

Lift Title: Remove G0 from Hall C

Lift #: C-08-016-L

Date: 06/02/08

Complete all information. Use as many sheets as necessary.	
Lift location: Hall C	Prepared by: A. Kenyon <i>A. Kenyon</i>
Division: PHY	Reviewed by: D. Kausch <i>DAVE KAUSCH</i>
Department: Hall C	Reviewed by: M. Nevarez <i>M. Nevarez</i> 6-11-08
Supervisor: W. Kellner	Approved by: W. Kellner <i>Walter Kellner</i>
Standard Requirements: (PPE, TOSPs, SOPs, etc.) Hardhats, safety shoes, gloves. Master rigger, journeyman rigger and crane operator. Follow standard rigging procedures and EH&S 6140 Crane & Hoist, 6147 Aerial Work Platforms, 6132 Ladders and Scaffolds, 6145 Fork Lift, and 6131 Trip and Fall Protection	

Step	Description	Safety Procedures/Practices/ Controls
1.	What is to be lifted?	G0 Magnet (magnet)
2.	Are there any special precautions?	See "Installing G0 Shipping Fixture"
3.	What is the weight of the load?	50 tons (100,000#)
4.	Where is the center of gravity?	Roughly along center line closer to cold box.
5.	Is the load stable? Does it need to be stabilized?	Yes/No
6.	What is the capacity of the crane/hoist?	100 ton(200,000#)/tower and 70ton(140,000#) or 152ton (304,000#) mobile crane
7.	Classify the lift per Appendix 6140-T4 of EH&S manual.	Complex
8.	List each piece of equipment, accessory, and rigging component, by type and rated capacity, that will be used during the lift.	
	Crane	Hydraulic Jacking Towers/2 70ton(140,000#) Mobile Cranes or 1 152ton(304,000#) Mobile Crane
	Hoist	NA
	Fork Truck	NA
	Slings (identify the configuration used: choker, basket, or vertical, and angle (see Figure 1 below))	25ton(50,000#) min at angle
	Shackles	25ton(50,000#) min at angle
	Eye Bolts/Swivel Eyes	4 2-1/2" Swivel Eyes, 50,000# each

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Step	Description	Safety Procedures/Practices/ Controls
	Other (Special Lifting Fixture, Below the Hook Lifting Devices, Multi Leg Bridle, etc)	Contractor discretion
9.	What rigger calcification is required? Journeyman/Master	Master
10.	What personnel will you need to assist with the lift?	
	Crane operator	Contractor discretion
	Fork operator	Contractor discretion
	Rigger	Contractor discretion
	Spotter	Contractor discretion
	Other	Contractor discretion
11.	Safety Equipment	See above
12.	Has rigging been inspected?	
12.a	Additional information	Attached will be a detailed plan of the lift.

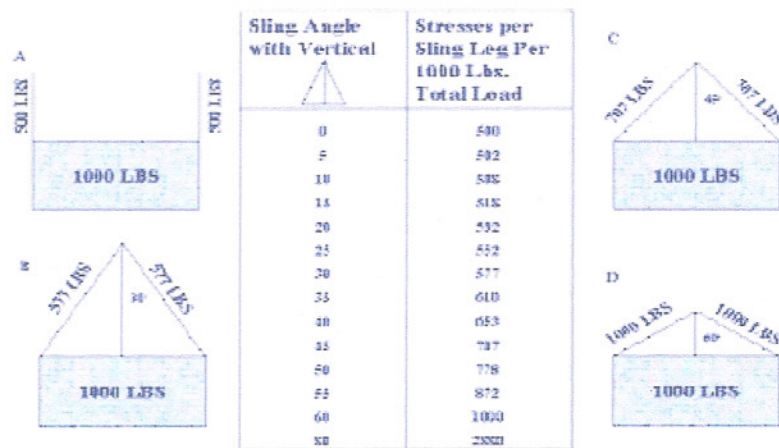


Figure 1: Sling Load

The chart may be used as a guide for assessing sling load.

On the rigging sketch (Figure 2) identify the following:

