AQUAMAGNA WATER CONDITIONER AND DESCALER

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PROCESS/PRODUCT DESCRIPTION:

- non-chemical water treatment
- scale removal
- high-strength ceramic magnet
- no energy input

The AquaMagna Water Conditioner and Descaler is a non-chemical method of water treatment. The technology uses permanent, high-strength barium ceramic magnets, which are configured for placement external to the pipe in order to inhibit scale formation due to industrial or domestic hard water. The AquaMagna also removes existing scale in heating and cooling equipment, such as heat exchangers or boilers, thereby improving heat transfer and lowering energy costs. An alternative or supplement to chemical treatment, magnetic fluid conditioning requires no energy input or maintenance. Magnetic fluid conditioning can also alleviate other problems associated with domestic hard water, such as skin abrasion, foul odour caused by the gasification of sulphates, and reduced water pressure due scale build up in pipes. Lodestones have been used since the early 1800's to remove scale from laundry tubs and pots used for cooking. However, recent developments in high-power ceramic based magnets have resulted in the ability to generate magnetic flux fields with sufficient power for water conditioning applications. The AquaMagna system is easy to install, permanent, and requires no plumbing based on guidelines for proper placement. Most installations generate a return on investment within one year.

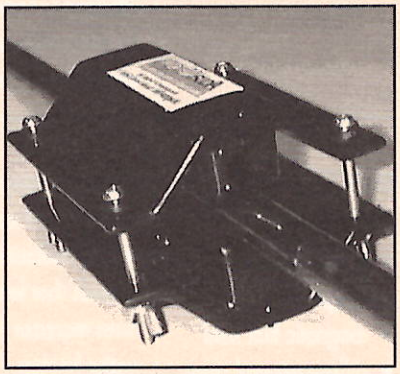

Figure 1: The AquaMagna Water Conditioner and Descaler

PROCESS/PRODUCT APPLICATION:

- hard water
- domestic water
- process water
- reverse osmosis
- heat exchangers
- cooling towers

Magnetic fluid conditioning can be used to prevent and remove hard water scale deposits in domestic, commercial, institutional, and industrial water/process water supply systems. For once-through or recirculating heating or cooling equipment, the AquaMagna descaler improves thermal efficiencies and reduces downtime. Figure 2 illustrates a cross-section of pipe before and after a period of treatment. Examples of increased energy consumption caused be the presence of scale (shown in Table 1) are taken from a U.S. Department of Energy, Federal Energy Management Program report on Non-Chemical Technologies for Scale and Hardness Control. A 70% increase in fuel requirements has been measured for 1/2" of scale formation in a domestic hot water heater. In addition, energy savings are realized through reducing the pump load required to move the water. The AquaMagna also keeps minerals in suspension for healthy domestic consumption. For applications that are sensitive to presence of particulate matter, a separation device, such a filter or settling basin may be used. Conventional salt softeners remove minerals and replace them with salt. Where salt softeners are used for industrial purposes, magnetic conditioning can improve performance by increasing solvency, or can replace the softener entirely. Reduced surface tension and viscosity increases water flow and solubility, optimizing the

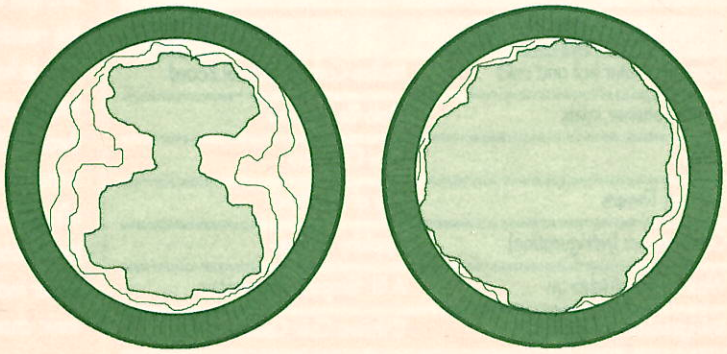

Figure 2: Scale Formation — Before and After Treatment

TABLE 1: INCREASED ENERGY CONSUMPTION AS A FUNCTION OF SCALE THICKNESS

SCALE THICKNESS (INCHES)	INCREASED ENERGY CONSUMPTION (%)
1/32	8.5
1/16	12.4
1/8	25.0
1/4	40.0

AquaMagna water conditioner and descaler

PROCESS/PRODUCT APPLICATION (cont.):

industrial use of chemical disinfectants, biocides, and corrosion inhibitors. Magnetic treatment can improve the efficiency of reverse osmosis systems by preventing scale from plugging membranes. Iron, if present in a significant concentration, must be removed from the water before magnetic water conditioning can be effective. The AquaMagna can also provide preventative maintenance by reducing scale-related electrolytic corrosion.

