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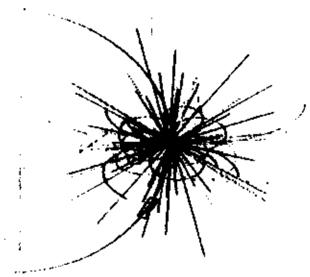
GEM CALORIMETER CRYOGENICS

Superconducting Super Collider Laboratory
Physics Research Division
Experimental Facilities Department/Cryogenics



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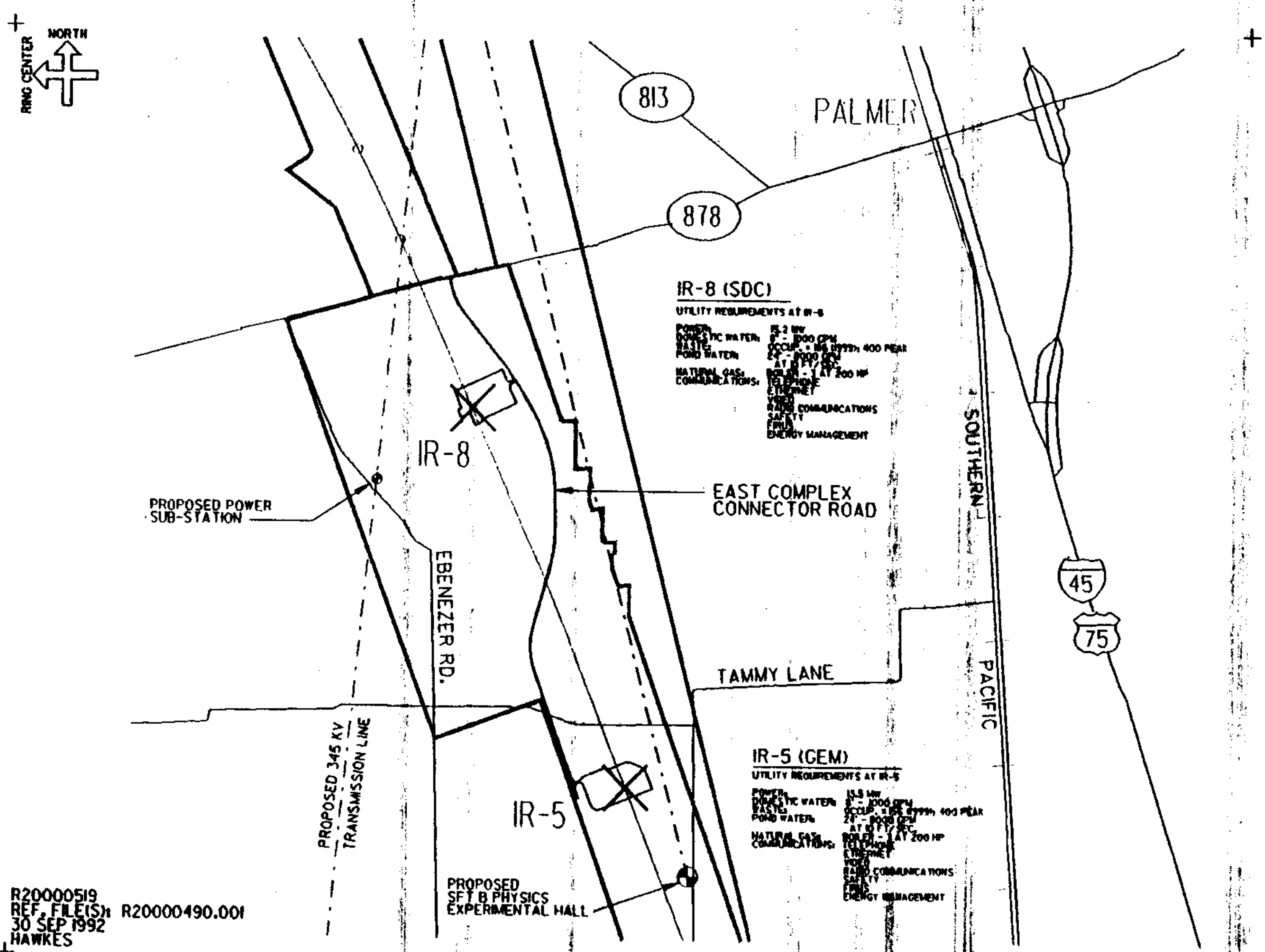
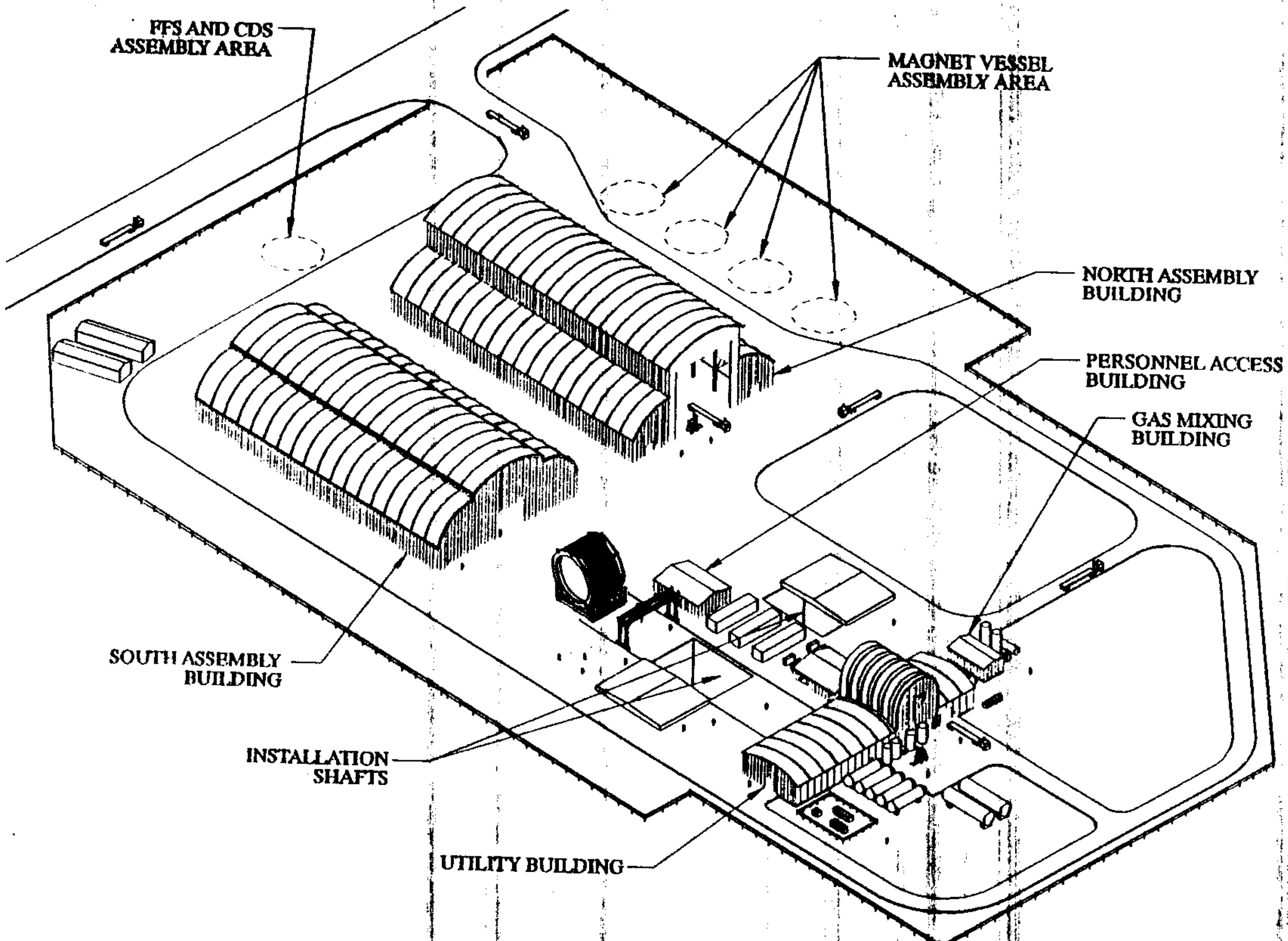
May 25, 1993

