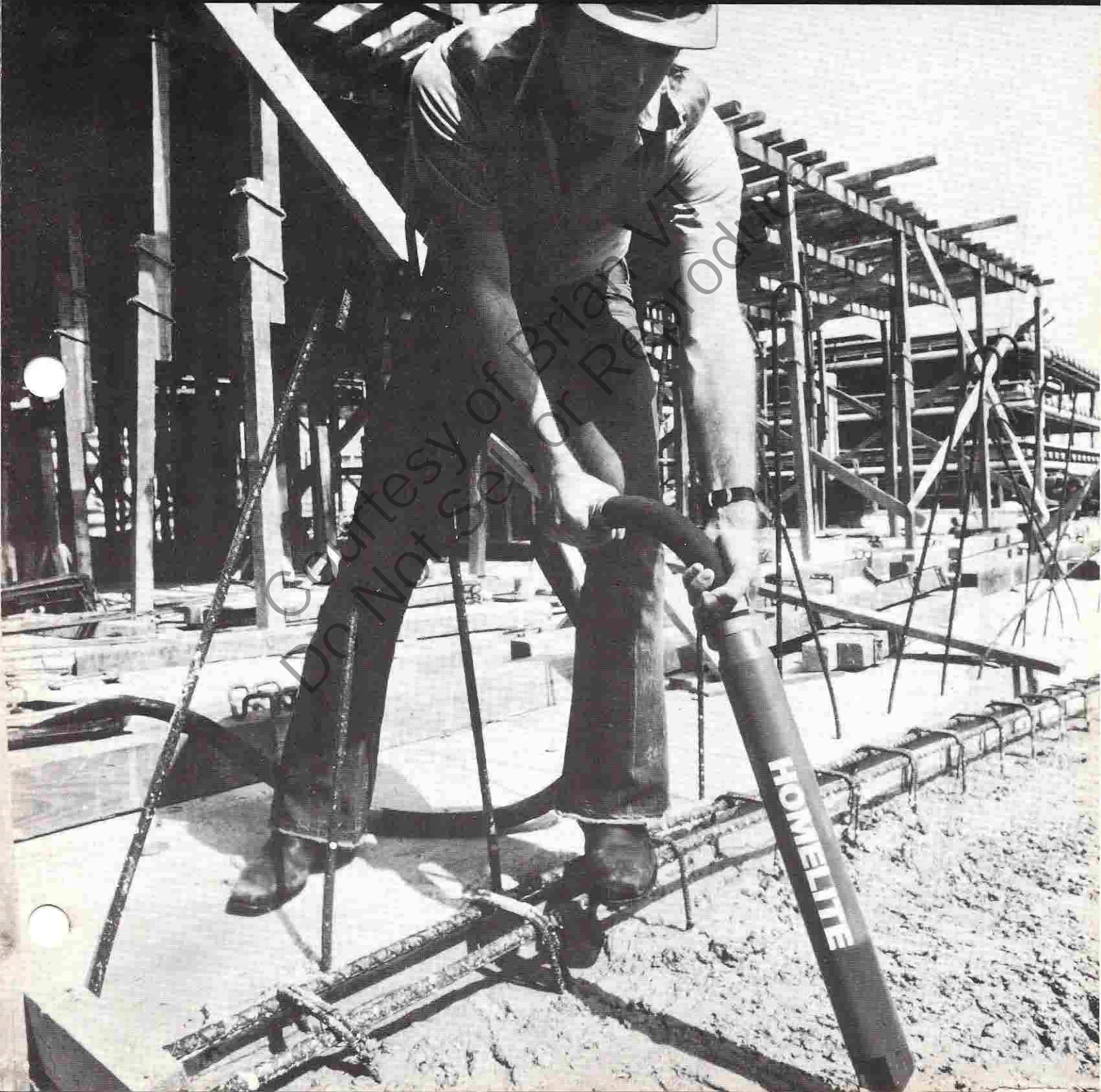


HOMELITE®

VIBRATOR BASICS



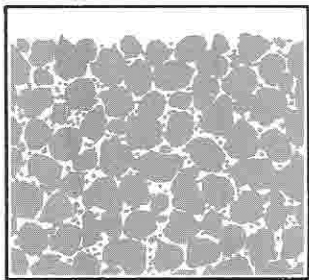
A little history

When European builders first attempted to use poured concrete as a building material, in the mid-nineteenth century, results were usually disappointing. The use of such a material, however, was so attractive that the profession continued to experiment for over eighty years, trying now a dry mix, now a wetter one, with equal lack of success. There simply seemed to be no way to get predictable results with poured concrete, at a practical cost.