1. Lift points
2. Shackles/swivel eyes

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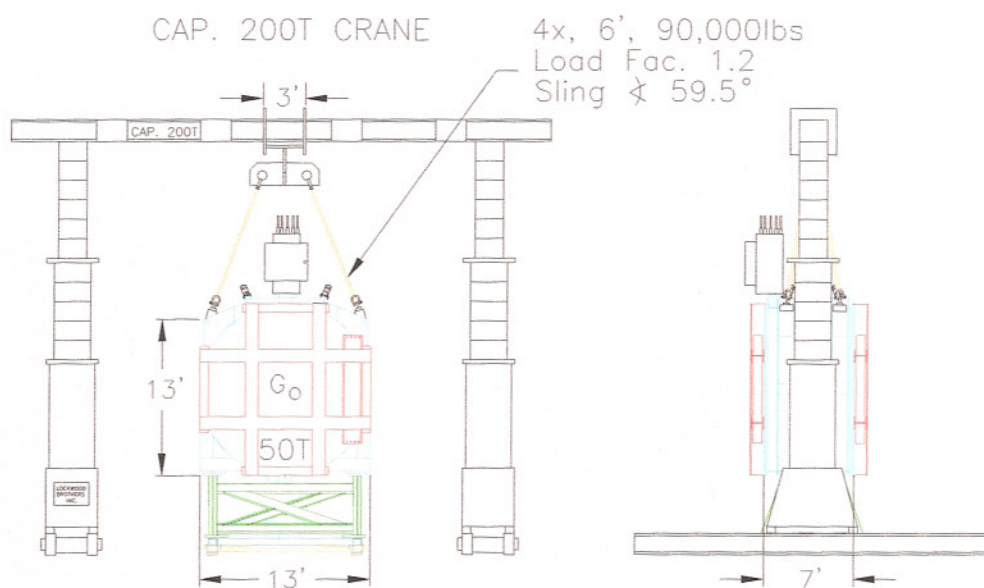
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3. Slings, sling angles, and sling loads
4. Accessories
5. Capacities

I. Lift Magnet off of Carriage and Move, Tracks in Position 1 (See Section VII)

Install 4 6' 90,000# slings, 4 30-ton (60,000#) shackles, and 2 60-ton (120,000#) shackles. Use two lifting towers and swivel.

Take slack out of slings and unbolt the magnet. Raise the magnet off of the carriage and move forward far enough to clear the carriage. Lower magnet closer to the floor and begin translating it along the tracks. Stop when the magnet has reached the starting point for position 2. Set magnet down cribbing, assuring that there is clearance for the vacuum ports. Reset the tracks for position 2 (see section VII).



Schematic 1 Two Views of the Pick

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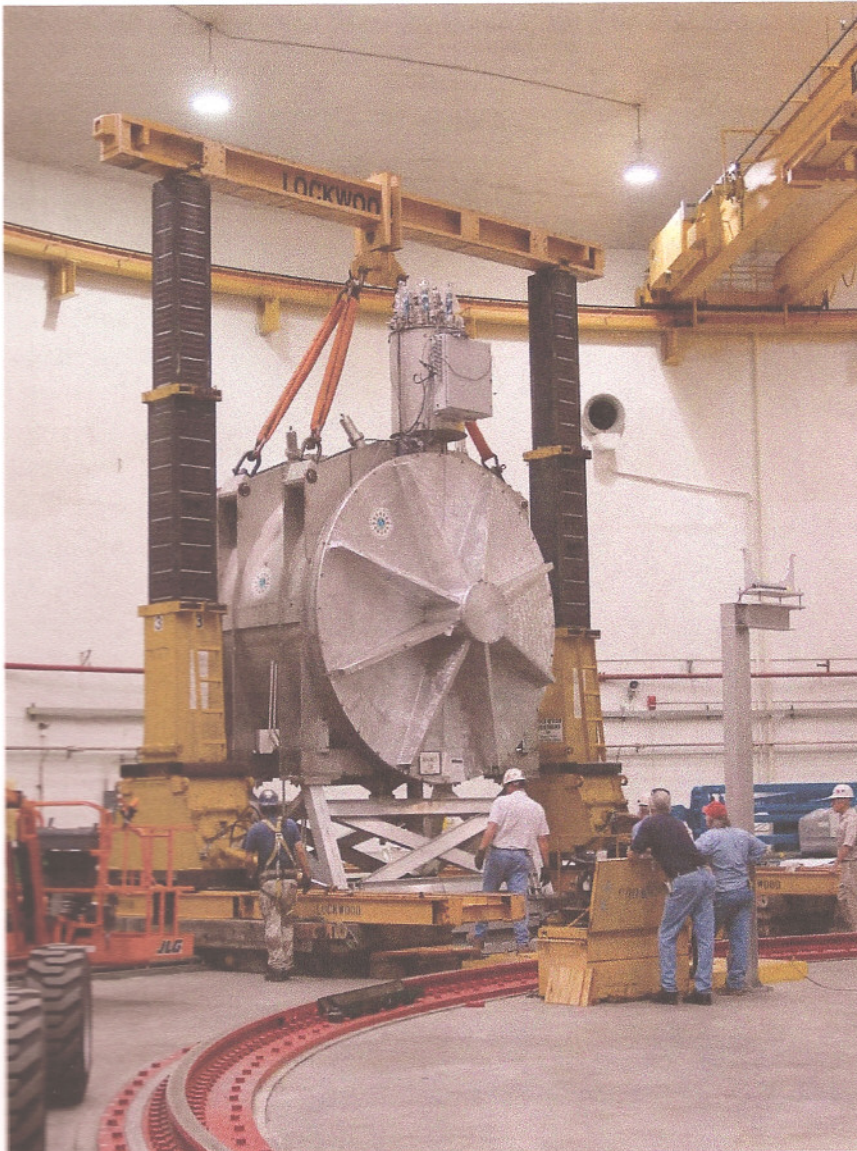


Photo 1 Standard Magnet Rigging with Swivel for Rotation.

