BROOKHAVEN NATIONAL LABORATORY

Work Permit # __SDD-2016-00! 6
Work Order # _____
Job# _____ Activity# _____

See "Instructions for Filling out the Work Permit" contained in the Work Planning and Control for Experiments and Operations Subject Area.

1. Work request WCC fills out this section. ☐ **Standing Work Permit**

Requester: Robert Pisani	Date: 9/12/2016	Ext.: 5301	Dept/Div/Group: PO
Other Contact person (if different from requester): Carter Biggs			Ext.:
Work Control Coordinator:		Start Date:	Est. End Date: 11/1/2016
Brief Description of Work: Removal Of EmCal Sectors (4 on the East, 4 on the West) from PHENIX as part of the PHENIX Removal & Repurposing Plan			
Building: 1008	Room: IR and Assembly Area	Equipment: PHENIX EmCal Sectors	Service Provider: PHENIX Techs, Engineers, Subsystem experts, PHENIX Electricians, C-A Carpenters and Riggers

2. WCC, Requester/Designee, Service Provider, and ESSH (as necessary) fill out this section or attach analysis

ESSH ANALYSIS

Radiation Concerns	☐ None	☒ Activation	☐ Airborne	☐ Contamination	☐ Radiation	☐ NORM	☐ Other
☐ Special nuclear materials involved, notify Isotope Special Materials Group				☐ Fissionable/Radiological materials involved, notify Laboratory Nuclear Safety Officer			
Radiation Generating Devices:	☐ Radiography		☐ Moisture Density Gauges		☐ Soil Density Gauges	☐ X-ray Equipment	

Safety and Security Concerns	☐ None	☐ Explosives	☐ Transport of Haz/Rad Material	☐ Pressurized Systems
☐ Adding/Removing Walls or Roofs	☐ Critical Lift	☐ Fumes/Mist/Dust*	☐ Magnetic Fields*	☐ Railroad Work
☐ Asbestos*	☐ Cryogenic	☐ Heat/Cold Stress	☐ Nanomaterials/particles*	☒ Rigging
☐ Beryllium*	☐ Electrical	☐ Hydraulic	☐ Noise*	☐ Silica*
☐ Biohazard*	☒ Elevated Work	☐ Lasers*	☐ Non-ionizing Radiation*	☐ Security Concerns
☐ Chemicals/Corrosives*	☐ Excavation	☐ Lead*	☐ Oxygen Deficiency*	☐ Suspect/Counterfeit Items
☐ Confined Space*	☐ Ergonomics*	☐ Material Handling	☐ Penetrating Fire Walls	☐ Vacuum
Ladder Access Required: ☒ Portable Ladder ☐ Fixed Ladder– Status/Restrictions:				
* Safety Health Rep. Review Required	☐ Haz, Rad, Bio Material Exceed DOE 151.1-C Levels - Contact OEM			☐ Other

Environmental Concerns	☒ None	☐ Work impacts Environmental Permit No.	
☐ Atmospheric Discharges (rad/non-rad/GHG)	☐ Land Use Institutional Controls	☐ Soil Activation/contamination	☐ Waste-Mixed
☐ Chemical or Rad Material Storage or Use	☐ Liquid Discharges	☐ Waste-Clean	☐ Waste-Radioactive
☐ Cesspools (UIC)	☐ PCB Management	☐ Waste-Hazardous	☐ Waste-Regulated Medical
☐ High water/power consumption	☐ Spill potential	☐ Waste-Industrial	☐ Historical Enviornmental Hazards
Waste disposition by:			☐ Other
Pollution Prevention (P2)/Waste Minimization Opportunity: ☒ No ☐ Yes		Environmental Preferable Products Available: ☒ No ☐ Yes	

FACILITY CONCERNS	☒ None	☐ Intermittent Energy Release		
☐ Access/Egress Limitations ☐ Credited Controls (Use USI Process) ☐ Configuration Management	☐ Electrical Noise	☐ Potential to Cause a False Alarm		☐ Vibrations
	☐ Impacts Facility Use Agreement		☐ Temperature Change	☐ Other
	☐ Maintenance Work on Ventilation Systems		☐ Utility Interruptions	

