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Well Service Coiled Tubing Units Vs. Drilling Rigs

This is the first quarterly update on the rapidly advancing coiled tubing (CT) industry by representatives from ICoTA (International Coiled Tubing Association).

A well servicing coiled tubing (CT) unit, like a workover rig, is designed for quick mobilization and relatively short-duration service jobs. The speed of the CT unit provides a competitive advantage over a conventional workover or snubbing unit. In most drilling operations, mobilization speed is less important because drilling operations are usually longer than workover operations. The competitive advantage of a CT drilling rig comes from increased capabilities, and improved safety and environmental conditions. A purpose-built CT drilling unit should emphasize the advantages of slimhole and CT drilling, and de-emphasize speed of mobilization.

"Hybrid" CT drilling units are built for continuous and jointed pipe drilling operations by combining a CT unit with a mast or a snubbing system for jointed pipe handling. These units are a step toward a purpose-built CT drilling unit, adding functionality while eliminating the cost of mobilizing more equipment. However, these systems are not fully integrated since one portion of the system (CT injector head) moves continuous pipe and another (drawworks, snubbing or casing jack) moves jointed pipe.

A modular, fully integrated, purpose-built CT and slimhole drilling system is being built by Baker Hughes INTEQ (Fig. 1). Some features of the system include:

- An injector similar to a typical CT injector that can move both jointed and continuous pipe, handle up to 7⅝-in. casing, pull up to 100,000 lb and have a bottomhole assembly (BHA) deployed through it.
- A backup casing jack for loads greater than 100,000 lb.
- Injector under the drill floor, and pipe handling equipment and tongs on the drill floor.
- A large-radius (15-ft) guide-arch system to minimize CT fatigue.

High-Strength Coiled Tubing

The growth of the CT industry during the last several years is largely attributable to the improved quality of materials and manufacturing techniques of the CT itself. As the success of new applications in the workover and drilling markets continue, demand increases for CT with higher axial load, burst and collapse ratings.

Quality Tubing Inc. is field testing a 100,000-psi minimum yield strength CT (see *PEI* supplement, "Coiled Tubing: The Economic Solution To Well Changes," August 1995.). More than 75 strings of this new product ranging from 1-in. to 2⅜-in. OD have been delivered to the field for workover and drilling operations in the Gulf of Mexico, North Sea, South America, Mexico and land operations in the U.S. Laboratory tests and field results indicate this product has a higher strength and fatigue life than its predecessors, particularly when used with internal pressures more than 3,000 psi. It is also being used when conventional string weight would approach or exceed crane or road weight limits since its thinner wall makes it lighter than conventional 70,000-psi or 80,000-psi tubulars.

4½-in. Coiled Tubing

The evolution of CT diameter moved forward in 1995 with the addition of 4½-in. CT made by Precision Tube Technology Inc. (Fig. 2). Many industry observers felt subsea and surface pipelines were the only application for such large CT. But the first string of 4½-in. OD string was shipped to Canadian Fracmaster as coiled casing to be run in a well with casing failures at the connections. If this test is successful, 5½-in. CT will be preferred for this application.

Fig. 1. A fully integrated slimhole drilling rig uses the same tubing handling system to drill with coiled or jointed tubing.

Just over 13½ miles of 4½-in. pipeline was shipped to Egypt for Gulf of Suez hydrocarbon transport and gas lift projects in 1996. After milling the 4½-in. OD by 0.25-in. wall thickness, the 52,000-psi minimum yield tubing received a three-layer, 90-ml (0.090 in.) coating. The 5- to 7-mil inner layer was

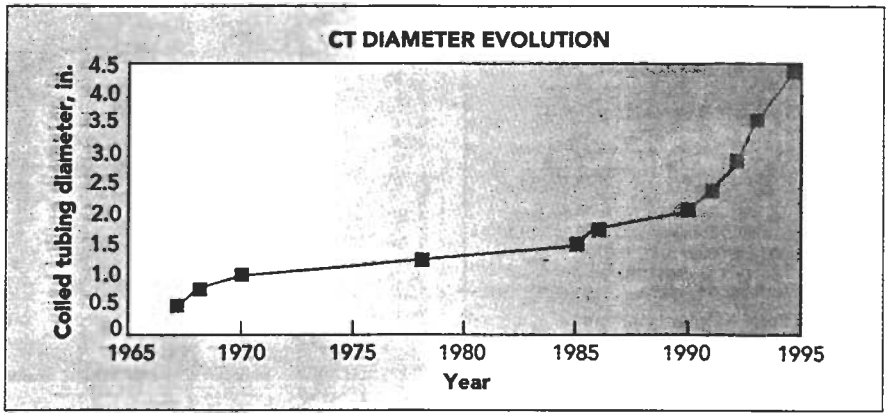

Fig. 2. Available coiled tubing sizes expanded steadily since the 1960s with size growth accelerating through the 1990s as a reflection of increased demand and new applications.

