US Army Corps of Engineers®

ENGINEERING AND CONSTRUCTION BULLETIN

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Subject: Ceramic Coated Piston Rods

Applicability: Information

1. Ceramic coated hydraulic cylinder piston rods have been used at Civil Works locks and dams for gate operating systems since the 1990s. Recent information provided by the field indicates that the ceramic coating system has been failing at a number of different projects. It is recommended that ceramic coated piston rods no longer be used at locks and dams for either new construction, or repair or rehabilitation projects. This ECB will discuss the type of failures that have been occurring, ways to possibly extend the life of ceramic coated piston rods now in use, and recommended piston rod surfaces.

2. Winfield Dam tainter gates, Olmsted Lock miter gates, and Braddock Dam tainter gates have all experienced failures of the ceramic coating on its piston rods. Winfield Dam has been in operation since mid-1990 and Braddock Dam since 2002. The hydraulic cylinders at Olmsted Lock were installed in 2000 but the lock will not be in regular use until the dam is completed. The piston rods at Winfield and Braddock Dams are rarely fully retracted into the hydraulic cylinder. Olmsted Lock miter gates are routinely exercised and the gates are stored in the open position with the piston rod fully retracted, but a portion of the rod remains exposed. The exposed portion is where failure occurred. Leaving the piston rod exposed to the elements for long periods is believed to allow moisture to penetrate the pores of the ceramic coating and slowly corrode the carbon steel base metal. The attached photos show that the corrosion of the base metal for both Winfield Dam and Olmsted Lock is obvious. The Braddock Dam piston rod coating is in the early stage of failure, and corrosion was observed only by magnified examination of the rod's surface.

3. It appears that the best means to extend the life of the ceramic coating is by periodic exercising of the equipment. This seals the pores in the ceramic coating and limits the entrance of moisture by applying a thin coating of hydraulic fluid to the rod's surface. For projects where periodic exercising is not possible and /or where a part of the rod remains exposed, Bosch Rexroth, the manufacturer of the ceramic coated piston rods for all three projects (trade-name Ceramax), recommends, in a 19 June 2008 Service Visit Report, subject, Winfield Locks and Dams West Virginia, USA, an additional maintenance procedure. Bosch Rexroth recommends: "New rods with a new coating will require a certain maintenance procedure, which contains periodic inspection of the rod surface and areas which will never be retracted will require periodic preventive treatment with a silicone based oil. We normally recommend GE SF96 silicone oil." Due to the physical location of the hydraulic cylinders at many Corps projects, this extra maintenance procedure is often difficult and time consuming to perform.

4. Performance of ceramic coated piston rods at Corps CW projects has proven not to be satisfactory. It may work well for installations where the gates are operated frequently, but even for those projects, a part of the rod (next to the clevis end) remains exposed to the elements and subject to coating failure. Based on the information provided above, Corps guidance and criteria will be revised to eliminate the option of ceramic coated rods. All new projects, and rehabilitation and repair projects should, depending on the installation, specify chrome plated stainless steel or nickel and chrome plated carbon steel piston rods in accordance with UFGS 41 24 27.00 10.

5. Point of contact for this ECB is Dan Casapulla, 202-761-4227

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JAMES R. HANNON
Acting Chief, Operations and Regulatory
Directorate of Civil Works

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JAMES C. DALTON, P.E.
Chief, Engineering and Construction
Directorate of Civil Works

Winfield Dam Tainter Gate

Winfield Dam


Olmsted Lock Miter Gate