Vacuum Equipment Prototype Results

December 96

LIGO-Gxxxxxxx

LIGO-G960243-00-V

Prototype tests: Background

- Proposed by PSI - Not originally a LIGO requirement.
- PSI wanted to control their risk.
- PSI wanted to link prototype results to acceptance testing.

Prototype tests: Scope

- Confirm mechanical constructability of a typical component - BSC.
- Confirm outgassing performance after proposed cleaning, bake, and vent cycles.
- Confirm vibration performance of 80K pump.

Results:Mechanical

- Joint fab between RANOR and PSI with PSI welding.
- Dimensional inspection revealed minor tolerance problems - but within LIGO specs.
- One leak found at final assembly and leak test - Conflat to nipple weld - now procured as an assembly from Varian.

Results:Mechanical

- deflection - measured at one point - consistent with PSI finite element analysis.
- Handling problems with doors - four lifting points instead of one.

Results:Bakeout

- 51 heating zones on BSC.
- Temperature range from 127 to 152 C.
- Poor fit in some places, shedding of fibers - As a result PSI rebid the blanket contract.
- Bakeout controller worked well - minor complaints about blanket connectors - will be changed.

Results:Vacuum

- Post bake - 7 x 10(-9) torr with 500 l/s ion pump.
- Backfilled and soaked with "dry nitrogen" for 24 hours - then begin 100 hour pumpdown.
- 100 hour result - 5 x 10(-8) torr - attributable to bad vent gas AND nitrogen adsorption/absorption by viton

Results:Vacuum - Isolatable Volume (100 hours)

- LIGO Goal - 1.2 x 10(-8) torr
- Predicted - 1.8 x 10(-8) torr after 24 hour N2 soak.
- Significant component is N2 which is 10 times goal. Other partial pressures ok.

Results:Vacuum - Isolatable Volume (100 hours)

Possible solutions for nitrogen problem:

- for initial IF - do nothing.
- Add distributed pumps along beam tube - getters, ion, cryo.
- Upgrade to metal seals.
- Subcool 80K pumps.

Prototype tests:80K pump tests

Vibration tests on cold 80K pump:

- Measurements over a range of boiloff.
- Little correlation between noise and flow.
- Warm measurements same as background.
- Background measurements taken on different day.

TABLE 3.4-1
ISOLATABLE SECTION ULTIMATE PRESSURES @ 100 HRS, PREDICTED
VERTEX + BEAM MANIFOLD

	LIGO Pressure Goals	Predicted Pressure 24 hr exposure	Predicted Pressure 1 hr exposure
Species	Torr	Torr	Torr
H2	5.0E-09	4.0E-09	4.0E-09
H2O	5.0E-09	2.4E-09	2.4E-09
N2	5.0E-10	**7.2E-09**	**7.0E-10**
CO	5.0E-10	3.0E-09	3.0E-09
CO2	2.0E-10	3.0E-10	3.0E-10
CH4	2.0E-10	9.0E-10	9.0E-10
OTHER	5.0E-10	6.6E-10	6.6E-10
TOTAL EXCLUDING H2O, H2	1.9E-09	1.2E-08	5.5E-09
TOTAL	**1.2E-08**	**1.8E-08**	**1.2E-08**

Vacuum Equipment Prototype Results

NOT PRESENTED DUE TO LACK OF TIME

J. Worden

December 96

LIGO-Gxxxxxxx

LIGO-G960243-00-V

Prototype tests: Background

- Proposed by PSI - Not originally a LIGO requirement.
- PSI wanted to control their risk.
- PSI wanted to link prototype results to acceptance testing.

Prototype tests: Scope

- Confirm mechanical constructability of a typical component - BSC.
- Confirm outgassing performance after proposed cleaning, bake, and vent cycles.
- Confirm vibration performance of 80K pump.

Results:Mechanical

- Joint fab between RANOR and PSI with PSI welding.
- Dimensional inspection revealed minor tolerance problems - but within LIGO specs.
- One leak found at final assembly and leak test - Conflat to nipple weld - now procured as an assembly from Varian.

