DCS chopper pumping station

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Figure 1. DCS chopper housing pumping station. The pumping station for the chopper housings consists of (i) plumbing to connect to the housing turbo molecular pumps, (ii) a manual lift-off valve for the primary pumping line, (iii) a manual lift-off valve for the rough pumping line, (iv) an automatic valve that closes in the event of a system failure, (v) a panel of Edwards TICs (turbo instrument controllers), (vi) a Pirani gauge for rough pump 1, (vii) a Pirani gauge for rough pump 2, (viii) rough pump 1, (ix) rough pump 2, and (x) a thermocouple vacuum gauge.

Figure 2. Flow diagram of DCS chopper housing pumping system. Roman numeral labels are defined in Fig. 1.
Figure 3. Detail of TIC panels. A close-up of the TICs shows standard conditions during chopper operation. Housings 1, 2, and 3 should have APGX approximately $8 \times 10^{-5}$ Torr, while housing 4 has an updated vacuum gauge that shows a more accurate pressure near $3 \times 10^{-4}$ Torr; these gauges are mounted on ports of the housings opposite to the pumping ports. Housings 1 and 2 should show APGL near $2 \times 10^{-1}$ Torr, from the rough pump Pirani gauges. Housings 3 and 4 are not connected to a roughing gauge, but controlled off housing 1.
In the event that the system is completely vented:

1) The primary manual valve (fig. 1-ii) and the roughing valve (fig. 1-iii) should be opened
2) Ensure that all TIC displays show the main menu (fig. 2-b) and the appropriate gauges read
3) Initiate a pumping cycle by pressing the physical “cycle on/off” button on the TIC for housing 1
4) At this time either roughing pump 1 (fig. 1-viii) or roughing pump 2 (fig. 1-ix) will turn on; and the configuration is set to use TIC 1 as the main control, and therefore roughing pump 1 will turn on
5) When the appropriate Pirani gauge reads a pressure less than $7 \times 10^{-1}$ Torr, the turbo molecular pumping cycle will begin
6) Before starting the choppers, the roughing valve must be closed to return the system to a protected mode (via the automatic valve in fig. 1-iv)
7) When the APGX reading on every housing is less than $1 \times 10^{-3}$ Torr, the choppers may be started
8) It may take as long as a day to reach housing pressures less than $1 \times 10^{-4}$ Torr on housings 1, 2, and 3 while 4 does not reach that low

Additional notes: The two manual valves are only different because that was the available equipment. Conductance in this configuration is mostly limited by the valves (a roughing gate valve instead of a lift-off valve would decrease initial pumping time). The rough pump 2 is actuated by a relay box, so the switch of the pump should remain on even while the pump is “off.” Each rough pump has an hour-meter on the back. If the pressure of the system goes above ??? Torr, the automatic valve will close and the system will isolate. The housing 4 gauge was replaced due to failure induced by an oil-lubricated roughing pump plating the gauge innards. There is a chopper between the pumping port and the vacuum gauge.