

Neutrino Beamline Absorber Hall Intermediate Water (INTW) Preliminary Design Review

Technical Design Aspects

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Absorber Hall Intermediate Water (INTW)

Outline

- Purpose
- Design Requirements
- Design Standards and Codes
- Design Layout and Details
 - Block Diagram
 - System Operational Parameters
 - Approximate Room Layout
 - Flow Model and P&ID
- Summary
 - Pending Items
 - Questions

Absorber Hall Intermediate Water (INTW)

Purpose

- The Absorber Hall Intermediate Water (INTW) System provides:
 - A means of heat transfer between conventional facilities cooling equipment and Radioactive Water (RAW) using Fermilab equipment .
 - A means of isolating that conventional facilities cooling equipment from any Fermilab equipment that may become radioactive.

Absorber Hall Intermediate Water (INTW)

Design Requirements

- The Absorber Hall Intermediate Water (INTW) System shall:
 - Require minimal unscheduled interventions for maintenance.
 - Have flows and capacities based on the connected load obtained from the Absorber RAW system engineer(s).
 - Have a nominal design temperature of 66°F.
 - Be considered non-radioactive with a maximum radioactivity of 1900 pCi/ml.
 - Be filtered to remove all particles larger than 5 microns.
 - Reject heat to a water chiller furnished and installed under the Conventional Facilities portion of the LBNF Project.

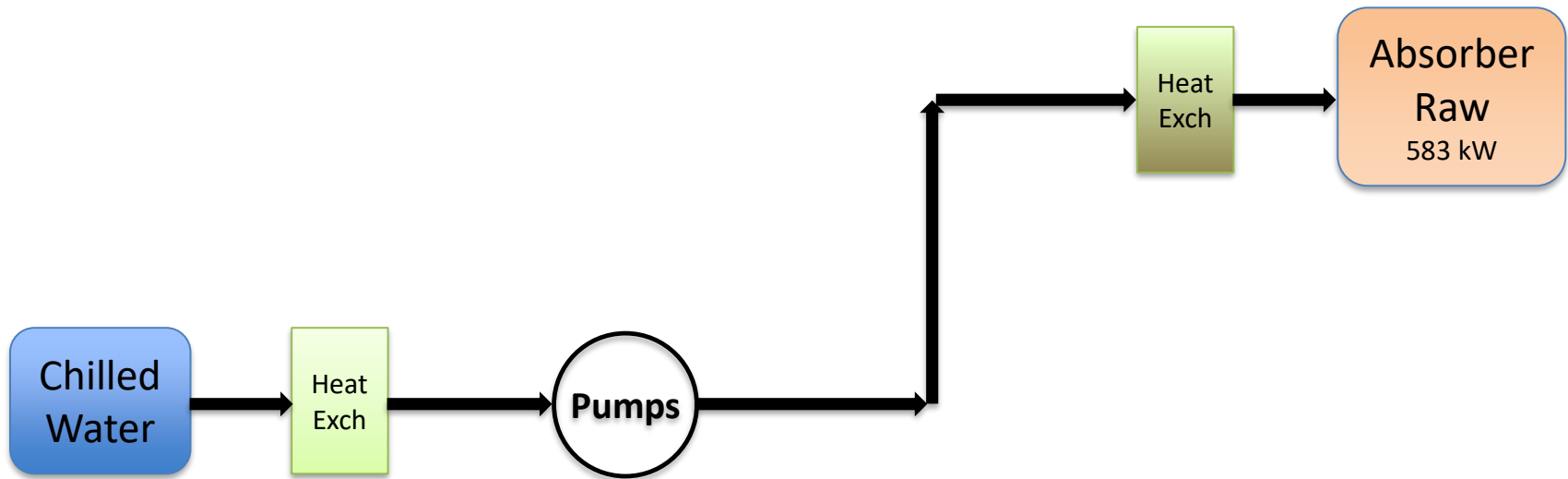
Absorber Hall Intermediate Water (INTW)

Design Standards and Codes

- In addition to complying with the following industrial and Fermilab standards and codes, the system design, particularly the system's operation modes, capacity, and valve regulating & controls, is mainly based on Numi/Nova systems' operational experience, lessons learned, and the latest feedback in operational input and upgrades.
 - ASME B31.3 Code for Category D Fluid Service.
 - ASME BPVC Section IX for Welding Process Specifications (WPS's) and welders & pipefitters' Personal Weld Qualifications.
 - Both piping and vessels will adhere to FESHM Chapters 5031, 5031.1, 5031.3, 5034 as well as the Fermilab Engineering Manual.
 - Piping and Tubing will be 304L or 316L ASTM A312 Stainless Steel

