



BEST PRACTICES:

Watertight Risers for Onsite Wastewater Tanks



NPCA

National Precast Concrete Association



NPCA file photo

Installed properly and in accordance with the manufacturer's recommendations, a product's integrity and structure improve performance and safety.

In the septic tank manufacturing industry, the tank often is viewed as the heart of the onsite wastewater treatment system.

A strong, durable, watertight precast concrete septic tank provides reliable and efficient initial treatment before transferring the effluent to the next stage of the treatment process. The tank undoubtedly anchors the system. However, the tank's auxiliary features – including the risers – also are major contributors to the system's success, and they play an unassuming role in achieving and maintaining watertightness.

RISERS' ROLES

Precast concrete septic tanks may be buried at a variety of depths. The depth of bury depends on the system's geographical location, the local water table height, surrounding soil conditions and other factors.

Risers are used to provide at-grade access to buried structures for inspections and maintenance, and they extend from the septic tank's top slab up to the ground surface or within a few inches thereof. Although risers appear to be a simple means of ingress to take care of a dirty job, they play a critical role in the function and watertightness of the tank.

WATERTIGHTNESS

Septic tanks are required to be watertight to prevent wastewater from seeping out of the tank and contaminating the surrounding environment while also preventing groundwater from seeping into the tank and disrupting the treatment environment.

"It's a mark of quality of the product," said Jeff Hoffman, owner of Flemington Precast & Supply of Flemington, N.J., and 45-year veteran of the precast concrete industry. "It means there's no infiltration of

groundwater into the tank and no exfiltration of effluent or sewage that can get out of it. It's keeping groundwater safe and unpolluted by septic effluent water."

FIVE COMPONENTS THAT AFFECT WATERTIGHTNESS

There are five critical components that affect the watertightness of any buried structure:

- **The material of which the structure is manufactured.**
- **The design of the structure.**
- **The structure's installation.**
- **The structure's joints and any other areas where the material is discontinuous.**
- **Backfill procedures.**

Not only do all five of these components apply to septic tanks, but they also apply to the risers.

COMPONENT 1: RISER MATERIAL

Septic tank risers typically are made of precast concrete or plastic. Precast concrete risers often are used with precast concrete tanks. However, most precast tanks can accommodate plastic risers, too. No matter the material, septic tank risers always should be manufactured in accordance with a strict quality control/quality assurance program.

Manufacturing risers with strong, dense and durable materials is the first key to ensuring a watertight riser system. Precast concrete risers should be manufactured using the same high-quality concrete that is used to make precast concrete septic tanks.

"Make your risers as good as your tanks," Hoffman said.

The mix design for precast risers should be proportioned in

accordance with the following American Concrete Institute (ACI) publications:

- **ACI 211.1**, “Practice for Selecting Proportions for Structural Lightweight Concrete” for traditional wet-cast concrete.
- **ACI 211.3**, “Practice for Selecting Proportions for No-Slump Concrete” for dry-cast or zero-slump concrete.
- **ACI 237**, “Self-Consolidating Concrete” for self-consolidating (SCC) concrete.

Riser mix designs must have a water-to-cementitious materials ratio (w/cm) of 0.48 or lower. Risers that will be exposed to freezing shall have a w/cm of 0.45 or lower. Additionally, the concrete’s minimum compressive strength must be at least 4,000 psi at 28 days or the age specified by design, and the riser sections must be cast and cured in a carefully controlled environment. Also consider using supplementary cementitious materials (SCMs) to improve density.

All of these factors contribute to making strong, dense, durable and watertight risers.

COMPONENT 2: RISER DESIGN

Engineering design primarily is based on the design element’s intended use during service. Materials, products and structures are designed with capacities based on the anticipated application and use, expected occupancy, predicted wear and repetition, climate and service life.

The same is true of risers.

Appropriate for their intended use

It is imperative that only structures designed to function as risers are used as risers, and they must be appropriate for their intended use. There is no shortage of stories about unique, homemade risers that inspectors and regulators have come across in the field.

“We have seen some guys use pipe as a riser,” Hoffman said. “It’s not designed to be used vertically. Some inspectors don’t know you can’t use it.”

Products designed to be installed horizontally, including various types of pipe, shall not be used as risers. Doing so poses a significant risk to the integrity of the risers and the onsite system, as well as to the health and safety of those nearby.

Additionally, some risers are specifically designed to withstand freeze-thaw cycles. Others require some simple yet important steps before the risers can be used in areas where freezing is expected. This may include removing certain components to allow for material expansion and contraction throughout the seasons. Review the riser supplier’s instructions for any precautions.

Able to withstand the anticipated loads

Risers usually are round but also may be square or rectangular depending on the application and tank access needs. They must be designed to withstand the load of subsequent riser sections, applied loads and surcharge loads at the ground surface, and lateral loads from soil and groundwater.

“There are different risers for different applications,” said Michael Kistner, a 45-year veteran of the precast concrete industry and vice president of Kistner Concrete Products of Lockport, N.Y. “There are light duty, non-traffic-rated residential septic tank risers all the way up to heavy duty commercial risers.”

Be sure to supply appropriate risers for traffic-rated tanks.

Many manufacturers’ warranties are void if the product is used in a way other than the scenario for which it was designed. Always consult

the riser manufacturer for guidance on proper use and applications for each type of riser.

