PIP-II Mechanical Engineering Fluids Support Tasks

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PIP-II project

Proton Improvement Plan – II (PIP-II) is an essential enhancement to the Fermilab accelerator complex, powering the world's most intense high-energy neutrino beam on its journey from Illinois to the Deep Underground Neutrino Experiment in South Dakota

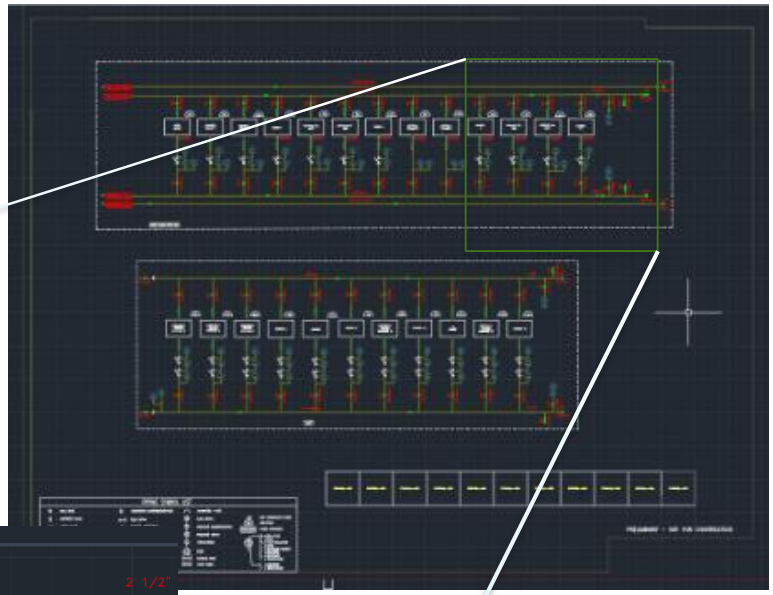
I was assigned to the fluid engineers who designed a cooling systems for PIP-II. My tasks supports the fluid piping systems.

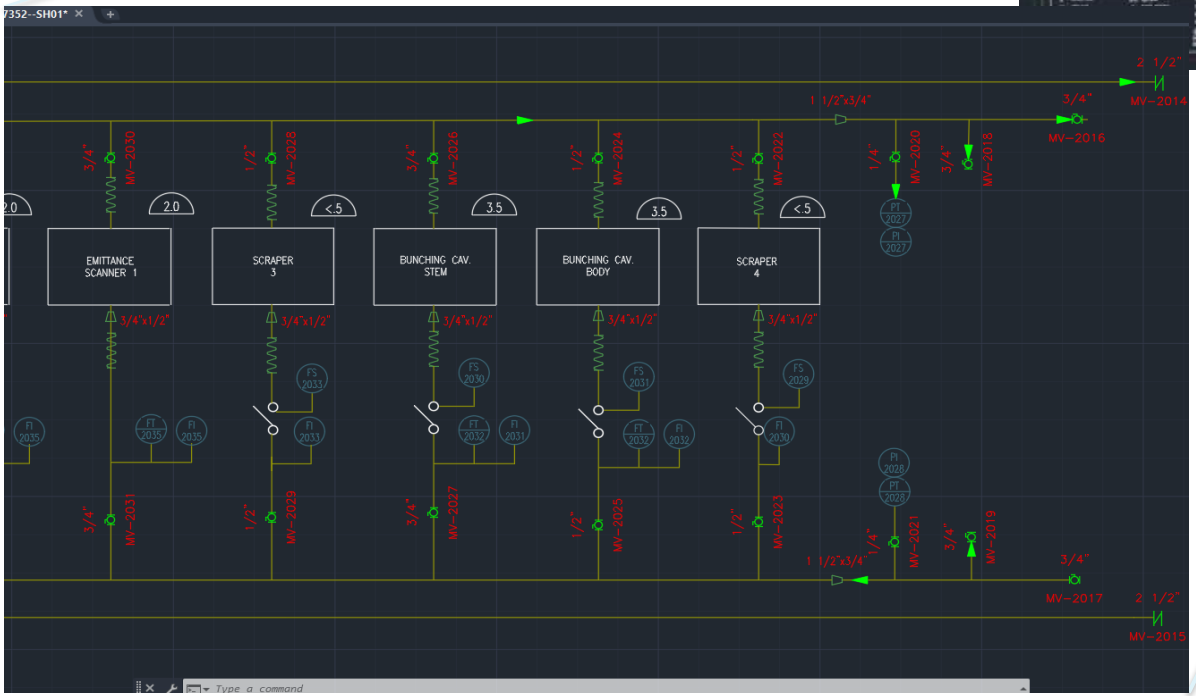
My Project Tasks

- Creating Engineering Notes
- AutoCad Plant 3D MEBT and LEBT P&ID drawings updates
- Creating purchase requisitions
- Studying, interpreting and applying ASME and FESHM code standard
- Updating PIP-II Interface Specification Document
- Applying Fluid Mechanics theory to solve PIP-II fluid system problems