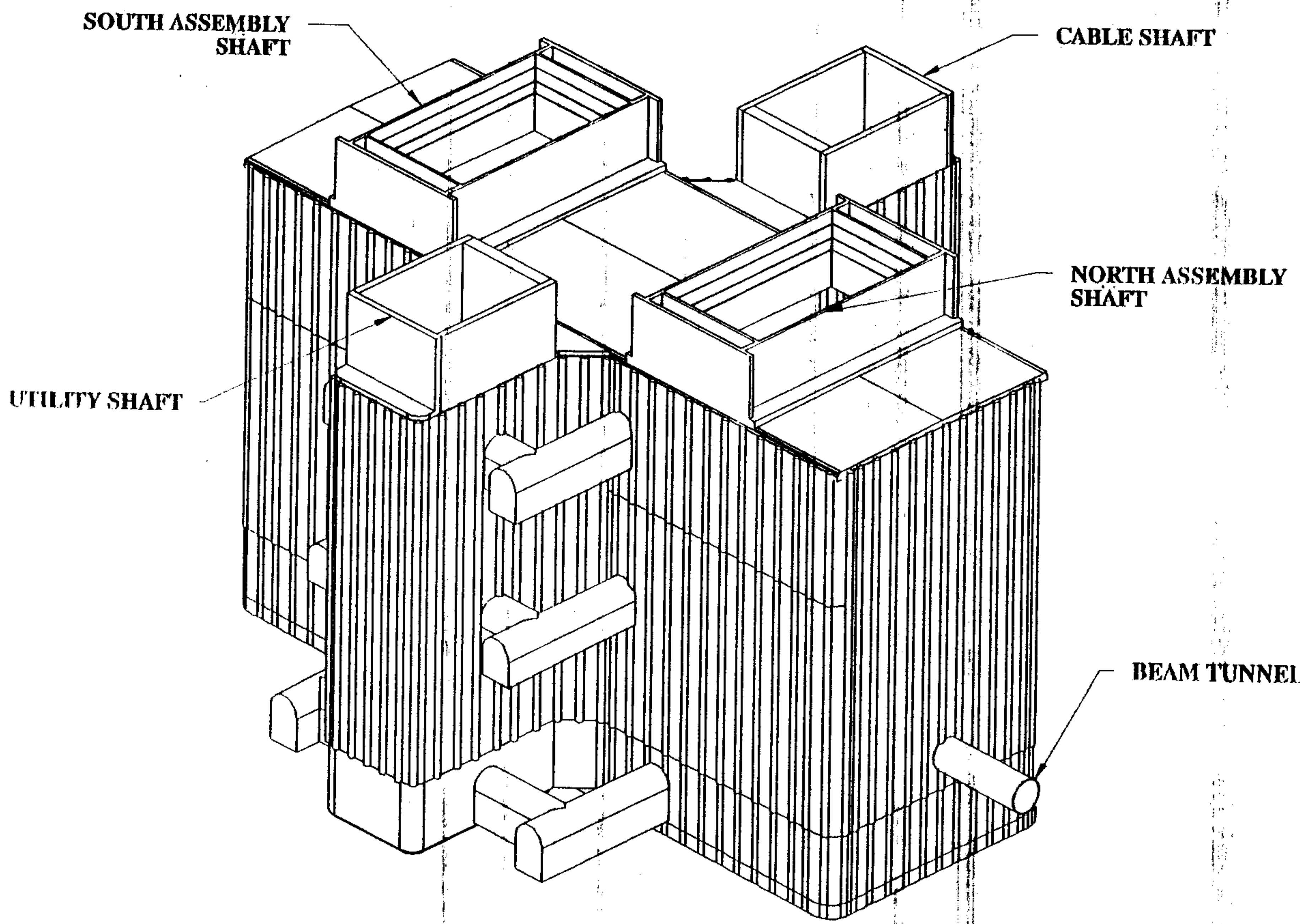
Outline

- Cryogenic Facilities Overview
- Purification
- Cooldown
- Fill Scenario
- Cooling loops
- Krypton Conservation
- Drain Scenario
- Vacuum


NORTH
RING CENTER
813
878
PALMER
45
75
SOUTHERN
PACIFIC
IR-8 (SDC)
UTILITY REQUIREMENTS AT IR-8
COMMUNICATIONS:
ETHERNET
RADIO COMMUNICATIONS
ENERGY MANAGEMENT
EAST COMPLEX
CONNECTOR ROAD
IR-8
PROPOSED POWER
SUB-STATION
EBENEZER RD.
TAMMY LANE
PROPOSED 345 KV
TRANSMISSION LINE
IR-5 (GEM)
UTILITY REQUIREMENTS AT IR-5
POND WATER:
COMMUNICATIONS:
ETHERNET
RADIO COMMUNICATIONS
ENERGY MANAGEMENT
IR-5
PROPOSED
SFT B PHYSICS
EXPERIMENTAL HALL
R20000519
REF. FILE(S): R20000490.001
30 SEP 1992
HAWKES



FFS AND CDS
ASSEMBLY AREA
MAGNET VESSEL
ASSEMBLY AREA
NORTH ASSEMBLY
BUILDING
PERSONNEL ACCESS
BUILDING
GAS MIXING
BUILDING
SOUTH ASSEMBLY
BUILDING
INSTALLATION
SHAFTS
UTILITY BUILDING



IR5 - GEM UNDERGROUND HALL

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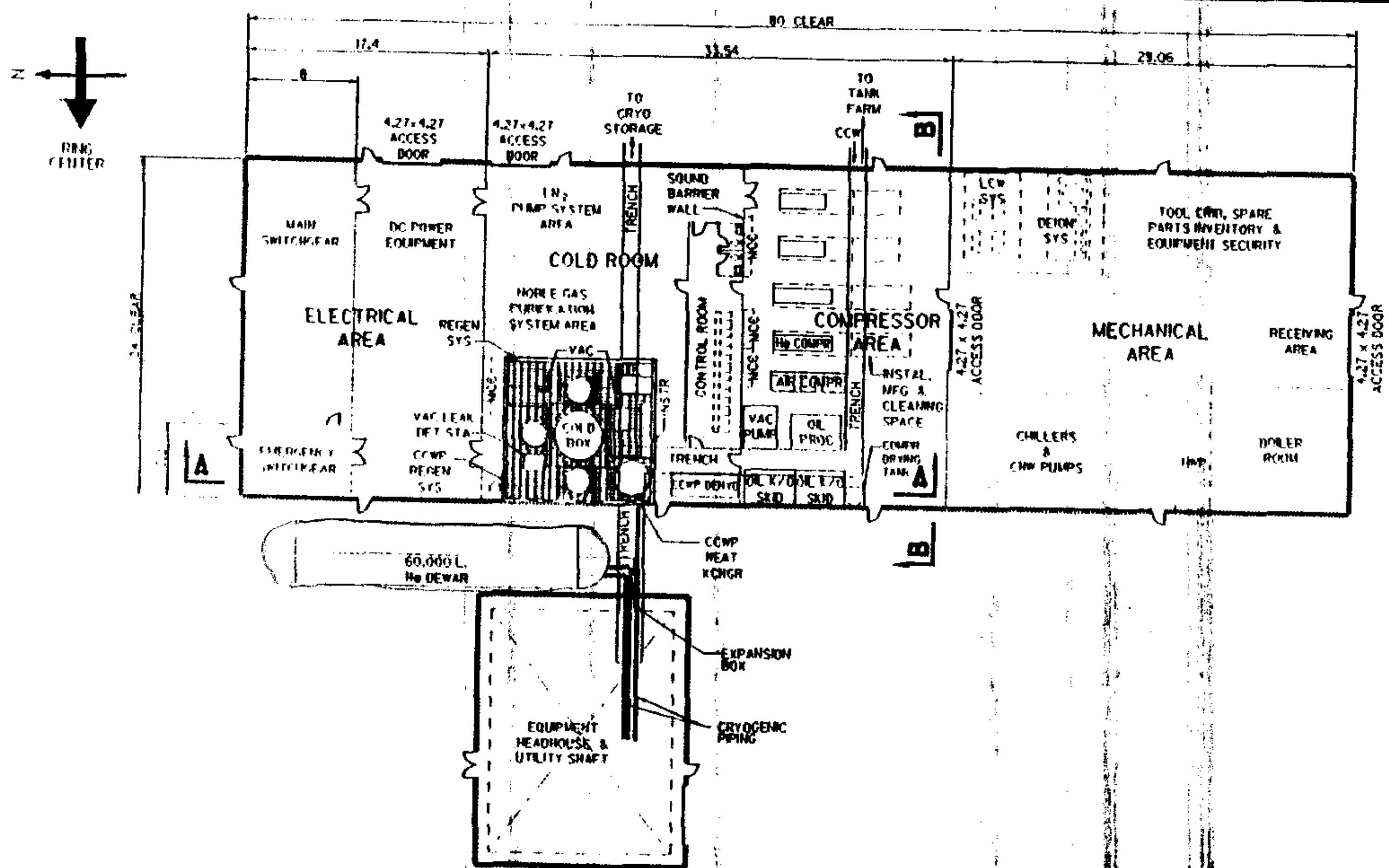

