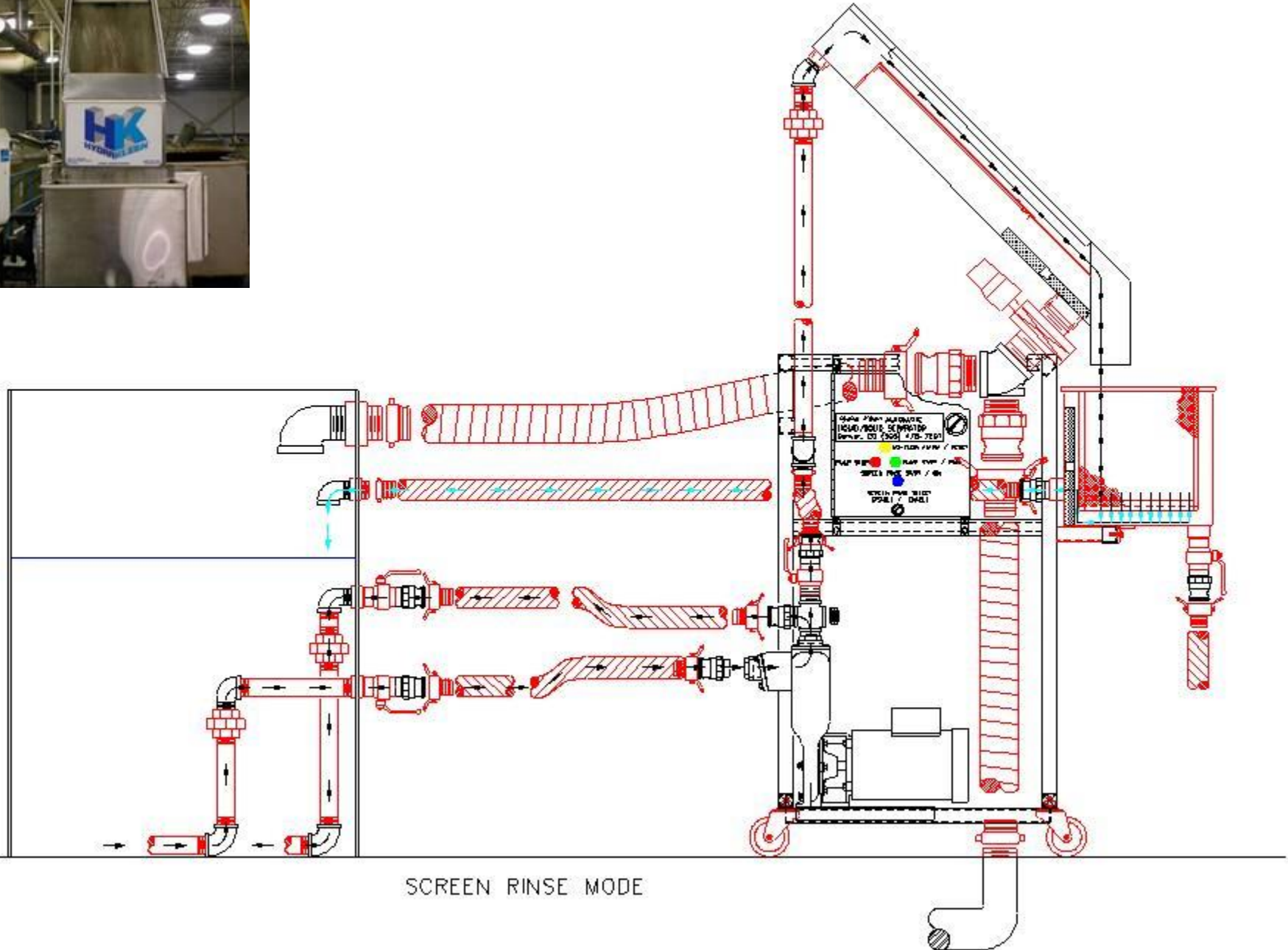
- ☾ Normal Run Mode**
- ☾ Screen Rinse Mode**
- ☾ Blowdown/Drain Mode**
- ☾ Maintenance Mode**