AutoCad Plant 3D

- Plant 3D is an Autodesk software used for design and layout of process piping systems.
- It has the tools and features needed to create detailed plant models, including piping, structural and equipment built on the familiar AutoCAD platform.
- I use it to update the MEBT and LEBT PIP-II P&ID drawings.
- Examples include adding interfaces and pipe fittings size reducers.





PIP-II Process Mechanical Fluids Systems Connection Interface Specification Document (ISD)

- Updating table 6.1 with correct interfaces fitting sizes and valve's names accordingly with an updated AutoCad drawings.
- Reviewing drawings on Teamcenter

Table 6-1. Referenced from P&ID Drawing Number # F10167352-- PIP-II Low Conductivity Water (LCW) System P&ID

Interface	Fitting Interface	Valve Name
LEBT		
Solenoids - LEBT	1/2",3/4" MPT X 1/2" Compression	MV-1984 to MV-2021
Chopper - LEBT	1/2" FPT X 1/2" Compression	
Collectors in 30 Magnet chamber - LEBT		
Scraper - LEBT		
Electrically isolated diaphragms (EID) - LEBT		
MEBT		
Scrapers - MEBT	1/2" MPT X 3/4" Compression	MV-2032 to MV-2047, MV-2048 to MV-2059
Bunching Cavities - MEBT (1 stem and 1 body per bunching cavity)	1/2" MPT X 3/4" Compression	
Emittance Scanners - MEBT	1/2" FPT X 3/4" Compression	
Kickers - MEBT	3/8" FPT X 3/4" Compression	
Absorbers - MEBT	1/2",3/4",1" FPT X 3/4" Compression	
Water jacket (Around beam tube) - MEBT	1/2" FPT X 3/4" Compression	
Linac		
650 Line 400 W Quadrupoles	1/2" FPT X 1/2" tube stub	MV-2062 to MV-2095, MV-2098 to MV-2159, MV-2160 to MV-2187
BTL		
[illegible]	1/2" FPT X 1/2" tube	MV-2214 to MV-2217, MV-2222 to MV2225

ASME and FESHM

- Maurice Ball supplied me small tasks that support the design of various PIP-II fluid piping systems.
- To achieve that I had to read carefully the American Society of Mechanical Engineers (ASME) Code for Pressure Piping B31.9 and FESHM 5031. Getting familiar with this documents helped me to understand engineering work and all the standards that engineers need to follow.
- ASME - The Code specifies engineering requirements deemed necessary for safe design and construction of pressure piping.
- The Code prohibits designs and practices known to be unsafe and contains warnings where caution, but not prohibition, is warranted.
- Fermilab Environment, Safety and Health Manual (FESHM) - This chapter defines procedures for designing, fabricating and testing piping systems. This chapter applies to all piping systems fabricated and/or operated at Fermilab or in any leased spaces with the exception of piping falling under the scope of FESHM 5035: Mechanical Refrigeration Systems

Engineering Notes

- Low Conductivity Water (LCW) Piping System has to be design according to Fermilab Environment, Safety and Health Manual (FESHM).
- A written analysis demonstrating that a given piping system satisfies the requirements of FESHM 5031.1 chapter.
- Reviewing specifications of the LCW system to obtain all the required information for the note.
- Great way to learn about the piping system! ☺

FESHM 5031.1 PIPING ENGINEERING NOTE FORM

Prepared by: Monika Sadowski Preparation Date: 07/22/2022

Piping System Title: Low Conductivity Water (LCW) System

Lab Location: F37 Service Building Lab Location code:

Purpose of system / system description: The purpose of the PIP-II LCW System is to provide cooling to LEBT, MEBT, Absorber Cooling Skid, Magnets and Power Supplies.