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II. Move Magnet over Cable Train, Position 2

Lift magnet and move over BIGCAL's cable train. Rotate magnet such that the beam line axis 90 with respect to the direction of travel. The extensions for the feet should be further from the truck ramp. Magnet is to rolled out backwards. Set the magnet down on cribbing assuring clearance for the vacuum ports. Leave room to install the foot brackets. Install the foot brackets on the side that was beam left. Remove two lifting eyes from the beam right side and install into the foot brackets.



Photo 2 Rotation in Illinois

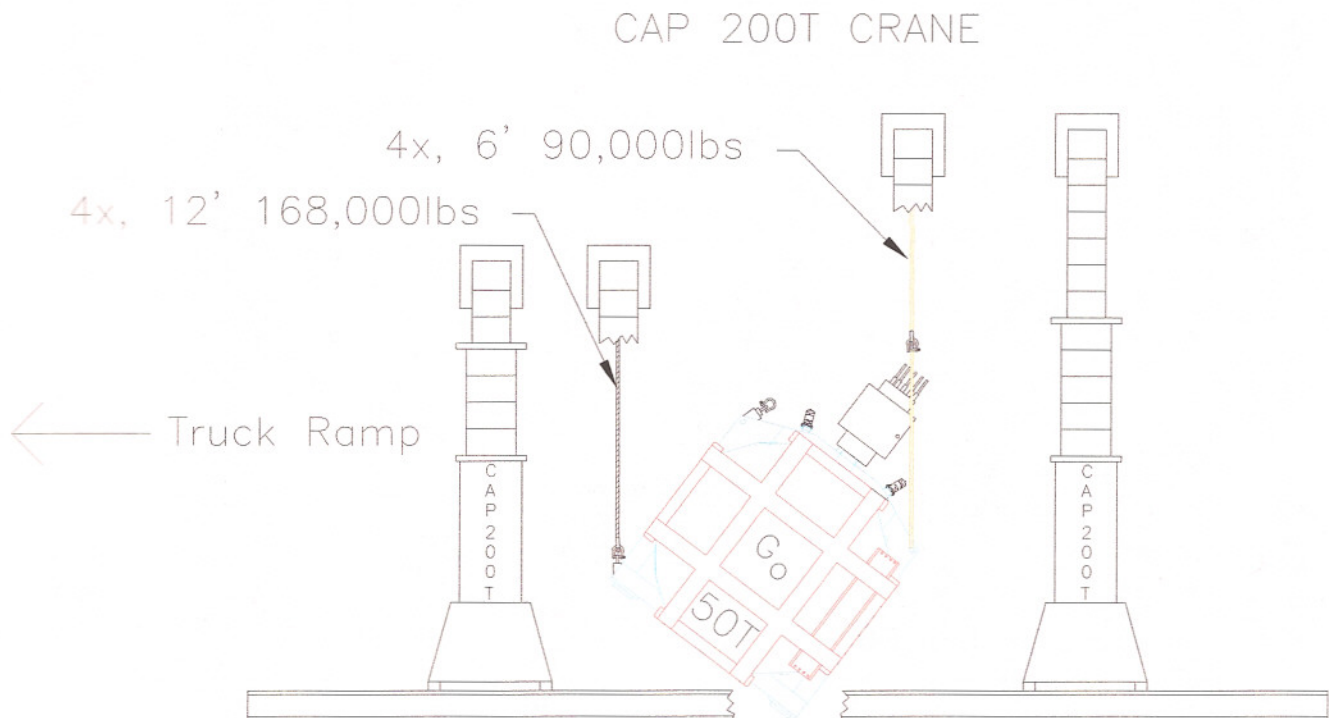
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III. Pitch Magnet Around Beam Line Axis

Set up two additional towers. Sling the two towers furthest from the truck ramp at the large round pin between the pick points so that the rigging will not contact the cryocan while pitching the magnet. Choke two 6' 90,000# slings around the pin and connect them to two more 6' 90,000# slings with 25 ton (50,000#) shackles. Install two 12' 168,000 slings on the other side to the swivel eyes in the foot brackets. Rotate magnet 90 degrees about the beam line axis by lowering one end while raising the other (see photo of Pitching in Illinois). Set magnet down leaving clearance to install the feet.