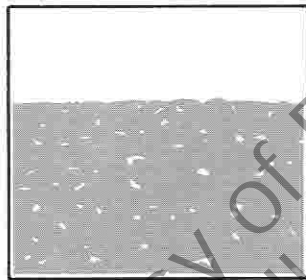
Then in 1927 a Frenchman, one Deniau, was granted a patent on the first vibrator, and the search was over. Other technical developments followed rapidly, and by 1930 most of the major problems had been solved. Concrete vibration was a fact of life.

Concrete vibration. What is it?

When freshly poured concrete is subjected to rapid vibratory impulses, the mortar "liquifies" and internal friction is drastically reduced. The process is called concrete vibration, or concrete consolidation. While in this liquified condition, the concrete settles under the action of gravity and becomes consolidated.



HONEYCOMBING - Mortar fails to fill voids between coarse particles of aggregate. Incomplete consolidation.



AIR VOIDS - Honeycombing eliminated, but concrete still entraps air. Amount trapped is largely dependent on vibratory equipment and procedure.

... and why?

Consolidation achieves several desirable ends.

- It causes the concrete to settle uniformly.
- It reduces air pockets in the concrete.
- It eliminates concrete stratification.
- It improves adhesion to the aggregate.

In very simple terms, vibrating concrete makes it stronger and more durable. It produces the cheapest, strongest concrete that can be obtained.

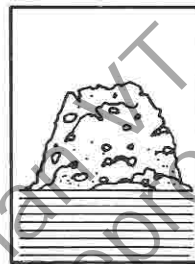
The right concrete for the job.

In general the dryer the concrete mix, the better concrete you will end up with, provided it is vibrated thoroughly. Different jobs require different handling and placing of concrete, and so different degrees of dryness are dictated by working conditions.

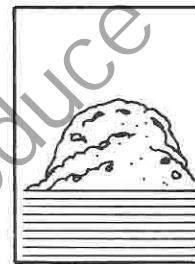
Dry concrete. Suitable for pre-cast work, such as concrete blocks; for hand packing, or a dry pack for ramming.

Medium wet concrete. Suitable for ordinary mass concrete uses: foundations, heavy walls, large arches, piers and abutments.

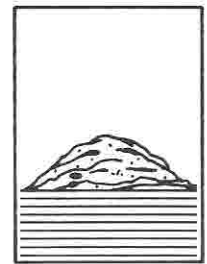
Wet, mushy concrete. Suitable as rubble concrete; and as reinforced concrete for applications such as thin building walls, columns, floors, conduits and tanks. Vibrating a very wet mix causes a watery mud-like layer called "laitance" to form on the surface, which must be removed.



Dry Mixture



Medium Mixture



Mushy Mixture

A **dry concrete** mixture has the consistency of damp earth; a **medium mixture** has a tenacious, jelly-like consistency that shakes on ramming; a **mushy mixture** will settle at a level surface when dumped on a pile and will flow very sluggishly into forms or around reinforcing bars.

Measuring concrete consistency.

The slump test. This is the method most often used. A form shaped as a frustum of a cone is filled with the concrete and immediately removed. The slump is a subsidence of the mass below its height when in the cover. The form has a base of 8" in diameter, a top of 4" in diameter and a height of 12". It is filled in three 4" layers of concrete, each layer being rodded by 25 strokes of $\frac{5}{8}$ " rod, 24" long and bullet shaped at the lower end.

The Kelly Ball test. A test, using the penetration of a half sphere, is also sometimes used. A 1" penetration by the Kelly Ball corresponds to about 2" of slump.

Formwork.

All formwork subject to vibration must be extremely strong.

