

*FOR THOSE WHO WANT TO STAY AHEAD IN
ENVIRONMENTAL ISSUES*



*OEM EQUIPMENT AND TURNKEY DELIVERIES FOR
DEMANDING WATER TREATMENT*

**WatMan**

Who is WatMan?

WatMan is one of the leading suppliers of tailor-made water treatment equipment and demanding turn-key plants in Finland, a country that is famous for its clean nature. Since our establishment in the early 1990s, our primary focus has been to develop, produce and deliver high-quality, innovative water treatment products that will help the customer to gain something extra. Our goal is to help make them more competitive and more successful.

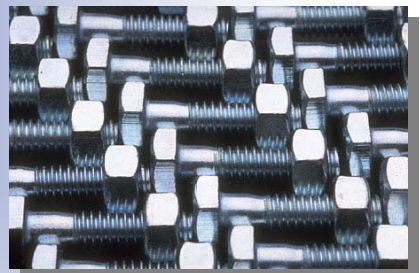
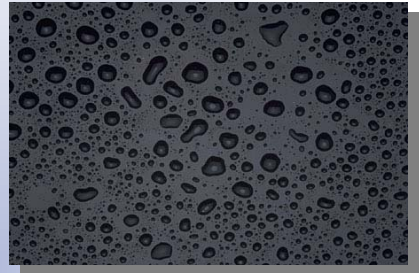
The WatMan equipment exists to produce more efficient processes, and end products or finished goods with an excellent outlook. On the other hand they also exist to help deal with following the letter of the most stringent environmental laws; most production facilities have to comply with the regulations by effectively controlling the effluents and process parameters. As a by-product our customers can have a positive effect on the general public's environmental views, and gain a reputation as a good neighbour.

We wish to be our customer's best and most reliable supplier of products and services. We always use computerised design, application-oriented and technologically sophisticated materials and manufacturing techniques, and highly skilled subcontractors. Some of the key words that best describe our functions are customer-orientation, commitment, teamwork, flexible action, and a mission for constant improvement. We are strongly driven by our goals of preservation and enhancement of our environment and quality of life.

In our view, lower costs can only be achieved by higher performance, and higher performance can be achieved by accurate design work.

We are confident that we can make you more competitive - both in monetary terms and in terms of environment friendliness.

Know Our Customers — Know Us



WatMan is a subsidiary of Pumplohja Corporation, located in Saukkola, Finland. Pumplohja is a manufacturer of medium heavy metal products, mainly for the HVAC sector's and process industry's needs. Pumplohja's specialities include pressure tanks and high-quality stainless and acid-proof steel structures. Pumplohja has production permits for pressure tanks from, among others, TÜV, Det Norske Veritas and Lloyds Register. Pumplohja's welding operations comply with the Finnish SFS-EN-792-2 quality system standard, and it operates in accordance with ISO 9001 standards. The majority of the tank production is exported to Central and Northern Europe.



Some of Pumplohja's more notable customers include Valmet Paper Machines (Metso), Kvaerner Masa Yards, Outokumpu Engineering, Fortum Engineering, Wärtsilä Finland, Tamrotor, Sarlin Hydor and Heider GmbH.

Pumplohja has some vital manufacturing related services such as assistance in pressure tank design and assistance in obtaining the required approvals for the structure plans. The idea is to solve the problems related to the transfer, storage and pressure boosting of different liquids.



Industrial Water Treatment

Introduction

"Today, one major concern of the industrial water and wastewater treatment is how to deal economically with the stringent environmental laws."

Industries, such as steel, surface treatment and the electronics' industries, generate two kinds of wastewater; diluted rinse water and strong concentrates, such as dumped solutions from degreasing, pickling and plating. As is well known, corrosive solutions are also released from ion exchangers, for example. These effluents — if not treated correctly — contain corrosive and toxic substances which can ultimately become concentrate in the food chain. In addition, corrosive agents can cause severe problems in sewer piping.

Toxic substances, especially some heavy metals, can completely prevent the operation of biological purification plants or can have permanent negative effects on natural waters. If not removed, even moderate amounts of heavy metals cause serious problems in communal wastewater by accumulating in sewage sludge and thus preventing it from being used properly. To our knowledge no commercial equipment is available to separate heavy metals from biological sludge economically.

Generally, great efforts are being made to minimize the amount of harmful compounds in effluents by using: (1) environment-friendly production processes that produce little or no waste; (2) local re-processors; and, (3) neutralization plants with appropriate processes.

