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Heat Transfer Review

ED 2000 Electronic Anti-Fouling System

Drexel University Reduces Cooling Costs by 10%

Drexel University is one of the leading engineering schools in the United States. The cooling system has seventeen chillers ranging from 118 tons to 600 tons. It was estimated that this cooling system was costing the University over $300,000 in energy costs per year. Drexel's new President charged everyone within the University to make the facility more efficient.

Bill Taylor, Energy Management Officer and Professor Young I. Cho together proved that the cooling system would run more efficiently with the ED 2000 Anti-Fouling System. The result was a 10% annual savings to the University.

Three sites were selected for this demonstration. One cooling system was monitored without ED 2000 and two cooling systems were monitored with ED 2000. The water management programs remained the same, probes were calibrated to insure the data was consistent and the building automation system was utilized to compile the needed data.

The condenser approach temperature was graphed over the course of the cooling season based on system load and outside air temperature. The objective was to measure the kW/ton based on identical conditions over the course of the cooling season. This would help quantify the savings provided by using the ED 2000 System.

The results demonstrated the chillers operating efficiencies improved. An example:

- 450 ton chiller
- 1244 running hours
- 0.84 kW/ton w/out ED 2000
- 0.61 kW/.ton with ED 2000
- **$6,129 annual savings**

As a result of this demonstration, the ED 2000 Anti-Fouling System has been installed on all of the other cooling systems within the University.

Main Administration Building
Drexel University
Philadelphia, Pennsylvania

ED 2000 Benefits

- Stabilize existing water treatment program
- Maintain condenser approach temperature and save energy Costs
- Eliminate abrasive acid cleaning
- Extend life of condenser tubes
- Eighteen-month payback

Inside this issue:

Millersville University Improves 175-ton Cooling System

Millersville University is one of Pennsylvania's fourteen state universities. Frank Coleman, Refrigeration Supervisor has had continued problems in maintaining the cooling system for the 11-story Ganser Library. The University is located in a hard water area of Lancaster County, Pennsylvania.

In 1996 he installed the ED 2000 without any additional scale inhibiting chemical treatment program. Today the 175 ton cooling system is operating at design.

Ganser Library, Millersville University
Millersville, Pennsylvania

Plate & Frame Heat Exchanger Used in Amine Scrubbing

The ED 2000 was installed in a Gas Processing Facility in Texas

Maintaining corrosion rates in gas production is a high priority. Acid gas (CO_2 & H_2S) typically exists in concentrations of 5% within the hydrocarbon gas stream. The removal of acid gas from the gas stream is accomplished through the use of an absorption/de-sorption system.

The solvent used is a 30% DEA solution mixed with water. The "lean" solution (without acid gas) enters the absorber and exits as "rich" solution. Heating and passing through a stripper regenerate the "rich" solution. The capacity requirements of the reboiler to heat the "rich" solution and the cooler to cool the "lean" solution can be offset by using an interchanger. In this application an Alfa Laval plate and frame heat exchanger was used (61 plates) as the interchanger.

Lean/rich amine exchangers can be extremely dirty, nearly always on the rich side. The fouling deposit is a black waxy substance very much like "shoe polish". It is made of fine particles of iron sulfide (generated by the attack of H_2S on the steel piping and vessels) and hydrocarbons which become absorbed or entrained into the amine.

The lean solution was entering the heat exchanger at 244ºF and leaving at 164ºF. The rich solution was entering the heat exchanger at 140ºF and leaving at 229ºF. Flow rate was 48 GPM.

Fouling forced the plant to acid clean the heat exchanger every 60 days when the temperature differentials would drop below 70º on the lean side and below 80º on the rich side.

One Electronic Descaling 2000 unit was installed on the inlet to the plate and frame heat exchanger.

- The plate and frame heat exchanger now operates continuously at the designed performance level for a six-month period versus 60 days.
- The heat transfer coefficient has been maintained.
- Downtime has been reduced by 50%.
- Labor costs for maintenance has been drastically reduced.
- Chemicals and chemical disposal has been eliminated.

"If this technology worked 1 out of 100 times, we should be able to make it work 99 out of 100 times." ***Prof. Young I. Cho, Drexel University, Philadelphia,***

ED 2000 Validation Reports Published in Scientific Journals

In the last 18 months, Professor Cho, heat transfer and fluid dynamics professor in the Mechanical Engineering Department of Drexel University, Philadelphia, Pennsylvania and his staff have published over fifteen articles in well-respected scientific journals in the field of fouling and the validation of the electronic descaling technologies.

These reports are featured in peer review journals on the lab and field test validation of the electronic descaling technology. These peer review journals are some of the most respected scientific journals in the heat transfer community. The process of publishing in these journals is a lengthy process that takes as long a three years.