Normal Run Mode

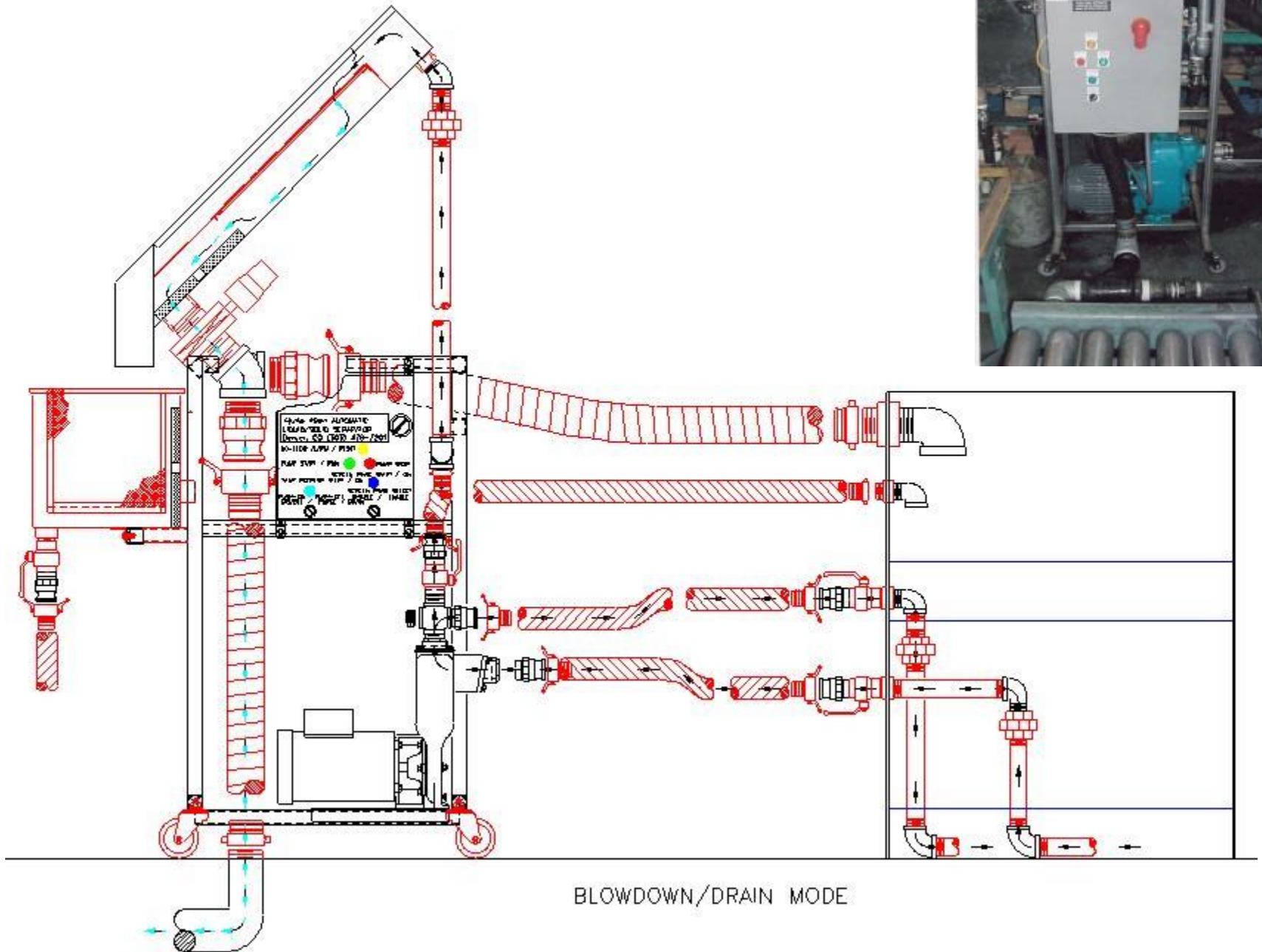


Screen Rinse Mode



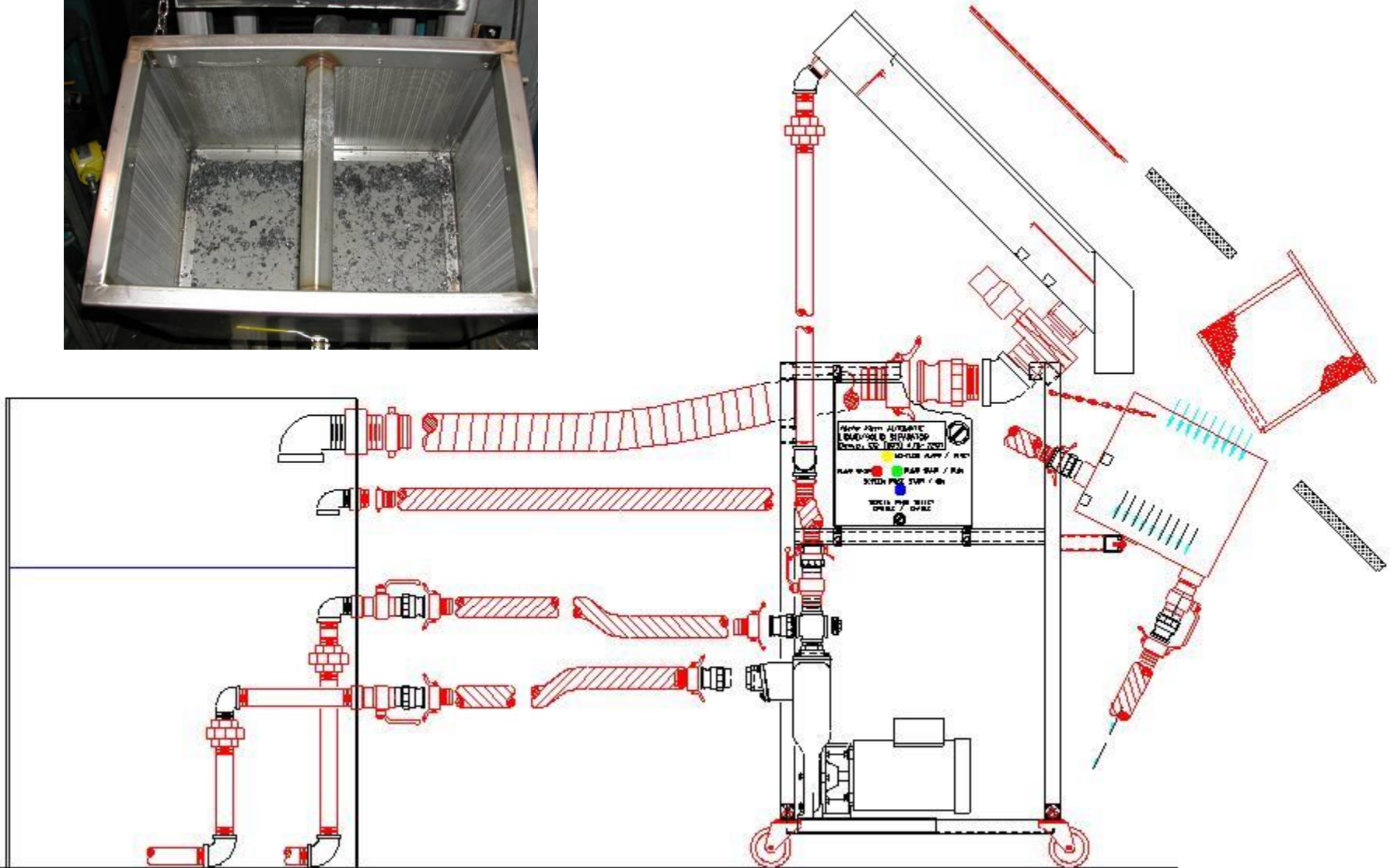
SCREEN RINSE MODE

Blowdown/Drain Mode



BLOWDOWN/DRAIN MODE

Maintenance Mode



MAINTENANCE MODE

Normal Run Mode



Screen Rinse Mode



Normal Run Mode



Screen Rinse Mode



Turning 2-day Dump Interval into 4 WEEKS



Total Immersion Agitation/Rinse Tanks



Automatic Liquid-Solid Separator

“Features”



**Comes Fully
Assembled**

Complete-packaged Unit

- ☞ Separation Pan w/Hillside Screen
- ☞ Screen Rinse & Drain Valves
- ☞ Basket Screen
- ☞ Sedimentation Box
- ☞ Pump
- ☞ Controller
- ☞ Mobile & Adjustable Height Stand
- ☞ Magnets (*option*)
- ☞ Oil/Water Separator (*option*)
- ☞ Bactericidal (*option*)