Today, Finland is primarily known for its hi-tech products, such as Nokia's cellular phones, and secondly for its lakes and clean nature. Our hope is to keep it that way by mindful of environmental regulations, with the final goal being to use production methods that minimize the impurity strain on the environment.

Know Our Customers — Know Us

We are proud to play a role in the following totalities:

Case 1: Semiconductor Manufacturing

Okmetic Ltd., is a Finnish leader in the manufacture of silicon wafers. More than 90% of its production output is exported. Okmetic applies results from silicon technology research at its new wafer manufacturing plant. The new plant produces six- and eight-inch silicon wafers for advanced microelectronics' applications. It is of particular importance that significant improvements have been achieved in the variation of the thickness and flatness of wafers. The quality of silicon crystals has been improved by applying a magnetic field to the damp turbulent flow of molten silicon during crystal growth.

As in the semiconductor sector, extremely demanding conditions are intrinsic to production. WatMan's customers often require exhaustive investigative work prior to any equipment or factory delivery. This is often the only way to proceed reliably at an existing plant.

Very detailed and clear preliminary plans, as well as the large size of the factory, were characteristics of the Okmetic project. From the beginning, the customer and its consultant had a very clear concept of the details of the desired neutralization plant. These details were complied with whenever possible.

The turnkey delivery of the neutralization plant included electrics, automation and plumbing. Identifying and mastering its role in the totality of the large factory delivery as well as its flexibility when dealing with the customer and subcontractors formed the core of the successful project for WatMan. A slightly smaller version of this Vantaa project was delivered to new Okmetic plant in Espoo.



Case 2: Surface Treatment Industry

"The surface treatment industry itself exists to produce durable products and to spare the environment."

K. Hartwall Ltd., is an enterprise in the metal industry with net sales of approximately 20 million euro. The company is well-known for its innovative carriage products used in the transport and storage of goods, especially foodstuffs. The primary material in carriages is steel, which is surface-treated to enhance the appearance, and corrosion resistant.

The galvanization plant is one off the biggest in Northern Europe. The neutralization plant was designed to treat the rinse water released from the surface-treatment production as well as the dumped plating baths. The automated plant can run without constantly being manned.

The main parameters of the plant can be monitored from the surface treatment production's mainframe computer, which also reports on any malfunctions. Moreover, pumps, mixers, chemical dosing, etc., can be controlled from the local control centre.



The equipment can also be operated manually, and the automation software informs the operator of any malfunctions. Waste water from the factory complies with the maximum limits set for metals in industrial process water coming to the Helsinki region's waste water treatment plant.

Case 3: Telecommunication Component Manufacturing

JMC Tools, formerly ADC Solitra Inc., offers integrated RF solutions for the telecommunications industry worldwide. The product range of the company covers high frequency components and modules for cellular and PCS systems, both analogue and digital. The company has close links with the world's leading OEM manufacturers of cellular phones and infrastructure and *has a strong*

applications-oriented view when it comes to technology development. JMC Tools has recently introduced a new line of wireless cell site products for cellular and PCS/PCN networks providing operators with cost-effective means for enhancing their existing or planned networks. Some high-quality products — such as JMC Tools' — cannot be manufactured without high-quality water.

Tap water is not pure enough in all areas to attain the desired product attributes. Even pure water contains a high level of dissolved non-organic minerals and various organic compounds that can interfere with sensitive processes. Deionized (DI) water is used in power plants to produce pure steam, as well as in fields such as the medical, surface treatment and electronics industries, and laboratories.

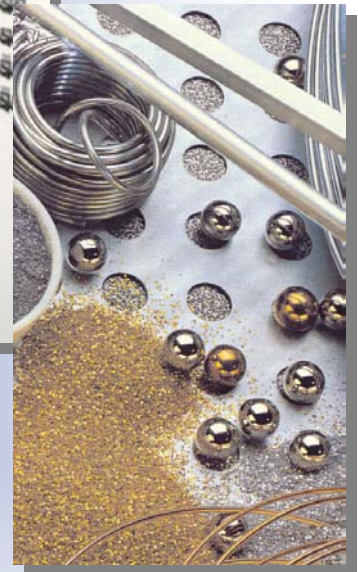
Several methods are used to produce DI water, the most common being distillation in small-scale, ion exchange and reverse osmosis. Each method has its own unique characteristics, and often the best end result is achieved by combining different techniques. Ion exchange traditionally involves strong chemicals that must be neutralized. Counter current regeneration combined with packed bed technology reduces the amount of chemicals needed, and is a technique that achieves the best possible water quality. In fact, counter current regeneration technology substantially improves the operational and environmental friendliness of the equipment.



