The Utility and Efficacy of Welding Collars

Introduction

For the majority of projects, the process of well design is a relatively straightforward exercise in which sound engineering principles are combined with the experience of the designer to select specific methods and construction materials to meet or exceed the performance objectives of the client. While there is no denying the obvious importance of performance objectives such as production capacity and efficiency, it is easy to overlook the importance of selecting materials that will facilitate the contractor's efforts to construct the well. This memorandum explains how the welding collars enable a contractor to more easily complete the well installation in a safe and timely manner.

Types of Connections

Steel well casing, louvered well screen and continuous wire-wrapped (CWW) well screen are manufactured in various lengths usually ranging from 10 to 40 feet. These individual joints are assembled at the job site, connected to one another, and lowered into the borehole as a continuous string. The four types of connections most often used in the water well industry are: 1) plain end; 2) threaded and coupled; 3) bell and spigot; and 4) welding collars. Most large diameter wells (i.e., greater than 12 inches in diameter) are constructed with casing and well screen that have plain ends or welding collars; both are described below.

Plain Ends. Casing and screen with plain ends are manufactured with either beveled or square edges depending upon the wall thickness; connections are made by butt welding in the field. Plain ended casing and screen have smooth sides and a uniform outside diameter (O.D.). With a uniform O.D., a tremie pipe and/or other ancillary pipes will lie flat up against the casing and screen minimizing their cross sectional diameter. An added benefit of the uniform O.D. is that gravel is more easily placed and consolidated in the annulus.

The downside of plain ended casing and screen is the requirement for special handling during installation. Elevators are used to pick up and lower each joint of casing and screen into the borehole. In order to secure the elevator the contractor (or manufacturer) must first precisely position and weld 4 small, rectangular pieces of steel ("lugs") around the circumference of the casing or screen at 90° to one another and at the same distance from the end. If lugs were not attached, the smooth sided casing or screen would simply slip through the elevators or a casing clamp, if used.

A typical procedure for installation begins by lifting a joint of casing or screen with the elevators into the derrick. Then, it is lowered slowly it until it butts up against the previously placed joint that is held in place by its lugs that rest upon a second elevator or clamp. A common technique is to use either a clamp-type alignment tool or tabs welded onto the lower casing to guide the upper casing or screen joint into place. After the two joints are butt-welded together, the lugs on the lower joint are removed and the string is lowered into the borehole. This procedure is repeated for each joint until all of the casing and screen is installed.

Casing and screen installation is a time consuming operation. A study by one contractor showed that the added cost to install plain end casing and screen ranged from $3 to $5 per foot of casing and screen, depending upon diameter.

Aside from the additional labor and installation time, plain end connections also require careful monitoring and precise handling to avoid problems with the well's straightness. This is because as each joint of casing and well screen is welded into place, the beveled edges of the two joints must be carefully matched so that a proper weld can be made. Small incremental offsets and/or vertical deviations can cumulatively result in a poorly assembled string.

In a worst-case scenario, if it became necessary to remove any casing or well screen from the borehole during installation, the contractor would have to re-attach lugs to each joint to accommodate the elevators. Then each connection would be cut with a torch. Before the joints could be reconnected and installed, the ends should be machined to restore the smooth beveled or square ends.

Welding Collars. A welding collar is a 4- to 6-inch wide steel end fitting that is attached at the factory to one end of each joint of blank casing, louvered screen, or CWW screen. Welding collars, as supplied by Roscoe Moss Company, are manufactured from the same type and thickness of steel as the casing and screen. A properly welded connection using a collar is as strong or stronger than the casing. Each collar has three alignment holes positioned 120° apart and located at the midpoint of the collar. During construction the alignment holes are used to visually verify that the plain end of each joint is properly seated in the collar before it is lap welded. Welding collars eliminate the need to attach lugs, speed up installation, and enhance the contractor's ability to align each joint at the connection. Should it be necessary to remove casing or screen from the borehole, the weld(s) can be cut by air arcing without damage to the machined-square connection, and then re-welded on installation.

Summary

Welding collars combine utility and efficacy by 1) promoting faster and easier installation; 2) minimizing alignment problems by more easily squaring the connection between each joint at the weld; and 3) enhancing the strength of connections. These benefits to the designer, contractor, and well owner clearly justify the use of welding collars, particularly on large-diameter wells.

References

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

A Guide to Water Well Casing and Screen Selection, Roscoe Moss Company.

The Engineer's Manual for Water Well Design, 1985, Roscoe Moss Company.