PLAN OF GEM UTILITY BUILDING SHOWING HELIUM DEWAR WITH CRYOGENIC LINES ENTERING SHAFT

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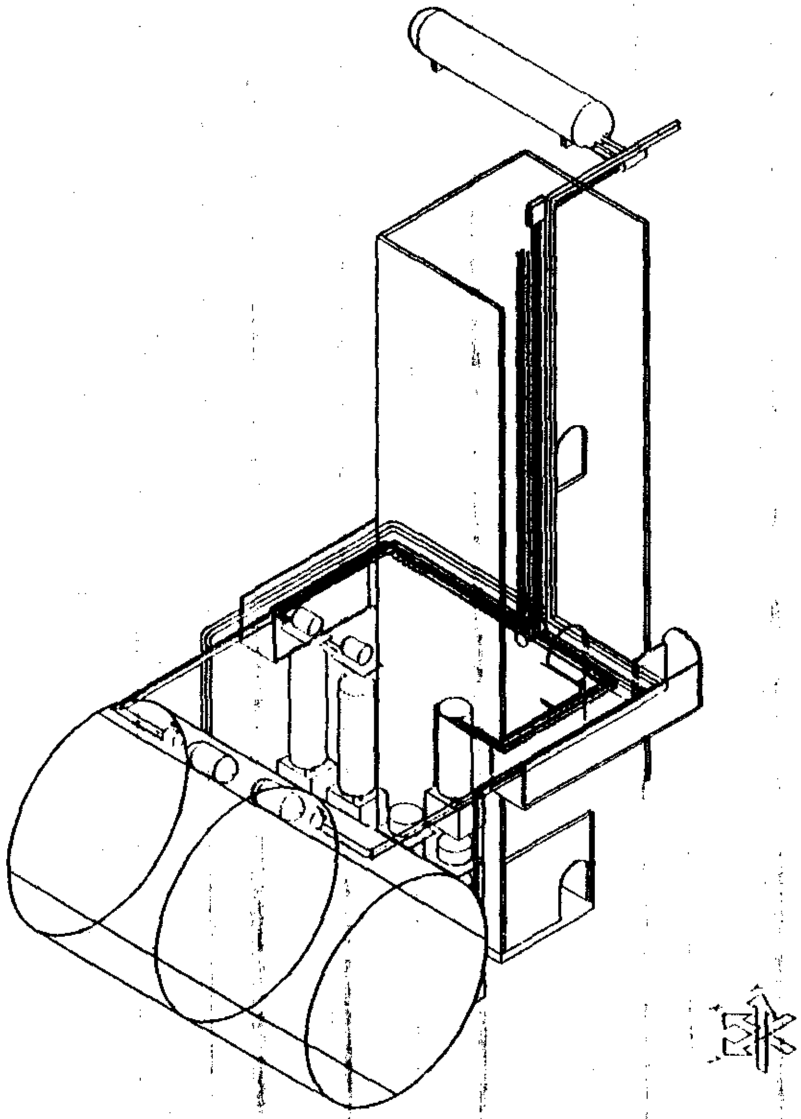

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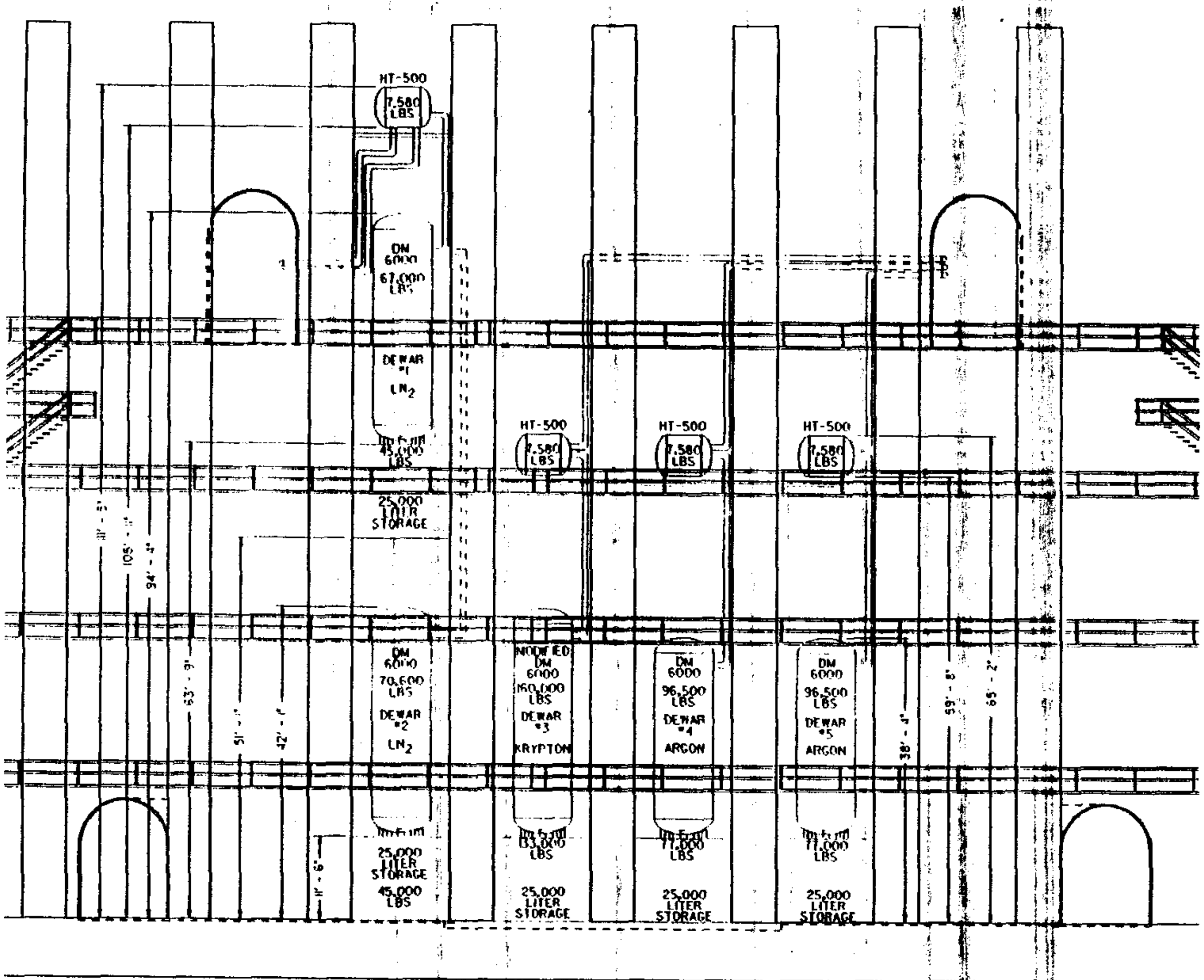

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Purification

- Check for Contaminants from:
  Equipment, Cables, Connections, etc.
- Check for Contaminants from:
  Assembly and Test Procedures.
- Decontamination of Vessel after Assembly.
- Purify Krypton before filling Calorimeter.
- On-line Purification of Gas and Liquid.

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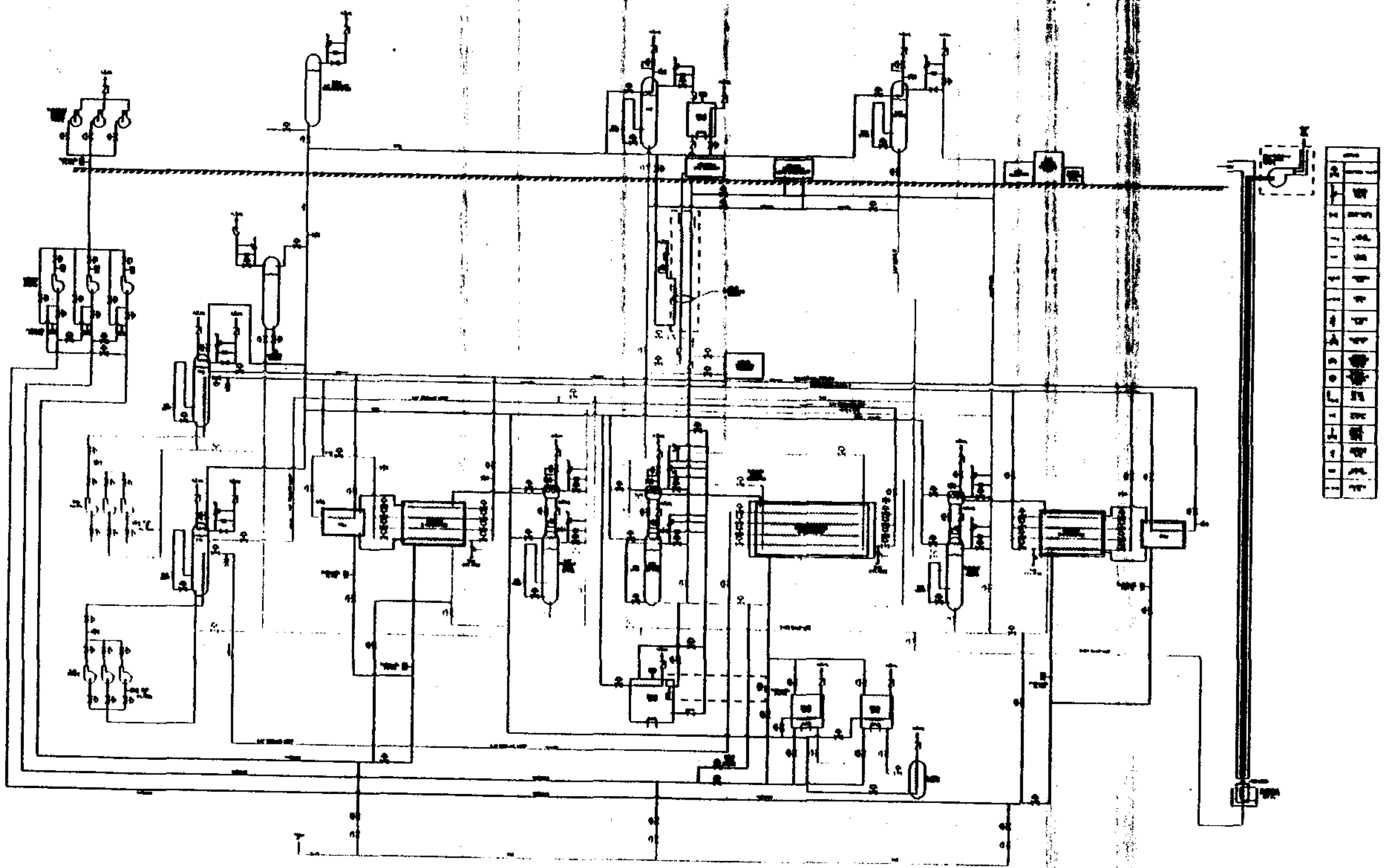