Results:Mechanical

- deflection - measured at one point - consistent with PSI finite element analysis.
- Handling problems with doors - four lifting points instead of one.

Results:Bakeout

- 51 heating zones on BSC.
- Temperature range from 127 to 152 C.
- Poor fit in some places, shedding of fibers - As a result PSI rebid the blanket contract.
- Bakeout controller worked well - minor complaints about blanket connectors - will be changed.

Results:Vacuum

- Post bake - 7 x 10(-9) torr with 500 l/s ion pump.
- Backfilled and soaked with "dry nitrogen" for 24 hours - then begin 100 hour pumpdown.
- 100 hour result - 5 x 10(-8) torr - attributable to bad vent gas AND nitrogen adsorption/absorption by viton

Results:Vacuum - Isolatable Volume (100 hours)

- LIGO Goal - 1.2 x 10(-8) torr
- Predicted - 1.8 x 10(-8) torr after 24 hour N2 soak.
- Significant component is N2 which is 10 times goal. Other partial pressures ok.

Results:Vacuum - Isolatable Volume (100 hours)

Possible solutions for nitrogen problem:

- for initial IF - do nothing.
- Add distributed pumps along beam tube - getters, ion, cryo.
- Upgrade to metal seals.
- Subcool 80K pumps.

Prototype tests:80K pump tests

Vibration tests on cold 80K pump:

- Measurements over a range of boiloff.
- Little correlation between noise and flow.
- Warm measurements same as background.
- Background measurements taken on different day.

