NIST United States Department of Commerce
Technology Administration
National Institute of Standards and Technology

NISTIR 5026

Thermal Hydraulic Tests of a Liquid Hydrogen Cold Neutron Source

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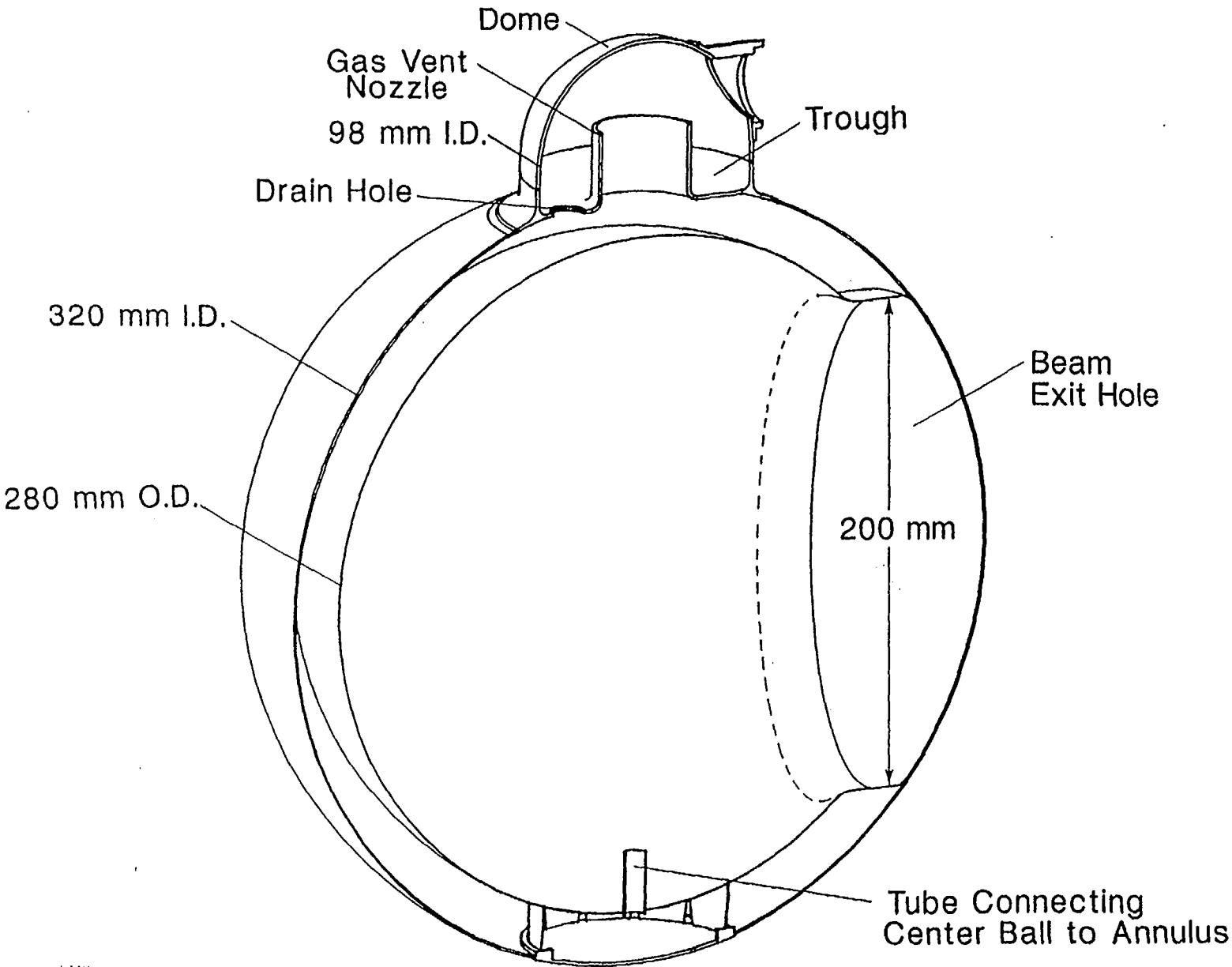


Figure 1. Design of the liquid hydrogen containing neutron moderator chamber for the NBSR.

