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IMPROVEMENTS AND BENEFITS IN CYLINDER ROD CORROSION RESISTANCE WITH THE TRIPLEX ROD CHROME PLATING PROCESS

For marine, offshore and underwater hydraulic cylinder applications, an important technical consideration is the subject of corrosion of cylinder rods that are left extended for significant periods of time. It is known that, by far, the best technical solution to this problem for these applications is the use of stainless steel rods, specifically rods of 17-4PH stainless steel treated to the 1150 degree F condition, with hard chrome plating. Unfortunately, the costs and delivery times increase dramatically with these stainless rods so that for many projects, their use is not feasible from the standpoint of project costs and schedules. Ready availability of this alloy in large rod sizes is a particular problem.

Theoretically, significant benefits in rod corrosion resistance relative to conventional chrome plated carbon steel rods could be achieved using rods nickel plated with the electroless nickel plating process. Electrolytically deposited nickel plating, however, is not technically acceptable for corrosion resistance. There are serious practical problems in attempting the electroless nickel plating process on cylinder rods of any significant size. It is extremely difficult on the larger rods to reliably electroless nickel plate a quality job that is free from significant defects and imperfections. The resulting defects and imperfections themselves would, most probably, be the site of significant corrosion activity with rods in marine use. Another problem with the electroless nickel plated rods is the hardness of the nickel layer as it has a Rockwell C scale hardness of only 46 to 48 as compared to 68 to 70 for the hard chrome plating used on cylinder rods. With the much softer nickel layer, susceptibility to abrasion and contact damage as well as scoring due to particle contaminants in the oil would be greater with a resulting practical expectation of greater rod surface damage accruing in service with attendant localized corrosion problems.

There is an additional risk with the electroless nickel process in that the post plating baking process required at elevated temperature to make the layer adhere better to the cylinder rod jeopardizes the metallurgical condition of heat treated alloy steel cylinder rods that may be otherwise utilized in the application. Therefore, as a result of all these technical problems described, Precision Equipment does not feel that rod nickel plating is a practical or satisfactory solution to the rod corrosion problem for marine application cylinder rods.

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The triplex hard chrome plating process offers a means of achieving a very substantial increase in corrosion resistance of cylinder rods used in marine, offshore and underwater applications. With the Triplex chrome plating a total thickness of 0.005 - 0.010 inches per side of plating is achieved, versus the 0.0005 - 0.0010 inches per side in standard chrome plated rods. Salt spray corrosion tests we are familiar with showed no failure (no evidence of corrosion) of the Triplex or Nickel plated samples after 80 hours exposure of salt spray at 95 degrees F. (Triplex plated samples total plating thickness 0.010 inches, nickel plated samples total plating thickness 0.0005 inches) as compared with significant corrosion observed after 4 hours with the standard chrome plated samples (standard chrome plating thickness is 0.001 inches per side for standard chromed cylinder shafting.) These results show a very substantial increase in rod corrosion resistance with Triplex chrome plating as compared with conventional chrome plating. Corrosion resistance performance of Triplex chrome plated rods of marine cylinders in use are observed to the much better than standard chrome plated rods for comparable applications.

Factors known to influence the corrosion resistance of the Triplex chrome plated rod are (1) the surface finish and surface condition before plating and (2) the thickness of each chrome layer deposited. The optimum Triplex chrome plating thickness for corrosion resistance has been found to the 0.005 - 0.010 inches thick per side. The chrome plating can be termed a passive coating in that when exposed to oxygen/moisture it forms a very thin protective oxide layer at the surface.

Atomic numbers for chromium and iron are respectively 24 and 26 and valances for chromium and iron are respectively (2,3,6 and 2,3).

For marine, offshore or underwater cylinder applications in which the possibility of electrochemical corrosion of the cylinder rods is of concern, consider possibilities of inhibiting corrosion with sacrificial anodes (e.g. Zink blocks attached to rod and base end attachments) or possibly with cathodic protection devices/counter EMF. Electrolysis induced corrosion problems can be minimized by elimination of leakage of current from related electrical systems and by maintaining cylinders in an electronegative state. Precision Equipment is happy to cooperate with the cylinder user in their corrosion control program by providing on the cylinder, attachment or mounting provisions specified by the customer.