Piping System ID Number (obtain from Teamcenter):

Appropriate governing piping code: ASME B31.3 Process Piping

Fluid Service Category (if B31.3):
Category-D / Normal / Category-M / High Pressure/High Purity (circle one)

Fluid Contents: Law Conductivity Water

Design Pressure: 150 psig Design Temperature:35° C (95 °F)

Piping Materials: 304 Stainless Steel Schedule 10

Drawing Numbers (PID's, weldments, etc.): P&ID's F10165158 (intermediate skid), F10165157 (vane skid), F10112577 (intermediate skid and chilled water block), F10173459 (ion source)

Designer/Manufacturer: Fermilab

Leak Test Type: Hydrostatic, Pneumatic (circle one)

Reduced Test Pressure Qualification: In-Service, Low Stress, Not Applicable (circle one)

Test Pressure: 12 psig Test Fluid: Air Test Date:

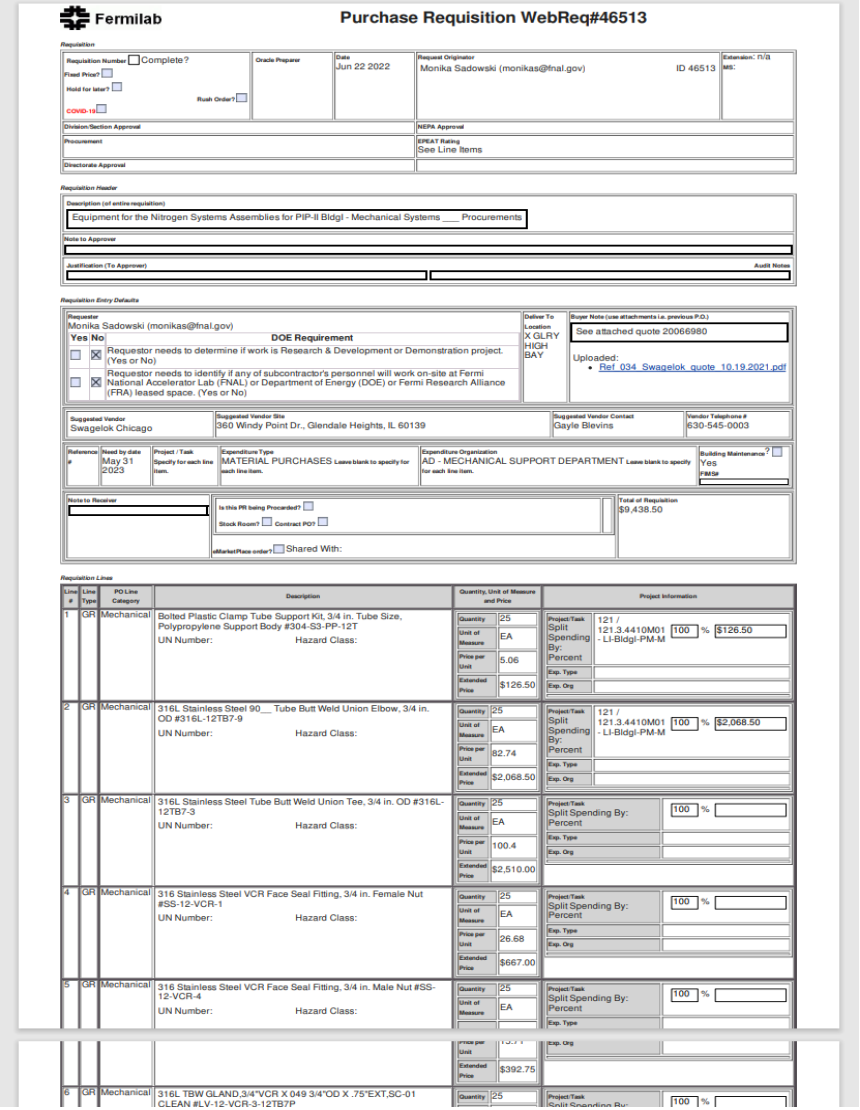
Statement of Compliance

Is this piping system considered exceptional? Yes ____ No__X__
If "Yes", follow the requirements for an Extended Engineering Note for Exceptional Piping Systems.