When dealing with low TDS feed water, packed-bed technology with counter current regeneration is normally the most economical choice, especially for producing large volumes of DI water.

Semi-permeable membranes have recently been the targets of rapid development. With reverse osmosis, it is possible today to achieve an excellent water quality with a low supply pressure and a good recovery ratio. Unlike in ion exchange, the amount of chemicals used is generally very small, so this is a particularly good method for sites that do not have a neutralization plant.

When dealing with moderate/high TDS feed water, reverse osmosis — not being sensitive to most neutral salts — is normally the most economical choice. Reverse osmosis does not need chemicals but has the drawback that it rejects a part of the feed as more or less concentrated effluent. Nevertheless, this concentrate can be re-used elsewhere in non-sensitive processes, such as pretreatment.



Case 4: Printed Circuit Board Manufacturing

Aspocomp Ltd., is a Finnish leader in the manufacture of printed circuit boards (PCB), thick film hybrid circuits and mechanical assemblies for the electronics industry. Its main customers are European manufacturers of electronics equipment.

Rather than producing and marketing its own products, Aspocomp relies on its customers who design the product and provide the specifications and drawings while Aspocomp provides the necessary production and process know-how via its ISO 9000-certified manufacturing operations. Product quality, prompt delivery and a flexible response to customer requirements form the foundation for Aspocomp's competitiveness.

Most PCB plants in existence today have had problems with following the letter of the environmental law because the PCB process chemistry is complicated, and additionally product quality must always be high: partly, this high quality can only be achieved by using plenty of water. Facilities have fulfilled the requirements of the regulations only by effectively controlling the effluents and the process parameters.



Dissolved in water by itself, copper as a simple salt of an ion that does not interact with copper, such as copper sulphate, will precipitate almost completely by only adjusting the pH. The problem arises when different waste streams are mixed together and, consequently, water treatment to remove heavy metals becomes difficult, or expensive, or both. When ammonia or any other complex forming agent, such as EDTA, is mixed with copper, a strong copper-complex will form. This complex can easily pass the normal neutralization treatment.

Effective agents (precipitants) that will remove copper from strong complexes, have been developed, but unfortunately, they are expensive. Much of the problem potential with the chelates can be solved by keeping the most difficult fractions separate and by maintaining the lowest level of copper possible.



When studying the alternatives in the Aspocomp Espoo facility, ion exchange waste treatment seemed to be a good approach. The resin used is very selective for bivalent cations such as Cu^{2+} , Zn^{2+} and Ni^{2+} , against sodium but also against calcium ions. Metals from the ion exchanger eluates can be precipitated by normal methods.

Major efforts — both in the production processes and in the effluent treatment — were made to meet the most stringent limits set for metals in industrial process water coming to POWT. Three years after finalizing the effluent treatment plant, ion exchange now seems to be a good choice. Effluent from the Aspocomp Espoo PCB facility not only complies with the maximum limits given by the local authorities but also with the lower internal copper limit given by Aspocomp itself.

The copper concentration of the effluent does not exceed 0,5 mg Cu/l.

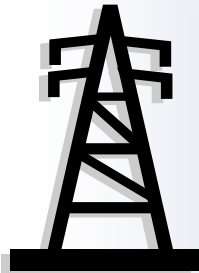
C a s e 5 : Steel Manufacturing

Rautaruukki is one of the largest steel producer and upgrader in the Nordic countries, where it has a leading market share in many of its major product groups. In addition, Rautaruukki has a competitive market position in several product groups in other Western European countries.

Rautaruukki's main products are mild and low alloy flat and long steel products and related upgraded products. Flat steel products include hot-rolled, cold-rolled and coated steel sheet, a substantial portion of which is further upgraded into welded steel pipes and tubes, cold-formed sections and products and components for construction. Long steel products are manufactured by Fundia, a subsidiary of Rautaruukki. In 1999, Rautaruukki had a total turnover of 2.4 billion euro and assets worth a total of 2.4 billion. Rautaruukki operates manufacturing facilities in 15 European countries.



Rautaruukki is committed to the principles of sustainable development. The Group's objective is to obtain certification for all its production units in accordance with the ISO 14001 standard by the year 2000. A key principle of the environmental system is continuous improvement through environmental objectives and programmes as well as the environmental audits that monitor the implementation of them. Each location carries out its own environmental programme which comprises numerical target values for the gradual reduction of emissions as well as investment and development plans for achieving the targets.



