Custom-built water treatment systems for industry, municipalities, and utilities.

Hungerford & Terry Incorporated

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This is Hungerford & Terry

Hungerford & Terry provides high-performance, cost-effective custom-built solutions to a wide range of water treatment problems for industry, government, and public utilities. We are privately owned and completely dedicated to creating the best possible solution to your water treatment problem.

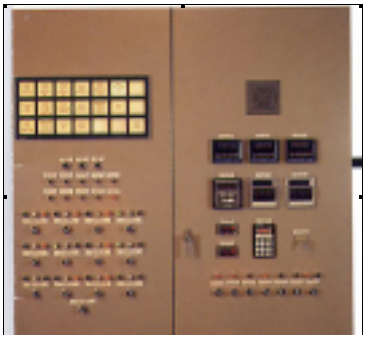
Since 1909, we've designed and manufactured thousands of systems incorporating dozens of unique water treatment technologies. Working with your engineers, we analyze the problem, design the solution, build the equipment, and provide continuing consultive support for years of reliable and economical performance.

A company you want to work with

We've built our company on quality people who deliver "real-world" engineering and solid construction. Many of Hungerford & Terry's management, along with the technical, sales, and support staff, hold engineering degrees. Our engineers, service technicians, and laboratory personnel are available for consultation whenever you need them: before the sale, during development and installation, and long after your system is up and running. Your Hungerford & Terry sales representative has many years of experience in the water treatment field and is ready to be your resource to an effective solution for the life of the installation and beyond.

Custom solutions

Our dedication to custom-built solutions means that we can create exactly the right system your water treatment objective requires. Working with you and your engineering staff, we'll design and build a system for the long term, one that will give superior service today and tomorrow through built-in quality, reliability, and performance.



Hungerford & Terry custom-built control systems offer the optimum in convenience and performance

We make sure that your system solves not only today's problem but that it is up-gradable to tomorrow's challenges as well. We maintain complete historical files on your system and on every system we've ever made. We want to make sure that you get the most from the equipment you've installed, so when you call us for help or a consultation, we can provide full support.

Our in-house laboratory

Hungerford & Terry's in-house laboratory facility lets us get the best possible start on developing the system that's right for your application. We can do a thorough analysis of your water samples to see exactly what you're up against. We've seen a lot of water treatment challenges over the years, so our experience can be brought to bear in solving your water treatment problem. That will give us a good start, but we don't stop there. Using computer modeling, we test the highest probability treatment methods against your water analysis to see how they'll actually perform. At that point we develop a pretty good idea of what it's going to take to solve your problem. After that, we can test our solution with a bench-level or field-study pilot plant. When a solution proves out, we've ready to engineer a system that will work.

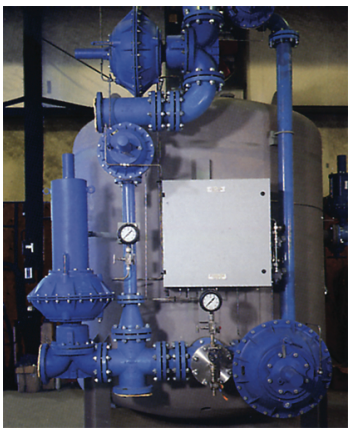
Engineering

When we engineer your system we stand solidly on what we already know and what our long and successful experience has told us works well. We've seen everything there is in water treatment, and we know what approach to use on your project – and what not to use. We are constantly searching for effective innovative technologies and methods that we can refine and adapt for our new customers and for our current ones, as well. We create solutions that will satisfy both our customers and our company into the future. We engineer and manufacture carefully, giving our customers systems that go far beyond minimum performance standards, that are easy to maintain and to operate, that are built of the best materials, and that will give years to decades of superior, trouble-free performance.

Built-in operating ease

We design and build our own automatic and semi-automatic control systems. Our control systems are designed to ensure that you get the most from your water treatment system with the greatest possible convenience. Precise and convenient control of the system is designed in from the start.

