

Fabrication of Ngai LIN Trailer

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Feel the Heat!

Chemically Speaking LLC

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- In 2002 the AP website posted pictures every week of a liquid nitrogen tanker being fabricated and assembled. To my surprise it was the trailer that they painted my picture onto. This was based in Austin, Texas. They arranged for me to see it in 2008 in a Walmart parking lot



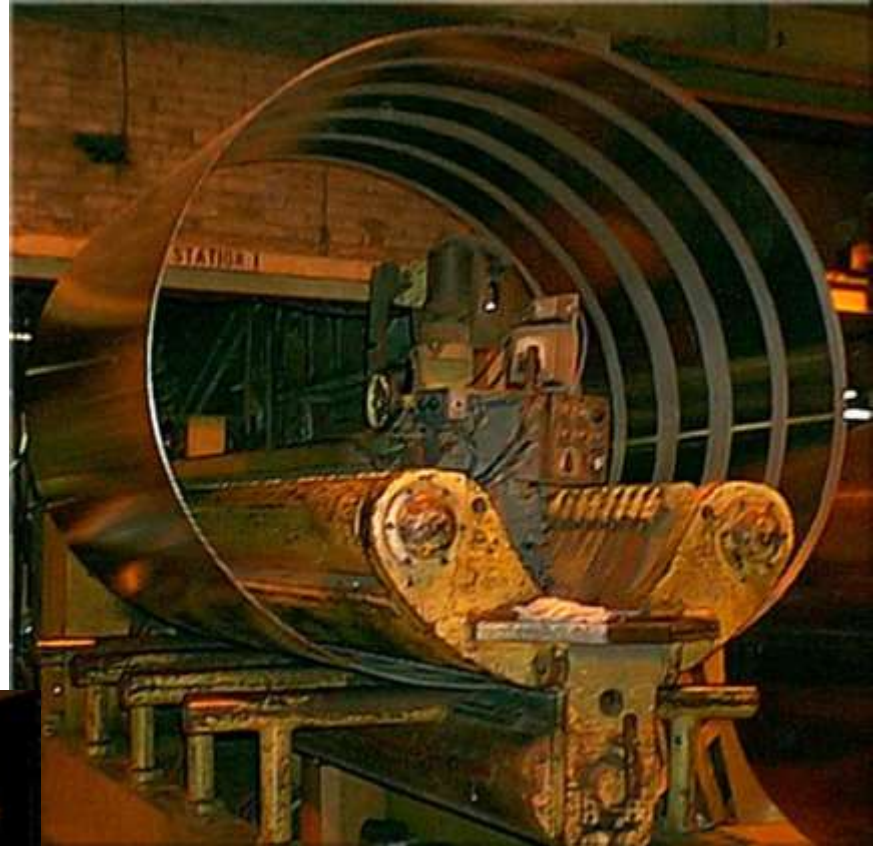
The Beginning

- Most materials used for the fabrication of trailers are order specifically for a new trailer order. However, this is not practical for some of the raw material items such as the aluminum for the inner and outer vessels, which have large minimum order quantities and long lead times. The aluminum is ordered directly from both US and oversea mills to specific physical and dimensional specifications. Typical minimum order quantities result in enough aluminum to manufacture 15 to 25 trailers. It is inventoried as flat sheets in long lengths as shown
- Some components such as axles, tires and pumps are ordered by APCI under national purchasing contracts and shipped directly to Russell Engineering.
- The start of the actual manufacturing process begins with the rolling of the aluminum plate into the tank shells and the forming of the internal piping



Week 2

- Once the shells have been rolled, the longitudinal weld is made on an automatic welder to provide consistent quality welds. For the inner vessel shells, the welds are 100% x-rayed to document the weld integrity. The outer vessel shells are fitted with Vacuum Rings to minimize the weight/thickness of the shell while preventing the shell from collapsing under vacuum. As with a majority of the trailer welds, the rings are welded with an automatic welder to assure weld quality and minimize labor costs.
- Meanwhile, the formed piping is welded to the inner vessel head and tested to 600 psig to assure it is leak free.