Case 6 : Power Plants

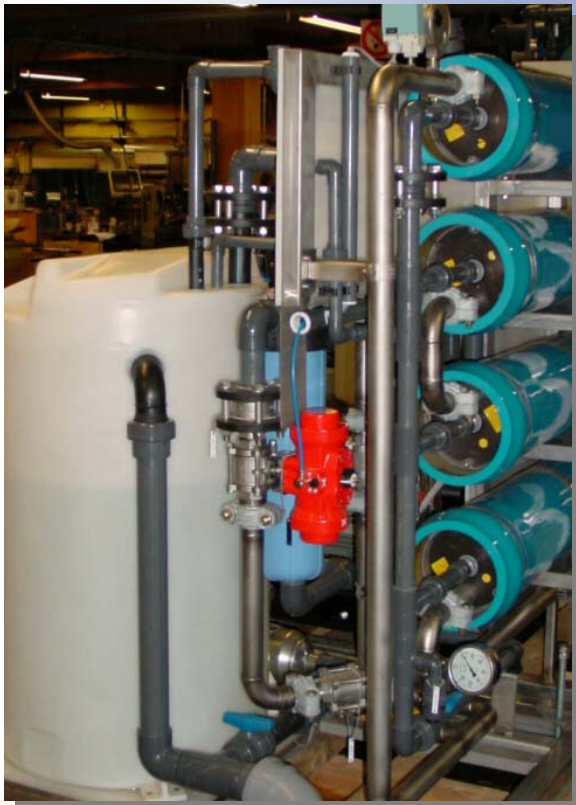
Wärtsilä power plant portfolio includes baseload, cogeneration, load management and gas compression applications – anything from floating barge power stations to decentralised units suitable for urban areas. High efficiency, fuel flexibility and modular design allow for truly competitive power production anywhere in the world. Supported by a complete range of services, the customers are provided with profitable solutions from a total energy supplier.

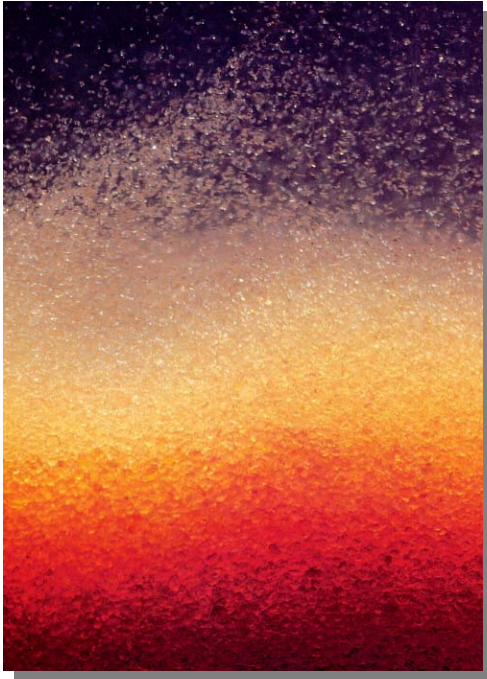
Towards decentralised energy. The energy business is undergoing major changes. The large, centralised power plant with widespread transmission systems is being replaced with small, decentralised cogeneration plants. Decentralised plants account for about 40% of all new power plants delivered worldwide. It makes good economical sense to put the energy production exactly where it's needed. Bringing the plant closer to the energy consumers reduces transmission costs, while using heat locally increases the overall plant efficiency.

Wärtsilä power plants are ideal for decentralised power. They fit in the surrounding environment and generate a minimum of noise. With cogeneration – or combined heat and power – the overall efficiency is high, which is also the best means of limiting carbon dioxide emissions. Overall, Wärtsilä provides the most advanced solutions for decentralised energy production at a highly competitive cost.

R&D today is focusing on environmental issues. Since the mid-1980s Wärtsilä has spent more than EUR 100 million on developing technologies that reduce exhaust gas emissions. Significant results have been achieved, and development is now more intense than ever.

Many customers today want to stay ahead of environmental legislation and Wärtsilä has taken up the challenge to support its customers' desires to gear themselves towards sustainable technology.





Case 7 : Custom Precision Mechanics Components Manufacturing

Ojala Group's (owned by Flextronics) mission is to build, maintain and develop mutually beneficial long-term partnerships with customers within the telecommunications, electrical and electronics industries as well as the automation and control industries. Ojala Group is committed to constantly satisfying its customers' changing needs thereby adding value to the customers.

Ojala Group offers its customers comprehensive capability and expertise, and a complete service in custom integrated enclosures and related products production processes, from design and engineering to JIT delivery. This highly competitive combination enables the customers to simplify their supplier base and to improve their competitiveness through higher cost-efficiency, quality levels and reliability of delivery.