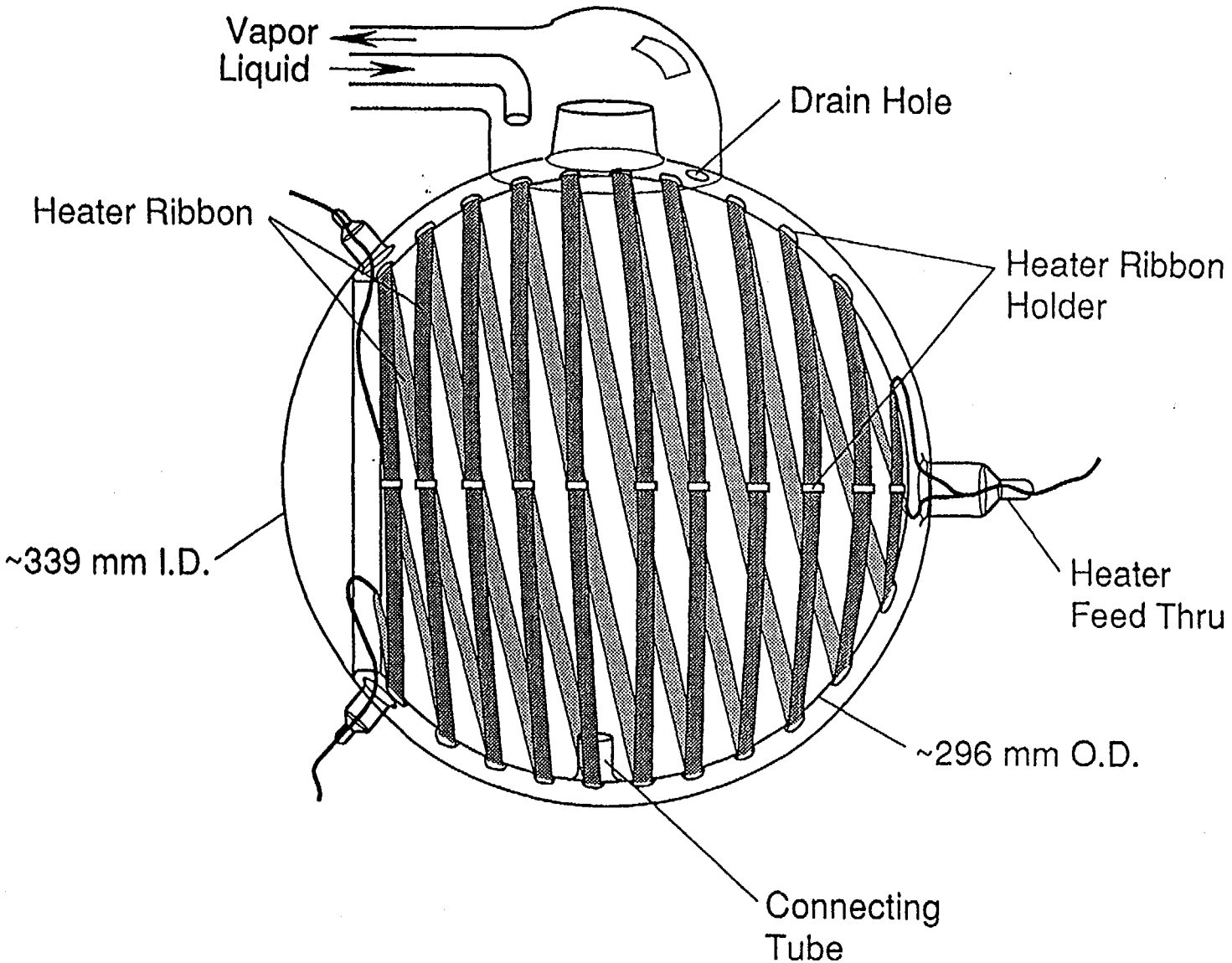


Figure 4. Drawing of the NIST-B electrically heated glass moderator chamber used to test the NBSR chamber.