Schematic 2 Pitching Magnet

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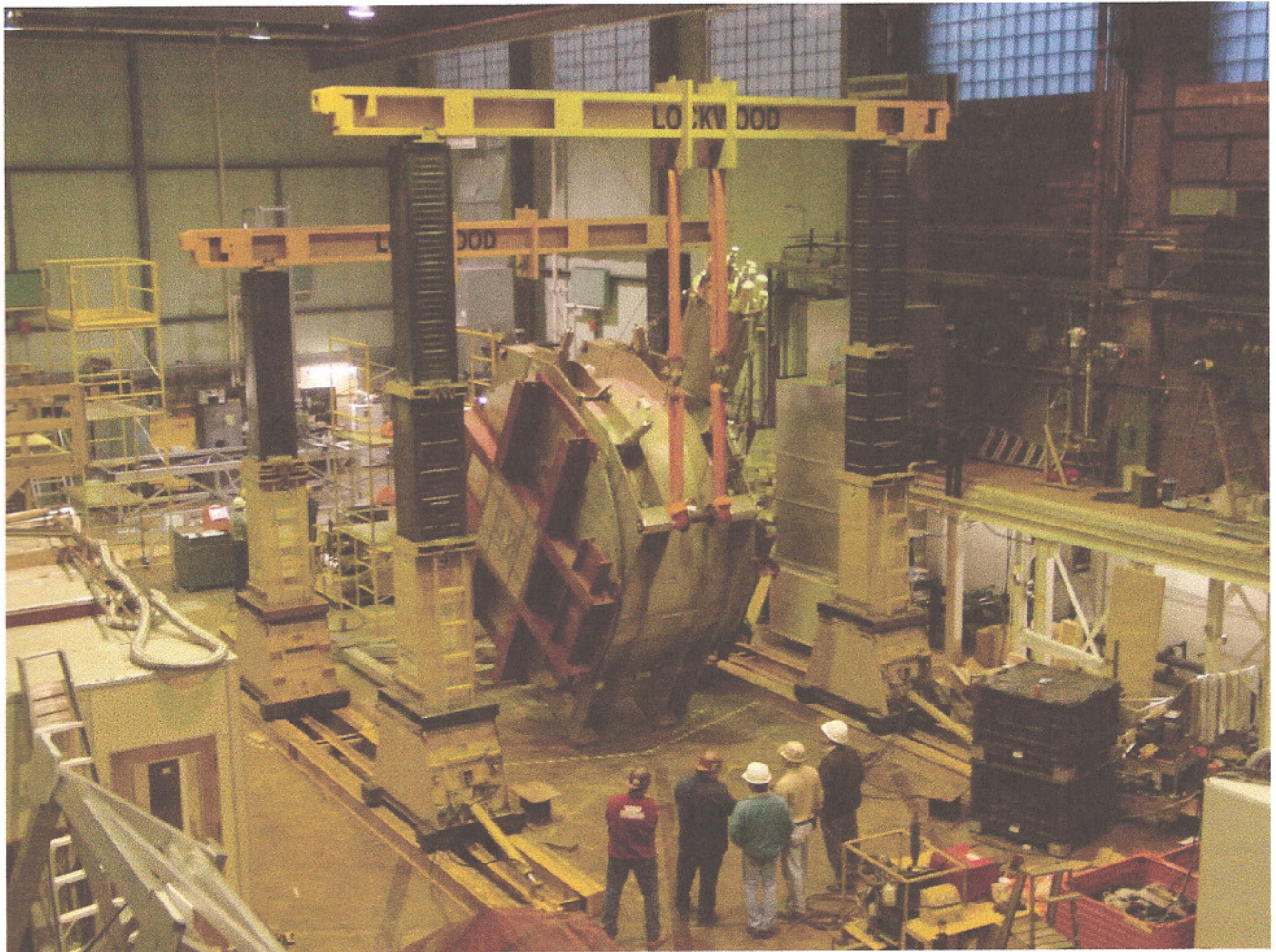


Photo 3 Pitching in Illinois

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Photo 4 Setup Before Pitching

IV. Install Feet, Move to Truck Ramp

Install the frame extensions and feet on to magnet. Remove one set of towers and position the other to lift magnet. Rig four slings to the swivel, as was done in section I. Move magnet over SOS rail bed. Set magnet on rollers, secure rollers, and prepare to roll up the ramp. Guide rails may be used at the contractor's discretion.

