

Types of Concrete Vibrators – What You Need to Know

By Rob Beiersdorfer

The most widely used concrete consolidation method is vibration. It consists of subjecting freshly placed concrete to rapid frequency impulses that liquefy the mix, and drastically reduce the internal friction between aggregate particles. This enables the concrete to be consolidated tightly and packed in the form around the contained rebar structure.

There are two basic categories of concrete vibrators: internal and external. Both of these categories can be subdivided into individual types of vibrators for specific applications.



Internal Concrete Vibrators

Internal vibrators induce oscillations into the concrete via a vibrating head that is inserted directly into the concrete. This type of vibrator produces movement from a rotating, offset weight contained within the cylindrical head. The effective area of the vibrating head is determined by the frequency and amplitude of the induced force. This force can be greatly influenced by the operator's placement of the head (both angle and depth) within the form-contained concrete. Typically, the area of influence around the head is a 1-ft to 2-ft radius.

The most common type of internal vibrator is an external motor shaft style. These are commonly referred to as stick vibrators. This style of vibrator produces vibration via rotating shaft that is contained/protected by an exterior protective shaft cover and is connected to an offset weight contained within the vibrating head. The shaft can be rigid or flexible and can be supplied in lengths from 1-ft to 8-ft. The external motor is typically powered with 120 or 240V single phase electric, but can also be powered pneumatically or via an internal combustion engine. This type of vibrator is very versatile and can be easily moved around a job site to accommodate many different vibration applications.

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A similar, but less used, internal vibrator is the motor-in-head shaft style. This type of vibrator produces vibration similar to the external motor shaft style, but delivers the required energy to the internal head motor via a shaft contained power source. The power is typically 120 or 240V single phase electric, but in some cases can be pneumatic.

Both of these styles of vibrators require concise, repeatable operator action in order to be successful. The operator is required to insert and remove the vibrating head in a way that ensures overlapping areas of vibrating influence. Larger heads produce larger force input into the concrete and therefore require fewer operator insertions. Lower slump concrete contains less water and requires higher vibration force levels to ensure liquification of the mix, so, a larger head size is needed. Conversely, high-flow concrete (SCC) uses smaller head vibrators to ensure proper flow and consolidation.

External Concrete Vibrators

An alternative to internal vibration is external vibrators. These provide surface finishes and compaction levels not possible with internal vibrators. External vibrators produce vibratory force from rotating, offset weight set(s) contained within the vibrator housing. The effective area of the vibration is determined by the frequency/amplitude of the induced force, coupled with how rigid the mount brackets are on the form walls. These brackets enable a very efficient transfer of force from the form walls into the contained concrete. When sized and mounted correctly, external vibrators typically produce a 5-ft wide by 2-ft deep area of vibration influence. External vibrators are mounted to the outside of the form in predetermined locations. These locations, along with scientifically determined operational frequencies and durations, provide consistent, repeatable results. External vibrators remove the variable of operator skill level that is needed with internal vibrators.

External vibrators transmit the vibration on to the wall of the form. This energy is then transmitted to the contained concrete. Often, external vibrators are used when it becomes difficult or impossible to insert stick vibrators into a form. This can be due to internal or external obstructions, such as an over abundance of rebar, or some other complicated form work. External vibrators are also used – in fact, required – when a superior surface finish is needed.

There are two basic types of external form vibrators: permanently mounted (bolt-on) and moveable (quick-change bracket). Three types of power source can be used: pneumatic and electric are the most common, but hydraulic is also an option. Pneumatic vibrators are higher frequency vibrators used primarily for surface finish. Electric vibrators, being the most easily adjusted via weight change or VFD controls, can be used for surface finish or consolidation due to their ability to produce a consistent high or low speed depending on the use. Hydraulic units are considered to be a low speed, compaction only type vibrator.

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The force produced from a form mounted vibrator is effective in two ways: first, the force produced is perpendicular to the form face which provides superior surface finishes. This is best done with higher RPM vibrators.

Second, is the faster, better compaction that is provided by a sinusoidal wave of vibration energy that is induced into the concrete in larger stroke/lower RPM vibrators. Lower slump concrete or heavily reinforced forms require higher force energy, while free-flowing concrete and less complicated forms require less energy.

Permanently mounted (foot mount) vibrators are bolted on and not removed from a form during or in between uses. They are best suited for repeated high volume use in the precast industry. The primary benefit they offer is the consistent repeatability of finished product quality. Once the proper mount location and operating duration have been determined, it becomes very simple to consistently produce exactly the same products. Simply put, external, permanently mounted vibrators provide an effective consistent method of consolidating and yielding superior surface finish concrete components.

Moveable form vibrators (quick-change, cradle-mounted wedge) are easily moved during the pour and from form to form between uses. They are ideally suited for the constantly changing product orders in the precast industry. Not only do they provide consistent repeatability of product quality, but, because they can be easily moved down the form (requiring fewer vibrators), they also allow for a significant cost savings. Once the proper location for a permanently installed cradle bracket and optimization of operation has been determined, it becomes very simple to consistently produce the same quality of product. External, moveable form vibrators provide an effective, consistent method of consolidating and yielding superior surface finish concrete components while at the same time enabling a cost-effective alternative to permanently mounted form vibrators.

Once the complete optimization of location and operation has been completed, external form vibrators offer consistent repeatability, remove operator error, reduce labor cost, and are a cost effective alternative to internal vibrators.

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Thanks for reading our post. If you'd like to learn more about concrete vibrators and finishing equipment, please contact one of our Vibration Specialists at **+215-333-5600** or at **infocenter@airmatic.com**.