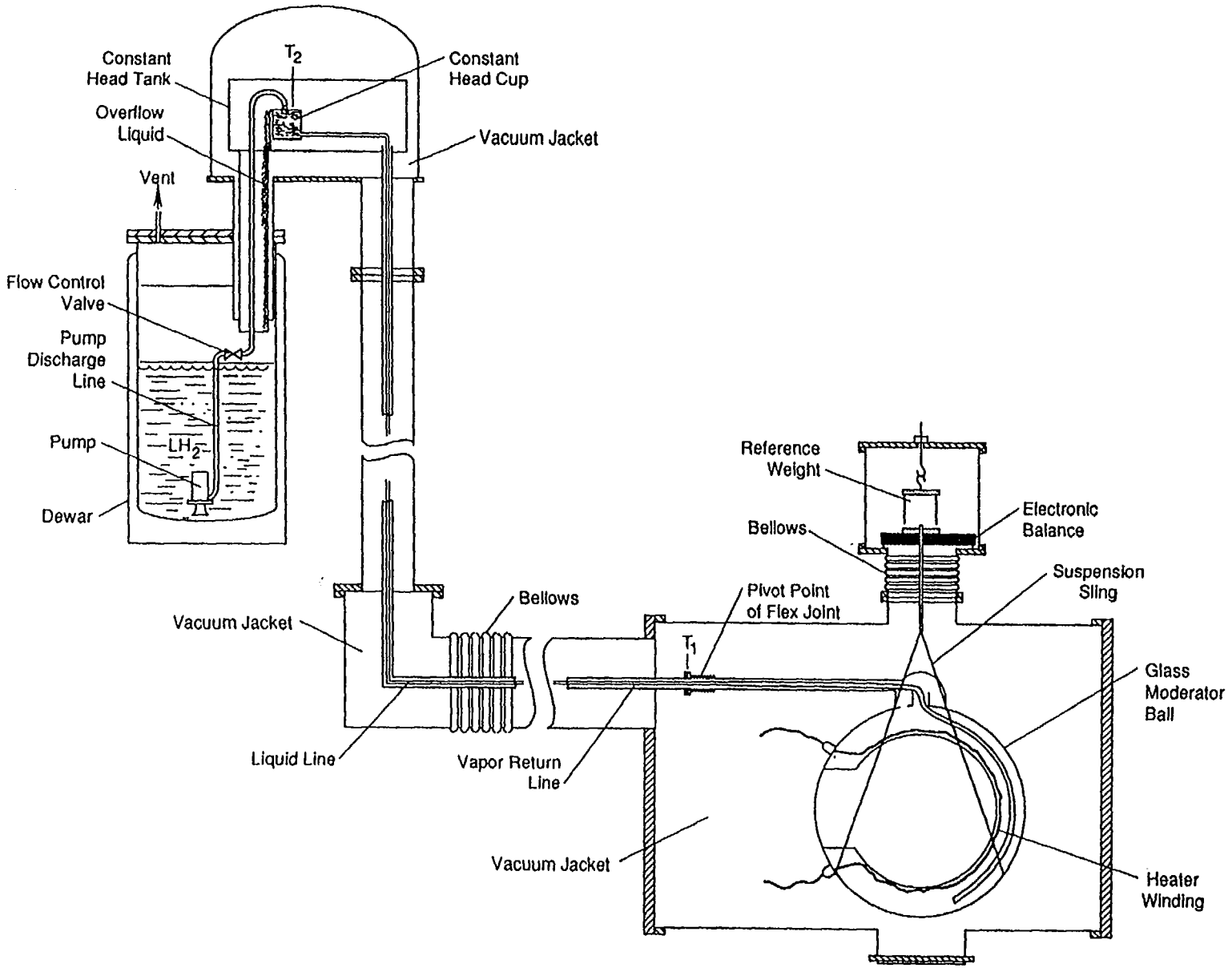


Figure 3. Unscaled diagram of the moderator test system built at NIST-B.