AquaMagna units are external to the pipe and are designed to fit pipe systems with outside diameters ranging from 1/4" to 13". Table 2 lists a variety of Aqua-Magna installations.

PROCESS/PRODUCT OPERATION:

- barium ceramic magnets
- magnetic flux field
- diffuse mineral compounds
- MagnetoHydro-Dynamics (MHD)
- Ionization by Magnetic Induction (IMI)

Water is characterized as hard due to high mineral content, which results in the crystallization of mineral compounds that form deposits as temperatures increase (ie. via domestic hot water heaters / industrial boilers, etc.). Polar molecules dissolved in water assume an ionic form. Heat sources promote scale formation in hard water by increasing the collision rate of oppositely charged ions — ie. calcium (+) with carbonate (-) and magnesium (+) with sulphate (-). AquaMagna barium ceramic based bi-pole magnets generate high strength magnetic flux fields that alter the reaction between scale forming ions in hard water. As water, an electrically conductive fluid, passes through the magnetic field, clusters of water molecules are broken down and aligned along the magnetic flux vector. Because magnetically charged water molecules take on a greater ionic charge than the minerals, increased attraction between mineral ions and water molecules results in the formation of smaller, more diffuse mineral compounds that remain in suspension and do not adhere to pipes or heating/cooling equipment. As these smaller, non-adherent particles flow downstream existing scale deposits are hydrated and eroded by the flowing water. This principle is known as MagnetoHydroDynamics (MHD) or Ionization by Magnetic Induction (IMI). Figure 3 shows the random placement of water molecules and crystallizing minerals entering the magnetic field where the smaller, magnetized water molecules are aligned, providing increased solvency. Ideal placement and configuration of the magnets is based on contact time (flow rate vs. length of magnetic field), pipe composition, mineral content, temperature, and travel distance. The proximity of 3-phase power lines can generate a secondary magnetic field requiring magnets to be shielded. Turbulence is also a factor as pump impellers, etc. can disrupt molecular orientation of the magnetized fluid.

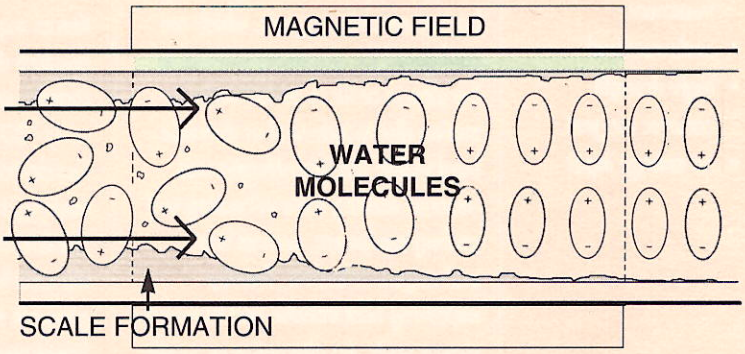

Figure 3: Magnetic Fluid Conditioning Process

TABLE 2: AQUAMAGNA INSTALLATIONS

APPLICATION	INDUSTRIAL/COMMERCIAL USER
Domestic water hot and cold	Halton Catholic School Board
Water softener inlets	Oakville Hospital
Boilers	Dow Chemical
Cooling Towers	City of Brantford
Compressors (refrigeration)	Appleby College
Wastewater discharge	A.G. Simpson Automotive
Refrigeration equipment	Oshawa Civic Centre
Heat exchangers	Menasco Aerospace
Pools and spas	Del Property Management
Irrigation water	Ontario Ministry of Agriculture
Spray humidification	Ontario Realty Corp.
Process spray equipment	Unilock Paving Stone
Steam lines	Stackpole Powder Metal Products

VENDOR INFORMATION:

Magna–Tek

AquaMagna water conditioners and descalers are manufactured by Magna-Tek in Oakville, Ontario. Established in 1995, Magna-Tek provides domestic and industrial consulting services with regards to designing and installing comprehensive magnetic conditioning and descaling systems. Magna-Tek is currently investigating opportunities in fuel conditioning, and has applied it for natural gas conditioning. Magna-Tek is a member company of the Plant Engineering and Maintenance Association of Canada (PEMAC).