WORK CONTROLS

Work Practices

☐ None	☐ Exhaust Ventilation	☒ Lockout/Tagout	☐ Spill Containment	☐ Security (see Instruction Sheet)
☐ Back-up Person/Watch	☐ HP Coverage	☐ Posting/Warning Signs	☐ Time Limitation	☐ Other
☐ Barricades	☐ IH Survey	☐ Scaffolding-requires inspection	☐ Warning Alarm (i.e. "high level")	☐ Electrical Inspection Required

Personal Protective Equipment

☐ None	☐ Ear Plugs	☒ Gloves, as necessary	☐ Lab Coat	☒ Safety Glasses, where req'd		
☐ Coveralls	☐ Ear Muffs	☐ Goggles	☐ Respirator*	☒ Safety Harness, when required		
☐ Disposable Clothing	☐ Face Shield	☒ Hard Hat, As required	☐ Shoe Covers	☒ Safety Shoes, as req'd	☐ High visibility cloths/vest	☐ Other

Permits Required (Permits must be valid when job is scheduled.)

☒ None	☐ Cutting/Welding	☐ Impair Fire Protection Systems
☐ Concrete/Masonry Penetration	☐ Digging/Core Drilling	☐ Rad Work Permit-RWP No
☐ Confined Space Entry	☐ Electrical Working Hot	☐ Other

Dosimetry/Monitoring

☒ None	☐ Heat Stress Monitor	☐ Real Time Monitor	☐ TLD
☐ Air Effluent	☐ Noise Survey/Dosimeter	☐ Self-reading Pencil Dosimeter	☐ Waste Characterization
☐ Ground Water	☐ O_2/Combustible Gas	☐ Self-reading Digital Dosimeter	☐ Other
☐ Liquid Effluent	☐ Passive Vapor Monitor	☐ Sorbent Tube/Filter Pump	

Training Requirements (List specific training requirements)

PHENIX Awareness, C-A Access, Working at Heights (where needed), Electrical Safety 1, LOTO where needed

Work screening has identified the following as the reason for permitted work:	**When work is categorized as worker planned work and a permit is used only the following signatures are required: (Although allowed, there is no need to use back of form)**
☐ **ESSH**	WCC: Date:
☐ **Complexity**	Service Provider: Date:
☒ **Work Coordination**	Authorization to start: Date:
☐ **Permit Not Required** (Sections 3 through 7 optional)	(Department/Division, or their equivalent, Sup/WCC/Designee)

3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)

Work Plan (procedures, timing, equipment, scheduling, coordination, notifications, and personnel availability need to be addressed in adequate detail): During the 2016 PHENIX R&R Shutdown, PHENIX will be performing R&R work to prepare for a new sPHENIX detector. As part of this effort, it is required that the EmCal sectors (east and west) be removed and disposed of safely at 1008. Most of this work will be worker planned work by skilled PHENIX technicians and appropriately trained BNL bargaining unit personnel. An attachment is included visually illustrating the removal of the RICH to aid in the process. The Vessel will then be shipped to Building 912 by CA-Riggers.
Special Working Conditions Required (e.g., Industrial Hygiene hold points or other monitoring)
Notifications to operations and Operational Limits Requirements:
Post Work Testing, Notification or Documentation Required:

Job Safety Analysis Required: ☐ Yes ☒ No	Review Done: ☒ in series ☐ team

Reviewed by: * Primary Reviewer signature (not required for Worker Planned Work) means that the Review Team members were appropriate for the work that was planned, the Team visited the job site, hazards and risks that could impact ESSH have been considered and controls established according to BNL requirements. In addition, this signature indicates that applicable JRAs, FRAs, as well as other planning documents have been reviewed and training requirements have been identified and recorded on this permit.

Title	Name (print)	Signature	Life #	Date
ES&H Professional				
F&O Facility Project Manager				
Service Provider				
Work Control Coordinator	Don Lynch		20146	
Safety Health Representative				
Research Space Manager				
Other				
Other				
Required Walkdown Completed				
*Primary Reviewer				

4. Job site personnel (Supervisor and workers) fill out this section.

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments) and all training required for this permit is current/complete. Job Supervisor/Contractor Supervisor signatures also includes verification that worker training required for this permit is current/complete.