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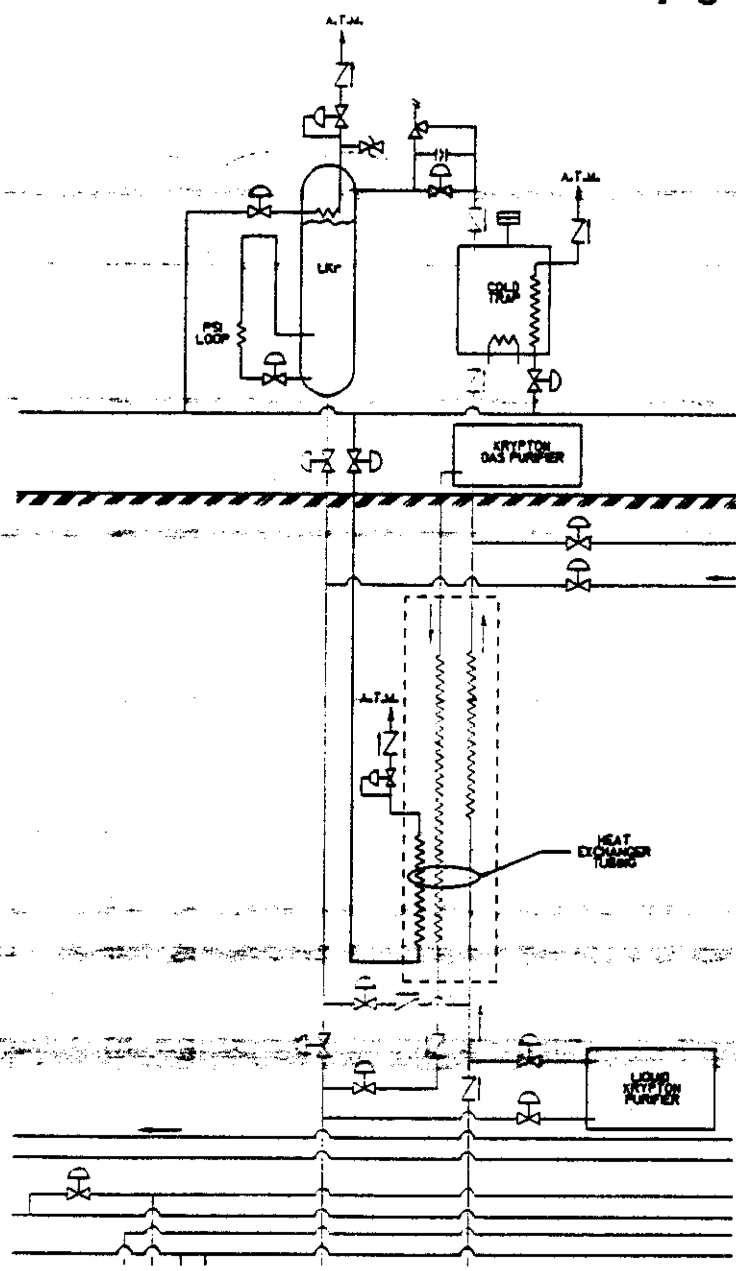

Cooldown

- Cooldown Media will be Helium Gas Cooled by LN_2.
- Accurate Control Using Cooldown Heat Exchanger (from Magnet)

1 deg K per hour Maximum Rate of Change.

- ΔT To Be Used.
  - 30 K 300-250K
  - 50 K 250-200K
  - 70 K 200-100K

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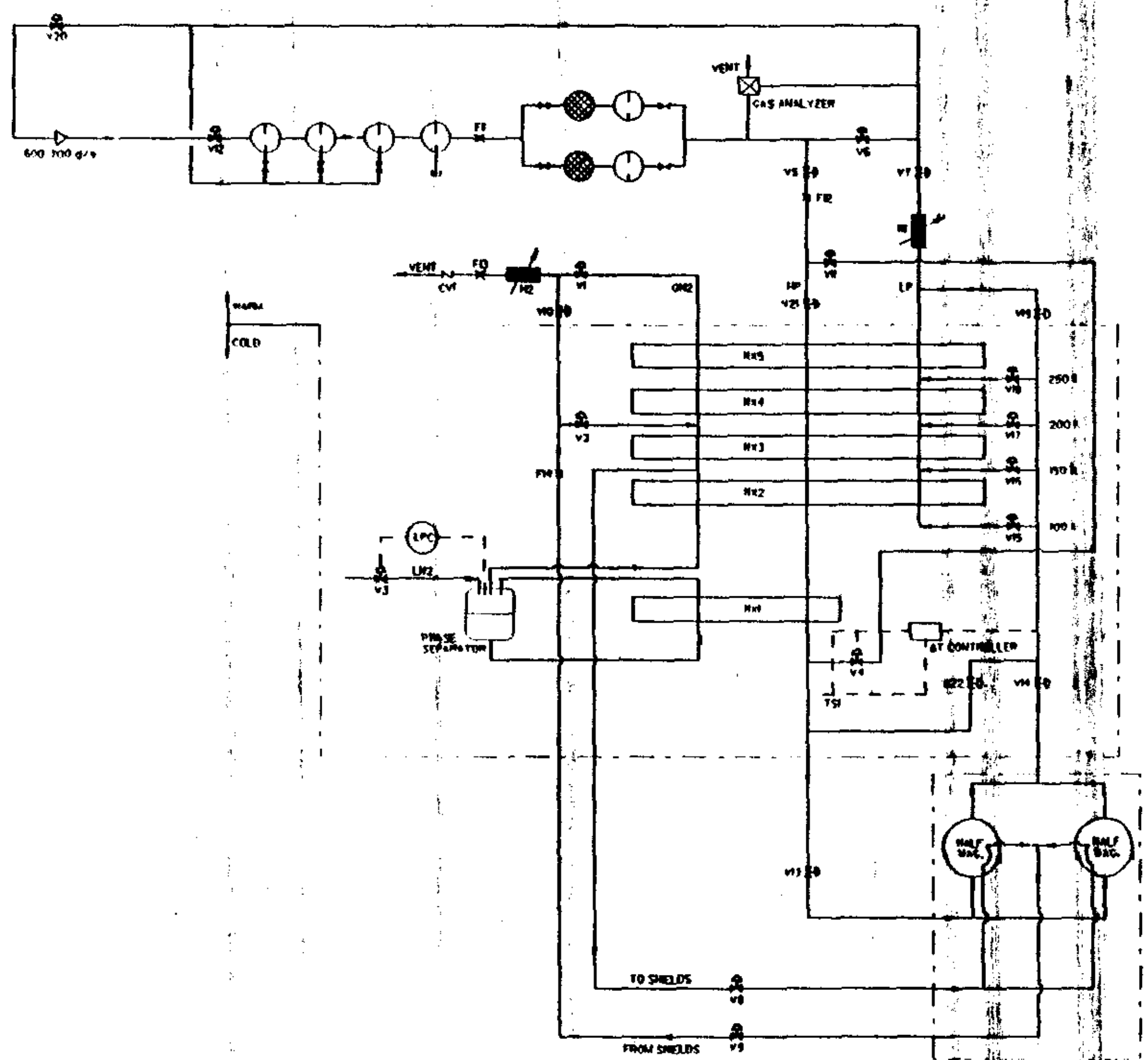