Caring for the environment is common responsibility. Environmental management systems in accordance with ISO 14001 are in use in all Ojala Group factories. Identification of environmental aspects and legal requirements is the principle for the implementation of the Environmental Management System. *The environmental objectives are efficient processing of raw materials and energy and minimization of waste and other environmental strains.*

Ojala Group operates responsibly by recycling all possible metal scrap and packaging material. To increase the awareness of environmental issues the company trains and informs its personnel on an ongoing basis.



Communal and Process Water Treatment

CATALYTIC FILTRATION

One of the main WatMan ground water treatment deliveries is the iron removal filters delivered to a province in Finland (in Pieksamaki); the capacity of the filters is 1600 litres per minute. Demanding test runs preceded the selection of the equipment, and an excellent efficiency of purification is achieved even with high-speed filtering. As a result of the fast catalytic reaction, the oxidation of the iron in the filtering media is complete, even though the filtering velocity exceeds 25 m/h. It is important to note that the backwash water velocity is lower than the filtering velocity; *this means remarkable savings compared to conventional filters.*

The fully automated, logic-controlled and chemical-free filters have operated flawlessly for 5 years and have produced water that clearly surpasses the norm. Iron concentration in the outlet is lower than 0,05 mg/l. Once again, the parent company Pumplohja supplied the steel pressure tanks and piping equipment for the site.

Water filters working on the same principle have been delivered to the City of Tammisaari and the communities of Tuulos, Oulunsalo and Karjalohja, among others. On the industrial side the same principle is employed in Metsä-Serla, Primalco, and Federal Bank of Russia in Moscow, among others.





DISSOLVED AIR FLOTATION (DAF)

Dissolved Air Flotation can be employed to remove high inlet levels of organics, suspended solids, oil and grease from industrial water and waste water. The microbubble DAF provides a practical solution to hard-to-handle water treatment problems.

A recycle feed pump transfers water to an air dissolving vessel and compressed air is then injected into the vessel. The air/water mixture is held pressurized in the vessel long enough for the air to dissolve in the water. When flowing through a pressure release valve, tiny, microscopic bubbles develop forming a white cloud of air in the water. The bubbles become attached to the suspended solids, oil and grease in the inlet water. Impurities float to the top of the flotation chamber. A moving scraper pushes the float, the formed waste, into further treatment. The other method of removing the floating sludge is to raise the chamber level and let the float freely overflow.

LAMELLA CLARIFIER

Lamella clarifier separates solids from a carrying liquid by directing the material between a series of inclined plates. The plates are normally spaced 10 cm apart with the result that large settling surfaces are concentrated. Stacking the inclined plates results in a separator having 5 – 10 times the clarification area of a conventional settler having the same floor space. To put it another way, it does the separator job in 1/10th of the space.

The WatMan lamella construction ensures laminar flow conditions, which results in stable hydraulic flow and high effluent quality. It permits great reduction in the space needed for clarification equipment, and allows easy relocation at a later date. Use of a lamella separator reduces maintenance to a minimum. There are no moving parts and its compactness allows it to be located in new, automated plants or in upgraded existing installations where space is often not available for a standard clarifier. Installation costs are also significantly reduced. As an option, we can design a clarifier with a sludge scraper. This is an excellent choice when having solids hard- to-handle, typically in wastewater applications.



CONTINUOUSLY WASHING SAND FILTER

A common problem for pressurized or non-pressurized fixed-bed filters, typically sand filters, is a constant plugging tendency, especially when treating water with medium to high ratios of suspended solids. The problem can sometimes be resolved by using multi-layer filters in which the capacity for holding suspended solids can easily be doubled. However, both types of filters must be backwashed regularly to remove the foulants and to attain the desired head loss. When using feed water as wash water, the feed water contaminants can be collected by the lower parts of the filter media or the lower collectors. This undesirable phenomena can cause a fluctuation in the quality of the water.

Continuously washing WatMan sand filters will never get plugged by the suspended solids or need to be taken out of service for the backwash. The amount of constant wash water needed is 5 – 10 % of the feed, there are no high peak flows to balance. There are no channels causing dead zones and the whole filtering area can be utilized efficiently. Low feed pressure is needed.

The extremely tough and simple structure will minimize the need for service and down time, and all the vital parts including the filter chassis are manufactured using chemically pickled acid proof steel. The basic filter has only one moving part, which is the sand washing screw. The main task is carried out by an air lift pump, which transfers the dirty sand into the washing screw chamber. As an option a balancing scraper and a filtered water wash pump can be delivered.

