

## 1.2 Hydraulic Cart Fluid Fill Procedure

*Operational Guidance*

## 1.2 Hydraulic Cart Fluid Fill Procedure

This procedure covers filling of the hydraulic cart with its nominal charge of hydraulic fluid. The cart might be blanked off, hooked to a test setup, or in its normal operational configuration connected to a bubble chamber. In all cases, there should be a main cart isolation shut-off valve (MV-10). The external plumbing should contain a valve port for fluid addition (MV-13), a valve port to a vacuum pump (MV-12), and possibly a valve to a secondary volume (MV-11) such as a bubble chamber or dummy load.

The basic goal is to get the cart filled with appropriately<sup>1</sup> de-gassed polypropylene glycol without air bubbles or voids. There are many paths to the summit, grasshopper.

- 1) For non-critical fills, requiring no degassing, glycol is drawn from a reservoir (5 gallon can or 55 gallon drum) using a fill pipe that is equipped with a valve, MV-24, at the tip. A rod extending up to the other end allows the valve to be opened and closed while the rod is submerged. A hose leads to the input port, MV-13, of the cart external plumbing.
- 2) Set the stepping motor controlled piston to an appropriate position<sup>2</sup>.
- 3) Open all internal hydraulic ports, open the pump down port, MV-12, and pump down the cart and any external plumbing.
- 4) Close off the pumping port, open the draw-pipe tip valve, MV-24, and suck in the glycol.
- 5) Close off the fill ports, MV-24 and MV-13. You're done.
- 6) IF you need to do a better de-gassing job, then you can transfer the glycol to a reservoir that can itself be pumped down prior to the transfer, *or*
- 7) Backfill the cart from the bubble chamber vessel. Here, we would be part way through procedure 2.1 Bubble Chamber Glycol Fill and would have a large volume of de-gassed glycol just on the other side of the valve from the cart. In this case, just (a) pump down the cart, (b) close off fill and pumping valves, and then (c) crack open the bubble chamber isolation valve, MV-11, to backfill the cart from the degassed reserve in the bubble chamber vessel. This may require bleeding the vessel up to atmosphere to make the transfer go. Then isolate the cart and go back to 2.1 and finish the chamber glycol fill.

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<sup>1</sup> For most testing purposes degassing the cart itself is not crucial. It just needs to be free of air bubbles. For the final setup prior to a live bubble chamber set-up, it is better to be a bit more careful...

<sup>2</sup> 50% is generally a good guess. For chamber operations, we will cool to 0°C and heat to 40°C. That is pretty symmetric around room temperature. Calculate the expected expansion of both CF<sub>3</sub>I and glycol.