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Photo 5 Installing Feet in Illinois

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Photo 6 Going up a Ramp in Illinois with Guide Rails

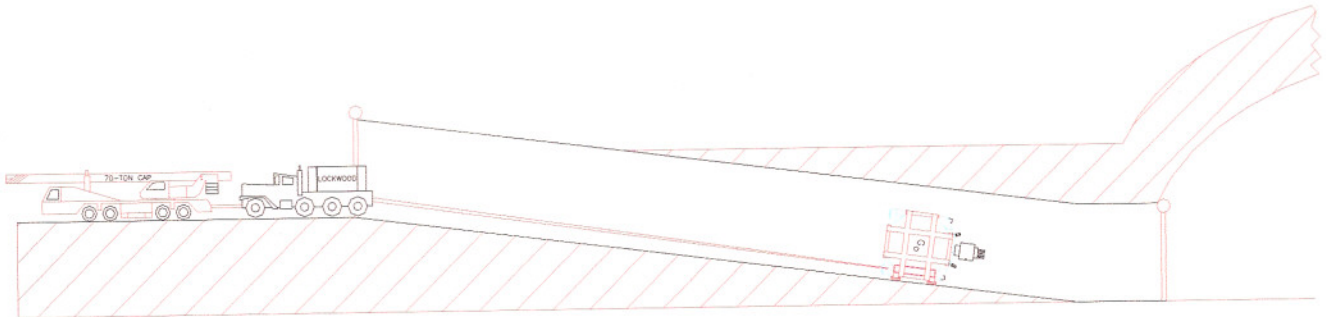
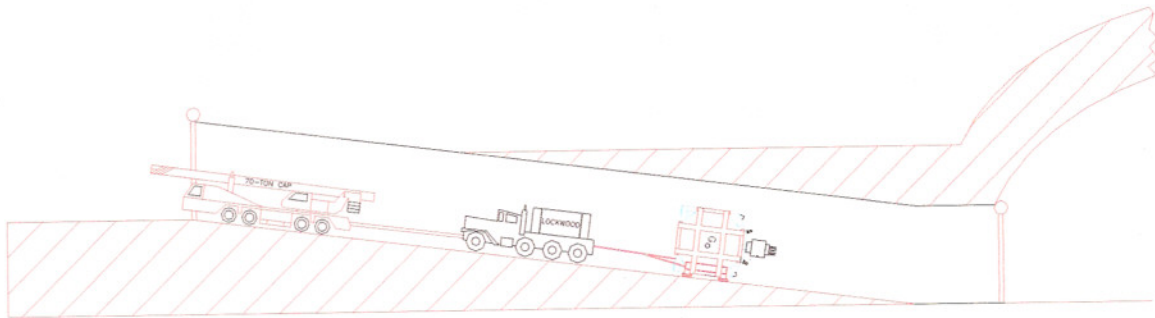
V. Move Magnet up Truck Ramp

Contractor will determine if magnet should be directly towed with their T-11 Prime Mover or suitably sized winch truck. In either case, steps should be taken to ensure that magnet cannot roll out of control in the event of equipment failure. Safety steps can be using a crane in front of the T-11 and a second towline between the T-11 and the magnet. The estimated tension in the tow cable is 5.8 tons (11,590#) rolling. This assumes a rolling friction coefficient of 0.02 for the rollers and a 5.7 degree grade. The coefficient is based on previous experience which showed that 1 ton (2,000#) was needed to roll a 60 ton (120,000#) magnet on a flat concrete. $T=W*(f*\cos\Theta+\sin\Theta)$

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Schematic 3 Two moving options

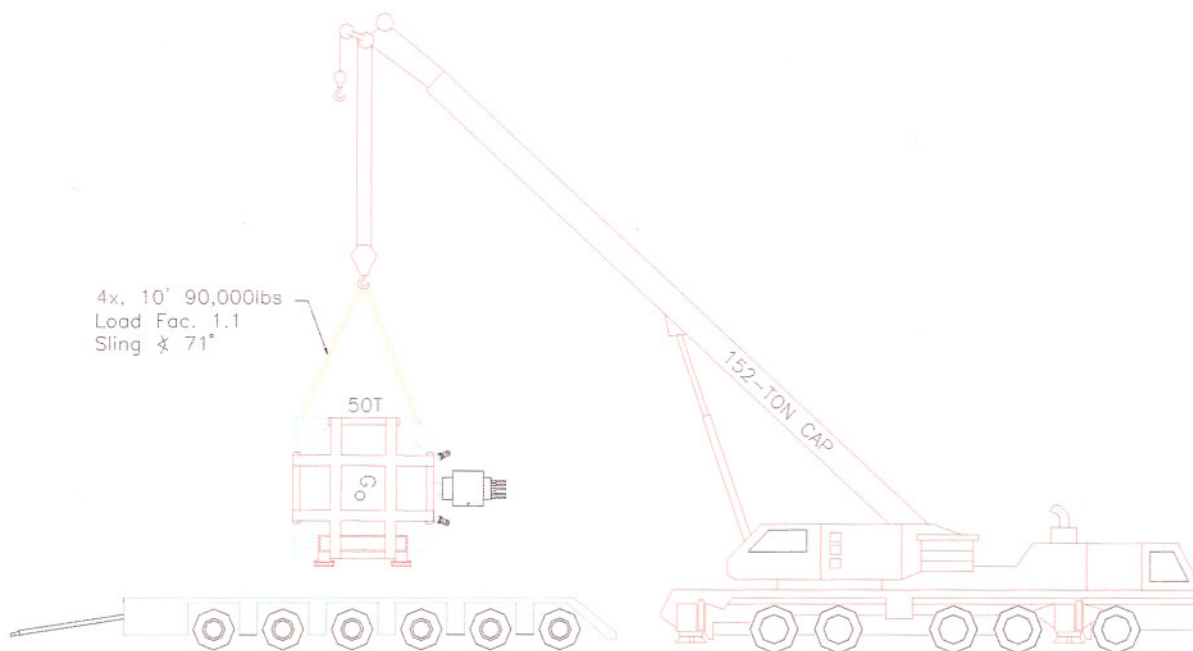
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VI. Crane Magnet on to Trailer and Move to Lead Storage Building