TABLE 3.4-1
ISOLATABLE SECTION ULTIMATE PRESSURES @ 100 HRS, PREDICTED
VERTEX + BEAM MANIFOLD

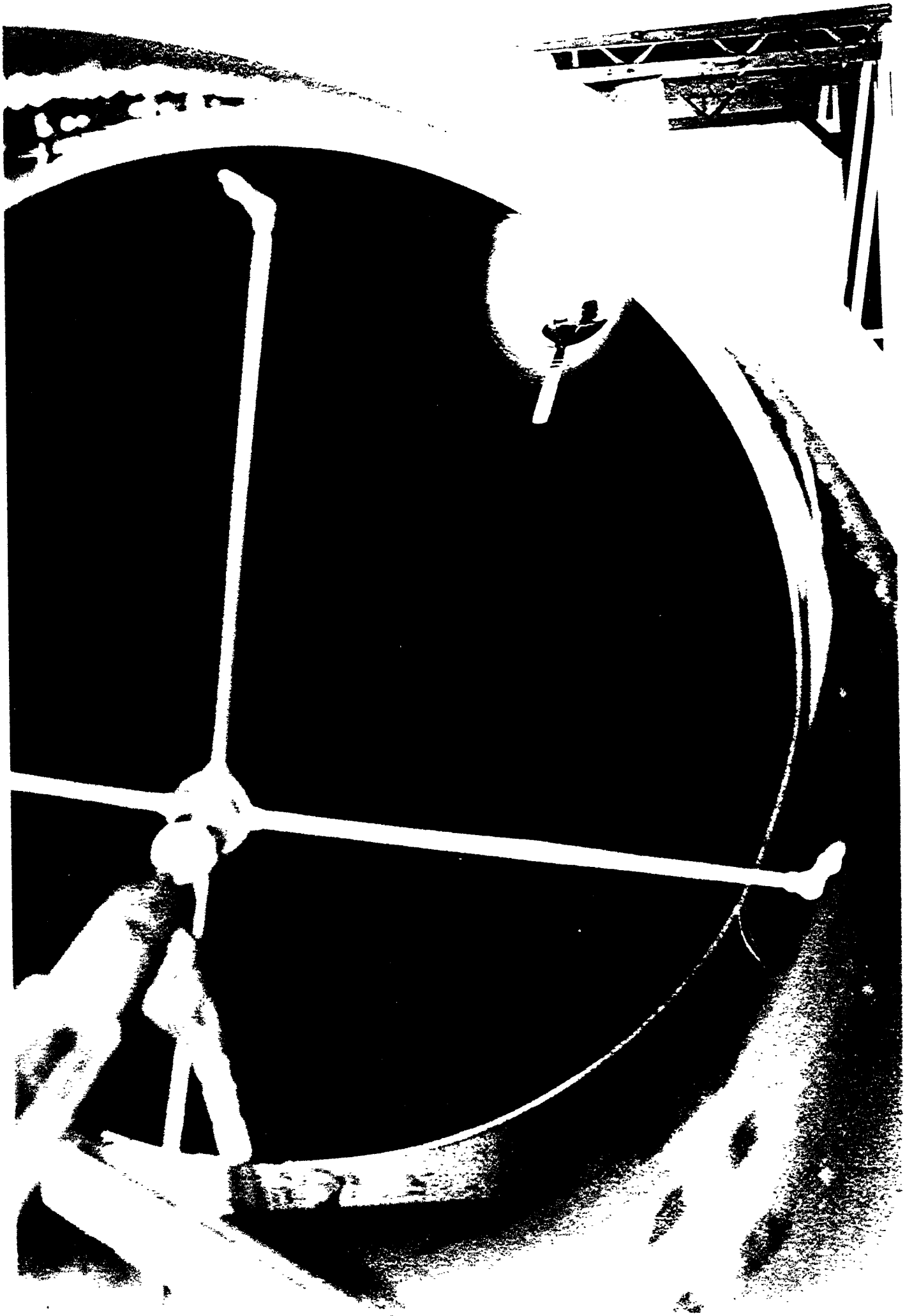
Species	LIGO Pressure Goals Torr	Predicted Pressure 24 hr exposure Torr	Predicted Pressure 1 hr exposure Torr
H2	5.0E-09	4.0E-09	4.0E-09
H2O	5.0E-09	2.4E-09	2.4E-09
N2	5.0E-10	7.2E-09	7.0E-10
CO	5.0E-10	3.0E-09	3.0E-09
CO2	2.0E-10	3.0E-10	3.0E-10
CH4	2.0E-10	9.0E-10	9.0E-10
OTHER	5.0E-10	6.6E-10	6.6E-10
TOTAL EXCLUDING H2O, H2	1.9E-09	1.2E-08	5.5E-09
TOTAL	**1.2E-08**	**1.8E-08**	**1.2E-08**