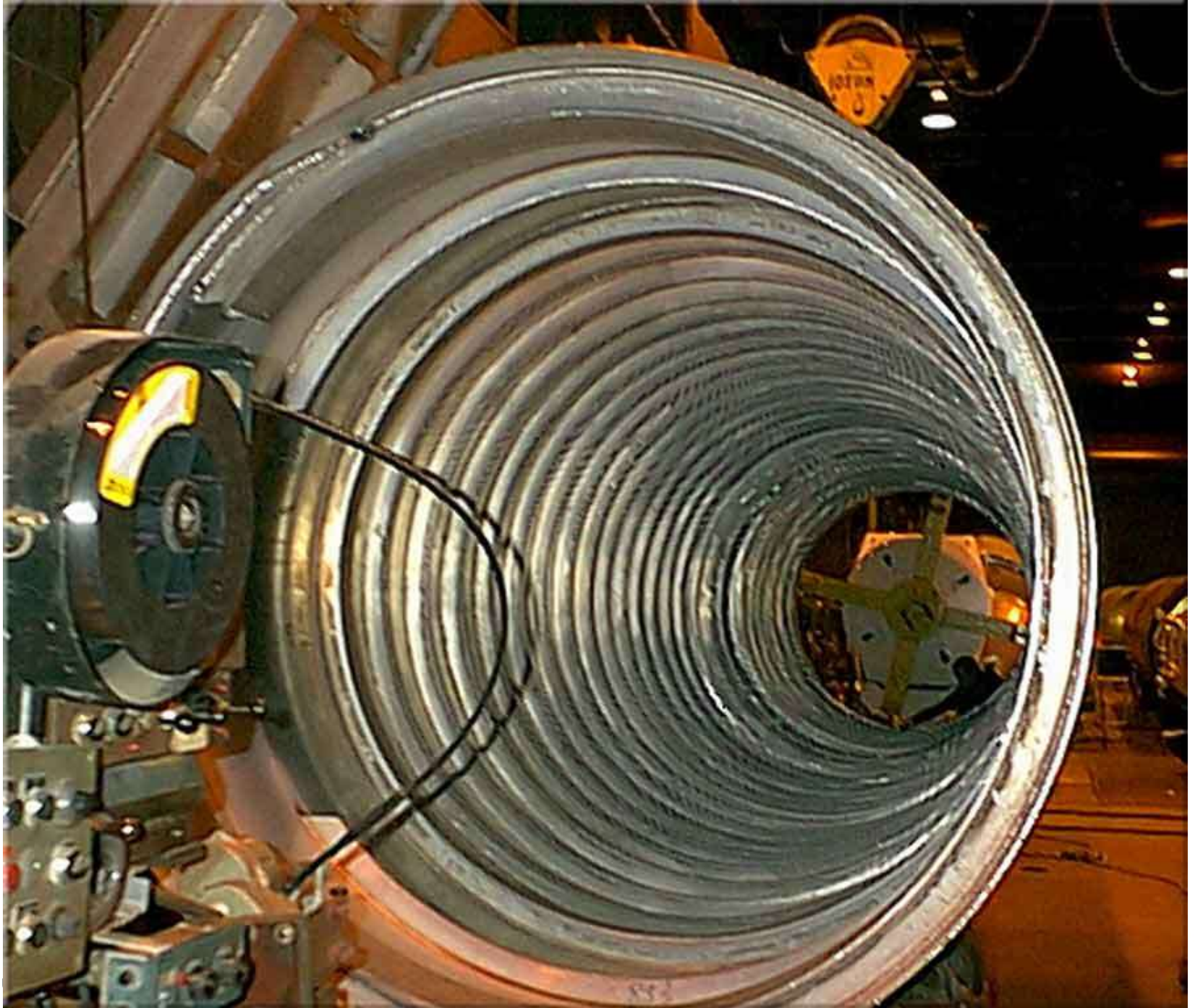


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Week 3

- During week 3 of the fabrication, the inner and outer vessel shells are butt welded end to end and the tank begins to take shape. The automatic circumferential welds of the inner vessel are once again 100% x-rayed. This is the first major Quality Control Hold Point and no further work is done on the vessel until the welds are proven to be 100% defect free.
- At the same time, work on the steel lower chassis of the trailer begins. The chassis is made from Cor-Ten corrosion resistant steel.
- This completes the major items of the trailer fabrication and the small detailed work begins.