Two methods may be used to load the magnet on to a suitable trailer (at contractor's discretion), a single 152-ton (304,000#) crane or two 70-ton (140,000#) cranes. A single crane would be a more preferred solution given the limited space the lead storage building. For a single crane, use 4 10' 90,000# slings, four 30-ton (60,000#) shackles, and two 60-ton (120,000#) shackles. Lift magnet off the rollers and set on trailer. For two cranes, use the same rigging hooking one pair slings to one crane etc. With close coordination raise the magnet off the rollers and set on the trailer. See section VIII for slings. Move the magnet over to the lead storage building. Once there, unload the magnet, set rollers and remove the swivel eyes. Roll into building and remove rollers.

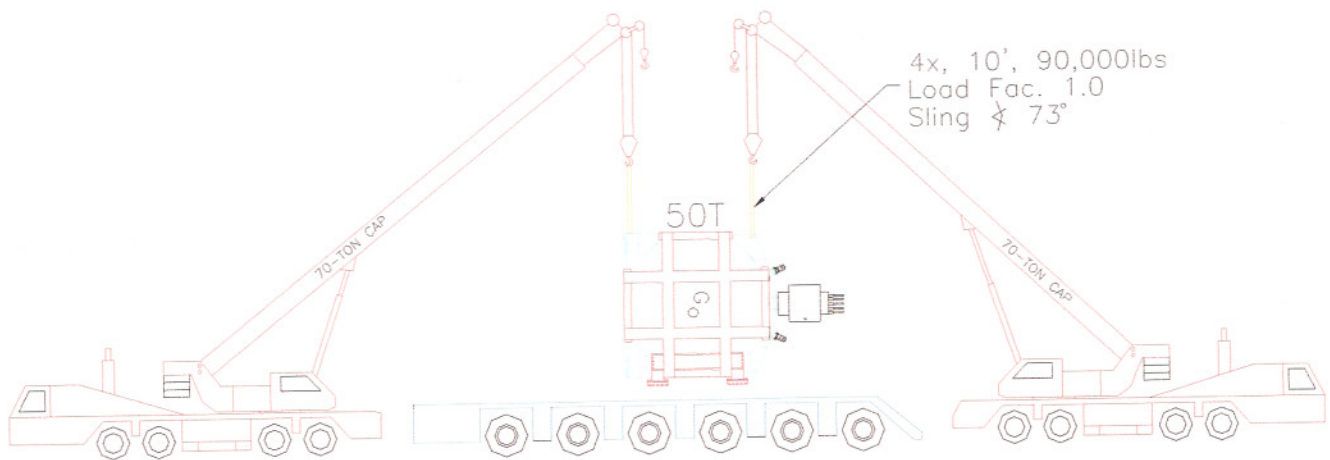


Schematic 4 152 Ton Crane Lift

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Schematic 5 Two 70 Ton Crane Lift

VII. Load Paths

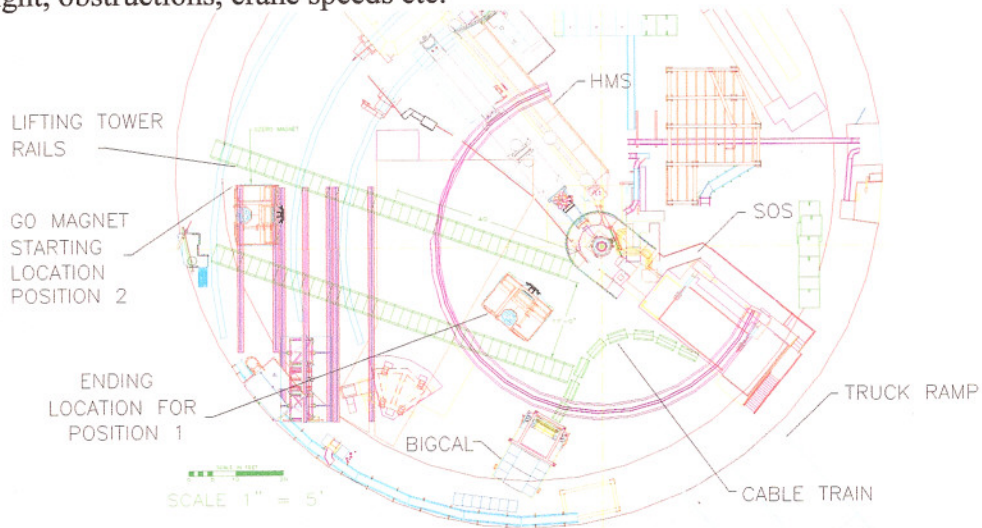
Sketch the load path for limited access pick or complex (or higher) lifts. Include all relevant aspects