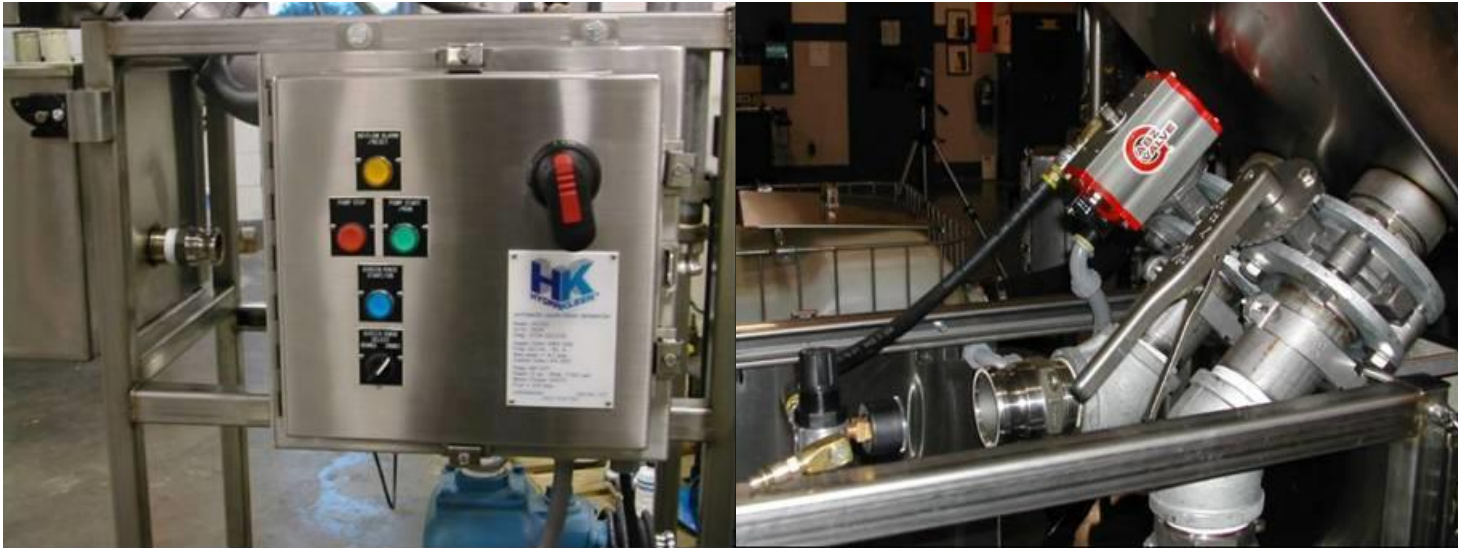


HK Pump & Screen Rinse Controller



Patented Auto Screen Rinse





Auto Rinse Valve & Manual Drain Valve



Auto Rinse Valve & Auto Drain Valve



Self-priming Trash Pump

Pump Flow Switch



Interconnections



**HK easily adapts & orients
to any configuration**

Installation requirements:

- ☪ **4 Hydraulic connections**
- ☪ **Electrical power supply**
- ☪ **Air supply**



Comes Fully Assembled – Uncrated in 10 minutes



Industrial Process Tanks

- ☾ **Immersion/Agitation Tanks**
- ☾ **Spray Washer Conveyors**
- ☾ **Parts Washers**
- ☾ **Rinse Tanks**
- ☾ **Holding Tanks**
- ☾ **Reservoir Tanks**
- ☾ **Equalization Tanks**
- ☾ **Settling & Flotation Tanks**



Hydraulic Performance

- ◆ Connects to any process tank
- ◆ Handles extremely heavy solid loading rates (in excess of 50%)
- ◆ May be used on other industrial liquids besides water
- ◆ Easily adapts to existing process configurations & ergonomically orients to Operator
- ◆ May be connected hydraulically in-line or in sidestream
- ◆ Integral flowswitch prevents pump from running dry
- ◆ Automatic self-cleaning mode requires no auxiliary water, alternative spraying, or direct mechanical cleaning systems
- ◆ Zero discharge
- ◆ Capable of reclaiming liquids and/or solids
- ◆ Excellent prefilter for finer filtration equipment; eliminates obstructed nozzles in spray systems
- ◆ Stainless steel filter elements in varying pore size easily removed and replaced for optimal hydraulic performance
- ◆ Optionally separates immiscible oils and fine ferrous material from liquids
- ◆ Self-priming pump good for lift & low suction head applications
- ◆ No strict physical property requirements of solids in specific gravity, size, shape, or character; no strict pressure or flow requirements

Hydraulic & Financial Performance

Financial Performance

- ◆ High capacity-to-footprint ratio
- ◆ Short payback period—high return on investment
- ◆ Dramatically extends the useful life of water and chemical additives
- ◆ Greatly reduces operation & maintenance costs
- ◆ Greatly reduces wastewater treatment costs
- ◆ Low energy consumption with energy-efficient design
- ◆ Very low asset depreciation rate
- ◆ Environmentally friendly with filter-to-waste option; advances sustainable growth
- ◆ Advances reuse & reclamation