CALORIMTER COOLDOWN

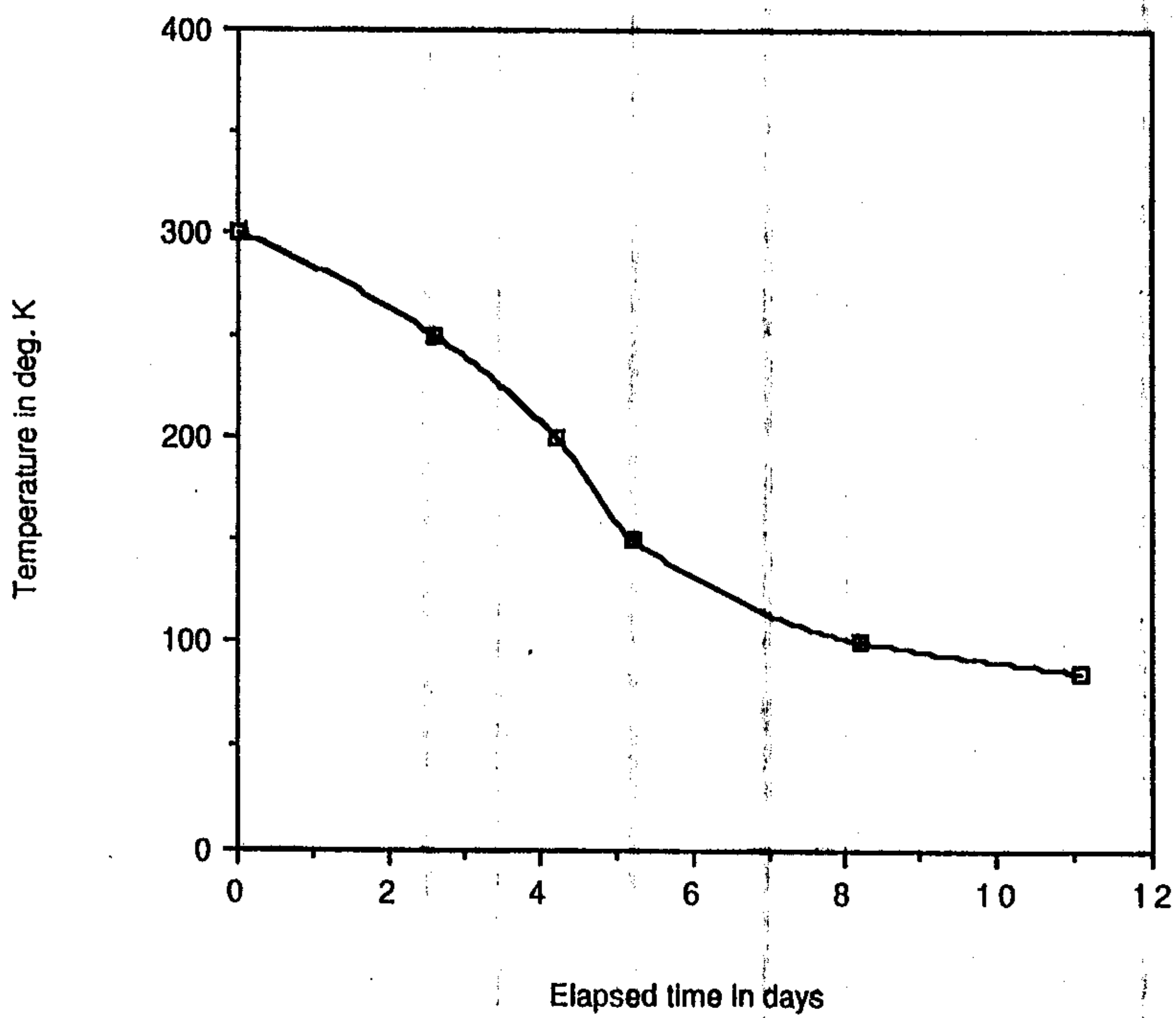
Barrel (Mass=473,000kg)

Calorimeter Start [K]	Calorimeter End [K]	Temp. Diff. DT [K]	Helium Flowrate [g/sec]	Cooldown Time [Days]	Estimated N2 Consumption [Tons/day]
300	250	30	300	2.6	1.75
250	200	50	300	1.6	4.03
200	150	70	300	1	3.41
150	100	20	300	3	7.45
100	85	5	300	2.9	5.9
			Total	11.1	22.54

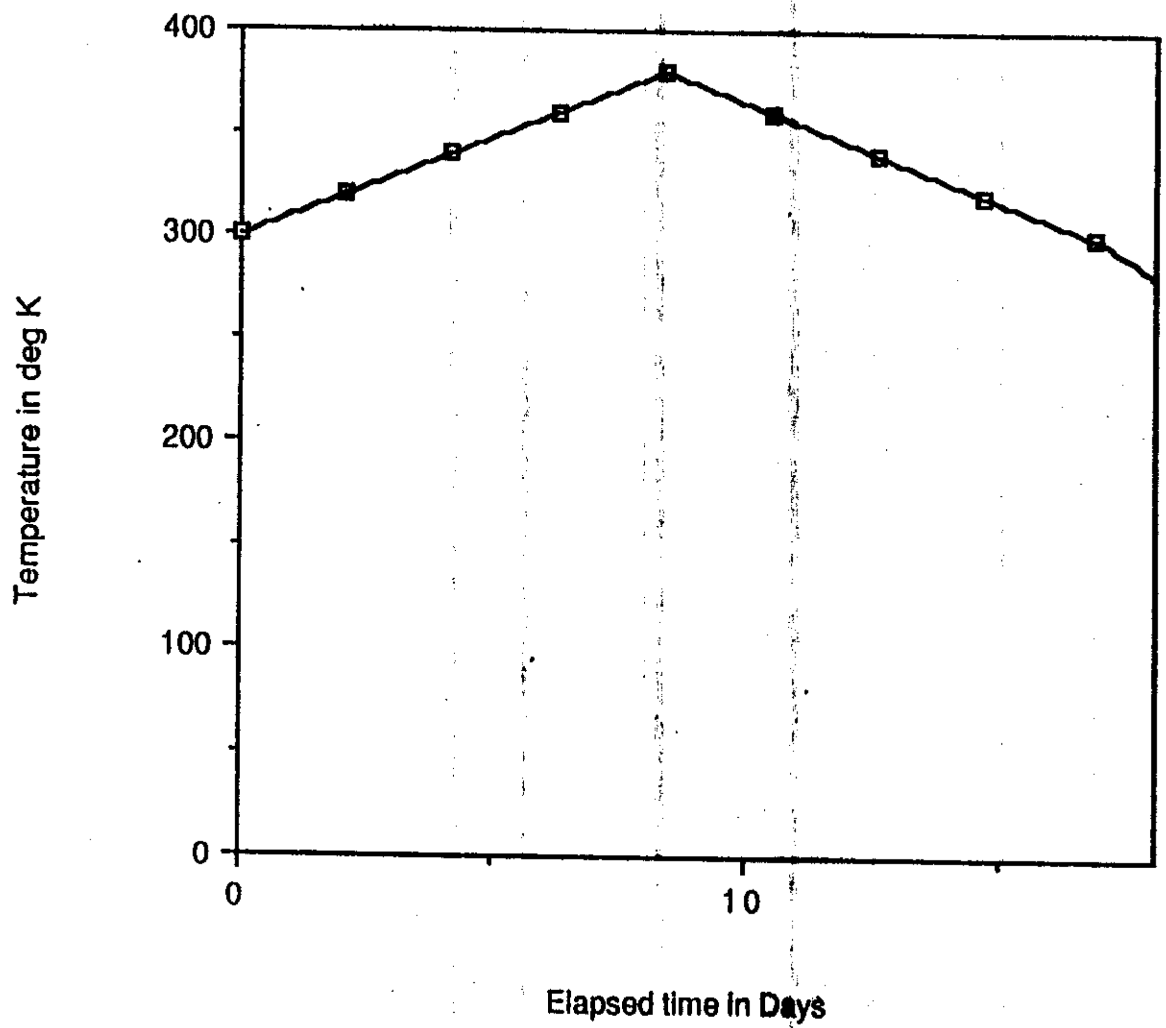
Cooldown of one endcap (Mass=382500)

Calorimeter Start [K]	Calorimeter End [K]	Temp. Diff. DT [K]	Helium Flowrate [g/sec]	Cooldown Time [Days]	Estimated N2 Consumption [Tons/day]
300	250	30	300	2.12	1.43
250	200	50	300	1.22	3.07
200	150	70	300	0.812	2.77
150	100	20	300	2.436	6
100	85	5	300	2.432	4.92
			Total	9.02	18.19

Barrel cooldown from 300 K to 85 K: Temperature vs time for a He mass flowrate of 300 g/sec



Barrel bake out : temperature vs time for a helium mass flowrate of 300 g/sec.



Fill Scenario

- Krypton will be Transferred from the Surface to the Hall Storage Vessel.
- Pressurize Hall Storage Vessel Sufficiently to Fill Barrel From Bottom.
- Condense Krypton Gas in the Head Dewar.
- Transfer Head Dewar Volume to Barrel to Complete Fill.