The validation of the electronic descaling technology can be found in several of the following:

- Int. Comm. Heat Mass Transfer
- 32nd National Heat Transfer Conference
- Compact Heat Exchangers for the Process Industry
- International Journal of Heat & Mass Transfer
- .1999 ASHRAE Summer Meeting
- 11th International Heat Transfer Conference
- Experimental Heat Transfer

For more information, visit Prof. Cho's web site at: http://httpsrv.ocs.drexel.edu/faculty/choyi

University of Delaware
Newark, Delaware

University Completes Campus-wide ED 2000 Installation

The University of Delaware is a major U.S. University located on in Newark, Delaware. In 1997 the University added an additional 1200-ton chiller to one of it's chiller plants. Dick Walter, Director of Facilities Management was interested in insuring these chillers would operate at maximum efficiency. As result the University installed an ED 2000 on one of three 1200 ton chillers.

As a result of the success of this installation, in 1999 he authorized the purchase of additional ED 2000 systems to complete the three chiller plants within the University, totaling 5,800 tons of cooling.

Professor Young Cho continues ED 2000 Validation

Professor Young I. Cho, a heat transfer professor at Drexel University, Philadelphia, Pennsylvania, has supervised the ED 2000 research project since its inception in 1992. Professor Cho collected a team of scientists to understand and improve what he believes is the most innovative process the heat transfer community has seen in years.

Professor Cho is a well respected member of the heat transfer community. He has authored/co-authored over 150 papers in the area of heat transfer and fluid mechanics. He is a reviewer for ASME Applied Mechanics Reviews, Journal of Heat Transfer, International Journal of the Heat and mass Transfer, AlChe Journal, AIAA and Chemical Engineering Communications. He is an editor of *Handbook of Heat Transfer* (McGraw Hill, 3rd ed.) and an associate editor for the *Advances in Heat Transfer* (Academic Press).

Research in the last few years has resulted in a number of new patents being awarded in both heat transfer and other sciences using the basis principles of electronic descaling technology. This research is the foundation for a better understanding of this technology and how it can be successfully applied to solving mineral precipitation fouling that has plagued industry.

Heat Exchanger Before ED 2000

Heat Exchanger After ED 2000

Holnam Cement Reduces Pumping Costs by $20,000

A Peerless pump transporting quarry water used for service water (cooling) and process water (slurry) in a cement plant fouled every 10-30 days and required an acid wash each time. The pump had an 8" intake pipe and a 12" output pipe transporting the water one half mile to the plant. The $CaCO_3$ of quarry water was 400 ppm.

The pump fouled every ten days in the winter months and every thirty days during the summer months. A crane was required at each of these shutdowns to remove and acid wash the pump. The cost for this process was $1,000 per cleaning or $24,000 per year.

One Electronic Descaling 2000 unit was installed on the pump intake.

- The pump now operates continuously at maximum efficiency (56 psi)
- The elimination of the acid wash has significantly reduced maintenance costs.
- The expected life of the pump has been extended.

"We have eliminated the need to acid wash the pump and have saved the plant over $20,000 per year."
John Harper, Holnam Cement.

Mack Trucks Improves Boiler Efficiency

Two 1000 kW electrode hot water boilers were used to provide hot water to a hot/chilled water HVAC system for this 265,000 square foot facility. The system was designed to run 24 hours a day, seven days per week.

Jackson-Cross, a management firm was contracted to improve efficiencies at this facility. One of the first cost savings steps was to reduce the amount of time these 1000 kW boilers were being used. Additionally, a water treatment system would allow the boilers to run more efficiently throughout the season.

The hot water boilers utilized ceramic electrodes to create a resistance type heating system. Up until this point, the electrodes were pulled annually and dipped into an acid solution to remove scale that had built up in the system. This was a two-day process as the scale collected on the electrodes was estimated to increase thermal resistance by as much as 20%. Over the course of the heating season this was estimated to increase the energy costs by as much as 35%.
In October 1996 the ED 2000 Anti-Fouling System was installed on the 8" feed pipe to both electric boilers. During the course of the season only one boiler was used on an as needed basis. The boiler ran at 100% efficiency. When the electrodes were pulled in September 1997 there was very little fouling. A light wash was required and they were placed back into service that day. The elimination of the scaling on the electrodes reduced thermal resistance and substantially improved the efficiency of the boiler, thus allowing the utilization of one boiler instead of two.

As a result of this success, the ED 2000 system was installed on both the 1000-ton cooling system in this building and the evaporative condensers located at the research laboratory.

Mack Trucks Corporate Headquarters
Allentown, Pennsylvania

ED 2000

ED 2000 Electronic Anti-Fouling System

"A Technology Come of Age"

For your nearest sales and service office, please contact:

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WERE ON THE WEB!
ED2000.NET

Featured Installations in Coming Issues

- **Siemens Automotive—**2100 ton process cooling system
- **Lockheed Martin**–500 ton process cooling system
- **Hilton Hotel—**900 ton comfort cooling system
- **BASF—**5000 ton cooling process cooling system
- **Sears —**300 ton comfort cooling system
- **Montgomery Wards –**300 ton cooling system
- **Park Hyatt Hotel –**comfort cooling system
- **Monel Chemical**–evaporative condenser
- **Montclair State University—**comfort cooling system
- **Lehigh Cement**–air compressors
- **Monroe County Detention**–comfort cooling system
- **Florida Keys Community College**–comfort cooling

ED 2000 Anti-Fouling Systems are available worldwide.