“Invest in Lower Costs”

Operation & Maintenance Attributes

Operation Attributes

- ◆ Adjustable height stand easily adapts to elevation requirements of application
- ◆ No consumable filtration media
- ◆ Eliminates obstructed nozzles in spray systems
- ◆ Greatly reduces total suspended solid (TSS) concentrations
- ◆ Increases product throughput
- ◆ High temperature applications
- ◆ Improves product quality and maintains consistent product quality
- ◆ Filter-to-waste
- ◆ Manual blowdown & drain
- ◆ Automatic blowdown & drain
- ◆ Easily relinquishes control to a master controller

Maintenance Attributes

- ◆ Easy installation & start up with no formal training required
- ◆ Open design allows easy access to all components; ergonomic design
- ◆ Design has no drilled holes and therefore no mating holes
- ◆ Easily retrofits or outfits as original equipment
- ◆ Design easily adapted and configured with optional equipment
- ◆ Easily disassembled and reassembled with no specialty tools required
- ◆ No high-frequency wear parts and only minimal moving parts
- ◆ Controls adjustable and easily understood

“STOP Maintaining & START Operating”



“Flexibility in Design”

Equipment Options

Separation Capabilities

- ◆ Ferrous--Magnets (ceramic or rare earth)
- ◆ Immiscible Oils--Oil/Water Separator
- ◆ Bactericidal

Hydraulic

- ◆ Tank blowdown (manual or automatic)
- ◆ Filter-to-waste (manual or automatic)
- ◆ Stainless steel or galvanized piping
- ◆ Tank suction manifold (w/ or w/out strainers)
- ◆ Tank sparging manifold (w/ or w/out nozzles)
- ◆ Stainless steel or bronze body isolation valving
- ◆ Viton, Buna, or EPDM butterfly valve seating

Pneumatic

- ◆ Combination air filter/regulator manifold

Controls

- ◆ Sedimentation box proximity switch
- ◆ Control locally or by master controller
- ◆ Hazardous environment -- explosion-proof

Materials

- ◆ Cam-Lok fittings in s/stl, ductile iron, or aluminum
- ◆ Mill grade or polished s/stl (304 or 316)
- ◆ Food grade construction

Specifications

- ◆ **Footprint:** 27"x30" for 150-gpm unit
- ◆ **Height:** adjustable (7 ft standard)
- ◆ **Weight:** 500 lb; 950 lb crated
- ◆ **Principle of Operation:** gravity
- ◆ **Packaging:** comes fully assembled & uncrated in less than 10 min.
- ◆ **Assembly:** self-priming pump, controller, filter elements on mobile skid
- ◆ **Installation:** less than one day; no specialty tools required; easily moves on wheel casters

◆ **Hydraulic Capacity:** 0-2000 gpm standard or larger on special order

◆ **Two Operational Modes:**

1) Normal Run Mode; 2) Screen Rinse Mode

◆ **Particulate Removal:** nominal < 10-micron; absolute = 50 micron

- ◆ **Temperature:** up to 210 degrees F
- ◆ **Hydraulic Connections:** 4 hydraulic connections with quick disconnect end fittings
- ◆ **Pump:** self-priming trash pump; 1-1/2" suction x 1-1/2" discharge passing 1" spherical solids (larger pump sizes & passage sizes available)
- ◆ **Drive:** 2 hp, stainless steel wash down motor (higher hp drives available)
- ◆ **Electrical Power Input:** 230 or 460 VAC, 3-phase, 60 hz (alternative voltage, phase, and frequency available)
- ◆ **Control Voltage Output:** 24 VDC or 120 VAC
- ◆ **Flow Switch:** 24 VDC or 120 VAC
- ◆ **Controller:** NEMA 4X 340 s/stl enclosure



HYDRAKLEEN takes Advantage of Elevation Space





NEMA 4X, Ex-Prf Controllers

Haz Env Purge Panels



Latest HK Features

1. Hoppered sed tank
2. Auto purging sed tank
3. Adjustable height
4. Fully automatic
5. Hazardous environment
6. Screen air scour
7. Screen spray



Screen Spray



APPLICATIONS

Industrial:

- Food & Drug; Canning, Bottling & Packaging; Beverage; Poultry, Dairy & Beef; Hog Farms & Washdown Waters
- General Manufacturing; Steel; Steel Wire Rope; Bearing Manufacturers; Aerospace; Pots, Pans & Caldrons
- Automotive, Remanufacturing, Parts Washers, Machine Tool Coolants, Cooling Towers, Raw Water
- Mining; Cement, Concrete & Mortar
- Plastics & Rubber, Inking, Paper, Textiles
- Oil Exploration, Petroleum, Petroleum By-products