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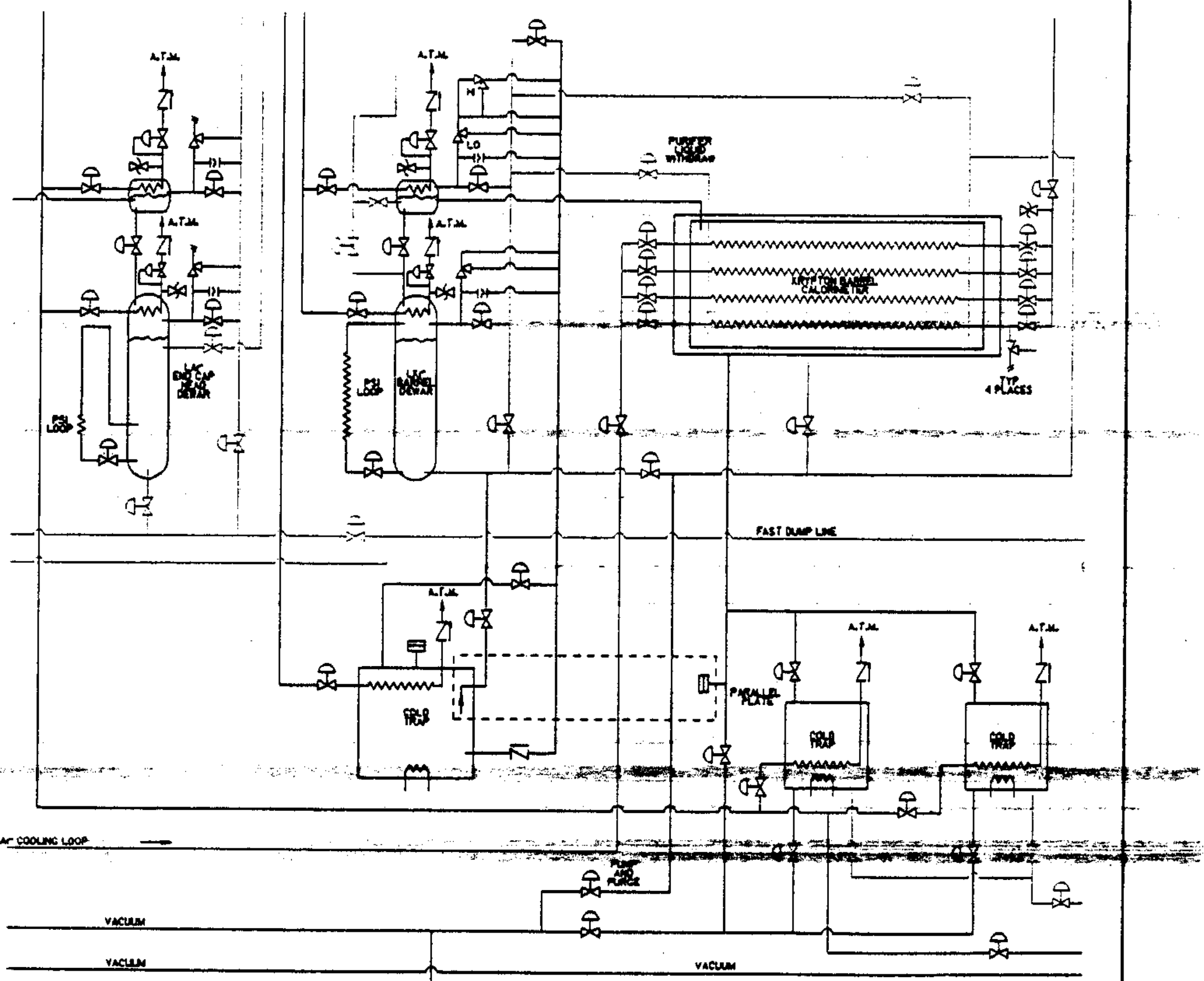

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Cooling Loops

- Storage Vessel condensing loops use:
  Subcooled LN2

- Barrel cooling loop is pumped:
  Subcooled liquid Argon

- End Cap cooling loop is pumped:
  Subcooled liquid Nitrogen.

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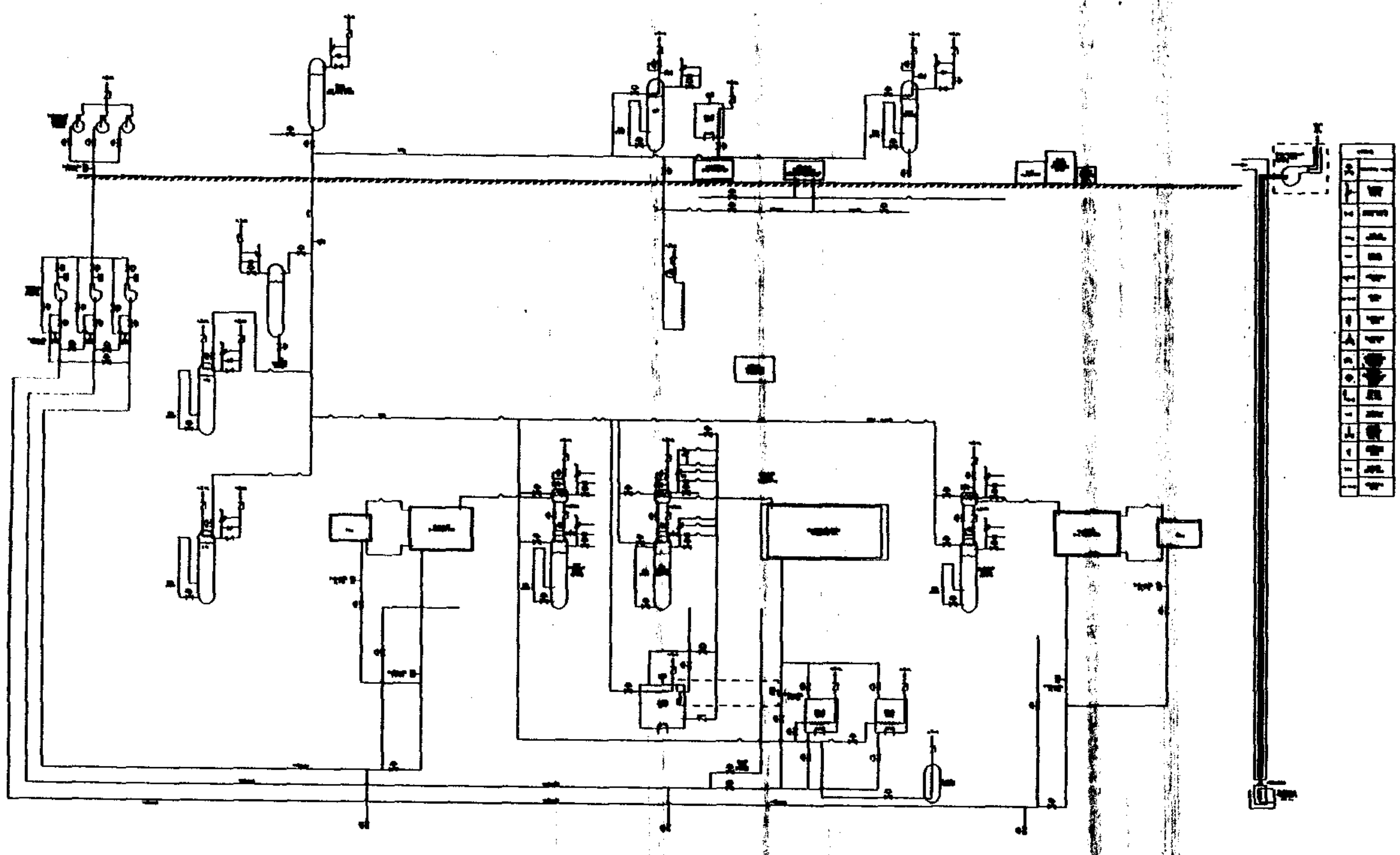

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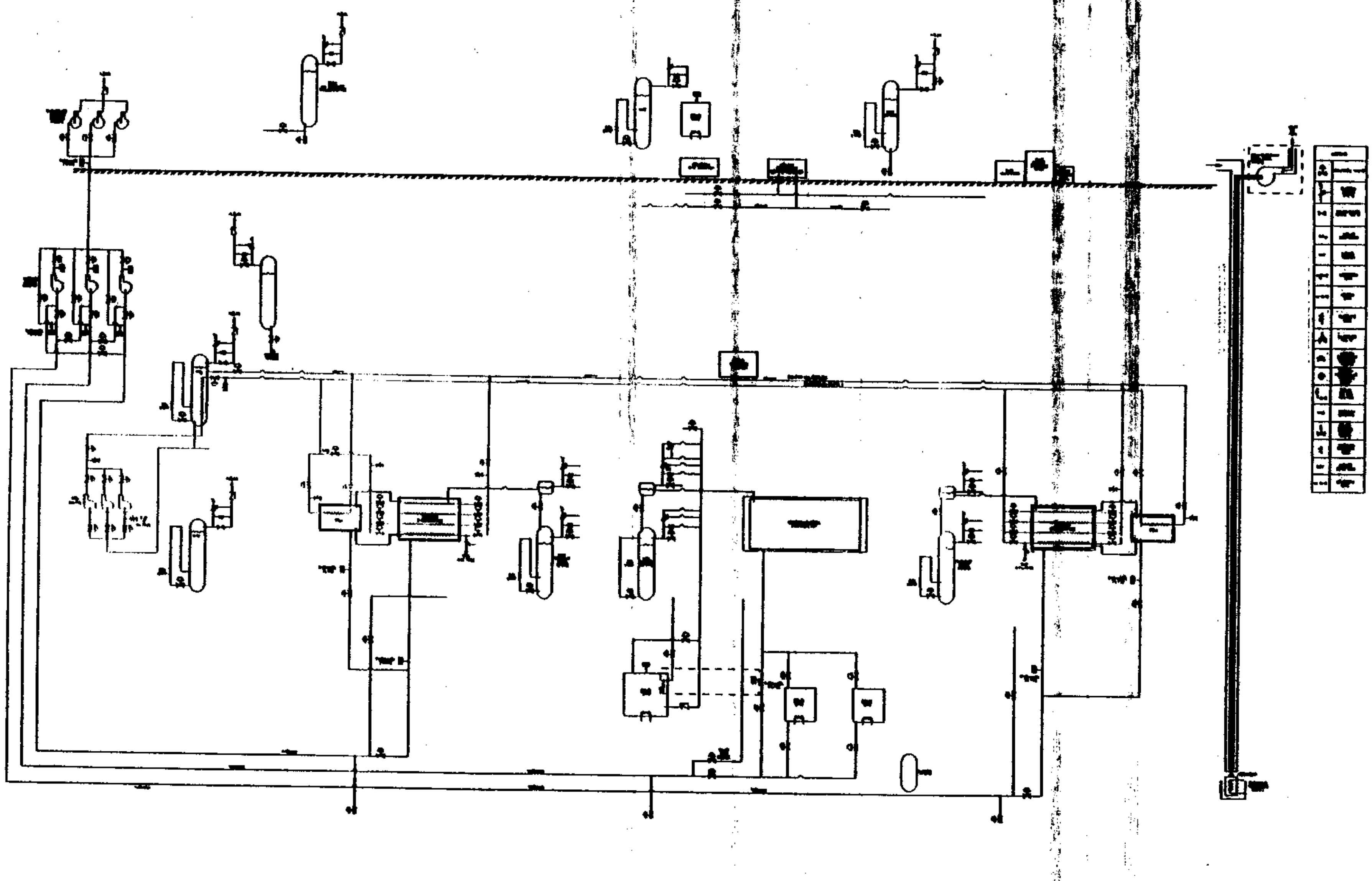