We do it all – because that's the only way a high-efficiency, high-quality, cost-effective water treatment solution can be created. From the first consultation through design, engineering, fabrication, assembly, installation, and final performance checkout, we are with you all the way. When your system goes on line, you can be absolutely certain that it is exactly the right system to do the job.



An ion-exchange system skid-mounted and assembled in our shop ready for shipment

Demineralization Systems

Ion-exchange demineralizers

Our superior custom-designed and custom-built demineralizers provide the very high purity levels required by modern processing applications. Required low levels of mineral contamination – including extremely low levels – are attainable using the right combination of Hungerford & Terry proven demineralizer technologies selected and sized for your application.

A two-bed system works well for most applications even though demineralizers can vary greatly depending on the particular application. For a very high proportion of raw-water contamination levels, the first bed involves the removal of calcium, magnesium, and sodium using a cation exchanger with cocurrent acid regeneration. The second bed uses an anion exchanger with cocurrent caustic regeneration to remove alkalies, chlorides, sulfates, silica, and carbon dioxide. Conductance levels of 5 to 10 μS/cm are typically achieved using well engineered systems of this basic design.

If higher quality water is essential, it is usually appropriate to use a countercurrent regeneration system to achieve conductance levels of less than 2 μS/cm. Hungerford & Terry is an industry leader in the design of countercurrent systems and is among the few companies supplying them in demineralization applications.

Additional and special demineralization problems can be addressed by the application of other supporting technologies. Very high alkalinity levels can be handled through the addition of a forced-draft aerator or decarbonator. Such approaches provide the economical reduction of CO_2load on the anion unit. When dissolved gases also require reduction, a vacuum degasifier can be added. Still further demineralization is available with the addition of mixed-bed demineralizers in series with a basic two-bed installation. Such systems yield conductance levels of less than 1 μS/cm.

Some large installations may require the use of multiple-train systems to achieve the desired capacity. Countercurrent regeneration in both cation and anion exchangers is frequently combined with high-capacity weak-acid cation or weak-base anion units to improve chemical efficiency and reduce waste acid and caustic. Such systems have the additional benefit of permitting the reclaiming of regenerant waste from one unit for use in other units.

Hungerford & Terry, Inc. is also a licensee of the Dowex Upcore® packed-bed ion exchange system. This technology offers all of the advantages of a counter-current regenerated system plus offers greater capacity and reduced waste volumes by making the most efficient use of the vessel size. This system also lends itself to retrofitting existing systems so that old, inefficient demineralizers can benefit from this technology at a fraction of the cost of a new system of equal performance.

High-rate, deep-bed polishers

Boilers are protected by Hungerford & Terry's very effective condensate polishers. Our high-rate, deep-bed polishers will remove suspended and dissolved material from returned condensate water through the use of mixed-bed demineralizers. These high-pressure demineralizers operate at flow rates of 25 to 50 GPM per square foot of bed surface area. The boiler is further protected by the external regeneration of the bed which prevents the intrusion of harmful acid and alkali into the return condensate. These polishers can operate beyond the ammonia break in high-pressure utility applications.

Sodium-cycle polishers

Our sodium-cycle polisher combines sodium chloride and sodium sulfite or sodium hydrosulfite during regeneration to remove influent metal oxides from the returned condensate along with any hardness that may have been introduced by a condenser leak. These economical polishers will deliver soft water to the boiler at very reasonable cost and will operate for up to several weeks without regeneration.

Reverse osmosis membrane technology

Hungerford & Terry now designs and builds reverse osmosis systems using the same high-quality, custom-design philosophy. These new treatment plants are offered as stand-alone systems or in conjunction with an H&T demineralizer. We can design and supply any necessary pretreatment equipment such as carbon filtration, softeners, and chemical feed systems. Our typical system will include a cleaning system and cartridge filters for protection of the membranes.

Filtration

Drinking water from a wide range of sources can be made sparkling clear and free of turbidity, color, taste, odor, and suspended matter by a well-engineered low-cost system employing the right Hungerford & Terry filter technology.