The feed water meets the distributor chamber in the lower section of the unit and flows upwards through the sand bed. As the water rises towards the surface, the debris remains in the sand bed. Water flows through the sand bed and leaves the filter unit in the upper part outlet. In the opposite direction to the water, the dirty sand and debris first sink into the bottom of the unit. From the bottom the air lift pump draws and transfers the sand up into the washing screw chamber. The purified sand drops into the filter chamber forming the top filtering layer. The wash water is led into the sewer or onwards for further treatment.

PACKED-BED ION EXCHANGE TECHNOLOGY

The term packed-bed is used if the resin bed is compacted against the upper nozzles during either the running sequence or the regeneration sequence. Counter-current regenerated packed-bed technology - such as Amberpack, Reversed Amberpack, Upcore etc. - can offer several advantages compared to conventional co-flow regenerated ion exchangers.

The packed-bed system is simple in design and costs less than comparable conventional systems. The construction is compact and inert resins can be used when found necessary. Counter-current regeneration is always utilized in packed-bed technology and the conventional "fast rinse to sewer" can normally be compensated by a recycling rinse. These attributes mean greater efficiency with less chemicals and less waste.

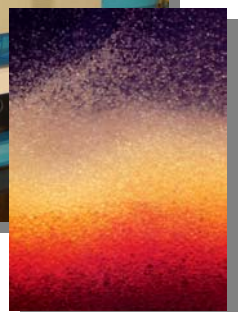
The feed water first meets the most exhausted resin, then flows towards the best regenerated or almost virgin resin. In an optimum situation the effluent side resin only sees the fresh regeneration chemical and the already treated DI water. In compact beds there is no mixing of different resin layers. The regeneration chemical can be introduced from the top or alternatively from the bottom, but always opposite to the water flow. As a product very low conductivity water can be obtained; the conductivity is normally less than 1.0 $\mu\text{S}/\text{cm}$ after the separate beds, and without the polisher. A value of less than 10 ppb can usually be obtained for silica. To attain the most stringent product quality, an appropriate and constant recycling DI water flow must be maintained. The other method is to use polishers in series with the basic train.

Depending on the nature and the structure of the system, the backwash can be made simultaneously with the regeneration phase in the pressure vessel, step-by-step or layer-by-layer in the resin wash tank or on batch-basis in the resin wash tank. With increasing head loss a pressure strike can be given or alternatively some part of the resin can be moved into the resin wash tank.

ION EXCHANGE vs. REVERSE OSMOSIS

WatMan is able to deliver both IX and RO technology, so we have no favourites among these technologies. Enclosed are some parameters that affect the decision of which technology to choose.

The total investment in a DI water system depends on the nature of the total plant, especially on the pretreatment and the possible posttreatment. The lay-out of the system should be considered carefully. For waters of low TDS, packed-bed ion exchange is more economical to operate than reverse osmosis (RO). Depending



on the amount of bicarbonate and silica in medium TDS water, packed-bed may still be more economical than RO. There is no point in using IX with high TDS waters because of the increasing consumption of chemicals.

IX needs strong chemicals, however the chemicals such as NaOH and H₂SO₄ or HCl are inexpensive. Strong acids and caustics need neutralization equipment. RO may require special antiscalants and/or membrane cleaning chemicals. RO systems normally use only minute amounts of corrosive chemicals. Neutralization may be needed depending on the nature of the membrane cleaning chemicals. Chemical usage and investment in the neutralization equipment should be considered when making cost calculations. Possible usage of brine should also be considered.

RO creates more wastewater because the recovery of RO is typically 50 - 80%: for each cubic metre produced by an RO system, 0.25 - 1 cubic metres are fed into the sewer. By comparison, the recovery of modern ion exchange system is usually 96%. It should be noted, however, that the RO reject may still be suitable for secondary use such as cooling. In a situation like this, the yield of RO may be close to 100%.

IX produces a higher quality of water compared to RO, which rejects normally 95-98% of the minerals. Modern IX technology retains 99% of the salts, or more. It is possible to add a polisher both after the IX and after the RO. As regards to feed water quality ion exchange is more forgiving than RO. Slow fouling of the RO membranes can be noticed from decreasing flux or from increasing feed pressure. A ruptured membrane always requires immediate plant shutdown. There is no sudden failure with ion exchange, processes such as slow fouling of the resin are time consuming.

