

Joining Dissimilar Metals With A Mechanical Connector

Introduction

Most high-capacity water wells are constructed of casing and well screen manufactured from a single type of steel such as low-carbon steel, copper-bearing steel, high-strength low-alloy steel, or stainless steel (Types 304 and 316L). However, there are exceptions such as when well screen manufactured from a noble metal (stainless steel) is welded to casing manufactured from a less noble metal. This direct coupling of two highly dissimilar metals typically promotes the occurrence of galvanic corrosion unless some suitable control measure, such as a mechanical connector, is employed. This memorandum provides a brief overview of galvanic corrosion and describes the design and use of a mechanical connector that is supplied by Roscoe Moss Company (RMC).

Galvanic Corrosion

Galvanic corrosion is a common form of corrosion that is induced when two dissimilar metals are in direct contact with one another under water. When a galvanic couple of this type is formed, the more positive (noble) metal functions as a cathode and will corrode slower than it would by itself. The less noble of the metals functions as an anode and will corrode faster than it would by itself. Two significant effects of galvanic corrosion that affect the operation of water wells are: 1) an increase in sand production caused by the widening of the screen openings which allow aquifer material and even gravel pack to enter the well; and 2) structural failure of the casing or well screen caused by a loss of collapse strength for the affected casing and/or screen.

Galvanic corrosion is preventable, controllable, and predictable. One way to qualitatively assess the relative tendency of various metals to corrode if connected to one another is to refer to each metal's position in the galvanic series (See the reference list for sources of information on this topic). If two metals are close together on the table, then they have a greater potential to corrode if they are coupled. Unfortunately, however, the galvanic series does not forecast the rate of corrosion; nevertheless, it is a reliable qualitative guide.

The occurrence of galvanic corrosion in many physical environments is well established but the degree to which it affects water wells continues to be a topic of discussion. Some have observed that although galvanic corrosion takes place initially, carbon steel rusts and polarizes rapidly, effectively inhibiting further deterioration (Roscoe Moss Company, 1990). This fact notwithstanding, an appropriate control measure for galvanic corrosion, such as a mechanical connector, should be used when joining stainless steel to low-carbon steel.

Mechanical Connector

The mechanical connector, as manufactured by RMC, is used to couple together joints of casing or joints of casing and screen. This device eliminates the need to weld two dissimilar metals directly together. The connector (shown in Figure 1) is either welded to a 20-foot joint of stainless steel casing at the factory or delivered loose to be connected at the jobsite. In the field, installation of the joint with the mechanical connector is routine. First, the lower end

of the joint is welded to the stainless steel joint below it. Then, it is lowered into the borehole until the mechanical connector is positioned at ground surface or the rig floor where it is held in place and supported with a landing clamp. Finally, a joint of low-carbon steel is lowered into mechanical connector and joined to it with a filet weld. No special handling procedures are needed to complete the installation. However, in certain situations some consideration for borehole diameter might be necessary because the diameter of the mechanical connector is about 2 inches larger than casing.

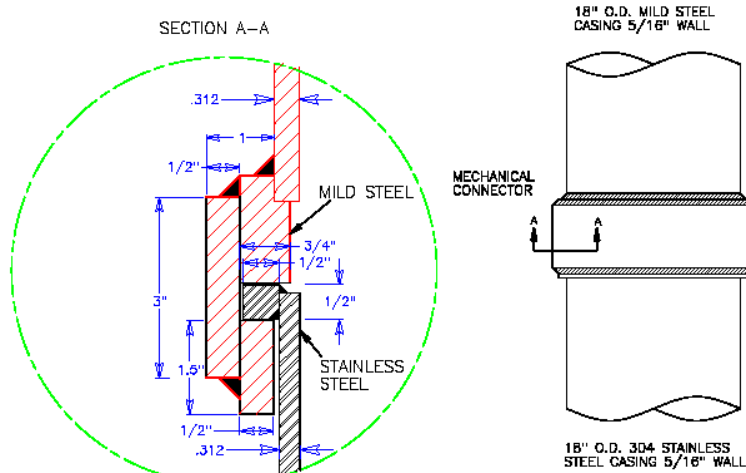


Figure 1

Summary

The mechanical connector manufactured by RMC is an effective accessory for joining together two dissimilar metals such as stainless steel and low-carbon steel casing and/or screen. Years of field experience indicate that this device protects against galvanic corrosion.

References

ASM Handbook, Volume 13 (formerly Ninth Edition, Metals Handbook) – Corrosion, ASM International

Handbook of Ground Water Development, 1990, Roscoe Moss Company, John Wiley and Sons, New York, NY.

About the Author

Robert Turnbull is the Chief Hydrogeologist of Roscoe Moss Company. In this capacity he provides technical support, as needed, to consultants, municipalities, and water districts to plan and design water supply wells. He can be contacted for such information or to answer inquiries regarding this technical memorandum via email at turnbull@roscoemoss.com. His website is www.blhydro.com. The corporate website for Roscoe Moss Company is www.roscoemoss.com.

