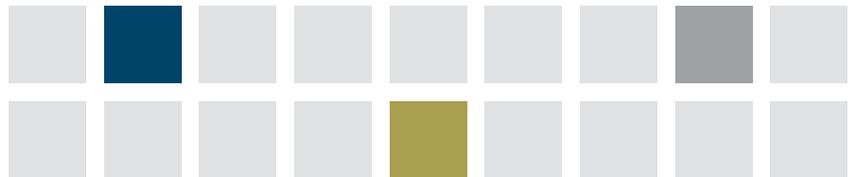


WATERTIGHT MANHOLE JOINTS

TECH NOTES



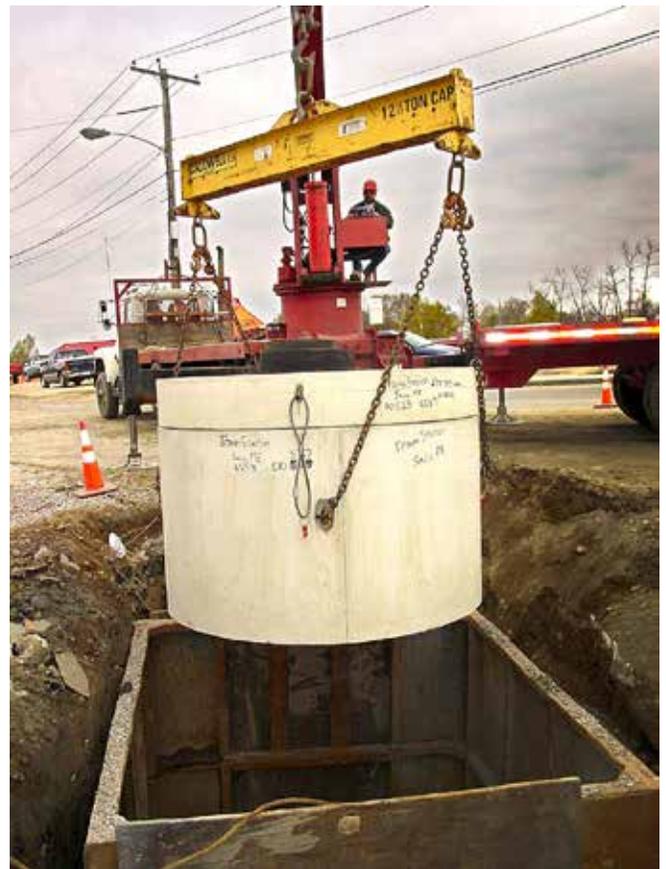
Precast concrete manholes began making their way into underground infrastructure in North America in the early 1970s. Since that time, they have become the preferred product over cast-in-place or brick manholes in most market areas. Precast manholes are easier and faster to construct than alternative methods and they are ready to backfill as soon as they are placed. This saves time and money, and reduces the safety risk of leaving the excavation open for an extended period of time required to construct a manhole on-site. Additionally, precast manholes are superior in quality compared with field-built manholes because they are made under controlled conditions in a plant specifically designed to manufacture precast concrete.

American Society for Testing and Materials (ASTM) C478, "Standard Specification for Precast Manhole Sections," governs the manufacturing and purchasing requirements for the sections that comprise precast manholes (base, riser, reducing cone or flat top sections and grade adjusting rings). The manhole sections vary in diameters from 48 in. to 144 in. The height of each section varies depending on the manufacturer's form equipment and the market area that is served. The sections are typically built with one of several types of off-set joints to prevent shifting of the sections during and after installation.

The need for watertight structures was largely ignored until the early 1980s. A common misconception for wastewater manholes was that watertight structures were needed solely to prevent the exfiltration of wastewater into the surrounding soils. Although this is a concern, the larger problem comes from the cost incurred for treating excess rainwater runoff that enters the systems through leaking manholes or pipes during flooding. In severe cases, infiltration for both sanitary and storm manholes can also lead to the loss of fines in the soils around the structures, creating voids and eventually the loss of pavement support. This can lead to the formation of potholes or even larger sinkholes. To address these concerns, the precast concrete industry developed manhole joints that could be sealed to prevent infiltration, exfiltration or the migration of soil fines through the joint.

DESIGN REQUIREMENTS

There are two different design requirements for manhole joints: soil tight and watertight. When designing a system, the specifier must consider what joint sealing requirements are desired and specify the joint type accordingly. Wastewater manholes should



be designed to prevent all infiltration/exfiltration of the manhole. Consult ASTM C443 for watertight joints. Storm manholes on the other hand should be designed to prevent soils from filtering into the system, but do not typically require complete watertight joints. Consult ASTM C990 for soil-tight joints. When designing a system, consider the distinction between C443 and C990:

- Use C443 "where infiltration or exfiltration is a factor in the design."
- Use C990 when systems "are not intended to operate under internal pressure, or are not subject to infiltration or exfiltration limits."
- Additionally, C990 states that "for precast concrete manhole sections and other vertical structures which are subject to internal or external pressure, infiltration or exfiltration limits are not prohibited from being specified."

It is important to note that testing of the joint has been performed and proven to withstand requirements for a watertight joint under C443, tested to a hydrostatic pressure of 13 psi held for 10 minutes with zero leaks.

JOINT TYPES

There are three basic joint types of round manhole sections: tongue and groove; confined groove (O-ring); and single offset. Regardless of the type of gasket used, it is important to properly equalize the gaskets prior to use.