Reviewed by: _____
(Print Name and lab ID #)
Signature: _____ Date: _____

Purchasing Requisition

- Previously mentioned piping systems now need to be procured.
- In this case I created the Purchase Requisition (PR) based on a quote for PIP-II Utility Nitrogen Piping System Assemblies
- Total cost was for just under $10,000
- Confirming quotes if they are still valid



Fermilab

Purchase Requisition WebReq#46513

Requisition

Requisition Number: Complete?
Fixed Price?
Hold for later?
Rush Order?
COVID-19

Oracle Preparer
Date: Jun 22 2022
Request Originator: Monika Sadowski (monikas@fnal.gov) ID 46513
Extension: n/a
MS:

Division/Section Approval
Procurement
Directorate Approval
NEPA Approval
EMEAT Rating: See Line Items

Requisition Header

Description (of entire requisition): Equipment for the Nitrogen Systems Assemblies for PIP-II Bldgl - Mechanical Systems ___ Procurements

Note to Approver
Justification (To Approver)
Audit Notes

Requisition Entry Defaults

Requester: Monika Sadowski (monikas@fnal.gov)

Yes	No	DOE Requirement
	X	Requestor needs to determine if work is Research & Development or Demonstration project. (Yes or No)
	X	Requestor needs to identify if any of subcontractor's personnel will work on-site at Fermi National Accelerator Lab (FNAL) or Department of Energy (DOE) or Fermi Research Alliance (FRA) leased space. (Yes or No)

Deliver To Location: X GLRY HIGH BAY

Buyer Note (use attachments i.e. previous P.O.): See attached quote 20066980

Uploaded:
- Ref_034_Swagelok_quote_10.19.2021.pdf

Suggested Vendor: Swagelok Chicago
Suggested Vendor Site: 360 Windy Point Dr., Glendale Heights, IL 60139
Suggested Vendor Contact: Gayle Blevins
Vendor Telephone #: 630-545-0003

Reference #
Need by date: May 31 2023
Project / Task: Specify for each line item.
Expenditure Type: MATERIAL PURCHASES Leave blank to specify for each line item.
Expenditure Organization: AD - MECHANICAL SUPPORT DEPARTMENT Leave blank to specify for each line item.
Building Maintenance? Yes
FMIS#

Note to Receiver
Is this PR being Procurded?
Stock Room? Contract PO?
eMarketPlace order? Shared With:
Total of Requisition: $9,438.50

Requisition Lines

Line #	Line Type	PO Line Category	Description	Quantity, Unit of Measure and Price	Project Information
1	GR	Mechanical	Bolted Plastic Clamp Tube Support Kit, 3/4 in. Tube Size, Polypropylene Support Body #304-S3-PP-12T UN Number: Hazard Class:	Quantity: 25 Unit of Measure: EA Price per Unit: 5.06 Extended Price: $126.50	Project/Task: Split Spending By: Percent 121 / 121.3.4410M01 - LI-Bldgl-PM-M 100 % $126.50 Exp. Type Exp. Org
2	GR	Mechanical	316L Stainless Steel 90__ Tube Butt Weld Union Elbow, 3/4 in. OD #316L-12TB7-9 UN Number: Hazard Class:	Quantity: 25 Unit of Measure: EA Price per Unit: 82.74 Extended Price: $2,068.50	Project/Task: Split Spending By: Percent 121 / 121.3.4410M01 - LI-Bldgl-PM-M 100 % $2,068.50 Exp. Type Exp. Org
3	GR	Mechanical	316L Stainless Steel Tube Butt Weld Union Tee, 3/4 in. OD #316L-12TB7-3 UN Number: Hazard Class:	Quantity: 25 Unit of Measure: EA Price per Unit: 100.4 Extended Price: $2,510.00	Project/Task: Split Spending By: Percent 100 % Exp. Type Exp. Org
4	GR	Mechanical	316 Stainless Steel VCR Face Seal Fitting, 3/4 in. Female Nut #SS-12-VCR-1 UN Number: Hazard Class:	Quantity: 25 Unit of Measure: EA Price per Unit: 26.68 Extended Price: $667.00	Project/Task: Split Spending By: Percent 100 % Exp. Type Exp. Org
5	GR	Mechanical	316 Stainless Steel VCR Face Seal Fitting, 3/4 in. Male Nut #SS-12-VCR-4 UN Number: Hazard Class:	Quantity: 25 Unit of Measure: EA Price per Unit: [illegible] Extended Price: $392.75	Project/Task: Split Spending By: Percent 100 % Exp. Type Exp. Org
6	GR	Mechanical	316L TBW GLAND,3/4"VCR X 049 3/4"OD X .75"EXT,SC-01 CLEAN #LV-12-VCR-3-12TB7P	Quantity: 25	Project/Task: Split Spending By: 100 %

Acknowledgement

Thank you to:

- Maurice Ball for all his guidance and for giving me the opportunity to learn about PIP-II project and to contribute to it.
- David Holeman for helping with AutoCad Plant 3D.
- Director Lia Merminga for creating this fellowship program and all involved.

Questions?