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Week 4

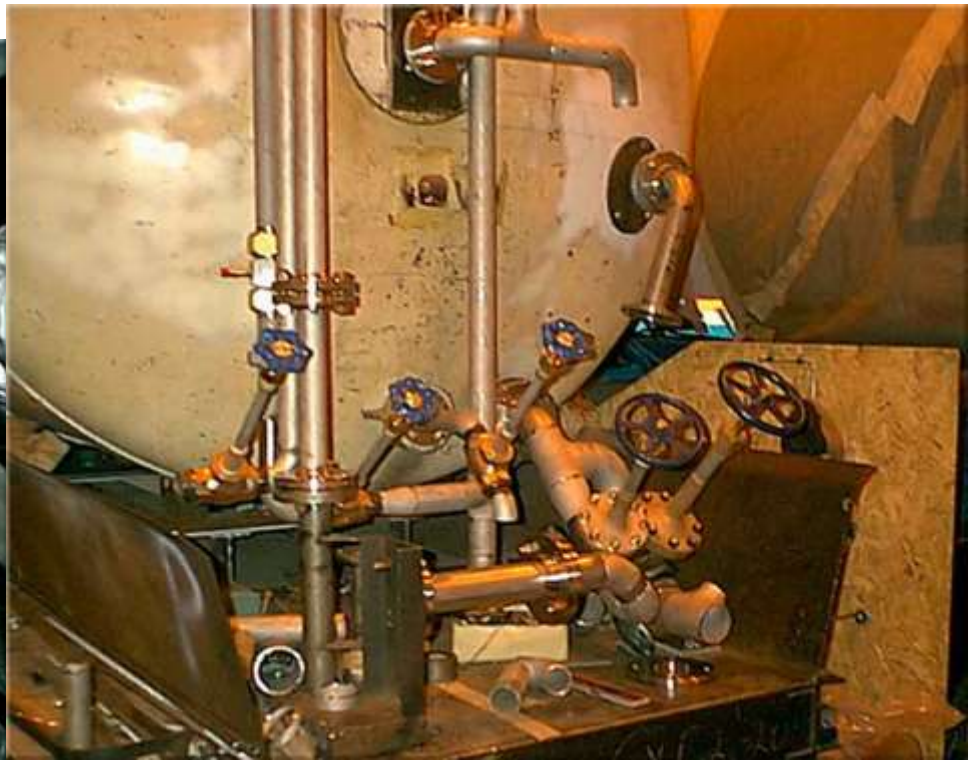
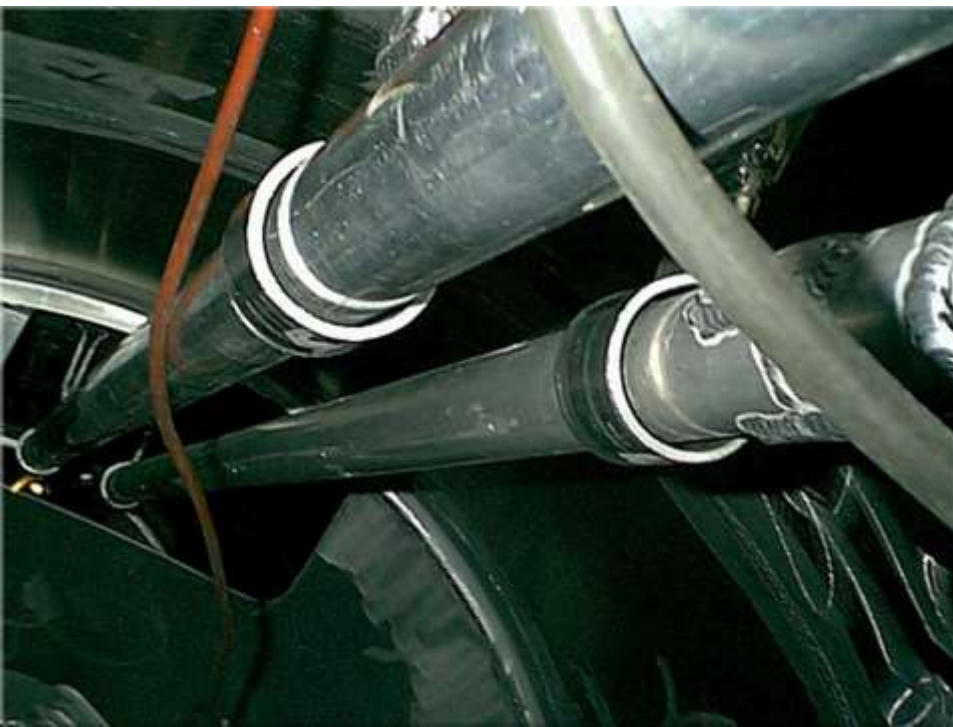
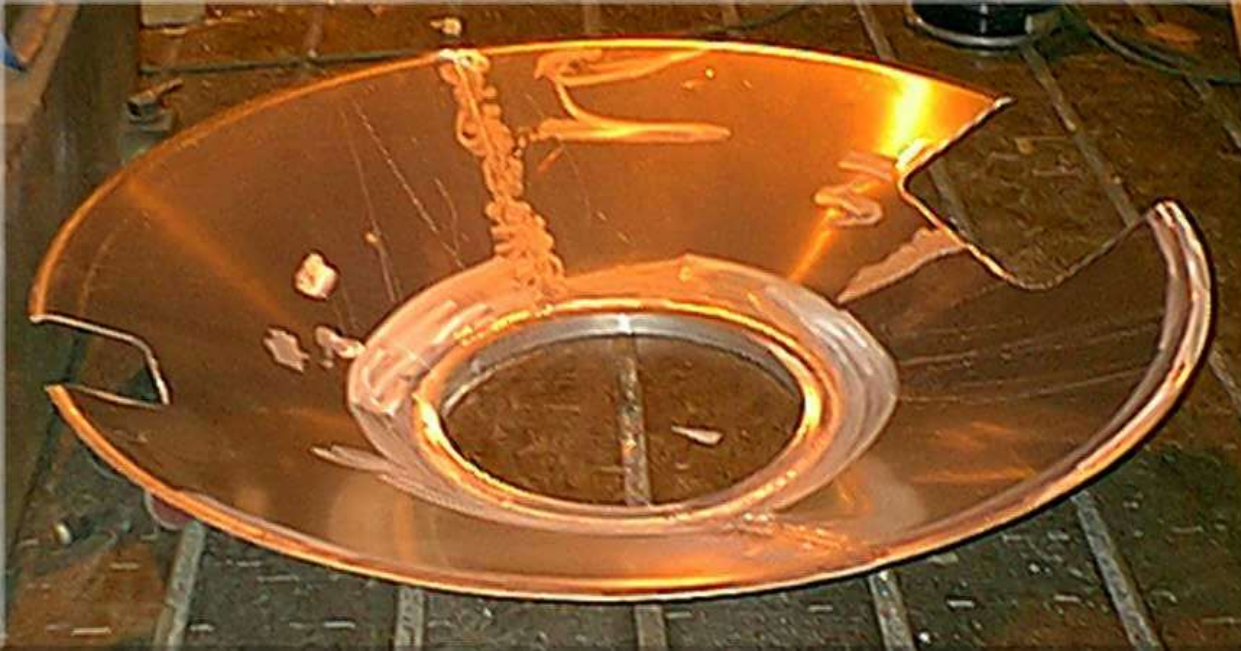
- Week 4 begins with welding the three baffles inside the inner vessel. These baffles minimize the sloshing action of the Nitrogen during stopping and turning. Once the baffles are in, the rear piping head of the trailer is fitted on. This closing seam is also 100% x-rayed.
- Meanwhile, the suspension and axles are welded onto the steel chassis. These trailers will have Hendrickson-Turner air ride suspension with a 6 ½" ride height. The low ride height and sloped trailer design will provide easily accessible piping for both operation and maintenance with no need for a rear step.