2 MGD iron and manganese filter system at work in a New Jersey municipality

GreensandPlus

Well waters containing iron and manganese can be economically and effectively treated with our own GreensandPlus filter technology. The GreensandPlus medium employs chemical oxidation and reduction in coordination with the catalytic properties of manganese oxides to achieve the desired filtration. The unique properties of GreensandPlus permit it to be used in several distinct ways. This gives GreensandPlus-based filtration systems an extraordinarily high degree of flexibility that makes our use of them highly responsive to the demands of the particular application and the specific features of the raw water to be treated.

GreensandPlus catalytic oxidation

Since 1990, we have been designing systems using catalytic oxidation. This process uses the catalytic properties of the manganese oxide coating in the presence of chlorine to very good effect. Manganese oxides are maintained in a regenerated condition by the oxidizing environment provided by the chlorine. No potassium permanganate is needed with a catalytic iron and manganese removal process.

The flow rate for catalytic systems is usually much higher than that available in more traditional systems. The higher flow rate is derived from the nature of the process itself, from a special catalytic grade of Ferrosand, and from attributes of the system design. The process yields unusually long operational runs of from 2 to 4 days. An air/water wash prior to backwashing maintains the GreensandPlus medium in a loose, clean state with little to no compaction. Because backwash volumes are very small, usually 0.25% to 0.5% of system capacity, no recovery is normally required. However, a recovery system to reclaim approximately 85% of the backwash waste can be provided.

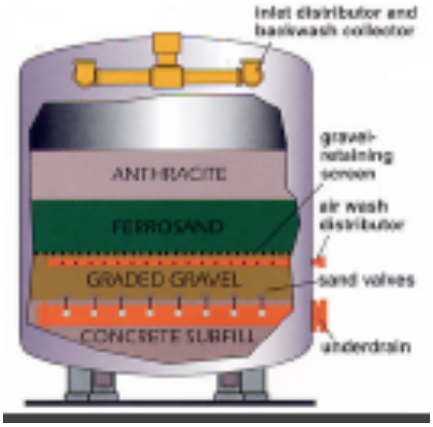
The GreensandPlus Catalytic System can be delivered as a completely assembled and packaged unit. It is fully automatic and uses the most advanced PLC controls with condition status fully indicated.

GreensandPlus CO and IR systems

GreensandPlus systems can be catalytically regenerated (CO) or intermittently regenerated (IR). Catalytic regeneration is achieved through the introduction of a pre-feed of chlorine and/or permanganate prior to filtration. The method is appropriate for relatively high iron contents.

Alternatively, intermittent batch regeneration with permanganate or chlorine can be cost effective and works well when iron content is relatively low. The most cost effective and appropriate system will be determined through an analysis of the client's specific treatment situation.

Additional design features



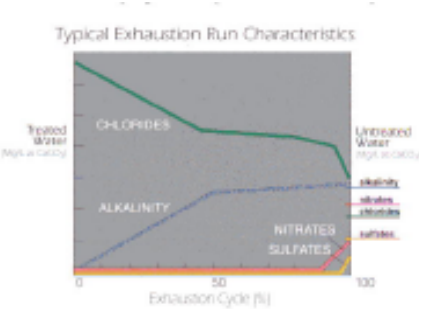
Our systems feature our proprietary header-lateral underdrain system with the non-clogging, non-corroding H&T sand valve for optimum distribution and minimal head loss. A non-ferrous lateral or hub-lateral underdrain is available. All systems feature highly stable filter beds and excellent backwash distribution for extended filter life. A supplemental air/water scour system is available for maximum filter-bed cleaning and longest media life. A stainless steel gravel-retaining screen ensures a stable gravel support bed during air wash operation or unforeseen backwash surges.

Nitrate Removal

Fertilizer runoff, septic tanks, and land disposal of wastes all threaten ground water and surface water with nitrates. H&T achieves very high levels of nitrate removal through a highly effective method involving the exchange of nitrates, alkalinity, and sulfates for chlorides using a strongly basic anion resin.

