# CRADLE-LOCK® TUBE STAKES

In 1988, Bob Hahn invented and patented the Cradle-Lock® stake as a means to efficiently and cost-effectively eliminate the problem of excessive support plate spacing. Older condensers have support plate spacing adequate for the copper-based tubes (prior to 1977 there were no Heat Exchanger Institute [HEI] standards for support plate spacing). With the trend toward installing the newer, lighter (and to maintain heat transfer coefficients, thinner-walled) specialty stainlesses and titanium tube materials, partial support plates or other methods had to be employed to prevent these new, thinner-walled tubes from vibrating. Not only was this costly and time-consuming, many times the intermediate support plates were misaligned and caused difficulty installing the new condenser tubes.

Since first installed in November of 1988, Day & Zimmermann's Cradle-Lock stakes have been installed in over 300 operating condensers and heat exchangers worldwide. There has not been one reported tube failure as a result of vibration where our stakes have been installed. Cradle-Lock stakes have been accepted as the industry's standard for vibration resolution in both nuclear and fossil plants throughout the world. Our patented designs, including those for straight, back-to-back, and spring stakes, allow us to eliminate tube vibration in condensers of *ALL* makes and sizes, regardless of the tubesheet layout.

Their state-of-the-art designs overcome many of the installation and operational disadvantages of conventional stakes. Cradle-Lock stakes are easier to install in that they virtually eliminate the necessity of wiring, bolting, or other means of securing the stakes together. All of Day & Zimmermann's Cradle-Lock stakes are ***customer-engineered*** for your condenser's actual tube material, size, pitch and support plate spacing. Before manufacture of the stakes, we fabricate a test tube bundle that duplicates as closely as possible the actual conditions present in your condenser. Sample bars of various thicknesses and lengths will be installed into the test bundle to arrive at the dimple-to-dimple dimensions and exact quantities best suited for your conditions. Once these dimensions are obtained, tube stakes will be designed and fabricated. Most of the time, the stakes are fabricated of 304 stainless steel (safety edged with a 2B finish). All edges are deburred after forming.

Unlike a flattened piece of tubing or other flat bar that creates only point contact, the spring action of the "V" design, coupled with the indentations (dimples), of our Cradle-Lock stake, when installed, locks the stakes and the tubes into a single vibration-free unit. Contact area between the stake and each tube is increased by hundreds of times (conventional stakes offer only point of contact and allow the tube to move up and down its length - ours "cradles" the tube throughout the surface area of each indentation). Cradle-Lock stakes will not shift over long periods of full capacity operation, as conventional stakes tend to do, thereby reducing maintenance.

Day & Zimmermann has been involved on projects where tube damage as a result of vibration has been detected on units where flat stakes have been installed. When these stakes were removed and replaced with Cradle-Lock, vibration was eliminated. While plastic stakes experienced only limited usage, we have found that they melted (primarily in the area of steam dumps where temperatures often times exceed 300 degrees) and offered no protection against vibration (our first order for Cradle-Lock was for a unit where this actually occurred). It has also been discovered that the plastic stakes become brittle over an extended period of use, and can completely disintegrate.

Installation of our stakes is facilitated with the use of a spreader bar temporarily inserted between the tubes. The rod serves to open the lane while the stake is being inserted, thus preventing the stakes from "locking up" when being inserted into the bundle.