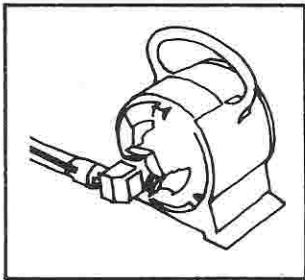
Timber forms. Must be well supported with wedges, and should be constructed with screws, not nails.

Steel forms. Panels must be braced to prevent bulging. Joints must be close fitting to prevent water and cement leakage, which result in honeycombed concrete.

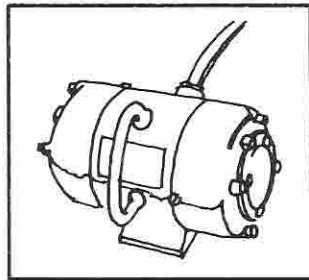
Selecting the right type of vibrator.

There are two types of vibrators: external, clamp-on or surface types; and internal vibrators.

External and surface vibrators.

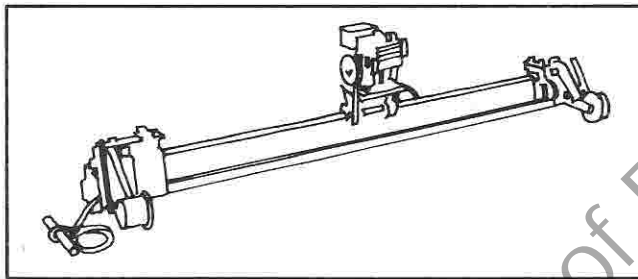


Pneumatic



Electric

External vibration. This means the forms are vibrated, not the concrete itself. External vibration is usually used with steel forms, or in pre-cast work employing smaller molds.

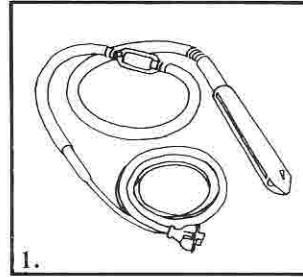


Surface vibration. This calls for mounting a vibrator to a screed, laying it across the surface of the concrete, and vibrating the material from the surface down.

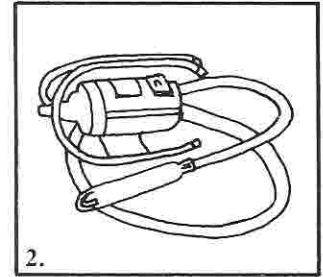
Internal type vibrators.

This is the most commonly used type, and is generally considered the best. Internal vibrators have a vibrating casing or head, which is immersed in, and acts directly against, the concrete. All internal vibrators presently in use are the rotary type. The vibratory impulses emanate at right angles to the head. An internal vibrator should have an adequate radius of action, and it should be capable of "melting down" and deaerating the concrete quickly. It should also be reliable in operation, light in weight, easy to handle and manipulate, resistant to wear, and easy to repair in the field. Finally, it should be capable of being run out of concrete for prolonged periods.

Internal type vibrators are made two ways — with flexible shafts, and with motor-in-head. Both come with several unique characteristics.



1.



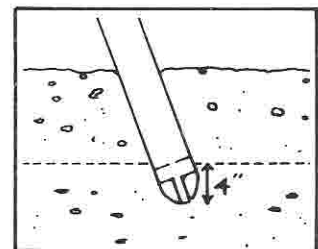
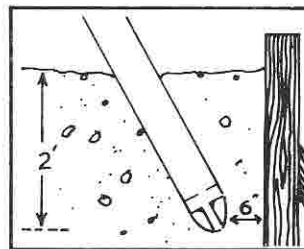
2.

Motor-in-head vibrators. These are the most efficient available, and are increasing in popularity. They're also called high-cycle vibrators, which tell it all. For power and effectiveness they can't be beat.

Flexible shaft vibrators. Often used on jobs where larger vibrators would be too cumbersome. The most widely used type of vibrator. Comes with an electric motor which is not immersed in the concrete; or in an engine-driven type for sites where electric power is not available.

A few pointers in using the internal vibrator.