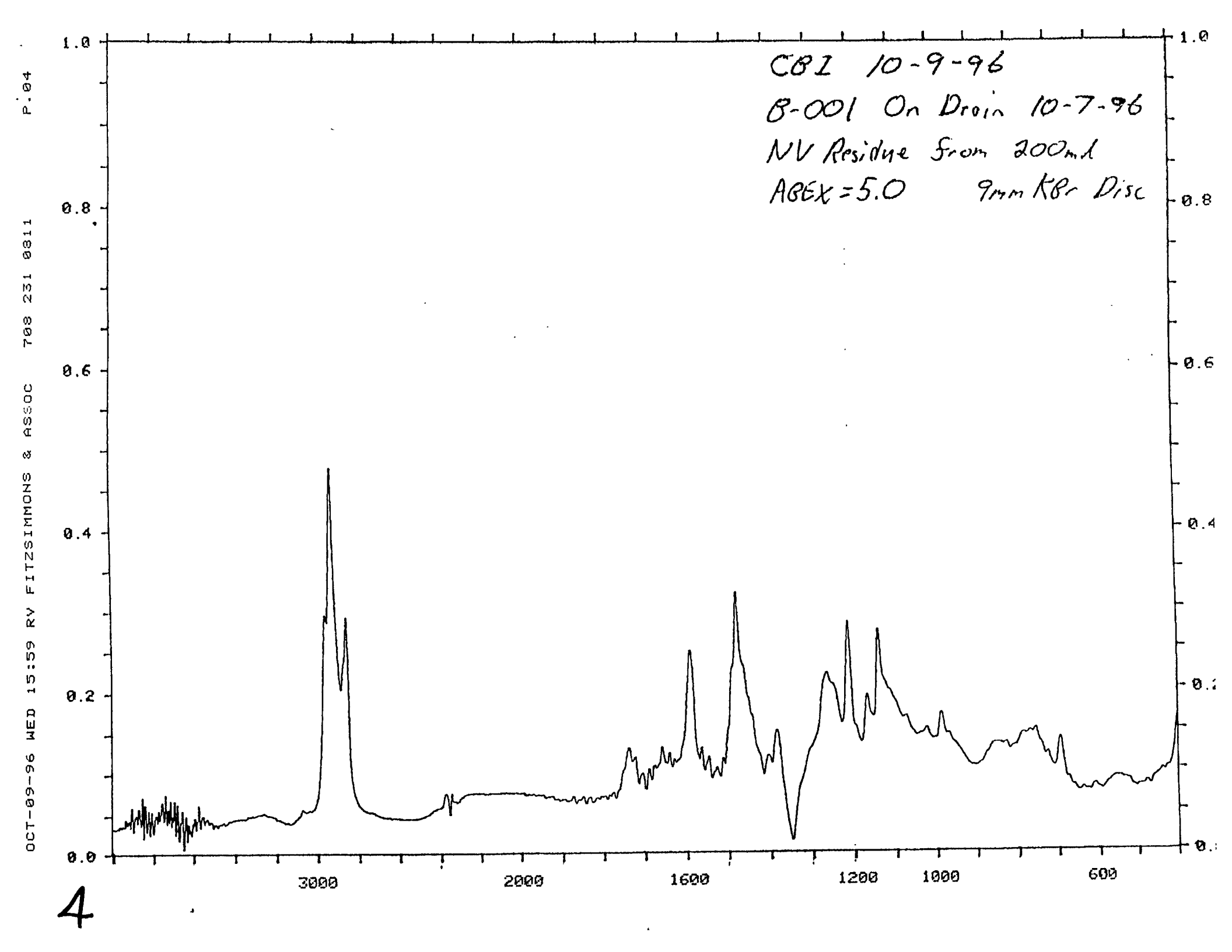
Beam Tube Installation

- Cleaning tube sections
- Shipping tube sections
- Fitup & welding girth seams
- Leak checking girth seams
- Baffle installation
- Support installation
- Alignment