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Week 5

- While the top fill spray header and vent lines are being installed inside the inner vessel, the completed chassis and suspension is being sand blasted and painted in advance of mounting the tank to it. By painting the chassis first, unrestricted access to all areas of the chassis assures good surface preparation and paint coverage.
- Fabrication of the external piping is started in week 5. By pre-fabricating the piping on a piping jig, we are able to keep the production moving with as many parallel operations as possible. It also assures that all trailers get piped alike which results in better quality and easier long term maintenance.



Week 6

- With all the work inside the inner vessel complete, the vessel is cleaned and the manway is welded closed. The vessel is now ready for testing. It is pressure tested and ASME code stamped. As a final test, it is helium leak checked to assure the long-term life of the trailer's vacuum. When the inner vessel passes this second major hold point, it is moved to the insulation room for the application of super insulation to both the vessel and the annular piping.
- At this point, most of the remaining trailer assemblies are also started. These include the upper chassis, the housing for the VW diesel engine, and the piping compartment.



IN Trailer

Week 7

- The insulated inner vessel is now positioned inside the outer vessel. The supports between the inner and outer vessel are put in place and the outer vessel heads are welded in place. All the openings in the outer vessel, including the areas around the supports and piping penetrations, are welded and the trailer is placed under vacuum for the first time. The third major hold points assures the vessel passes yet another helium leak test before any further work is completed. When the vessel is confirmed to be leak tight, it is mounted on the previously completed chassis and rolled to the finishing building.



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Week 8

- The trailer finishing building is really a final assembly area for mounting the previously completed subassemblies to the trailer. The piping is bolted and welded in place, the VW drive is mounted, the piping compartment is put on, and the lights are wired. This is also the time when all the automotive equipment is checked out. The brakes are adjusted, the suspension air bags are checked, and the axle alignment is confirmed.



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Weeks 9 & 10

- Weeks 9 and 10 are primarily devoted to painting and decaling the trailer. This entails prepping the surface, priming with DuPont 525-333 High Solids Primer, and painting with 333M Polyurethane Enamel. The decals are then applied and a clear coat of Dupont 611P is sprayed over them. These two weeks are also used to compile and review the quality assurance file to assure that all documentation is complete



Done!

- Once painted, the trailer is thoroughly tested to confirm everything is in working order. It is road tested and taken to a certified scale to establish the tare weight. Upon return, the axle alignment is rechecked and the trailer is prepared for process testing. The trailer is filled with approximately 2000 gallons of LIN, the VW is started and the LIN is pumped in a closed loop for 30 minutes. All components are tested in a fully pressurized and cold condition to assure proper operation. With the testing complete, the trailer is given one final visual inspection and is ready for shipment.



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Thank You

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