Absorber Hall Intermediate Water (INTW)

Block Diagram



kW Loading obtained from Absorber
RAW System Engineer(s)

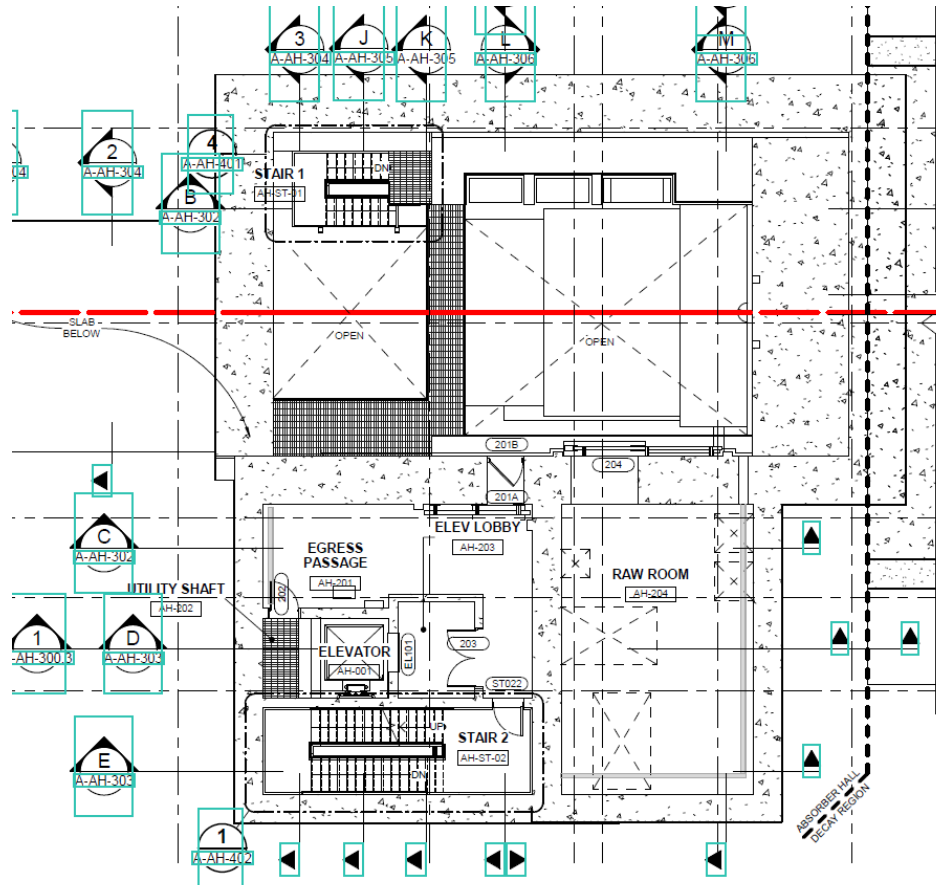
Absorber Hall Intermediate Water (INTW)

System Operational Parameters

LBNF Loading - Summary												
Absorber Hall @ 2.4 MW		RAW Skid				INTW Skid						
Absorber Hall Skids @ 2.4 MW Item	Design kW	Design GPM	Design TD °F	Design EWT °F	Design LWT °F	Design kW	Design GPM	Design TD °F	Design EWT °F	Design LWT °F	Notes	
Absorber Skids:	583	400	10	80	90	583	320	12	66	78	HEX Sized for 583 kW and 400 GPM (per AD)	
	Chilled Water				INTW							
Chilled to INTW Heat Exchanger:	583	400	10	45	55	583	320	12	78	66	HEX Sized for 583 kW	
	Filtration Loop:						5					Approx: 45 mins to filter 150 gallon system volume
	Pump Size:						325	GPM				
Absorber RAW Info (AD)						Pump Heat						
Pump	1,600 GPM @ 50 TDH (21.6 Psi) 105 Ft. Shut-off Head 1,600 GPM is required by the Absorber system. Only 400 GPM passes through the Heat Exchanger					Pump heat is < 5 kW and is lost in total system noise (~ 1 kW)						
Heat Exchanger	400 GPM @ 90°F in / 80°F (10°F ΔT), 4.22 Psi ΔP Calc'd Load = 583 kW					Absorber RAW - 2.4 MW Design Basis Since the 1.2 MW Beamline case kW loading is approximately equal to the 2.4 MW Beamline case kW loading, the 2.4 MW Beamline Case will be used as the design basis for the INTW system.						
Chiller (by CF)	45°F out, at 10°F ΔT (per Lee Hammond)											