Not presented due to lack of time

CAPACITY 4000

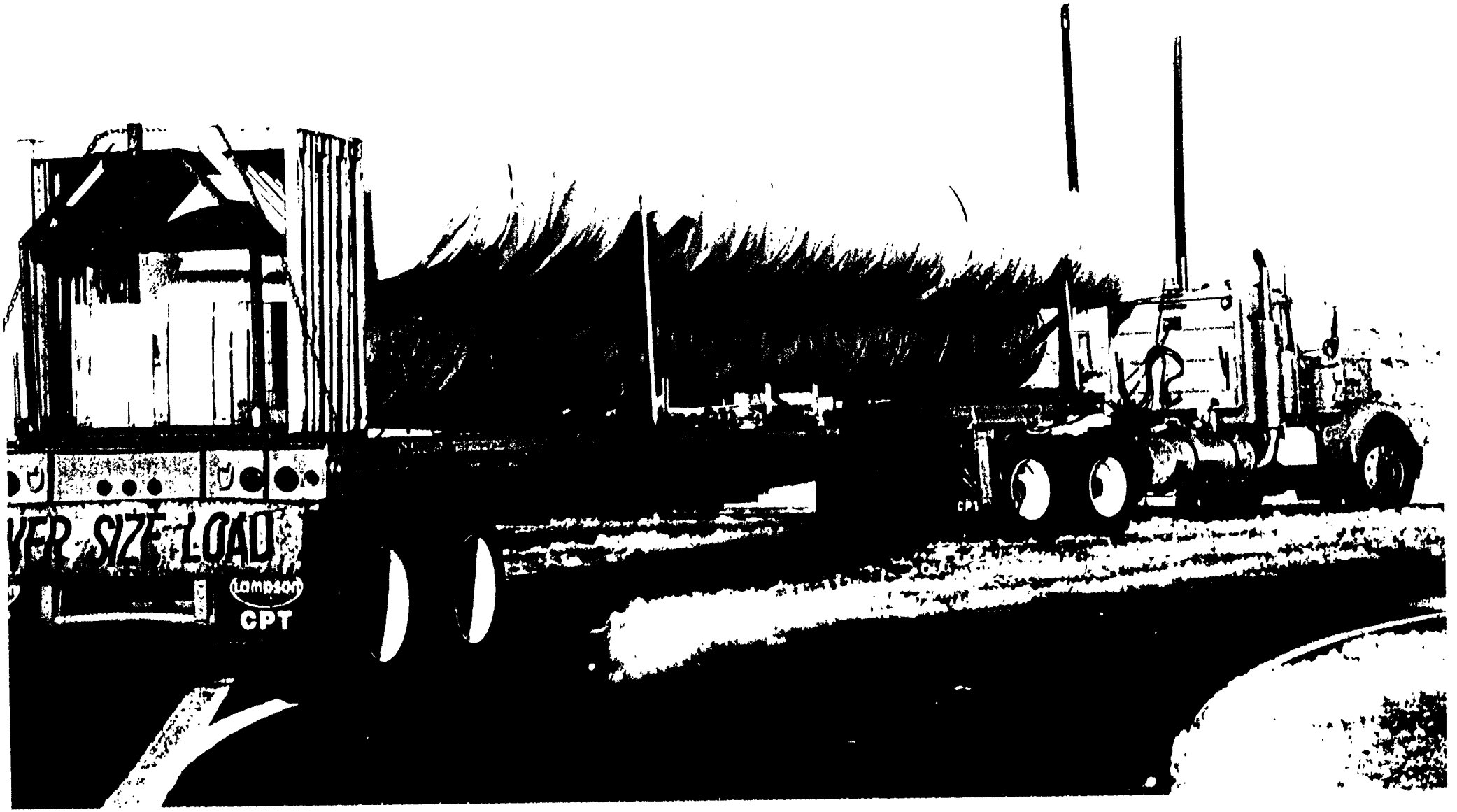



CBI 10-9-96
B-001 On Drain 10-7-96
NV Residue from 200mL
ABEX=5.0 9mm KBr Disc
1.0
0.8
0.6
0.4
0.2
0.0
3000
2000
1600
1200
1000
600
OCT-09-96 WED 15:59 RV FITZSIMMONS & ASSOC 708 231 0811 P.04

4

FTIR Results

Tube No.	Z1480 x1E-4	Z2950 x1E-4	Comments
B001	0.32	0.47	Recleaned, after process/equipment mods.
B002	0.00	0.00	Recleaned, after process/equipment mods.
B003	0.06	0.37	Recleaned, after process/equipment mods.
G001	0.00	0.21	
I001	0.03	0.27	
G002	0.19	0.83	
H001	0.18	0.58	
S001A	15.7	4.01	After second wash (first wash drying looked suspect)
S002B	0.21	0.85	After second wash (first wash drying looked suspect)
S001F	1.25	1.00	After alcohol wipedown and sixth wash
A003	0.15	0.65	
S001G	1.27	0.56	After second alcohol wipedown and seventh wash
A009	0.03	0.31	
S001J	0.62	1.47	After tenth wash + two additional steam rinses
B045	0.37	1.47	
C001	0.25	0.65	
C002	0.34	1.23	
A047	0.19	0.62	


VER SIZE LOAD
Lampson
CPT

7

NO SMOKING
3571
003