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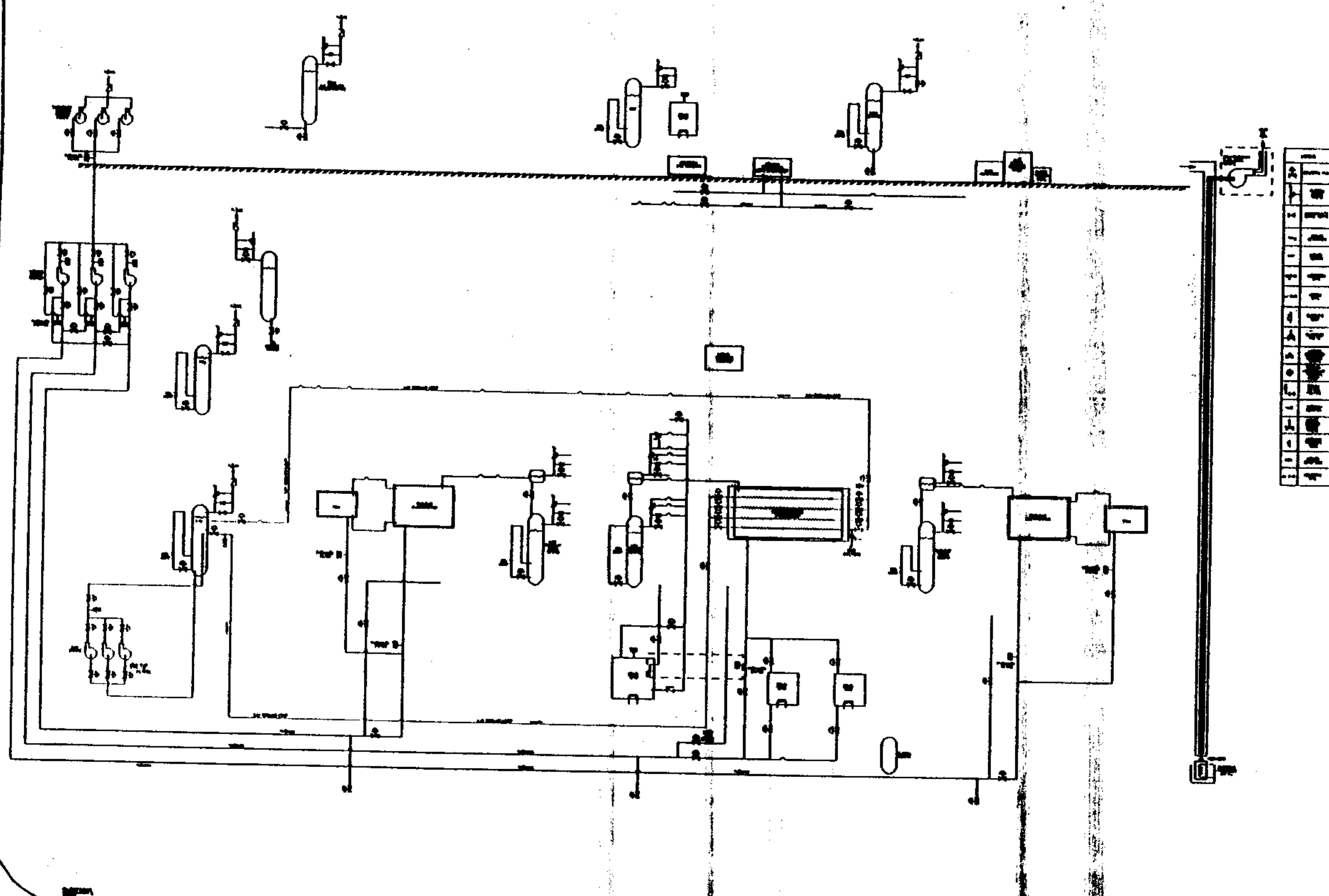

Krypton Conservation

- Discharge of All Relief Valves Piped to Condenser Area.

- Cold Traps in Vacuum Pumping Circuit Collect Small Vessel Leaks.

- Disaster Catch Basin will be Semi-Sealed with LN_2 Condensers.

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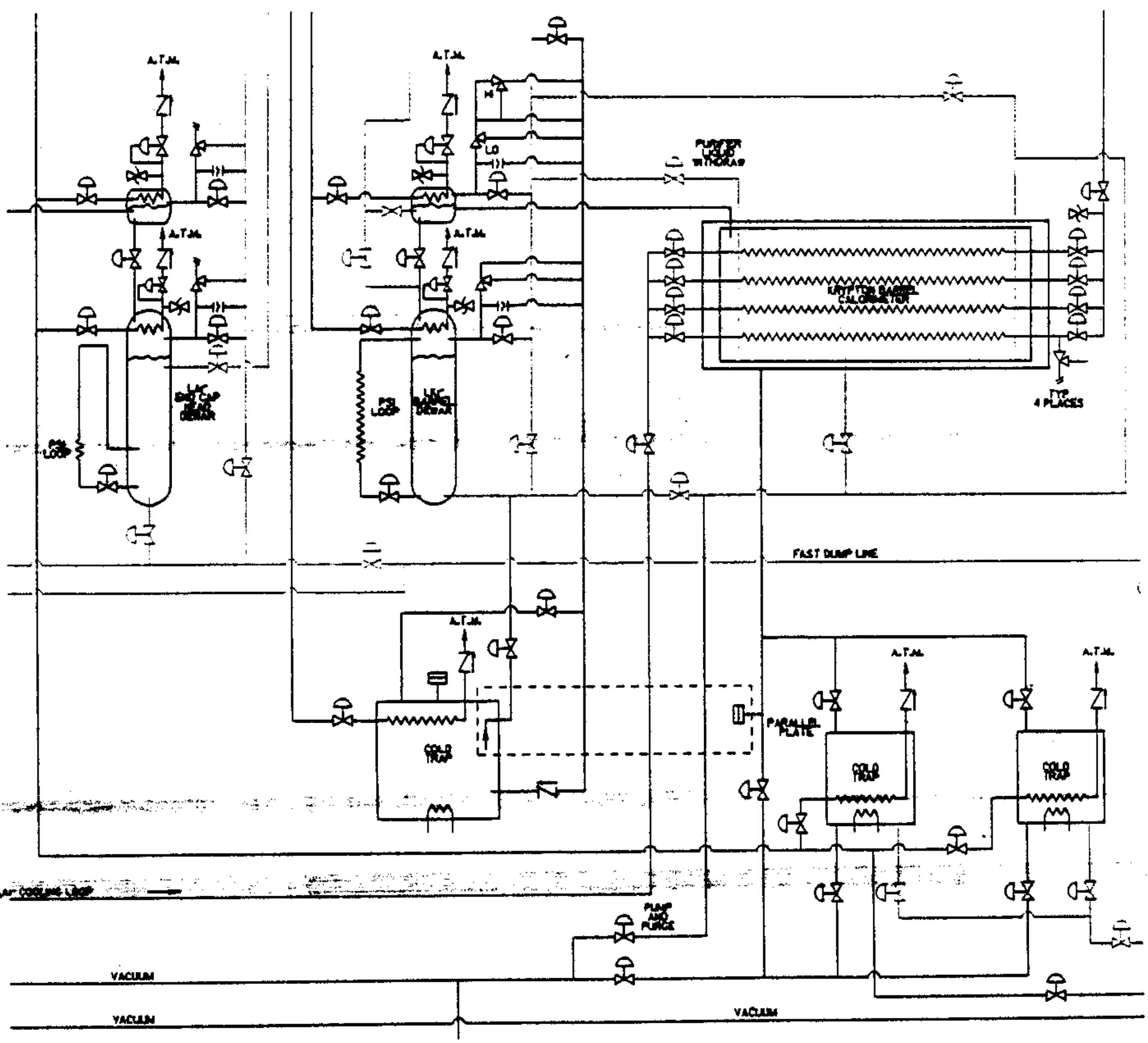

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Drain Scenario

- Open barrel bottom drain valve.
- Open barrel storage dewar bottom valve.
- Back pressure barrel to complete transfer.
- Close all valves.