RO removes all the particles very effectively, but suitable pretreatment must be involved to remove the suspended solids, iron and hardness from the feed water. IX effluent quality is almost independent of the temperature, RO permeate conductivity will be made higher by the rising temperature and lowering pressure correspondingly. RO loses up to 20% of the flux (capacity) with a 10 °C temperature decrease.

Low pressure RO membranes working on very low pressure - as low as 5 - 8 bars - remarkably save energy compared to high to medium pressure membranes. Conventional RO requires up to 10 times more kWh to operate than ion exchange. In large-scale production, energy consumption creates a noticeable expense. Comparing different methods, the type of IX plant and the type of RO unit - especially the type of membranes - must be observed and considered.

SELECTIVE ION EXCHANGE

Nowadays, production effluents are effectively controlled by the authorities, who are advised of the decisions made by Paris and Helsinki Commissions. Even more stringent limits can be set locally for each case. Conventional precipitation does not produce an effluent that is pure enough. For this reason modern metal treating facilities are equipped with microfilters or sand filters followed by selective ion exchangers.

Strong ion exchange resins tend to remove all the ions, whether this is preferred or not. Selective ion exchange can be used to selectively pick up certain ions by their affinities, typically heavy metals, precious metals or nitrate. Heavy metals can be separated from high concentrations of univalent cations and also from common divalent cations. Removal can be achieved both from weakly acidic and weakly basic solutions; weak complex forming agents such as phosphates or ammonia do not interfere. Certain strong chelates prefer to form a liquid complex which may be more stable than the corresponding resin counterpart could offer.

The WatMan tailor-made Selix-series IX offers an excellent choice to follow the letter of the environmental law. All the materials contact with the chemicals are made of plastic, so no corrosion will take place during the years. The units are logic-controlled semi-automatic or volume-based fully automated. The separate valves can be manually overdriven. The construction is very simple in order to avoid time-consuming services, and the only ongoing service is to add chemicals. To guarantee the best possible spare parts service, components with an excellent reputation have been chosen.

The best macroporous chelating resins with standard bead size distribution, advanced kinetics of ion exchange and outstanding mechanical stability are used. The units are designed to purify the effluent flawlessly. This also applies to maximum flows. The highest possible purification result can be obtained when installing two units in series. In each case one, two or three units can be installed in one system.

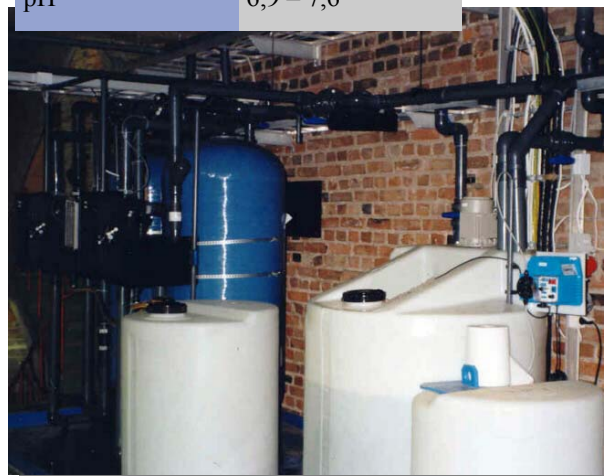
The selective extraction of heavy metals typically follows the affinity series: copper > lead > nickel > zinc > cadmium > iron > calcium > sodium

Depending on the nature of the matrix, the most favorable copper at the left might have a K value of several thousands meaning nearly absolute selectivity over calcium and sodium. Solutions with a matrix of strong complexing agents can be treated with special resins. Low regenerant costs as well as low investment costs are achieved due to the high operating capacity of the resins. Low effluent heavy metal leakage level can still be measured after 1000-2000 bed volumes of treated water.



Table 1: Average surface treatment plant effluent concentrations after selective ion exchangers. [Period of six months]

<u>Metal in treated waste water</u>	<u>Concentration [mg Me / L]</u>
Chromium (Cr)	0,023
Copper (Cu)	0,033
Lead (Pb)	< 0,001
Nickel (Ni)	0,011
Zinc (Zn)	0,288
Silver (Ag)	< 0,001
pH	6,9 – 7,6



QUALITY IN WATMAN

Based on the basic quality definition, we can summarize WatMan quality more specifically as

- ✓ satisfaction of customers' needs
- ✓ suitability for intended use and purpose
- ✓ performance according to a prescribed standard or specification
- ✓ no missing or malfunctioning parts or early failures
- ✓ availability at competitive price, but with profitability
- ✓ constant upgrading of the quality and the quality levels

