



**Fermilab**

**Particle Physics Division  
Mechanical Department Engineering Note**

Number: MD-ENG-303

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Project Internal Reference: None

Project: NOvA IPND Muon Catcher Installation

Title: Fork Truck Fork Modification per FESHM 5023

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Key Words:

Applicable Codes: FESHM 5023

Abstract Summary:

Analysis to show the modification to the commercially produced forks maintains the load capacity and this load capacity exceeds the anticipated load.

Discussion:

John Voirin has prepared a PowerPoint presentation describing the NOvA IPND Muon Catcher Steel plane installation and why use of shorter forks on the existing fork truck is necessary. His presentation is attached to the end of this document.

A frame has been designed, documented in an engineering note and built to keep the top of the muon catcher steel plane vertical without applying a load to the PVC extrusions. This frame sets the muon catcher steel plane 13 inches from the mast. Kyle Beczkiewicz has authored this note.

Data:

|  |               |
|--|---------------|
| Weight of a steel Muon Catcher Plane for the IPND:                           | 20,000 pounds |
| Capacity of the Hoist Electric Fork Truck:                                   | 22,000 pounds |
| Capacity of the un-modified Replacement Forks<br>at 24 inches from the mast: | 21,000 pounds |

|   |           |
|---|-----------|
| Location of the Muon Catcher Plane (centerline)<br>from the mast: | 13 inches |
|---|-----------|

Calculations:

|  |                   |
|--|-------------------|
| Moment on the root of the forks as manufactured<br>( $M = 24 \text{ inches} * 21,000 \text{ pounds}$ ) | 504,000 in-pounds |
|--|-------------------|

|   |                   |
|---|-------------------|
| Moment on the root of the forks as modified with<br>the IPND Muon Catcher weight<br>( $M = 13 \text{ inches} * 20,000 \text{ pounds}$ ) | 260,000 in-pounds |
|---|-------------------|

Moment applied to the modified forks is less than the design moment;  
therefore the modification does not reduce the load capacity.

# Nova Muon Catcher

Installation Proposal

# Nova Muon Catcher

- The Muon Catcher planes are 104” wide by 165” tall and 4” thick.
- Weight 20,000 lbs plus plastic extrusions.
- Desired location on stand in Nova Surface Bld.
- NSB does NOT have a crane
- Stand is offset from roll up door and 127” away.