Absorber Hall Intermediate Water (INTW)

Approximate Layout – General Rooms Arrangement



MIDDLE LEVEL PLAN @ EL. 693.33'

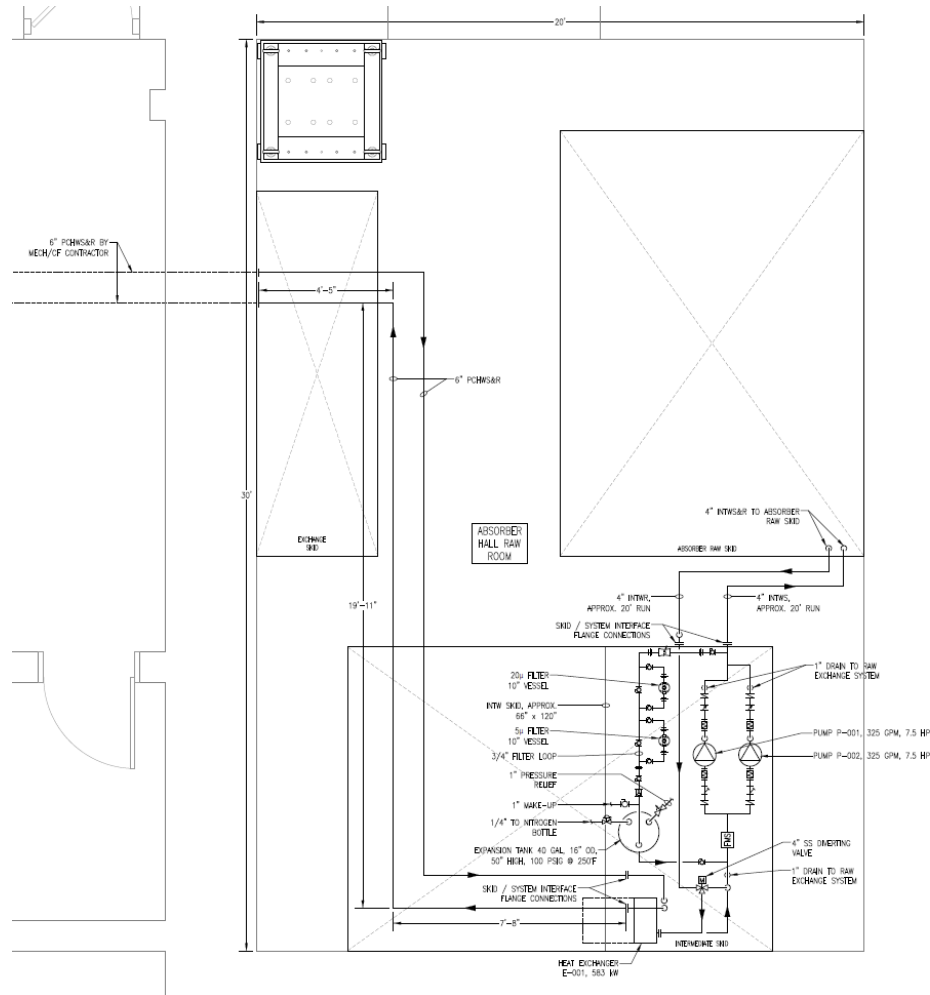
SCALE: 1/8" = 1'-0"

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A-AH-102

Routing for Chilled Water from CF Chiller still undetermined (Noted in 50% NSCF Design Review)

Absorber Hall Intermediate Water (INTW)