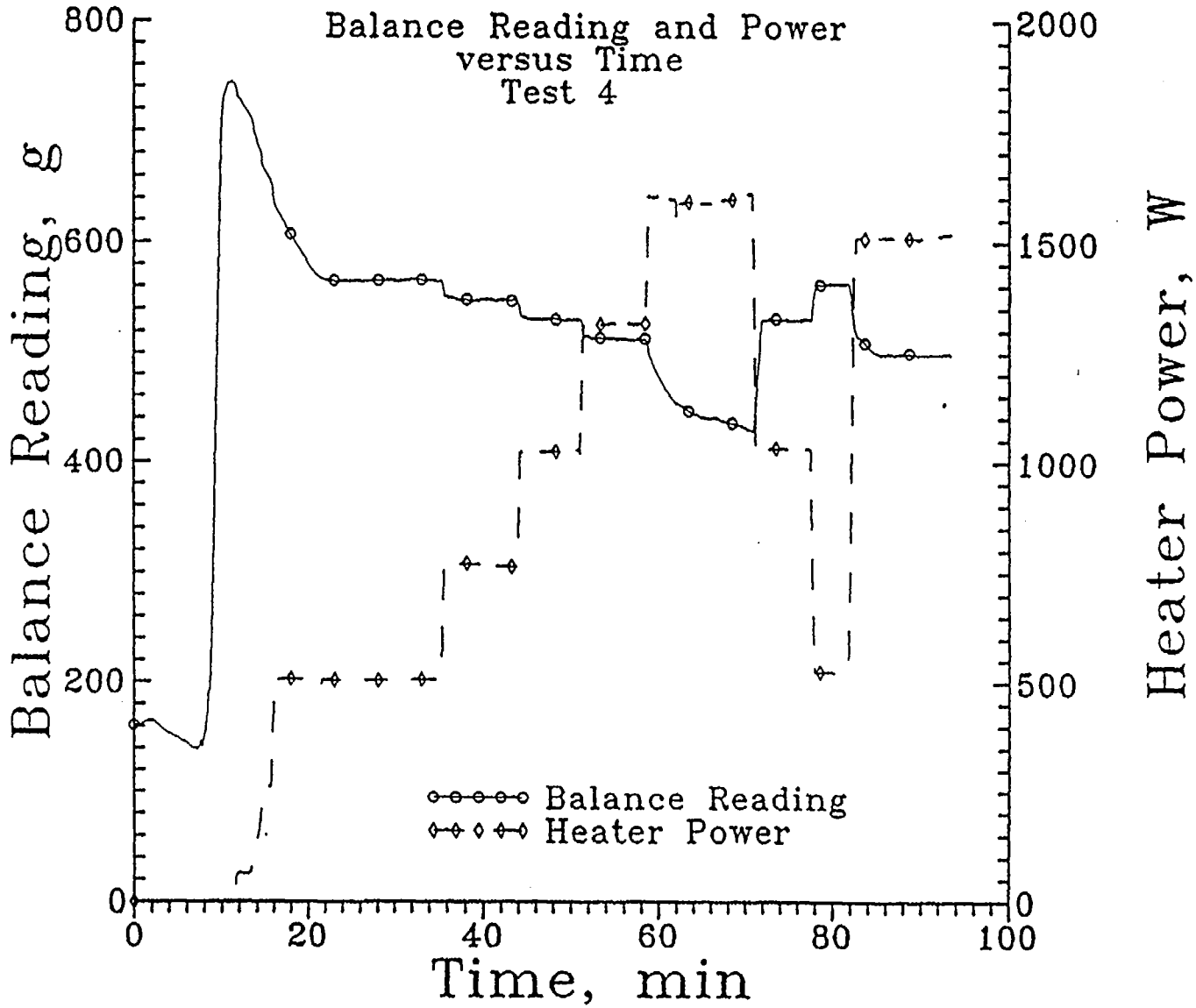
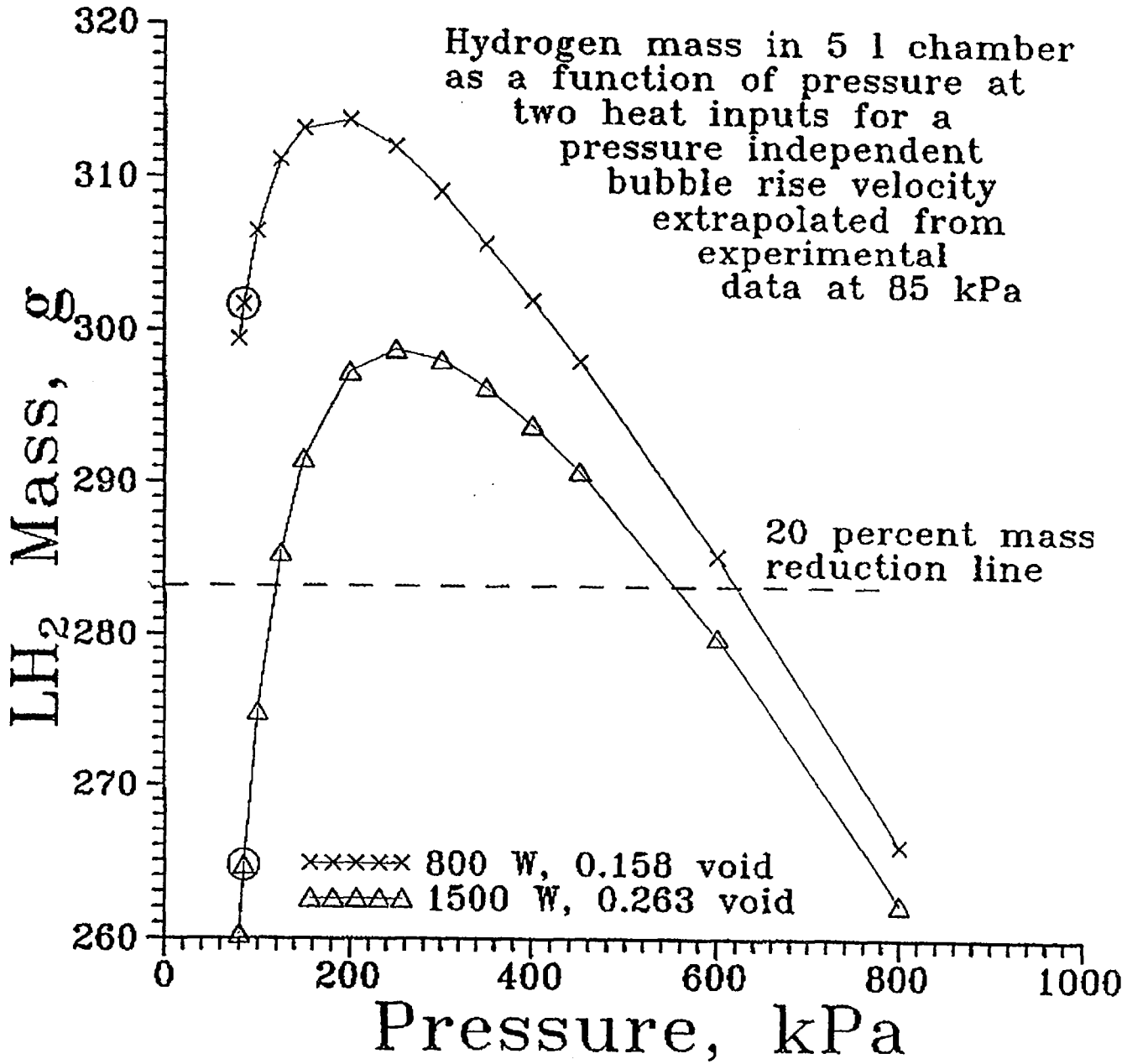
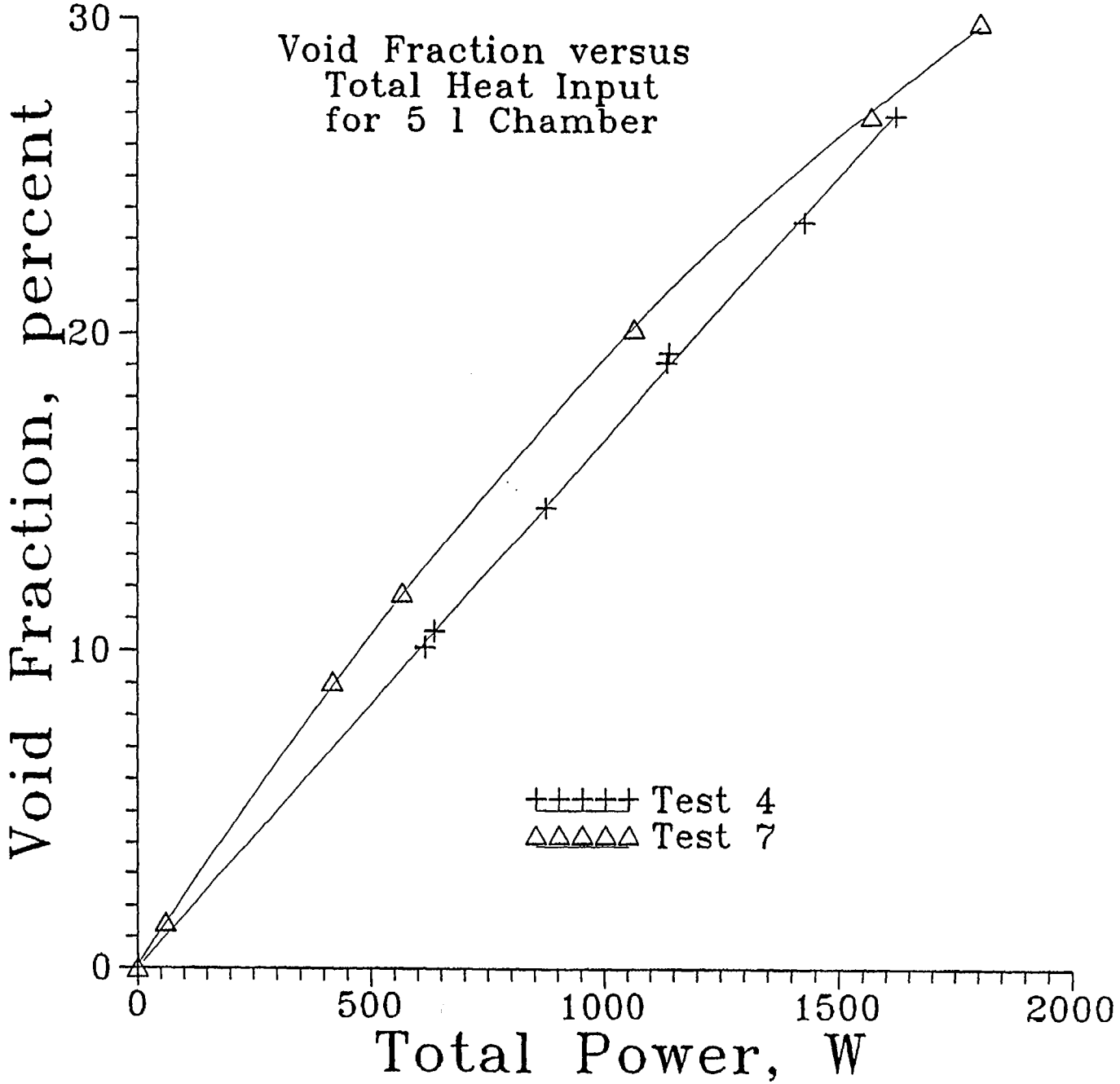


Figure 7. Test 4 showing the balance reading as a function of time at the power levels shown and 85 kPa pressure.


Hydrogen mass in 5 l chamber as a function of pressure at two heat inputs for a pressure independent bubble rise velocity extrapolated from experimental data at 85 kPa
20 percent mass reduction line
800 W, 0.158 void
1500 W, 0.263 void
LH2 Mass, g
Pressure, kPa
320
310
300
290
280
270
260
0
200
400
600
800
1000


Void Fraction versus
Total Heat Input
for 5 l Chamber
Void Fraction, percent
30
20
10
0
0
500
1000
1500
2000
Total Power, W
Test 4
Test 7

Results of Boulder Tests

1. Stable operation possible up to at least 2200 watts with two-phase flow.

2. LH_2 mass quickly reaches new, stable value after heat load change.

3. Void fraction well below 20 % at anticipated power and pressure.

4. Restart of LH_2 flow verified after extending supply line.

5. Visual inspection showed no dryout or unexpected voids.