Reactor Jack Development for Moving Vertical Reactors

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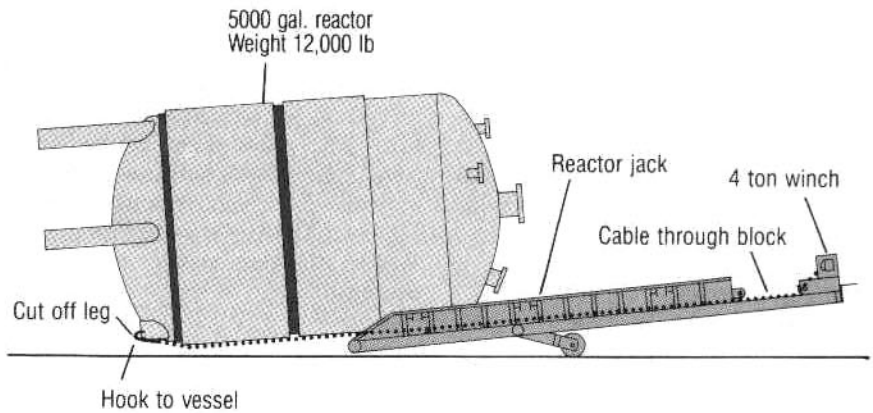
A common problem in chemical processing plants is the installation of reactors and vessels in tight quarters. As production goals, growth and space availability change, it is often necessary to rearrange process vessels to maximize or alter their use. Figure 1 shows an inexpensive tool developed by PPG/Mazer Chemicals, Gurnee, Ill., which has been proven to solve the problem.

The lifting power of the tool is supplied by a winch which is mounted to a bracket on the tongue portion. PPG/Mazer Chemicals uses an 8000-lb capacity hydraulic winch, with a ⅜″ plow-steel wire rope (6×37 IRWC). Four-parted snatch blocks are provided at either end of the tongue and channel sections of the jack.

Figure 2 shows the loading of the reactor onto the jack. A fairly large reactor is shown in the illustration (108″ diameter, 120″ long, ASME flanged and dished heads, 8″ pipe legs extending two feet beyond the bottom flange). Vessels with a variety of dimensions can be lifted with the reactor jack; the largest that PPG/Mazer Chemicals has experi-

Figure 1



Reactor jack

ence with has a 12′ diameter, and is 12′ long. The approximate weight was 18,000 lb.

Note that one leg of the reactor has been removed for the preparation. The removal of the leg allows the center of mass to remain behind the pivot (fulcrum) until the reactor is standing in place and to minimize the required overhead clearance. The four-parted winch line has been unhooked from the winch-mounting bracket and attached to the reactor leg. The lift lugs, or other means of attaching the cable to the vessel, could have been used. The winch is started, and the vessel is dragged up the incline of the channel and back until it is resting fully on the jack. The flange of the 10″ channel which contacts the reactor is covered with a wear strip of ⅝″ polyethylene and attached with countersunk bolts to protect vessel jackets and reduce friction.

For reactors with legs as shown in Figure 2, locate the tip of the jack below the knuckle radius of the bottom head. This allows a smooth transition of the fulcrum from the steel wheels on the jack tip to the bottom head of the reactor. In no case should the tip be more than 3′-6″ from the end of the reactor legs. This limitation is due to the trigonometry of the jack in the full upright position (see Figure 5).

Figure 3 shows the transport of the vessel. The jack is equipped with three tie-down winches with 2″ flat hook straps (10,000 psi tensile strength) to secure the vessel. The arrangement is sufficient for light-wall or fiberglass tanks. A reactor requires chains from the bottom nozzle and agitator to the ladder rungs on the channel portions as shown.

The landing gear should be placed in the retracted forward position. If the center of mass does not fall between the wheel axles and the tongue, there is a dead-bolt retainer made from two short pieces of 1″ pipe. The dead-bolt retainers are welded to the tongue section, and straddle a rung on the channel section. A steel bull pin through the pipe locks the two sections together for

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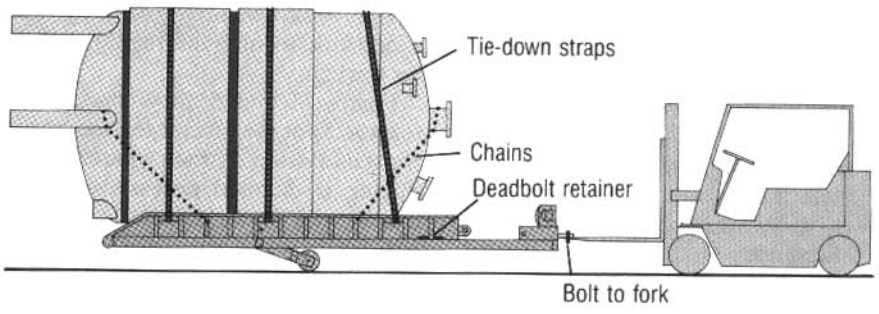
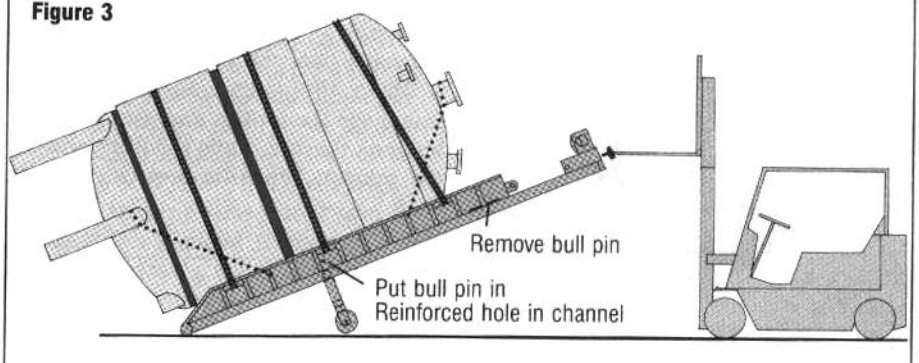
Figure 2