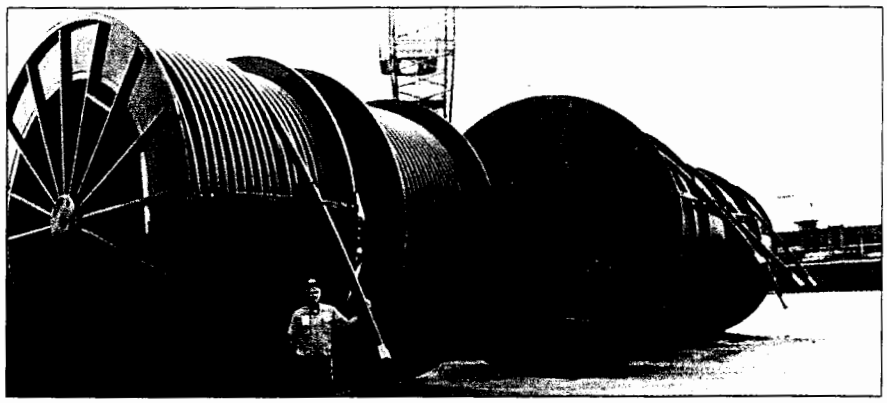

Fig. 3. Coiled tubing spools bound for the Gulf of Suez hold an average of 4,000 ft of tubing and weigh about 65,000 lb. The reels are designed for shipping and installation.

fusion bonded epoxy (FBE) to provide the primary corrosion protection. The second 6- to 10-mil layer was a copolymer adhesive that was co-extruded with a 65- to 75- mil, high-density polyethylene outer mechanical protective layer. The pipeline was shipped on 17-ft diameter steel spools with an average of 4,000 ft per spool (Fig. 3). Each of the shipping/installation spools weigh about 65,000 lb.

Coiled Tubing Cable Installation System

For years the oil and gas industry has sought a way to install cable in drill pipe. Systems were developed to run the cable into the drill pipe once it reached total depth. Other systems embedded a cable in the drill pipe wall. These systems were expensive and often unreliable.

One of the most significant advantages of CT is its ability to accommodate a downhole communications and power supply cable. The first CT cables, for logging horizontal wells, were installed in the mid 1980s by dropping the cable into CT hung off in a well or by pumping the cable through horizontal CT. Both methods were sufficiently expensive to limit the growth of this segment of the CT industry.

Recently a cable installation system was developed by CTES L.C. as a joint industry project for Atlas Wireline, Halliburton, Nowsco, Precision Tube Technology, Quality Tubing and Schlumberger Dowell. This system allows cable to be pumped into reeled CT.[1]

Four such systems have been built and a fifth will be completed this month (Fig. 4). The systems being built are rated for 10,000 psi, usually with 7/16-in. cable in up to 20,200 ft of CT. These systems can be used to install and remove cable offshore to reduce the weight of reels to be lifted onto platforms. ●

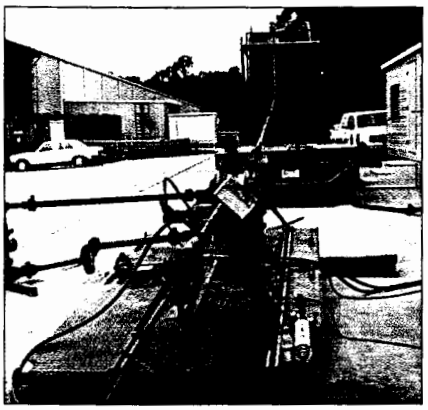

Fig. 4. A joint coiled tubing-industry project has resulted in an economic, portable method for installing electrical cables in coiled tubing on the reel.

Reference

1. Newman, K., Haver, N.A., Stone, L.R., Tong, D.: "Development Of A Coiled Tubing Cable Installation," SPE paper No. 30679 presented at the SPE Annual Technical Conference, Dallas, Texas (October 995).

ABOUT THE AUTHOR

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