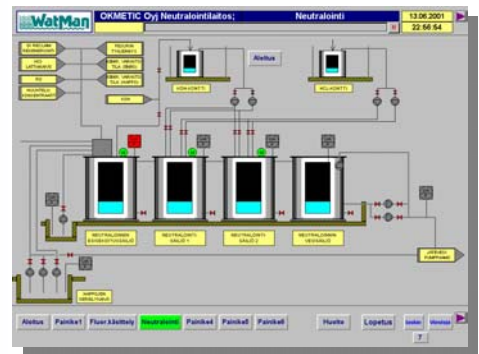
Poor quality means a deviation from the prescribed standard or specification. In other words, the product (or service) does not do what it is supposed to. Quality control entails the prevention, detection and correction of product or service defects that could lead to customer dissatisfaction.

The main objectives of quality control can be described as maintaining design standards, meeting customers' specifications, determining personnel effectiveness and detecting and correcting defective products or services. We understand that quality control is a set of processes used to monitor the performance of the system. The final goal of quality control is naturally to maintain the promised level. We also understand that loss can mean maintenance and repair costs, operating costs, customer dissatisfaction and/or injuries caused by poor design.

We believe in total quality management. Our aim is for everyone in the organization to understand customer expectations and to meet those expectations every time. We understand that we can ultimately achieve lower production and operating costs, and hopefully attract more customers. We expect our subcontractors to act in the same manner as we do, and only use components and services of high quality. To maintain and control a high quality in individual projects, we always form a project organisation. The customer often plays a major role in this organisation.

The most important part, however, is to feel personal responsibility for the customer.

Know Our Customers — Know Us



OEM EQUIPMENT AND TURNKEY DELIVERIES FOR DEMANDING WATER TREATMENT

PROCESSES AND EQUIPMENT

- IRON and MANGANESE REMOVAL
- ALKALIZATION
- SOFTENING
- DESALINATION
- HEAVY METAL REMOVAL
- OIL and GREASE REMOVAL
- PRESSURIZED FILTRATION
- CONTINUOUS WASHING FILTRATION
- FLOCCULATION
- LAMELLA CLARIFICATION
- FLOTATION (DAF)
- REVERSE OSMOSIS and NANOFILTRATION
- ULTRAFILTRATION and MICROFILTRATION
- ION EXCHANGE
- SELECTIVE ION EXCHANGE
- SOLIDS DRYING (THICKENING, PRESSING)
- CHEMICAL DOSING and STEAM SAMPLING
- STORAGE/REACTION TANKS
- PRESSURE VESSELS
- PUMPS AND PRESSURE BOOSTING

WE SERVE

- THE SURFACE TREATMENT INDUSTRY
- THE ELECTROPLATING INDUSTRY
- THE ELECTRONICS INDUSTRY
- THE MICROELECTRONICS INDUSTRY
- THE STEEL INDUSTRY
- THE MINING INDUSTRY
- POWER PLANTS
- ANY OTHER STEAM or WATER USERS
- COMMUNITIES and CITIES
- RESEARCH CENTRES and LABORATORIES
- DESIGNERS and CONSULTANTS

WE USE

- LINED STEEL (EPOXY, VINYL, RUBBER)
- GALVANIZED STEEL
- STAINLESS STEEL (304, 316, SMO)
- PLASTIC (PVC, PP, PE, GRP)
- SPECIAL PLASTICS (FEP, HALAR)

- PLC's: Siemens, Siemens WinCC, Allen-Bradley, Mitsubishi, Klöckner-Möller, etc.

COMPANY OVERVIEW

Oy Wat Man Ab Water Management (WatMan) is a versatile supplier of water and waste water treatment and water recycling projects. As a subsidiary of Pumplohja Corporation, we have the advantage of a wide range of expertise and experience in the production of pressure tanks, pumps and other steel products. We deliver both OEM equipment and turnkey plants mainly to steel and surface treatment industries, the electronics and the microelectronics industries, and power plants. Typical processes that we deliver are chemical treatment and chemical dosing, filtration, clarifying, ion exchange and membrane processes. We find custom engineered solutions, and even retrofit or upgrade existing systems. Supporting the idea of our parent company to transfer and store liquids, our aim is to solve the problems mainly related to water quality in different parts of any production process.



WatMan

Oy WatMan Ab (Vedenkäsittely, Water Management)
YRITTÄJÄNTIE 4, FIN-09430 SAUKKOLA, FINLAND
TEL. (019) 357 071; +358-19-357 071 FAX (019) 357 0770; +358-19-357 0770
E-mail: info@watman.fi
www.watman.fi