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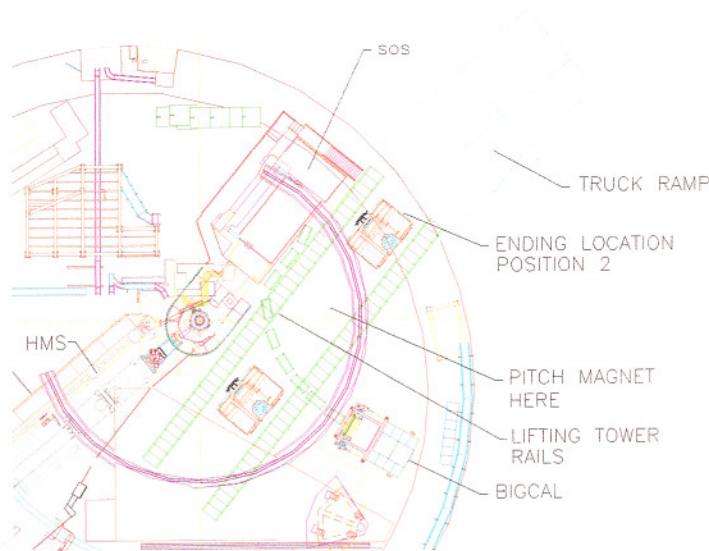
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such as load height, obstructions, crane speeds etc.



Schematic 6 Position 1 for Rails



Schematic 7 Position 2 for Rails

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VIII. Rigging

- 4 – 6' 90,000# slings
- 4 – 10' 90,000# slings
- 2 – 12' 168,000# slings
- 4 – 50,000# shackles
- 4 – 60,000# shackles
- 2 – 120,000# shackles

IX. Reference and Attachments

References:

-“Steps in moving the G0 Spectrometer [magnet] out of the NPL Barn at UIUC”, Bartoszek Engineering, <http://www.bartoszekeng.com/g0/steps/steps.htm>

-“Design of the G0 Cryostat Shipping Fixture”, Bartoszek Engineering, <http://www.bartoszekeng.com/g0/shipfix/shipfix.htm>

-University of Illinois, Nuclear Physics Lab web pages: <http://www.npl.uiuc.edu/exp/G0/sms/sms-transport.html>, <http://www.npl.uiuc.edu/exp/G0/sms/pictures-jlab-a40823-turnaround.html>, <http://www.npl.uiuc.edu/exp/G0/drawings/sms-uiuc-drawings.html>

Attachments:

-“Installing G0 Shipping Fixture”, A. Kenyon

Attachment

Installing G0 Shipping Fixture

28 May, 2008

A. Kenyon

The g0 shipping fixture was used to transport the magnet from Illinois to JLab. It was designed to fix the cold mass to the vacuum vessel so that the magnet could be lifted, rotated, rolled, and moved without damaging the internals. The g0 shipping fixture must be properly installed to ensure that the cold mass (whose weight is on the order of 40 tons (80,000#)) does not cause and/or become damaged while the magnet is being moved. The fixture shall be installed by Hall C technicians. This should serve as a rough guideline and it is necessary that those installing it are qualified. These qualifications include, but are not limited to, journeyman rigger, master rigger, crane operator, fork lift operator, fall protection, ODH, RWI, aerial platform, and Hall C awareness. See attachment Design of the G0 Cryostat Shipping Fixture.

Lube all threaded connections with anti-seize.

Torque specifications per Bartoszek Engineering.

Bolt Size	Torque (ft-lb)	
	A325	SAE Gr. 8
½-13	100	127
¾-10	350	450
1-8	850	1090

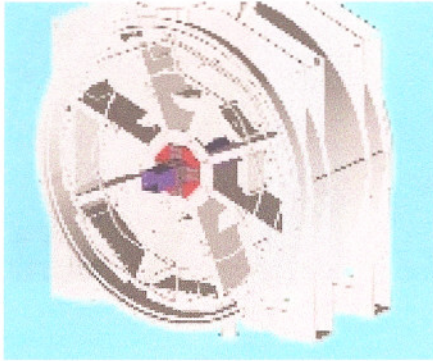
I. Install Hubs and Center Beam

Install a hub by bolting it to the end of the center beam installation box beam. Remember to connect a come along to the end of the beam to compensate for the change in center of mass when the hub is installed. Orient the hubs so that when the center beam is installed it will be parallel to the floor with a level held across the section. The hubs can be temporarily held in place by two hold down clamps. Once both hubs are in place, install the center beam using the installation box beam. Remember to connect a come along to the end of the beam to compensate for the change in center of mass once the center beam is disconnected.