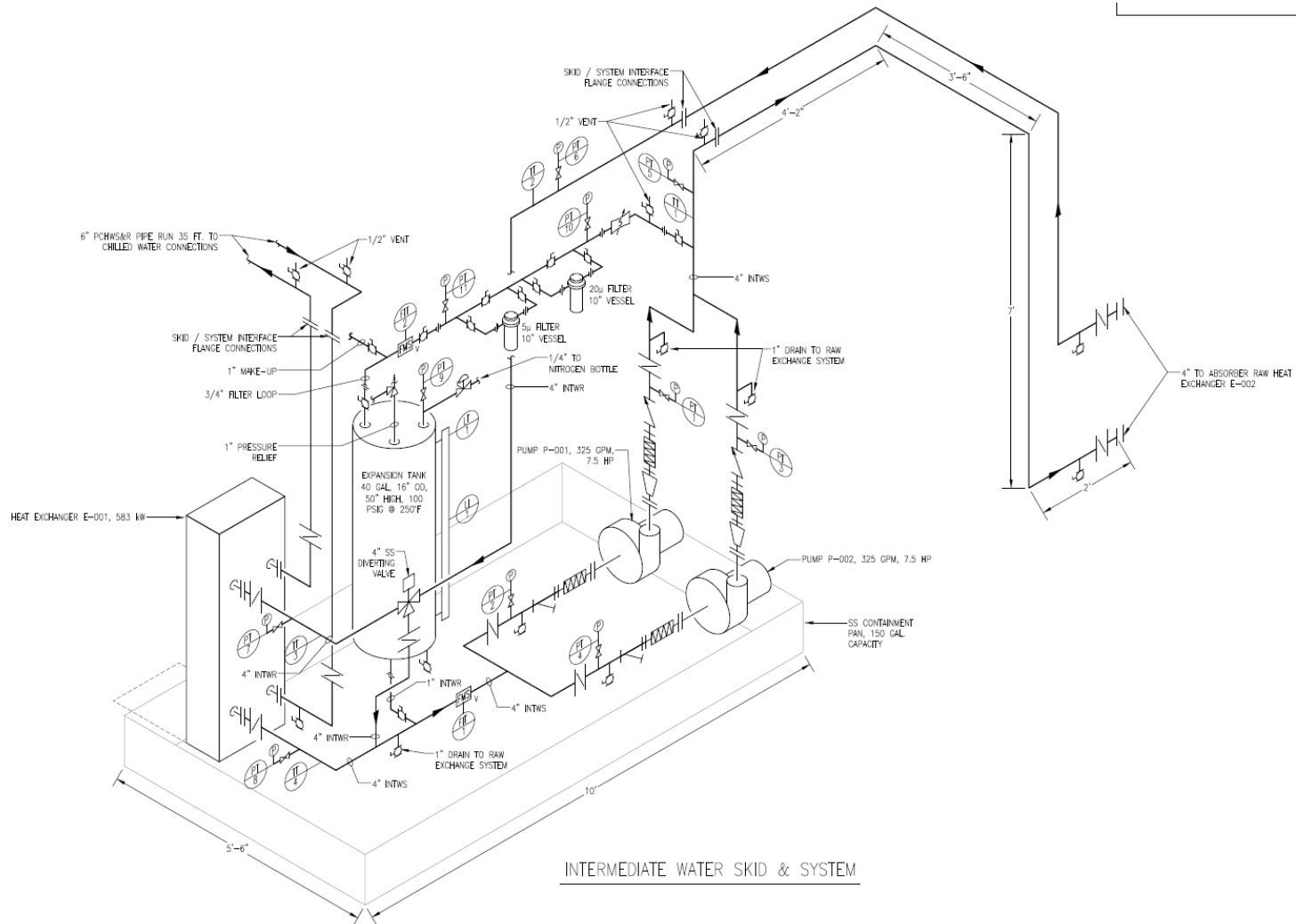
Approximate General Layout



Routing for Chilled Water from CF Chiller to INTW Skid still undetermined (Noted in 50% NSCF Design Review)

Absorber Hall Intermediate Water (INTW)