COMPONENT 3: RISER JOINTS AND PENETRATIONS

Any area of material discontinuity, including joints and penetrations, could become an opportunity for a leak if not properly addressed. Similar to how exterior doors use weather stripping to prevent moisture and air infiltration and engines rely on gaskets to keep oil, fuel and coolant in their required locations, precast concrete onsite wastewater structures use preformed flexible joint sealants to create strong, watertight seals.

Proper preparation of riser joints begins at the precast plant when the tank’s top slab or top section is cast. Whenever possible, the riser’s base section should be cast into the tank’s top slab (for top-seam tanks) or top section (for mid-seam or multi-segment tanks). This creates continuity between the tank and the first riser section and reduces the potential for discontinuity and leakage. When using plastic risers with concrete tanks, make sure the riser lid is positioned on the riser during casting to prevent the riser section from deforming under the weight of the surrounding fresh concrete.

In many cases, however, the riser’s base section is not cast into the lid or top section of tank. Rather, it is installed later on the job site. In this case, the joint between the tank and the first riser section is a key opportunity to ensure a watertight seal.

No matter the riser material and joint configuration, proper joint sealant application is imperative. Always use joint sealant that complies with ASTM C990, “Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.” Check out the recent NPCA article, titled “Best Practices for Preformed Flexible Joint Sealant,” for a detailed discussion on the topic of sealants, joints, and rigid vs. flexible connections.

“We need to keep the groundwater out,” Hoffman said. “If you have groundwater going into the tank and out to the drain field, that infiltration could overload the septic system which was designed for a certain capacity.”

In addition to using preformed flexible joint sealant, consider taking extra precautions in areas with a high water table where the risers are routinely exposed to hydrostatic pressure and in regions with sandy soil, as sand particles could compromise a joint seal if the joint surface and sealant are not properly prepared. In some cases, an external joint wrap may be recommended.

“The concrete is watertight,” Kistner said. “If you see infiltration in the risers, it’s because they were improperly installed or sealed.”

COMPONENT 4: RISER INSTALLATION

The installation of a product or structure is the make-or-break point of any project. If it’s not installed properly and in accordance with the manufacturer’s recommendations, the product’s integrity or structure can be compromised and threaten its performance and safety.

It is the riser manufacturer’s responsibility to provide detailed installation instructions, and it is the installer’s responsibility to follow the instructions. Sometimes – particularly in the case of precast risers – the riser supplier also may be the installer.

“Install the risers per the instructions provided by the riser manufacturer,” Kistner said.

What may seem like a routine task for the installers who assemble thousands of riser sections annually is still an integral component of a watertight treatment system and should be treated as such. If you install the risers, be sure all the necessary equipment and tools are on-hand before getting started. This includes the correct type and quantity

of screws for plastic risers and a sufficient supply of preformed flexible joint sealant. If you supply the risers with the tank shipment, consider providing a material checklist along with the installation instructions.

“The installation may seem obvious, but we provide the information anyway,” said Kistner, whose company only supplies precast concrete risers. “We provide a manual and literally show them, tell them and document how to do it. We’ll also have the contractor sign off saying he received the installation documentation during the delivery. It eliminates a lot of problems.”

Installation of the first riser sets the tone for the subsequent riser sections.

“The riser should be centered over the opening in the top of the tank, and the sealant has to be mounted right,” Hoffman said.

There should be equal spacing around the entire riser perimeter, and the riser must be level. Inconsistent spacing or an uneven riser could cause gaps or insufficient seals.

For plastic risers, make sure every screw is used to secure the connection and help achieve a watertight seal. Most suppliers recommend tightening the screws in an alternating or star-shaped pattern – just like lug nuts on a car tire – to ensure even tightening and a smooth seal.

For precast risers, the most important factor during installation is proper sealant application from one riser section to the next to create a strong, watertight seal.

“Make sure the installation is properly executed,” Kistner said. “The installation is critical.”

Before applying the sealant, the joint surfaces should be clean, dry and free of debris. Apply the sealant as close to the center of the joint as possible to ensure the sealant remains within the confines of the joint when it is compressed. Joint sealant that is allowed to squeeze out of the joints could compromise the seal.

COMPONENT 5: BACKFILLING

Backfilling is an important final step to ensure watertight risers and a watertight treatment system. In addition to filling the excavation, the backfill material can provide support to the buried structure. The greatest concern at this stage is that the risers could shift under the force of the incoming fill or that they could be knocked out of position with a backhoe.

Be sure to use only approved or specified soils for backfilling. The material should be free from large rocks, stones and other items that could cause unintended point loads on the buried structure.

“Be very careful not to hit the riser with the backhoe bucket when you backfill,” Hoffman said. “Don’t cause the riser to shift, especially if it’s already been vacuum tested. It’s best to do the backfill in lifts and give it a little bit of compaction as you’re going up.”

Kistner agreed.

“Fill the excavation evenly around the structure to avoid eccentrically loading the risers,” he said. “Use proper backfill material, and backfill in lifts as recommended by local regulations, and you won’t have a problem disturbing a riser joint.”

WATERTIGHTNESS AT ANY DEPTH

In many aspects, the septic tank is the nucleus of the onsite wastewater treatment system with so much of the treatment and continuous workings of the system depending solely on the tank.

However, many other tank components, such as the risers, can bolster – or hinder – the system’s watertightness. Optimize each system’s watertightness, and each tank’s watertightness, by focusing on these key components to ensuring watertight risers.