Job Supervisor: Carter Biggs		Contractor Supervisor:	
Workers:	Life#:	Workers :	Life#:

Workers are encouraged to provide feedback on ESSH concerns or on ideas for improved job work flow. Use feedback form or space below.

5. Department/Division, or their equivalent, Line Manager or Designee

Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.)

Name:	Signature:	Life#:	Date:

6. Worker provides feedback.

Worker Feedback (use attached sheets as necessary)

a) WCM/WCC: Are there any changes as a result of worker feedback? ☐ Yes ☐ No

Note: See Work Planning and Control for Experiments and Operations Subject Area section 2.6.

7. Post Job Review/Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of job site to work supervisor.) The WCC ensures that the change process to update drawings, placards, postings, procedures, etc., is initiated, if necessary.

Name:	Signature:	Life#:	Date:

Comments:

Work Plan Attachment, W.P.# SDD-2016-005
Removal and Repurposing of the PHENIX EmCal Sectors at Building 1008
Note: The Lead Scintillator (PbSc) Secotors weigh 20 tons (East 2&3, West 0, 1, 2, 3).
The PbGlass Sectors Weigh 21.5 tons (East 0&1).

Introduction
Safe handling of the RmCal Sectors while removing from the PHENIX Detector Carriage will eliminate danger to workers at Brookhaven National Laboratory (BNL). This procedure will provide detailed instructions for safe removal of the detector assembly from the PHENIX East and West Carriages.

1.0 Purpose & Scope
The purpose of this procedure is to provide directions for handling and removing the EmCal Sectors. It applies to BNL personnel, outside contractors, contract labor and to personnel designated to operate equipment covered by this procedure. Safety standards provided by BNL for Material Handling (1.6.0) and required training and certification (1.6.1) will apply. There are two parts to the procedure: The lift of the detector assembly off the Detector Carriage, and movement of the detector sectors from the assembly hall floor to the truck for transportation to building 912. This procedure will be used for the removal of the 8 EmCal Sectors: 4 on the East Carriage, and 4 on the West carriage.

2.0 Responsibilities

2.1 All operations shall be performed under the direction of the PHENIX Experimental Hall "Person-in-Charge" or his designee.

2.2 Due to the component value, as well as the inherent personnel risk involved in handling such large objects, this procedure and all relevant BNL safety guidelines must be strictly adhered to. In accordance with BNL policy, any individual may cease operations if they in any way feel unsafe or if they believe unsafe procedures are being followed. Such a complaint shall be reviewed by the cognizant engineer, and if necessary, BNL ES & H Services.

3.0 Prerequisites

3.1 All personnel involved in this procedure shall wear hard hats.

3.2 Personnel involved in this procedure shall wear safety shoes.

3.3 Personnel involved in this procedure shall wear safety glasses

4.0 Precautions

4.1 Visitors shall not be permitted in the PEH during these procedures.

4.2 Some operations will require personnel to work in close proximity to suspended loads. Do not permit yourself or anyone else to be positioned under the load.

5.0 Equipment/Parts List

5.1 The following equipment & hardware is called for in various sections of this procedure:
- a) 30-ton EmCal lift beam, Serial No. 92724
- b) M-24 swivel eyes, 3-ton capacity (4)
- c) 9.5-ton shackles (2)
- d) 17-ton shackles (2)
- e) Swivel-eyes:
  - 3-ton capacity (4)
  - 2-ton capacity (4)

f) Chainhoists:
    - 5-ton capacity (2)
    - 2-ton capacity (2)

g) Slings:
    - 15-ton capacity, 2'6" long (2)
- 10-ton capacity (4)
- 5-ton capacity (2)
- 3-ton capacity (2)
- 2-ton capacity (3)

6.0 Preparations

Note: All lifting hardware shall be checked for current inspection stickers and shall be visually inspected for defects prior to each lift. Any items found to have expired inspection tags or any evidence of physical degradation shall be immediately removed from service and replaced with conforming hardware of the same capacity.