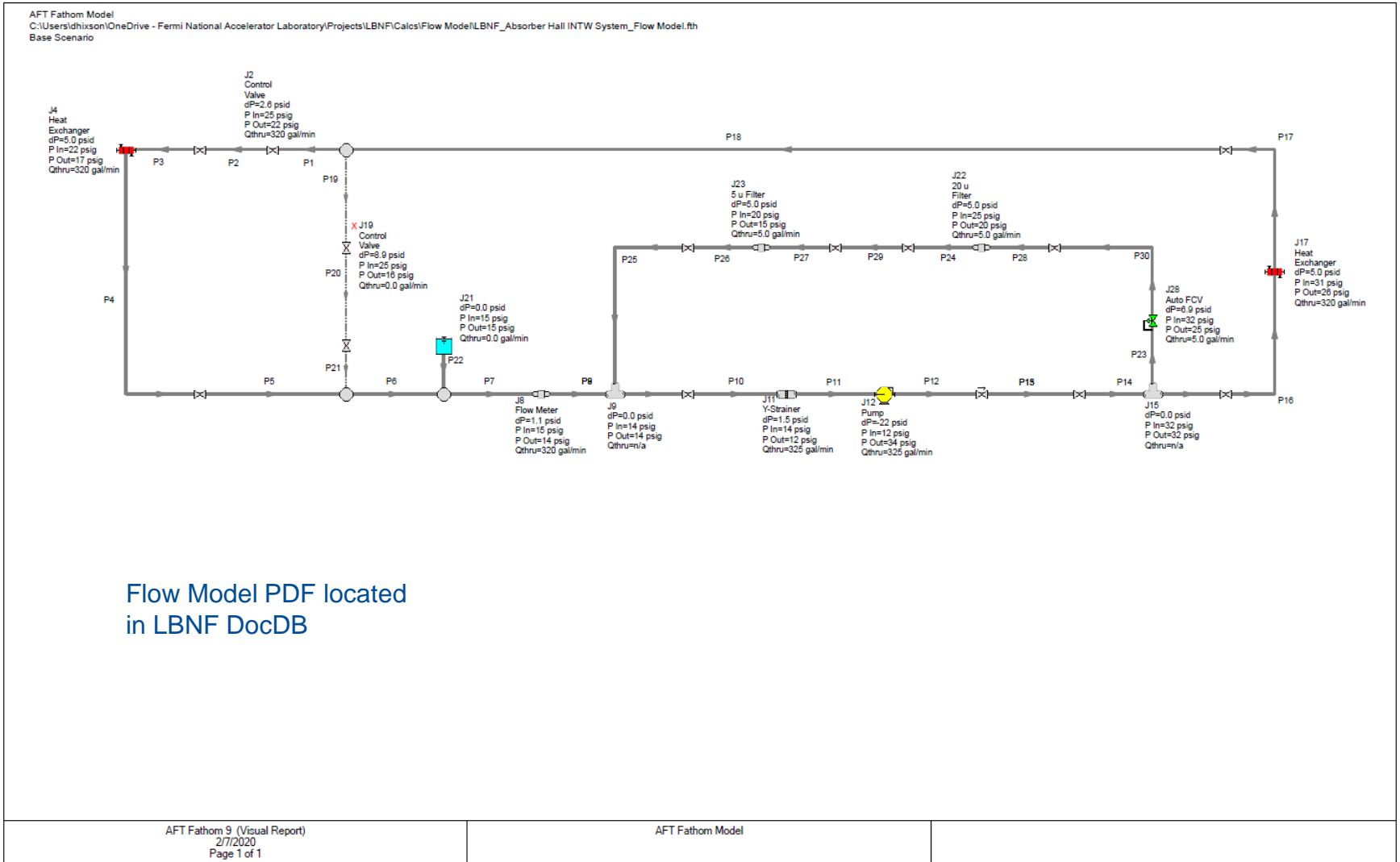
Approximate Isometric



Routing for Chilled Water from CF Chiller to INTW Skid still undetermined (Noted in 50% NSCF Design Review)