Skid mounted and assembled nitrate removal system ready for shipment.

Only Hungerford & Terry offers the efficiency and economy of a countercurrent regeneration system for nitrate removal. The very high efficiency of our countercurrent system and its low leakage levels, indicated in the graph, allow a maximum amount of untreated water to bypass the system to be blended with treated water. Any amount of nitrate concentration below Federal Standards is thus readily achievable in a plant that is extremely efficient.



This innovative nitrate removal system – designed to your specification – will greatly reduce the size of the treatment plant. It will use as little as half of the regenerant per cubic foot of ion exchange resin used by a conventional system. It provides maximum efficiency and reduced operating costs and waste.

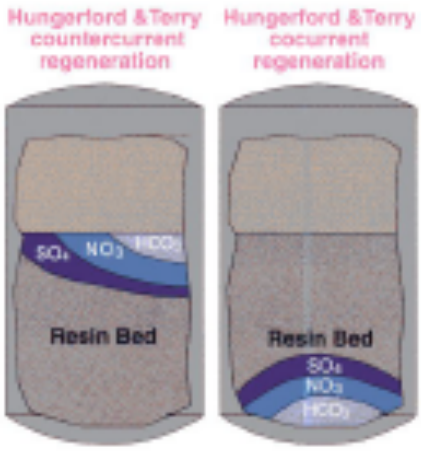
Regenerate cycle of operation

Regeneration begins with a back-flow of raw water through the regenerant collector to remove suspended material and to decompact the resin. A brine solution is then injected to remove nitrates and sulfates. A slow rinse then flushes our most of the brine and removes still more nitrate and sulfate. Finally, a fast downflow rinse removes residual levels of nitrate, sulfate, and brine. By fully regenerating the bottom of the ion exchange bed, leakage is reduced to a fraction of a part per million allowing greater input water bypass of the system.

Cocurrent regeneration is appropriate is some cases

Cocurrent systems may be appropriate for smaller systems or when initial capital costs are very important. The basic chemistry is the same as that of a countercurrent system. In the more conventional cocurrent approach, however, regenerant brine enters from the top rather than the bottom. Thus a cocurrent system is normally backwashed after every service run yielding a regeneration sequence that includes an upflow backwash. After the backwash, downflow brine injection is followed by a downflow slow rinse and a downflow fast rinse.

The countercurrent system uses automated value systems controlled by H&T-designed control system. Actuation can be pneumatic, hydraulic, or electric depending on the customer's preference. Tank linings, painting, man hole sizes, and other features can be specified by the customer. H&T's application-specific configurations include choices of valve operation techniques, exchanger tank options, internal distribution options, and varying degrees of automatic control.



Pretreatment Systems

Sodium and hydrogen cycle softeners

Hungerford & Terry, Inc., Clayton, NJ – pretreatment units shown above consist of three GreensandPlus™ pressure filters. Anthracite and GreensandPlus media are used to remove iron and manganese in order to protect the RO membranes.

Hungerford & Terry supplies water softening equipment for a very wide range of industrial and commercial applications. Water is softened by removing the hardness-producing ions (calcium and magnesium) using a cation exchange resin. System may be cocurrently or countercurrently regenerated to achieve the lowest possible hardness leakage. During regeneration, sodium ions replace the calcium and magnesium ions on the ion exchange resin bead, restoring the resin's capacity to soften water.

