



Benefits of pre-cast pump base plate and foundation systems

Polymer concrete technology provides improved reliability and lower cost in harsh industrial environments.

Installing and maintaining pump foundations and base plates have always posed challenges to plant maintenance and construction personnel in the demanding pulp and paper mill environment. The challenges increase when dealing with corrosion damage to metal base plates and repairing corrosion damage to the concrete matrix of pump foundations while preventing future damage.

Conventional pump installations typically consist of a steel reinforced concrete block foundation with an anchor bolted and grouted metal pump base plate. The base plate is drilled and tapped to accept the pump, motor, and accessories. Pump and motor mounting surfaces are typically machined at the factory to a flatness of at least 5 mils/ft. This facilitates pump and motor alignment and improves the reliability of the installation.

One drawback of metal base plates and even non-metallic base plates is the possibility of warping the base plate during installation onto the concrete foundation. Warping can make proper alignment impossible due to "soft foot," bolt binding, or both. These can be sufficiently severe to require costly and lengthy field machining to return the base plate to the required specifications. Proper void-free grouting of the base plate is also difficult, time-consuming, and costly. If done incorrectly, it can adversely affect future reliability of the pump installation.

For pumps in corrosive environments, incidental flange leaks and pump seal leaks expose the concrete foundation and the base plate to harsh chemical attack. In time, this corrosion destabilizes the foundation, base plate, or both. This then causes increased vibration in the pump and motor supported by the system.

BENEFITS OF POLYMER CONCRETE MATERIAL

A better option for a pump support system takes advantage of the unique properties of polymer concrete. Specific inert aggregates

blended into thermosetting resins such as epoxy or vinyl ester produce rigid materials with high compressive, flexural, and tensile strengths, after proper curing. These materials have inherent resistance to a wide range of corrosive materials. This unique material is prepared, poured into precision molds, and cured under controlled conditions to produce a pump support system with consistent properties. To minimize cost and weight and increase rigidity,

the device is pre-cast as a hollow box. Dimensions are typically a 1.5-in. wall thickness and wall heights up to 24 in. or more. During installation, workers pour standard concrete into a fill hole in the top wall.

Because properly formulated polymer concrete exhibits very little shrinkage during the curing

process, a pump foundation can be pre-cast with metal mounting pads or threaded alloy inserts set at precise locations. This allows workers to mount the pump, motor, and accessories directly to the foundation. In this way, the pre-cast box becomes not only the foundation for the pump but also the base plate, fabricated as a single unit.

For pumps that handle corrosive materials, polymer concrete allows fabrication of a variety of base plate and foundation combinations using minimal quantities of expensive metal alloys supported in and bonded to the polymer concrete shell. This design eliminates the need for acid brick or coatings typically used to acid-proof conventional pump installations in corrosive service.

RAPID TURNAROUND

Use of pre-cast base plate and foundation combination units to install a totally new pump installation or to repair or upgrade an existing installation can save time. Traditional foundation repair is a complex, multi-step process that is lengthy and expensive. It often involves considerable downtime for the equipment. This repair process also requires a high



A pre-cast pump support system and pump.



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degree of skilled labor to install the base plate properly and fill it with grout without warping the base plate or incorporating voids into the grout. Improperly installed or grouted base plates can compromise equipment reliability and cause future costly maintenance and more downtime. If the concrete foundation requires acid proofing, the mill expends additional time and money. Acid proofing failure is very common, since effectively sealing the interface between the steel base plate and the concrete foundation is difficult.

A better, faster, and less risky solution uses the pre-cast base plate and foundation. The existing pump, motor, and base plate are removed, and the existing concrete foundation is only partially demolished. Only sufficient concrete is removed to expose existing rebar while removing any unsound concrete. Workers then lower the pre-cast base plate and foundation shell over the existing prepared concrete foundation. They bolt the pump to the top of the pre-cast unit and place shims under the bottom edges of the pre-cast unit to help leveling and ensure matching of the suction and discharge piping to the pump flanges. If necessary, the unit can be field trimmed using a diamond blade and hand-held worm gear drive saw.

Next, workers fill the space between the inside wall of the pre-cast unit and the old concrete foundation through the fill hole using standard concrete mix. After cure (usually overnight), they seal the fill hole with a pre-cast plug. The motor and accessories are then attached to the pre-cast unit, and the pump returned to service. This type of repair or upgrade is usually complete in one or two days, depending on site conditions. By contrast, a conventional repair or upgrade can take a week or longer to complete.

Pre-cast base plate and foundation technology eliminates the need for concrete forms, anchor bolts, epoxy grout, and the associated time and labor. The inherently rigid nature of pre-cast units prevents warping and soft foot issues. This reduces the risk of a reliability compromised repair or upgrade installation or the need for field machining.

NEW CONSTRUCTION-LOWER TOTAL INSTALLED COST

When using the pre-cast base plate and foundation device for new construction, pump vendors take delivery of the pre-cast units and then mount and align the equipment to the pre-cast units at the factory. They deliver the complete pump packages to the construction site. Installation consists of doweling in a steel rebar

cage into the concrete slab or footing as normally done when forming and pouring conventional concrete foundations. Workers then place the pre-cast unit over the rebar cage, level it, and fill it with standard concrete. Removing the pump and motor from the device during installation is unnecessary. This installation typically requires only a few hours to complete, uses lower skilled labor, and saves valuable construction time during plant upgrades. After maintenance workers complete a final alignment check, the finished installation is ready for service. Due to the rigid nature of the device, realignment is often unnecessary.

Changing to a different sized motor for a given pump becomes a mere change-out of the pre-cast motor block that is bolted to the shell of the pre-cast base plate and foundation unit. Motor adjusting devices are incorporated into the shell adjacent to the single piece motor block, and move the entire motor block instead of the motor feet themselves. This facilitates alignment and virtually eliminates bolt binding. Polymer concrete also allows mills



New installation of a pre-cast polymer pump base.

to incorporate cast-in drip catch basins with integral drain fittings at the pump end of the pre-cast unit to collect leaks and pipe them to a collection basin or trench.

VIBRATION SIGNATURE TESTING

Mill workers commonly use vibration signature testing on rotating equipment to diagnose and predict pending failures with pump and motor operation. Workers typically report readings as velocity amplitudes in inches per second at various frequencies. Generally accepted thinking suggests that lower velocity amplitudes on a vibration signature for a given pump system mean the equipment will operate longer before maintenance is necessary.

Vibration signatures observed on pumps mounted to pre-cast base plate and foundation units indicate that these units act like vibration dampeners for rotating equipment. Mills must still properly execute pump and motor alignment, remove pipe strain, and properly size the pump for service or the signatures will be unacceptable.

Polymer concrete technology can provide dimensionally stable, corrosion resistant, pre-cast base plate and foundation systems that lower total installed cost and improve rotating equipment reliability. Over time, these new designs may contribute significantly toward eclipsing conventional pump support systems in the pulp and paper industry. **SI**