# Muon Catcher Stand



# Door Offset



# Plane with Fixture



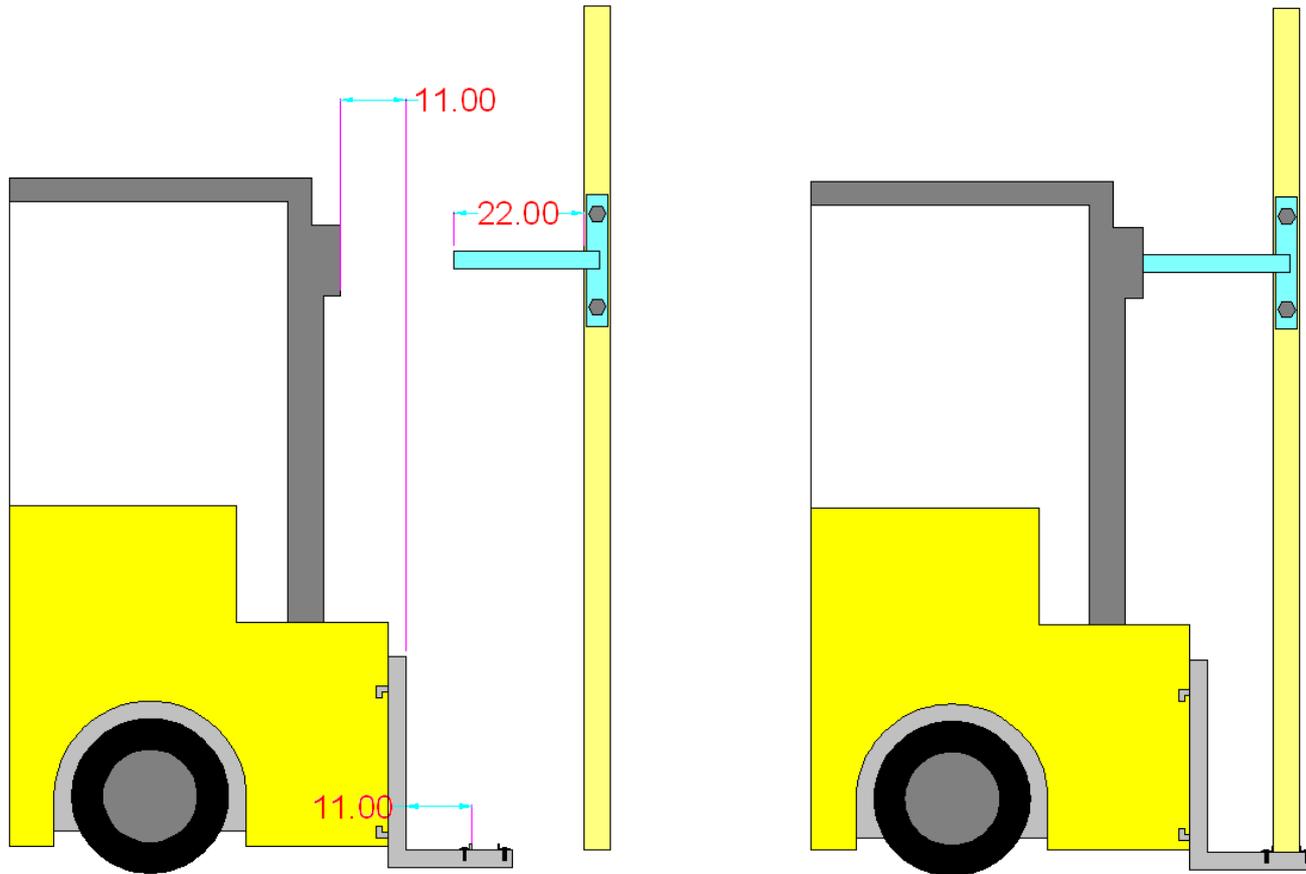
# Installation Process

- Planes will be assembled in lab F and escorted around the ring (wide load) to Minos surface building. Use 15 ton crane to unload.
- Using spreader bar plane will be stood up and placed on the electric Hoist lift truck with capacity of 22000 lbs.
- We can then drive across the lot and place the plane on the stand. HA available.

# Forklift



# Fork Modification



# Procedure

- Plane will be stood off the mast with a fixture so it is parallel to the mast. This fixture has an engineering note.
- The current forks are 60" long and extend beyond the plane being carried by 42".
- Some planes are shorter than others making it difficult to not puncture the previous extrusions when installing