Operating in the sodium cycle, the sodium in the treated water is increased proportionately to the amount of calcium and magnesium in the untreated water. For applications where sodium increase is a concern, Hungerford & Terry produces a line of weak-acid softeners that operate in the hydrogen cycle instead of the sodium cycle. Where total hardness is numerically equal to the alkalinity in the raw water, the hardness can be economically removed using an acid-regenerated weak-acid (carboxylic) cation exchange resin. The quantity of hardness which exceeds the alkalinity will not be removed. The ion exchange mechanism in the weak-acid softening process is an exchange of calcium and magnesium

ions for hydrogen ions. Therefore, no sodium is added to the treated water. Either hydrochloric acid or sulfuric acid requires a higher flow rate and lower concentrations to avoid precipitation in the ion exchange bed during regeneration. During the ion exchange process with weak acid resin, carbonic acid is formed and can be stripped off using a forced draft degasifier following the softener. Also, a small quantity of sodium hydroxide can be added following the decarbonator to neutralize any remaining CO_2 and to provide non-corrosive water with a neutral pH. The system can be designed for stoichiometric quantities of acid so that the waste produced does not require neutralization prior to disposal.

Clarifiers

Surface water color, turbidity, and suspended matter are effectively removed with a Hungerford & Terry clarifier. The process involves accurately flash mixing coagulant, polymer, and other chemicals in proportion to water flow and recirculating pre-formed floc via the turbine mixer and recirculation tube. Precipitants are generated in the mixing zone of the downcomer and gradually grow larger forming a sludge blanket. Ultimately, the precipitants settle out as a floc. The clarified water rises and is collected in the launder trough located along the top of the tank sidewall. Cold lime softening uses similar equipment but is designed to remove alkalinity and the hardness associated with alkalinity to produce a water that is clear, colorless, and with reduced hardness, alkalinity, and iron. Equipment is available sized for a flow rate of 200 gallons per minute up to several thousand gallons per minutes.

Gravity filters

Following clarification or lime softening, filtration would be required to remove any floc carryover and suspended material. The Hungerford & Terry gravity filter system is available in single or multi-cell rectangular design or circular tanks with self-contained backwash storage. An air scour system or a surface washer can be included to ensure a high degree of agitation of the filter bed during backwashing which ensures that the filter bed is clean and that there are no areas of compaction or cementation. Underdrain systems consist of a flat false bottom plate with distribution nozzles. A full range of sizes is available from 50 gallons per minute up to several thousand gallons per minute.

....Some of our customers:

Municipal/Governmental

• Town of Allendale, SC • American Water Works Service Company • Auburn Water District, MA • Town of Bellingham, MA • Brady Township, PA • Town of Braintree, MA • Town of Brattleboro, VT • Brunswick-Topsham Water, ME • City of Bryan, TX • Burlington County Landfill, NJ • Calcasieu Parish, LA • California American Water • Village of Cedar Point, IL • Centennial Water & Sanitation, CO • Center Township Water • City of Circle Pines, MN •Town of Clintonville, PA • Borough of Colchester, CT • Connecticut Water • Cowanshannock Township, PA • Cresswell Heights Water, PA • City of Dartmouth, MA • Dedham Water, MA • DeGray Lake Federal Park • Town of Dover, NH • East Chelmsford Water, MA • Township of East Hanover, NJ • East Lyme Water & Sewer, CT • Boro of East Stroudsburg, PA • Town of Edgewood, IN • Farmington Woods, CT • Village of Fenton, LA • Village of Florien, LA • City of Follansbee, WV • Township of Freehold, NJ • Town of Fruitland, MD • Gallia County, OH • Gibsland, LA • City of Goshen, IN • City of Grand Haven, MI • City of Grand Island, NE • City of Hackberry, LA • Town of Hanover, MA • City of Harrison, OH • Town of Hartford, VT • Town of Havelock, NC • Town of Holliston, MA • City of Hudson, MA • Iberville Parish, LA • Township of Jefferson, NJ • Jefferson Davis Water Works, LA • City of Lacassine, LA • Township of Lacey, NJ • Lake Charles Harbor, LA • Lakewood Township, NJ • City of Leesville, LA • Town of Lovettville, VA • City of Mallard Lakes Development •Township of Manchester, NJ • City of Middletown, CT • Town of Minerva, OH • Mansfield Retirement Community, NJ • Mantua, NJ • Monfield Realty • Monmouth Battlefield State Park, NJ • Monroe Township, NJ • Morgan County, IN • City of Morristown, NJ • Mount Laurel Township, NJ • Township of Mount Olive, NJ • Navajo Engineering & Construction, AZ • Town of Newkirk, OK • New Jersey Turnpike • State of New Jersey • State of New York • Borough of Ocean Gate, NJ • Ocean Township, NJ • Onslow County Water & Sewer, NC • Pembroke Water, MA • Phoenix City, AL • Town of Plainville, MA • Town of Plymouth, MA • City of Pocomoke, MD • City of Point Pleasant, WV • Town of Purcellville, VA • Borough of Quakertown, PA • Raynham Center Water • Ryan Ranch, CA • City of San Jancinto, CA • Borough of Sharpesburg, PA • Shippingport Water Authority, PA • Borough of South River, NJ • Southern Wayne Sanitary • City of Spencer, MA • Suffolk County Water, NY • City of Sulphur, LA • City of Sydney, Nova Scotia • Village of Tequesta, FL • Town of Sturbridge, MA • City of Turners Falls, MA • City of Ulster Water Ulster Water District, NY • Union Electric • Union Water • Town of Unionville, CT • US Department of the Army • US Department of Energy • US Department of the Interior • Town of Vienna, MD • Town of Wappingers Falls, NY • City of Washington, NC • City of Welsh, LA • Town of West Brookfield, MA • Township of West Milford, NJ • City of Willmar, MN • Village of Windham , OH • City of Woodbury, NJ • Woodlake Tax District, CT • City of Zanesville, OH •

