

DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY FACILITIES ENGINEER ACTIVITY, KOREA
APO SAN FRANCISCO 96301



Belt

5 October 1982

EAFF-E-U

SUBJECT: Magnetic Descaling Devices

USAKCA
ATTN: Captain Amacher
Ch, Small Purchase Division
APO 96301

1. Pursuant to the discussion between Mr. Belt, FEA-K and Captain Amacher, Small Purchase Division, the following is submitted as justification for sole source purchase of Hydrodynamics descaling devices over those other known manufacturers who have indicated interest in furnishing units for Korea.

2. Of the four known manufacturers indicating interest, which are, Descal-A-Matic Corp., Bon Aqua Corp., Kentune Corp. and Hydrodynamics Corp., only one, Hydrodynamics Corp., fulfills the complete technical specification required for efficient functioning and long life of magnetic descaling devices. Hydrodynamics uses the principle of "Lorentz Force" under Faraday's law using magneto-hydrodynamics (MHD) conversion in which an ionized fluid is passed across the lines of force of a magnetic field at right angles where an electrical current is produced. Thus, when a conductive fluid flows thru a pipe surrounded by an external magnet system composed of a rare earth-cobalt alloy permanent magnet, and the magnetic field is exactly perpendicular to the direction of fluid flow, a force is created that acts on the moving charged particles in the fluid (in the case of Korea, iron, manganese and calcium salts) to separate the negatively and positively charged materials. This force is called a "Lorentz Force" and is the principle by which descaling devices eliminate scaling and gradually soften and remove existing scaling on pipes. The highest degree of application of this principle is called "Category II" of the four Categories in "Lorentz Force" application and is always 100% effective when properly manufactured and installed. Hydrodynamics meets the above conditions, therefore it is guaranteed for 10 years, has no external power source and requires no maintenance except to change a small sacrificial anode once every two or three years. Hydrodynamics units have proven over 2.5 years service in Korea to be 100% effective. The units are uniformly manufactured to high standards, and FEA-K finds no reason to doubt the 10 year guarantee. The units are usually used on boilers that are 25 HP or greater and chilled water units that are 25 refrigeration tons or greater.

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3. Messrs Gruber and Carda in a research report for the Colorado School of Mines in July 1981 on the, "Performance Analysis of Permanent Magnet Type Treatment Devices", conveniently catalogued magnetic devices into four categories. There are units available being manufactured in the U.S. and Europe representative of all four categories.

a. Category I units are totally inappropriate, as the magnetic field is not perpendicular to the flow of the ionized fluid, and the magnetic field would never impact on the fluid in an iron pipe. It is believed that manufactured units of this type are responsible for much of the negative results reported for magnetic devices.

b. Category II units can give 100% effectiveness because the flow is always perpendicular to the magnetic field. However, in highly conductive fluids the design may not yield the full potential of the magnetic field. Korean water with iron, manganese and calcium salts, and in the neutral range of 7 pH, is a very poor conductor, therefore, Category II devices can yield the highest effectiveness. If a Category II device has the additional factor of a rare earth-cobalt alloy permanent magnet then the device can be assumed to reach 100% effectiveness and to last almost indefinitely, if a sacrificial anode is properly installed for replacement as required. This device is probably more expensive to manufacture.

c. Category III devices have life expectancy and field strength (magnetic) dampening problems with the magnetics; and the design of the device is not optimum for assuring that the fluid flow will be perpendicular to the magnetic lines of force. This Category III type seldom reaches more than 50% effectiveness and has a useful life of only one or two years. This device is inexpensive to manufacture.

d. Category IV is a design incompatible with assuring that the ionized fluid passes through a magnetic field perpendicular to the lines of force. This Category usually produces units with, at most, 25% effectiveness and a useful life of one or two years. This device is inexpensive to manufacture.

4. Category II units are the only ones which reach the real potential of magnetic descaling devices and offer the U.S. Government maximum effectiveness and operating life for the funds expended. Hydrodynamics Corp. units are the

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only applicant manufacturer which falls within this Category II, uses the MHD energy range and yields highly successful results operating in conditions of CaCO_3 and CaSO_4 scaling. Before attempting to purchase any number of Hydrodynamics units, FEA-K purchased two units of which one has been operating in Camp Casey for about 2.5 years with 100% effectiveness and the other unit for a shorter time in the Yongsan area again with 100% effectiveness. These units are guaranteed for a minimum of 10 years if the sacrificial anode is properly replaced every 2 to 3 years. EAFE-E-U is holding pipe samples showing the effectiveness of the unit installed at Camp Casey for examination by your technical staff.

5. The available literature from the other three applicants, Descal-A-Matic, Bon Aqua and Kentune, is superficial, misleading, and devoid of almost all technical information. The following summarizes FEA-K findings:

a. Descal-A-Matic is either a Category III or IV manufactured unit. This information was obtained by telephone with CONUS. It has no sacrificial anode to protect the unit, and the manufacturer offers no guarantee. Its probable life is not more than two years and its efficiency is somewhere between 25% and 50%. Purchase of these units would be a waste of U.S. Government funds when compared to a Category II type.

b. Hon Aqua is probably a Category III type with a guarantee of one year on the unit, no sacrificial anode, and has an estimated efficiency of 50%. Purchase of these units would be a waste of U.S. Government funds when compared to a Category II type.

c. Kentune is probably a Category I or IV type but FEA-K does not have sufficient literature to identify the Category exactly. Kentune is not a Category II. It has no sacrificial anode and offers no guarantee. FEA-K estimates its efficiency at 25%, or less. Purchase of these units would be a waste of U.S. Government funds when compared to a Category II type.

6. In conclusion FEA-K would like to emphasize that it is attempting to acquire the best technology available for the solution of difficult boiler and chiller water facility maintenance in a geographically difficult area some 9000 miles from the CONUS supply base. Chemical treatment of boiler and chiller water is not practical in Korea. The result has been a degradation of the life cycle on boilers and chillers to roughly one-third of the normal

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life. This one-third reduction in life cycle is enormously expensive in replacement of boilers, chillers and piping. Magnetic descalers attack this problem at its source. FEA-K is only insisting upon Hydrodynamics at the present time because no other manufacturer has come forward with an equal, technically sound product. If other manufacturers are found who fall under the Category II classification, FEA-K would be most willing to order and test several units and, if the tests are successful, order these units in lieu of Hydrodynamics if there is a financial advantage. For the moment the technical and financial advantage is with the recommended sole source of Hydrodynamics Corp.

FOR THE COMMANDER:



KENNETH G. BELT
Acting C, Eng Div