Attachment

Installing G0 Shipping Fixture

28 May, 2008



II. Install Clamp Plate on US end of Magnet, Remove Shear Pin Mount

The clamp plates were originally made to stabilize the cold mass while g0 was being rotated for backward operation. One clamp plate is to be placed at the 6:00 position (bottom). The cold mass should be pulled back just enough to allow for the shear pin mount to be removed.



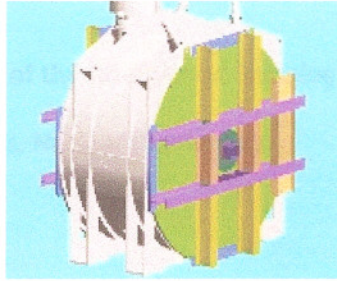
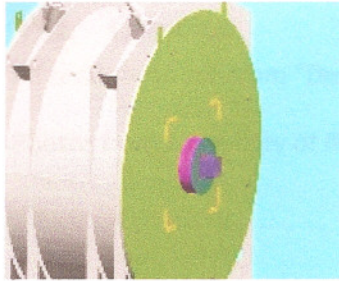
III. Install Downstream Cover and Welded Shipping Fixture Frame.

Once the load is off the shear pin the downstream "water-tight" cover may be installed. Leave o-ring installed. Crane cover into place and bolt the cover to the cryostat in 12 places with $\frac{3}{4}$ " bolts. The proper cover plate will have short bumpers. Three bolts centered on 45°, 135°, 225° and 315°. This should leave five bolts open at 0°, 90°, 180°, and 270°. Do not adjust the threaded rod bumpers. They are to transmit some of the load to the fixture. Once the cover is on a test fit will be needed for the welded frame. The proper frame will have the foot mounts on the beam-right side. Crane the frame into place and bolt on using only four bolts on each axis. Check the circular bosses that the rods are threaded into while tightening the bolts. The frame come should contact all the bosses once the frame bolts are tightened. If the cover can be flexed greater than 1/16" from the frame the threaded rods need to be adjusted. Once the rods are all adjusted, install the rest of the bolts in frame and torque.

Attachment

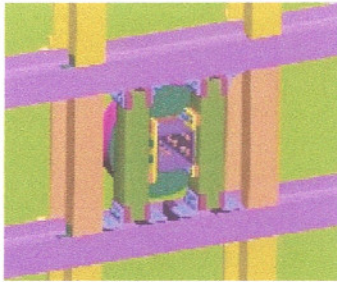
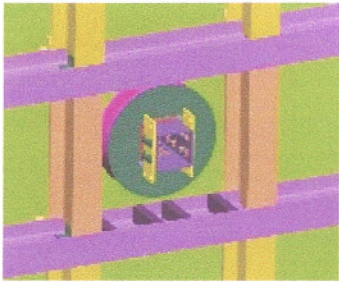
Installing GO Shipping Fixture

28 May, 2008



IV. Install Downstream Center Connection.

Install the plates, angles, beams, etc. All 1"-8 bolts must be torques to 480 ft-lbs. To ensure that to load is properly transferred to the fixture.

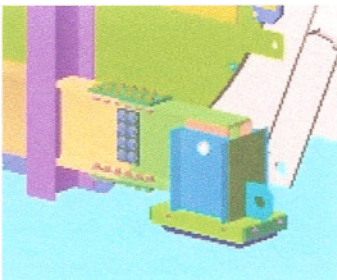
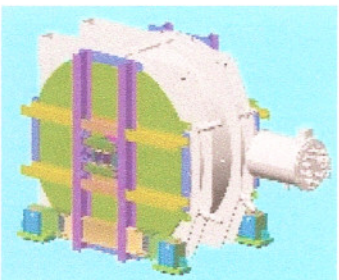


V. Install Upstream Cover, Welded Frame, and Center Connection.

Release the load from the clamp plate and remove the plate. Follow III. & IV. above for the upstream end.

VI. Install Feet and Rollers

Once the magnet has been lifted, rotated horizontal, and moved closer to the truck ramp door the feet may be installed. The magnet must be set down on cribbing or short stands.



Attachment

Installing G0 Shipping Fixture

28 May, 2008

VII. Credits

All renderings are from "Design of the G0 Cryostat Shipping Fixture" by Bartoszek Engineering.

Photos from University of Illinois, Nuclear Physics Lab.