Utilities

• Alabama Electric • Allegheny Power, PA • American Electric Power, WV • Arkansas Power & Light • Bechtel National • Black & Veatch Power Development Company • Brownsville Utilities, TX • Carolina Power & Light, NC • Chugach Electric, AK • Consumers Power, MI • CRS Sirrine • Deseret Generating & Transmission, UT • Florida Power & Light • Hawaiian Electric • Houston Lighting & Power • Iowa Power & Light • Iowa-Illinois Gas & Electric • Jersey Central Power & Light, NJ • Kansas City Power and Light • Kansas City Board of Public Utilities • Kansas Gas & Electric • Kissimmee Utility, FL • Long Island Lighting, NY • Louisiana Power & Light • Mountain Top Public Service, WV • Manitowoc Utilities, WI • Northern States Power, MN • Omaha Public Power • Orlando Utilities Commission, FL • Pennsylvania Electric • Pennsylvania Power & Light • Platte River Power, CO • San Antonio Public Service • Seminole Electric, FL • Southern Maryland Electric Cooperative • Taiwan Power • Tennessee Valley Authority • Texas Utilities Generating • Utah Power & Light • Western Farmers Electric •

Industrial/Commercial

• Babcock & Wilcox • Bell Labs • Campbell Soup • Camsco Produce • Combustion Engineering • Dow Corning • E. I. DuPont de Nemours • Exxon • Federation Chemical • Furman Foods • GAF • Goldsboro Milling • Six Flags Great Adventure • Greenwood Mills • Greenwood Water • Hunstman Polypropylene • ITT Rayonier • M. W. Kellogg • Merck, Sharpe & Dohme • Nucor Steel • Opryland USA • Ore-Ida Foods • Pliva-Zagreb Chemical • Purity Oil • Sandoz • Showell Farms • Sun Oil • Timken • Union Carbide • Wellman, Inc. • Westinghouse • Weyerhaeuser • Wheeling Pittsburgh Steel • Willamette Industrial •

Hungerford & Terry is a privately-owned corporation serving the municipal, industrial, and utility markets with high-quality, custom-designed water treatment systems. For most of this century, we have provided the finest in efficient, effective, and reliable responses to their water treatment needs.

We will continue to provide our clients with the systems and support they will need to meet the challenges of new regulation and changing conditions. From the first basic water purification system we built in 1909 to today's computerized, technically advanced equipment, all of our customers can depend on Hungerford & Terry to design and build the best systems possible and to stand behind every treatment system we make.

Every Hungerford & Terry system is backed by our many years of experience.

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