Municipal:

- Drinking Water Supply, Wastewater Treatment

Commercial:

- Golf Course Irrigation, Farming & Agricultural Irrigation, Aquaculture, Car/Truck Washes



HK Retrofit





National marketer of fresh mushrooms, supplying products for sale to supermarkets and foodservice operations



Petroleum Exploration



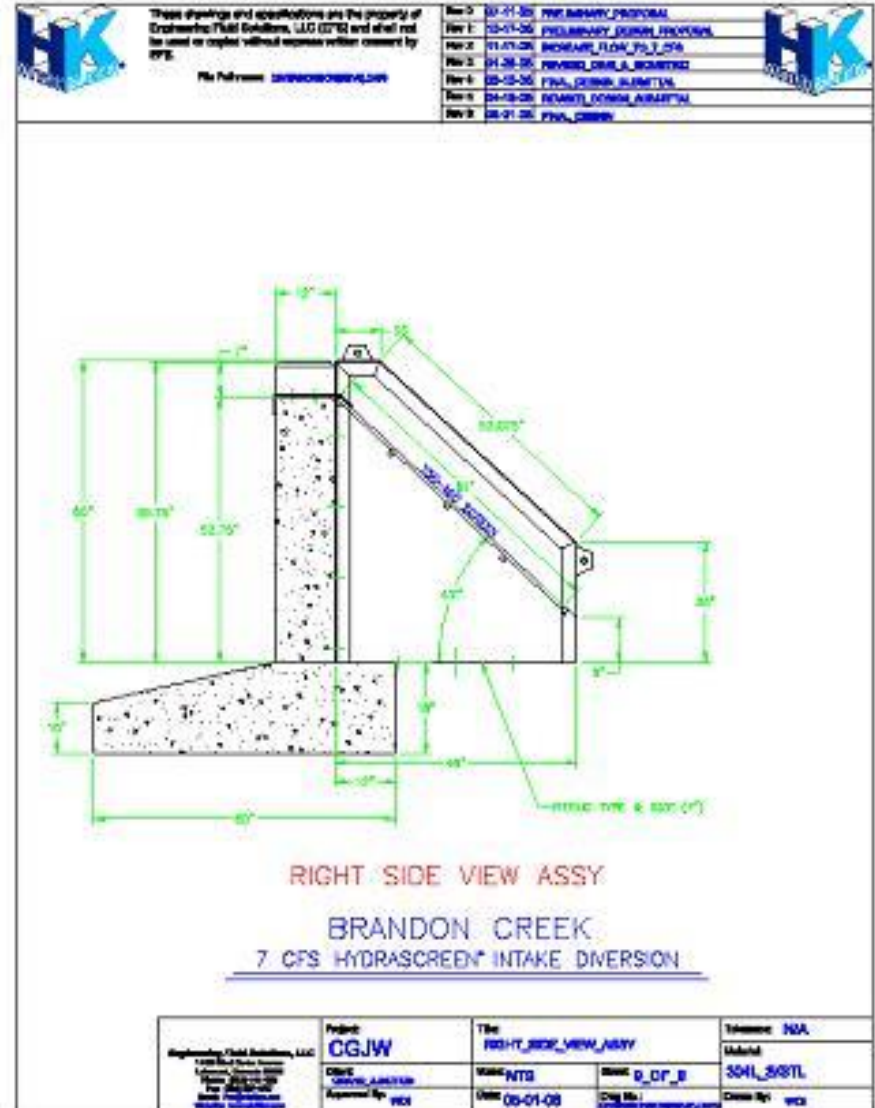
Complete-Packaged Systems (Petroleum By-products)





***Gourmet Canned Seafood
shipped directly from the
cannery in Washington state***







Johnson Matthey

***Johnson Matthey - a world leader
in advanced materials technology***







Custom Equipment



Demonstration/Pilot Equipment

Laboratory Testing



On-site Trial Testing



Product Development 1st Article Food Grade Separator



Product Development

2nd Article Food Grade Separator



Engineering



Fabrication



Transport



Install



SAVING TIME, MONEY & RESOURCES

***Providing Engineering Design, Fabrication &
Onsite Project Management in Fluid Handling***



***Higher Product Throughput
Improved Product Quality
All at a Much Lower Cost***



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