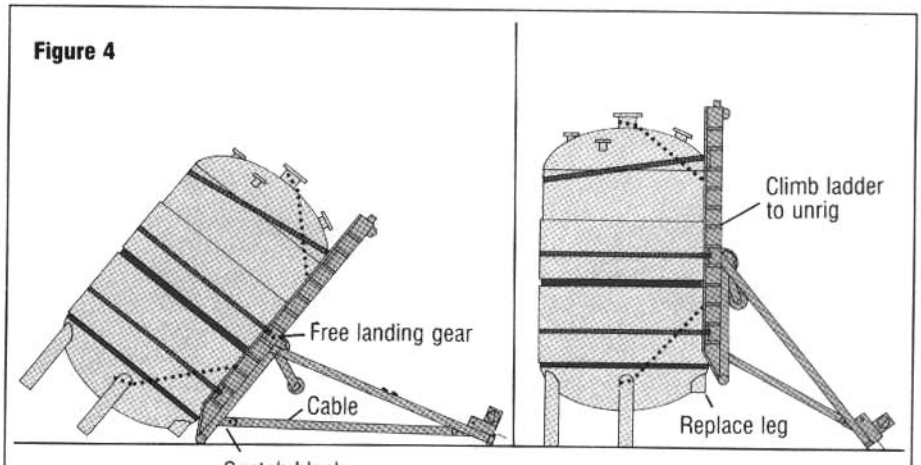
Loading the vessel

Figure 3



Transporting the vessel

Figure 4



Setting the landing gear

Attach whatever safety rigging is deemed necessary.

transportation. On the end of the tongue is a 6" long 6 × 4 × ⅜" steel angle with a 1" hole in the center. The hole can be aligned with a similar hole in the tip of a jeep fork; a bolt holds the two together for towing.

Figures 4 and 5 show the elevated reactor. Spot the reactor legs next to the chosen location. Attach whatever safety rigging is deemed necessary. Lift the tongue with the forklift until the landing gear swings free. Set the landing gear by aligning the reinforced holes in the channel with the holes in the channel section. Lock it in place with bull pins. Now, when the tongue is lowered, the landing gear provides a brace point to break over the tongue and channel sections. Remove the dead bolt retainer and lower the tongue while taking up the cable slack with the winch.

When the tongue is on the floor, disengage the forklift and use the winch to draw the jack ends together and lift the reactor. With the reactor on three legs, replace the missing lag and remove the jack.

The process can be reversed by attaching the jack to a standing reactor parallel to two legs. The jack's steel wheels should be on the ground (see Figure 5). Then, using a lever hoist between the tongue and channel in the lugs provided and a forklift as a counterweight, tip the reactor onto two legs as the winch is operated slowly. It is important to pin the landing gear into the perpendicular position as soon as it is free. As the jack hinge approaches the line of action of the force in the cable, the cable tension increases rapidly. The landing gear provides a safe brace point.

When relocating insulated reactors, a wine bottle-type rack (see Figure 6) can be fabricated to fit inside the channel section of the jack. This keeps the load off the reactor shell, and preserves the insulation.

PPG/Mazer Chemicals is developing a slightly more complicated system which uses a hydraulic cylinder, similar to a rear dump trailer in place of winch and blocks. ■

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Figure 5

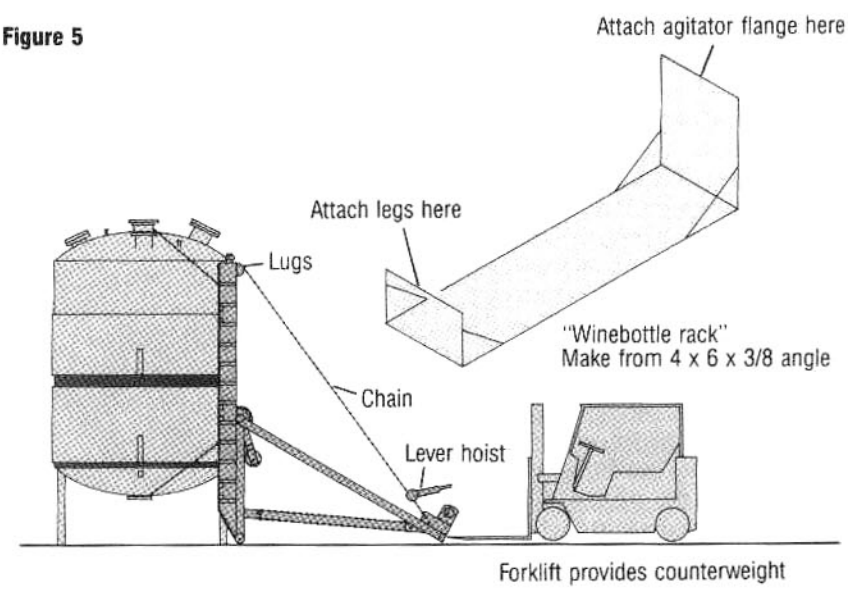

Figure 5. Standing the vessel