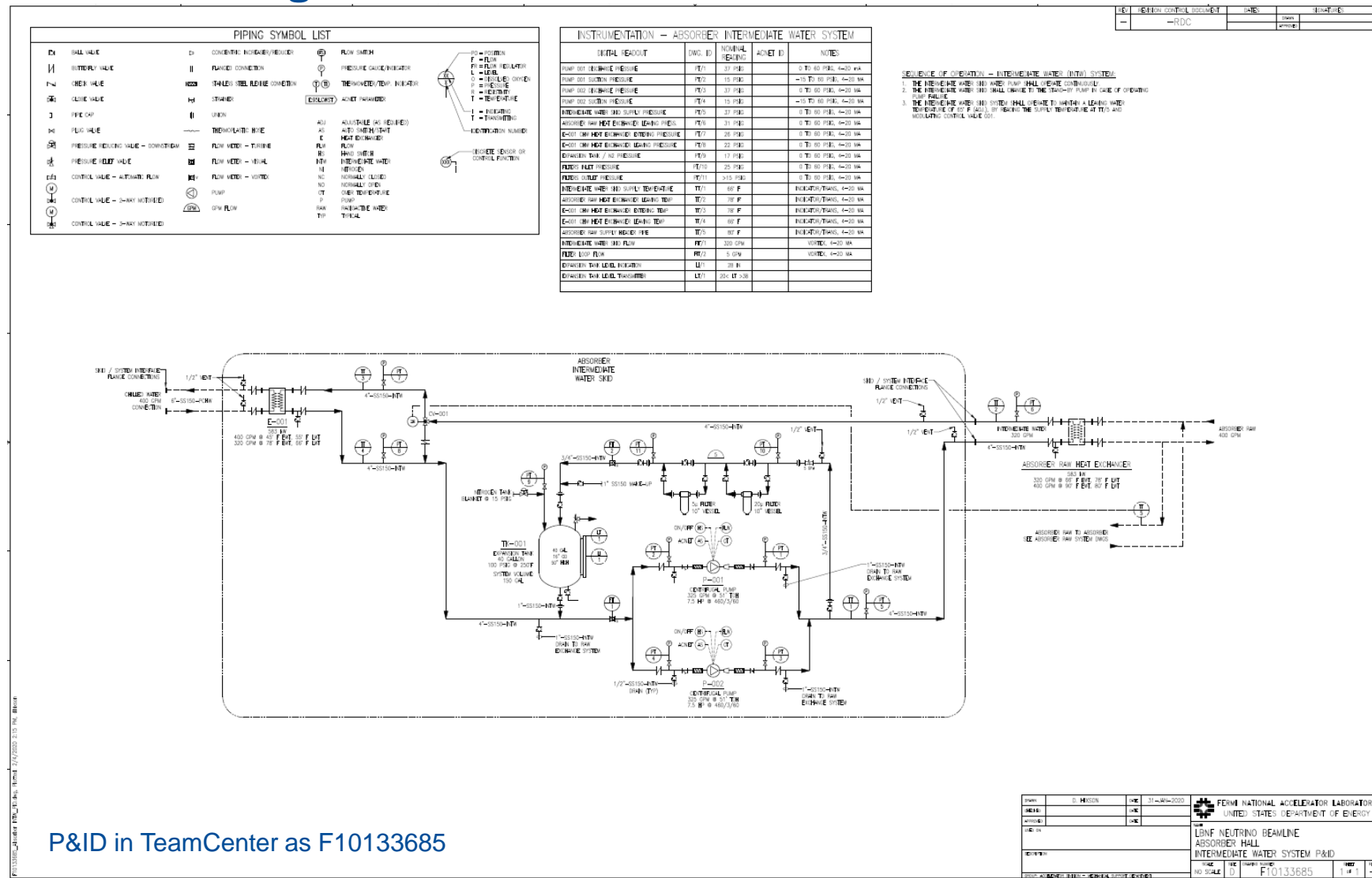
Absorber Hall Intermediate Water (INTW)

Flow Model



Absorber Hall Intermediate Water (INTW)

P&ID Drawing



P&ID in TeamCenter as F10133685

Absorber Hall Intermediate Water (INTW)

P&ID - Major Equipment, Piping, Fittings, Estimate

- The Absorber Hall Intermediate Water (INTW) system has been designed for the 2.4 MW Beam. (see page 7)
- Major Equipment has been sized and selected
 - Pumps and Heat Exchangers
- Piping has been sized
 - Final Pipe Routing may vary based upon the final RAW Room layout
- Major Valves and Fittings have been sized and selected
 - Flanges, Large Valves, Strainers, etc.
- Item costs selected above show good equivalence to the estimate
 - Per LBNF DocDB 9504 - BOE form for 131.01.03.03.03.06.03

Absorber Hall Intermediate Water (INTW)

Summary

- A means of heat transfer between conventional facilities cooling equipment and Radioactive Water (RAW) using Fermilab equipment .
- A means of isolating that conventional facilities cooling equipment from any Fermilab equipment that may become radioactive.
- Have flows and capacities based on the connected loads obtained from the Absorber RAW system engineer(s).
- Be considered non-radioactive with a maximum radioactivity of 1900 pCi/ml.
- Be filtered to remove all particles larger than 5 microns.
- Mainly based on Numi/Nova systems' operational experience Design Layout and Details, applicable ASME Codes, FESHM, and the Fermi Engineering Manual.
- Piping and Tubing will be 304L or 316L ASTM A312 Stainless Steel

Absorber Hall Intermediate Water (INTW)

Pending Items for Final Design

- CF Chilled Water piping routing to the AH INTW Skid
 - Noted in 50% NSCF Design Review
- Finalize INTW Skid Footprint based on finalized RAW room layout and the other RAW skid footprints
- Determine arrangement of equipment, piping, fittings, etc. on the final INTW Skid footprint
- Coordinate and route INTW piping to each of the other RAW skids.
- Finalize water temperature control parameters

Absorber Hall Intermediate Water (INTW)

Questions?