TONGUE AND GROOVE JOINT (ASTM C990 and AASHTO M198)

This joint consists of a tongue and groove with no offsets or defining areas for gasket material placement. It is limited to a mastic or butyl seal, typically in rope form. When installed properly it has been proven to pass stringent hydrostatic and vacuum testing procedures. It is typically used for stormwater manholes where a soil-tight joint is desired, but in some areas it is also used for wastewater applications. Performance testing of this joint proves to withstand requirements for a watertight joint in accordance with ASTM C443: hydrostatic pressures of 13 psi held for 10 minutes with zero leaks.

CONFINED GROOVE JOINT (ASTM C443 and ASTM C-361)

This is the first “rubber gasket” joint established by the industry. The spigot end of the pipe contains a confined groove for seating of the gasket. It is typically called out as an “O-ring” joint, but it should be noted that it can also be used with various types of profile gaskets. Although this is a proven joint design, the confined groove tends to be more high maintenance compared to a single offset joint because of additional pieces involved with the equipment header that forms the spigot end of the manhole section. The header contains a snap ring that forms the confined area where the gasket seats. These snap rings can be troublesome for the precaster and can reduce efficiency due to the time involved with setting up the equipment. It also increases the need for patching of the joint from damage caused by the snap ring when removing the joint casting equipment.

SINGLE OFF-SET JOINT (ASTM C-443)

This joint design started making its appearance in the early 1990’s. It quickly became popular for vertical manhole installations and is considered a cleaner, more user-friendly application because it requires less lubrication than an O-ring joint. There are many different shapes and styles of profile gaskets available including pre-lubricated closed-cell gaskets that allow for a completely lube free installation.



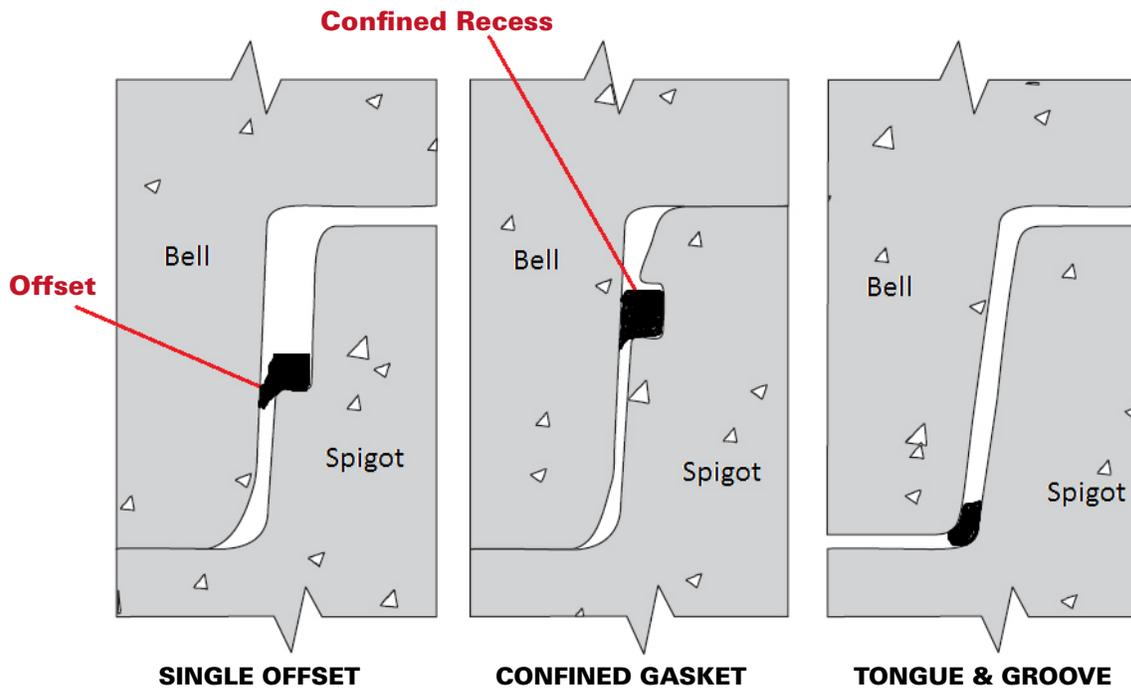
Tongue and groove joint



Confined groove joint



Single offset joint



REPAIRS

If a leak is discovered after installation, the first place to check is the joint. It is important to know that leaks can be sealed even after the manhole has been installed. There are several ways to seal a leak, but the methods will vary depending on whether the backfill is in place around the outside of the structure. The procedure is much easier if done prior to backfill which is why testing of the manhole is recommended before backfilling in most cases.

CONCLUSION

The focus on minimizing exfiltration and infiltration on stormwater structures has increased dramatically in recent years. Building long-lasting sustainable infrastructure is important not only to the surrounding environment, but also saves valuable tax dollars from being spent on maintenance and repairs. Precast concrete manhole sections, sealants and gaskets, lids and bases are assembled to form a system. A system is only as strong as its weakest link. Joints on any structure (including manholes) can be a potential weakness. That is why manufacturers, installers and QC inspectors should ensure that joints are well-constructed, the structure is properly installed, and the proper gaskets and sealants are installed according to manufacturer's recommendations. Future generations will be thankful for our diligence.

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