- Move the vibrator frequently.
- Remove head slowly so the hole it makes fills in behind it.
- With timber forms, make sure vibrator never touches the form where concrete will be exposed. Damaged forms will mar the concrete's surface.
- When a new layer of concrete is poured over a previously poured layer that is still unset, push the vibrator at least four inches into the previous layer to assure uniform consolidation and bonding.
- Do not let the vibrator touch reinforcement bars in semi-set concrete — it can break the bond.
- Do not try to compact a layer of concrete more than two feet thick. Air has to be forced to the surface and internal vibration is inefficient at a depth greater than this.



Glossary

AGGREGATE — Any of several hard inert materials (as sand, gravel, or slag) used for mixing with a cementing material to form concrete, mortar or plaster.

CENTRIFUGAL FORCE — The force which tends to make a rotating body move away from the center of rotation: it is due to inertia.

CONCRETE — A solid material made by mixing various portions of cement, sand, water, and aggregate consisting of broken stones or gravel. The strength of hardened concrete and its resistance to wear depend on the proportions of these materials used and their grades.

CONSOLIDATION — The act of forming into a firm, compact mass or body.

CONTINUOUS SHAFT — A shaft without interruption or break.

DEAERATING — Removing bubbles and minor pockets of air and other superfluous gaseous elements.

ECCENTRIC — A mechanical device consisting of a disk through which a shaft is keyed eccentrically. A circular strap works freely round the rim of the disk, communicating its motion to one end of a rod, whose other end moves in a straight line, so as to produce reciprocating motion.

ECCENTRIC WEIGHT — A weight purposely set on one side of the center line to create an unbalanced condition.

EXTERNAL VIBRATOR — A method of vibrating concrete forms, not the concrete itself. See text.

FREQUENCY — In physics, (a) the number of vibrations or cycles per unit of time; (b) the number of cycles per second of an alternating electric current.

FREQUENCY CONVERTER — A device for transforming electrical energy, as from direct to alternating current.

FRUSTUM — The part of a cone-shaped solid next to the base that is formed by cutting off the top by a plane parallel to the base.

GROUT — Thin mortar used for filling spaces (as the joints in masonry); also: any of various other materials (as a mixture of cement and water or chemicals that solidify) used for a similar purpose.

HIGH-CYCLE GENERATOR — An electric generator with a 180 Hz, 3 phase output.

HONEYCOMBED — Pitted or checked with indentations.

HYDRATION — The process of forming a compound of complex ions formed by the union of water with some other substance.

IMPACT FORCE — The force created by the collision of two bodies.

INDUCTION MOTOR — An alternating-current electric motor in which the rotor has a voltage induced into it by the alternating electric fields of the stator.

KELLY BALL TEST — A test for measuring concrete slump. See text.

LAITANCE — An accumulation of fine particles on the surface of fresh concrete due to an upward movement of water (as when excessive mixing water is used).

RODDED — Concrete strengthened by insertion of metal rods.

RUBBLE — Waterworn or rough broken stones or bricks used in coarse masonry or in filling courses of walls.

SCREED — A leveling device drawn

over freshly poured concrete.

SEGREGATION — The separation of concrete mix components.

SINGLE PHASE — Of or relating to a circuit energized by a single alternating electromotive force.

SLUMP TEST — A test to measure concrete consistency or its ability to flow.

SPUD — A tool or device (as for digging, lifting, or cutting) having the characteristics of a spade and a chisel.

STRATIFICATION — The arrangement of substances in strata or layers, one upon another, like the leaves of a book.

SUBSIDENCE — The act of sinking, falling to the bottom; to settle as lees.

SURFACE TYPE VIBRATOR — A vibrator mounted on a screed, that works from the surface down. See text.

TORQUE — A force that tends to produce rotation or torsion. Also, a measure of the effectiveness of such a force.

TRANSDUCTION — Energy transformed from one form into another.

UNIVERSAL MOTOR — An electric motor that can be used on either an alternating or direct current supply.

UTILITY LINE — The wires provided and owned by a utility company, that carry a utility power supply.

UTILITY POWER SUPPLY — A service (as light, power, or water) provided by a public utility.

VISCOUS — The property of a fluid that lends it resistance to free flow. Viscous flow is numerically determined by the kinematic coefficient of viscosity, or the ratio of viscous resistance to gravitational inertia.

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