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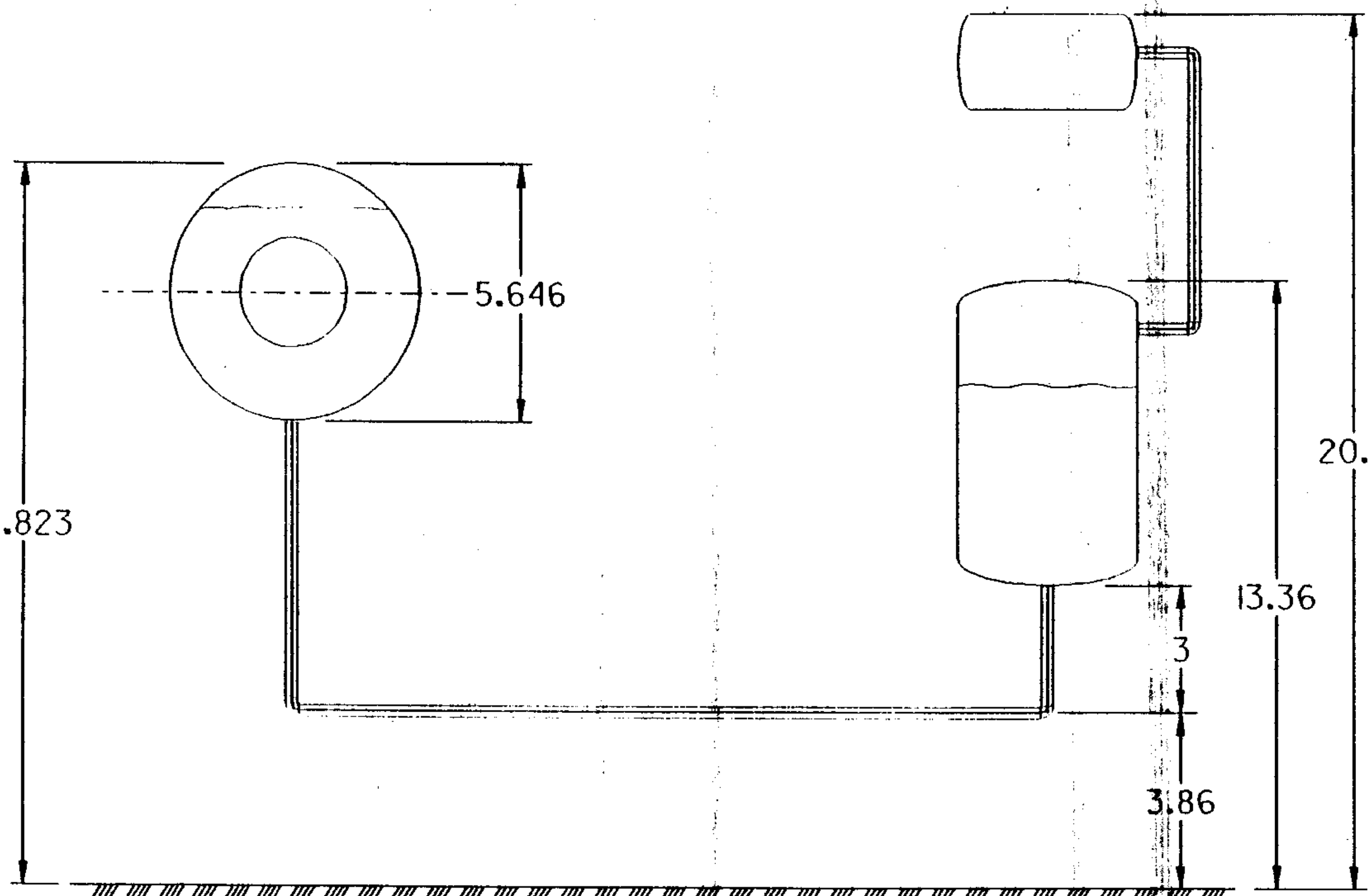

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Vacuum System

- Surface: 2 Stage Roughing (3 Each).
- Lower Level Utility Shaft: Roots Blowers (3 Each).
- Diffusion Pumps Just Outside Detector.
- (Option) Helium Cryopumps Inside Detector Vacuum Piping.

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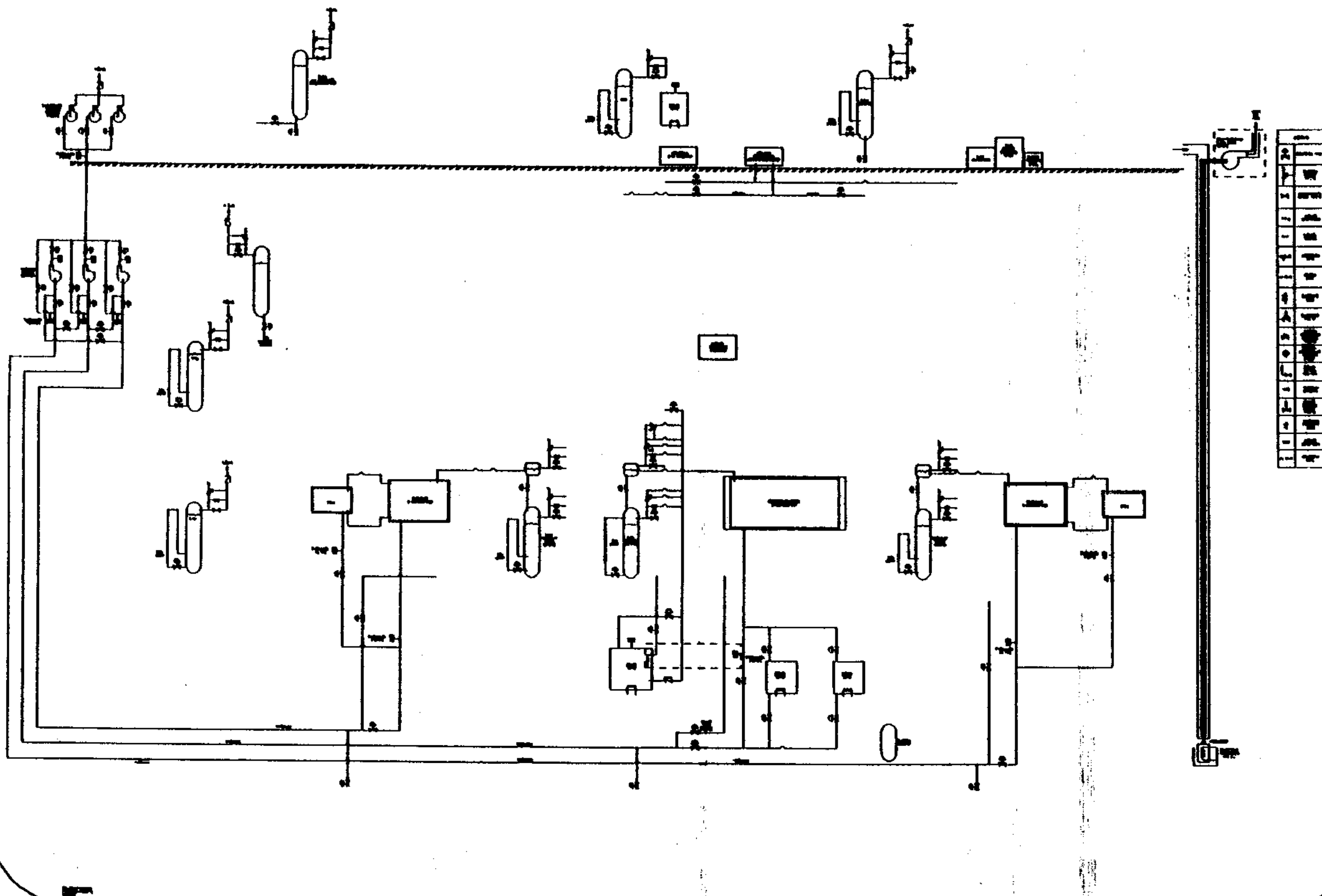

Work In Progress

- Sizing of Equipment and Piping.
- Equipment Location.
- Piping Routes.
- Assembly and Installation Concepts.
- Timing and Phasing of Installation.
- Surface Cooldown Test.
- Acceptance Test Criteria.
- Development of Laboratory for Purification and Testing.

Summary

- The TDR Design Meets the Current Cryogenic and Vacuum Requirements of the Calorimeter.

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