Aerix Industries™
Advanced Engineered Foam Solutions

T E C H N I C A L B U L L E T I N

Bulletin # 13-0611- Production Methods and Equipment

Aerix Industries™ cellular concretes are lightweight concretes with a Portland cement base containing many small air cells uniformly distributed throughout the concrete. Simple and precise control of the volume of these air cells, produced mechanically by means of special foaming agents, resulting in a *controlled density* over a broad range from 20 to 120 pounds per cubic foot (320 to 1920 kilograms per cubic meter).

Cellular concrete may also contain fine and/or coarse aggregates, normal or lightweight. This rigid foam differs from conventional aggregate concrete in the methods of production and the more extensive range of uses. It may be either cast-in-place or precast. The microscopic, uniformly dispersed, non-interconnecting air cells result in excellent workability and pumpability of the fresh concrete and provides excellent thermal insulation. They also result in an inherent economy by using low cost air cells in place of all or a portion of expensive and bulky lightweight aggregates. For example, a single 55-gallon (208 liter) drum of concentrated foaming agent may be aerated to produce more than 250 cubic yards (190 cubic meters) of low-density insulating cellular concrete at a dry density of 30 pounds per cubic foot (480 kg per cubic meter).

In addition to the specially formulated foaming agents used for all types of Portland cement cellular concrete, Aerix Industries has developed other special foaming agents for use with other cementitious hydraulic binders such as gypsum plaster, refractory and ceramic cements and inorganic foams. The remainder of this discussion will be confined to cellular concretes using Portland Type cement.

Classification of Cellular Concrete by Density

The quantity of preformed foam or foaming agent that is introduced into a given concrete mixture will govern the density, strength, thermal conductivity and cost of the final product. Therefore, it is possible to choose form a wide range of numerical values by simply varying the quantity of foam being introduced into the mix. Variations in cement content as well as amount and type of sand and other aggregates further extend the possibilities for designing a cellular concrete for almost any end user.

Aerix Industries cellular concretes include Mearlcrete™ Low Density Cellular Concrete (LDCC) made with Mearlcrete foam liquid concentrate. Mearlcrete LDCC is used in UL fire and FM rated roof decks, UL fire rated soundproofing floor fill, leveling fill and precast products. Densities for these applications usually range from 25 to 100 pounds per cubic foot (400 to 1600 kg per cubic meter). LDCC produced with the AQUAERIX™ or AERLITE™ family of foaming agents is used for geotechnical applications such as tunnel backfills, load reducing fills for bridge approaches, replacement of unstable soils, fill for abandoned underground structures and for

shock absorption. Densities usually range from 20 to 60 pounds per cubic foot (320 to 960 kg per cubic meter).

Methods of Mechanical Foaming

In this process, a foam generator is used to produce a predetermined quantity of preformed foam, which is injected into the mixer and blended with the cement slurry. The preformed foam is somewhat similar in appearance to shaving lather. There are two types of foam generating systems now available.

The BATCH SYSTEM comprises of a tank in which the foam liquid concentrate and water are first premixed. This dilute solution is then discharged from either a pressurized tank or by means of a mechanical pump through a foam-making nozzle in which the solution is blended with compressed air in fixed proportions.

The second type is CONTINUOUS GENERATING SYSTEM such as the Autofoam System. This unit continuously draws the concentrate directly from its shipping container, automatically blends it with water and compressed air in fixed proportions, and forms the stable micro-bubbled foam. Both types utilize a foam refining column or nozzle calibrated for foam quality and discharge rate.

The tank type assembly is designed primarily for operations where the foam generator is used intermittently, or where relatively small quantities of foam are required. Though sometimes used for intermittent operations, Autofoam assemblies are more frequently used in conjunction with continuous concrete mixing and placing equipment, where continuous foam delivery is desired, or where the volumes of foam required are so large as to make storage tanks for the dilute solution uneconomic.

In operations where a mortar mixer or other batch mixing equipment is used, water, cement and aggregate (if any) are first mixed to form slurry. A predetermined quantity of foam is then injected into the mixer and thoroughly blended with the slurry. The resulting cellular concrete is discharged and the cycle repeated. Since the proportions of foam, water, cement and fine aggregate can be duplicated with precision for successive batches, quality control can be maintained over the product.

Where continuous equipment is used, both the cement slurry and preformed foam are made simultaneously and blended together automatically at a constant predetermined yet adjustable rate to produce any desired concrete density. Continuous systems are used mostly where the cellular concrete is placed through pumping through pipe or flexible hose. Continuous mixing and placing assemblies are very compact, relatively simple and easy to operate. They are being used for both field and factory operations.

Specially designed batch mixers may also be used in conjunction with surge hopper equipped pumps. If the rates of mixing and pumping are properly adjusted, a continuous flow of cellular concrete can be obtained at the point of placement.

Available Types of Foam Generating Equipment

Laboratory Unit

For product evaluation and trial, Aerix Industries manufactures state-of-the-art, portable, lab foam generators for producing accurate mix design results in the laboratory. The transportable units meet varying production flow of up to three cubic feet per minute of foam. The unit can be removed from its case for easy cleaning.

Pressure Tank Assemblies

Pressure tank units can be sized for any reasonable production rate for use with either continuous or batch mixing system. Pressure tanks are supplied in standard sizes for 30, 80 and 200 gallon (113, 303 and 757 liter) capacity to accommodate the work anticipated. Where continuous use is desired, two tanks may be coupled together in parallel so one may be discharging while the second is being charged with premixed solution. Some assemblies are also supplied with an integral air compressor to provide a self-contained portable unit.

Calibrated Foam Nozzles with either a fixed or variable output and capacities up to 40 cubic feet (1.13m³) per minute are available with these and the following types of foam assemblies. The capacity for any assembly is usually adjusted to the customer's specifications and requirements so that if special conditions should require still larger capacities, they can be readily supplied.

Autofoam Generating Units

Small compact foam generating units which automatically draw the foam liquid concentrate from its shipping container, proportion it with the correct amount of water and compressed air to generate preformed foam are available and adaptable for most general uses. They are, of course, ideal for continuous or large-scale production but can also be adapted for intermittent use where tank units would be considered too bulky or clumsy.

Optional Control Timers

For applications where precise duplication of foam discharge is required for successive batches, electric timers and solenoid valves are available in lieu of manually operated shut off valves. These timers are dustproof, waterproof and accurate to within one-tenth of a second. For convenience they may be equipped with a remote switch for manual start, automatic stop and reset. Timers may be used with any of the above foam generators.

Mix Proportions

Various mixes and related data have been developed for many applications described elsewhere. To permit our making appropriate recommendations, it would be helpful if information is provided on the type of application or product being considered, design requirements, with

regard to structural strength, density range, insulating value and also production cycle limitations.

If modification of existing production is being considered, it would be desirable to include information on materials presently being used, and their mix proportions, the type of mixing equipment being considered or available and a brief description of any existing plant facilities and procedures.

The range of possible applications of cellular concrete, as well as processing variations for producing cellular concrete, is very extensive.