# Plane with spreaderbar

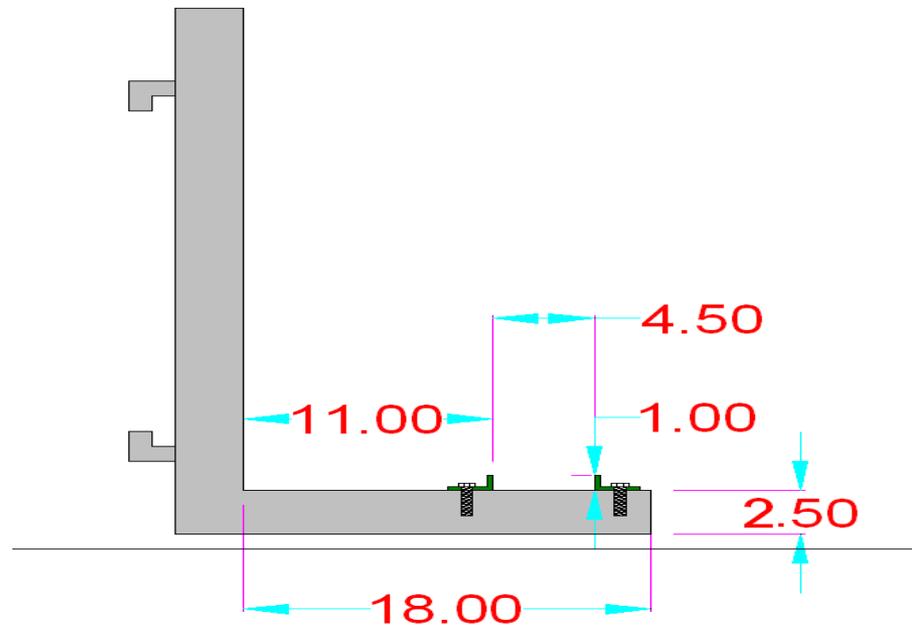


# Fork Info

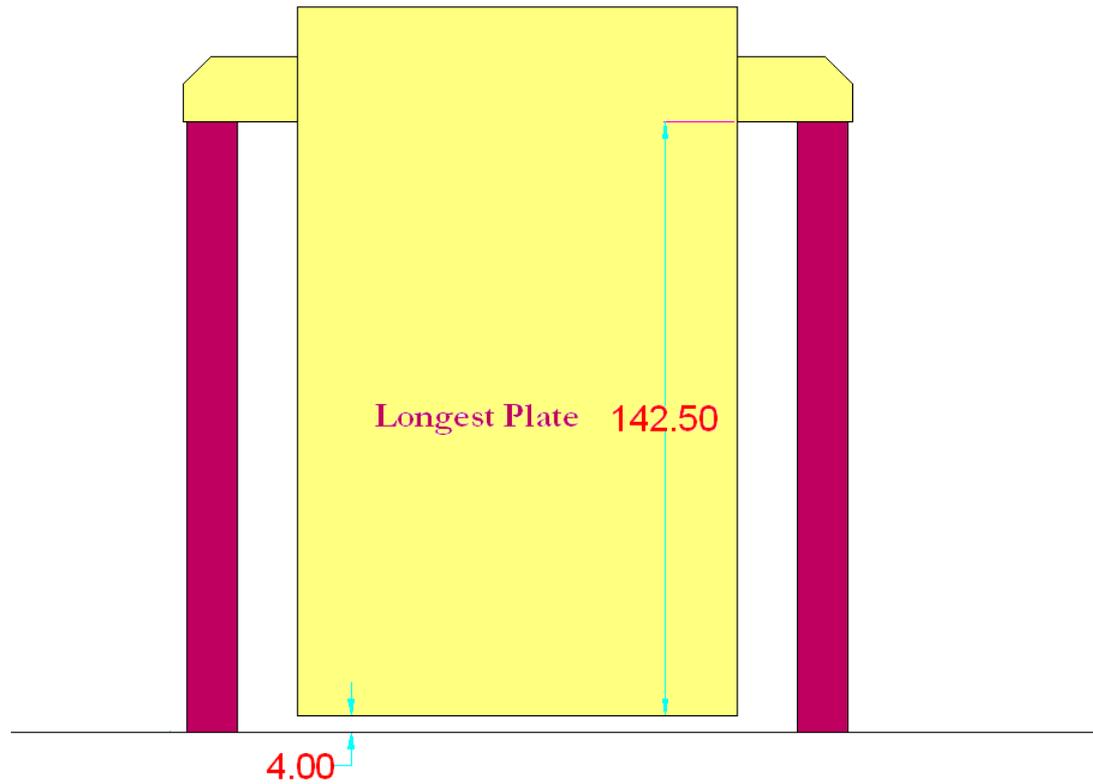
- New forks are available for this truck. Industry standard hook type class IV. \$895 pair. Overnight delivery available for \$75.
- We can shorten these forks and bolt angle to secure the base of plate. Engineers are making a note addressing requirements outlined in FESHM 5023.

# Fork Info

- Longest plate is 142.5"
- Stand is 146.5"
- Clearance from base is 4" Forks are 2.5"



# Vertical Clearance



# Summary

- With this plan we will be able to safely and efficiently install the Muon Catcher into the NSB.
- This process will also work when we move this down into the Nova enclosure underground.
- We will need to modify the installation cart in Minos to accommodate moving the planes from the shaft area to the Minos area crane.

# Nova Muon Catcher

- <http://www.budgetforklift.com/forklift-forks.html>