6.1 Disconnect and remove all cables, gas, and water lines from EmCal sectors detector.
6.2 Racks and platforms on E3,E2, E1 and E0 will be removed prior to removing any EmCal Sectors

7.0Procedures

Procedure No. 2.5.2.9/01 C should be followed in reverse to remove the EmCal Sectors. This procedure is attached at the end of this document. Please note: Each sector have its own section

Section 7.1: PbSc Sector "0"

Section 7.2: PbSc Sector "1"

Section 7.3: PbSc Sectors "2" & "3"

Section 7.4: PbGl Sector "0"

Section 7.5: PbGl Sector "1"

Note that each PbSc Sector weighs 20-tons while the PbGl's weigh 21.5- tons each.

EmCAL Installation Procedure

PHENIX Procedure No. PP-2.5.2.9/01

Revision "C"

Date: 6/30/99

Hand Processed Changes

HPC #	*Date*	*Page #'s*	*Initials*

PHENIX SE&I *EmCal Subsystem*

PHENIX Safety *RHIC Safety*

1.0 Purpose & Scope

REVISION CONTROL SHEET

LETTER	DESCRIPTION	DATE	WRITTEN BY	APPROVED BY	TYPED BY
A	First Issue	No info available	n/a	n/a	n/a
B	Revisions not recorded	9/22/1998	n/a	(4 unintelligible)	n/a
C	Revisions not recorded	6/30/1999	n/a	n/a	n/a
RETIRED	Installation Complete	3/7/2007	D. Lynch	D.Lynch, P. Giannotti, R. Pisani for the PHENIX experiment	n/a

1.1 The purpose of this procedure is to provide directions for rigging the four EmCal Sectors onto the carriages in Bldg. 1008. There are five separate sections to this procedure, each covering the installation of different EmCal Sectors:

Section 7.1: PbSc Sector "0"
Section 7.2: PbSc Sector "1"
Section 7.3: PbSc Sectors "2" & "3"
Section 7.4: PbGl Sector "0"
Section 7.5: PbGl Sector "1"

Note that each PbSc Sector weighs 20-tons while the PbGl's weigh 21.5-tons each.

2.0 Responsibilities

2.1 All operations shall be performed under the direction of the Phenix Experimental Hall "Person-in-Charge" or his designee.

2.2 Due to the delicacy of interior detector components and their value, as well as the inherent personnel risk involved in handling such large objects, this procedure and all relevant BNL safety guidelines must be strictly adhered to. In accordance with BNL policy, any individual may cease operations if they in any way feel unsafe or if they believe unsafe procedures are being followed. Such a complaint shall be reviewed by the cognizant engineer, and if necessary, BNL ES & H Services.

3.0 Prerequisites

3.1 Training: All personnel involved in this procedure shall have reviewed this procedure, and be fully knowledgeable about the way in which the EmCal Sectors mount to the carriage. All personnel shall sign an acknowledgement sheet to that effect.

3.2 All personnel involved in this procedure must have a current BNL Safety Awareness Certificate (SAC).

3.3 All personnel involved in this procedure shall wear hard hats in accordance with RHIC SEAPPM 1.16.0.

3.4 Personnel involved in this procedure shall wear safety shoes.

4.0 Precautions

4.1 Visitors shall not be permitted in the PEH during these procedures.

4.2 The area where rigging operations will be performed shall be cordoned-off to all personnel except for the Person-in-Charge and the three technicians assigned to perform this procedure. Others may enter the area only with the specific approval of the Person-in-Charge.

4.3 Some operations will require personnel to work in close proximity to suspended loads. Do not permit yourself or anyone else to be positioned under the load.

5.0 Equipment List

5.1 The following equipment & hardware is called for in various sections of this procedure:

30-ton EmCal lift beam, Serial No. 92724
M-24 swivel eyes, 3-ton capacity (4)
9.5-ton shackles (2)
17-ton shackles (2)

Swivel-eyes: 3-ton capacity (4)
2-ton capacity (4)

Chainhoists: 5-ton capacity (2)
2-ton capacity (2)

Slings: 15-ton capacity, 2'6" long (2)
10-ton capacity (4)
5-ton capacity (2)
3-ton capacity (2)
2-ton capacity (3)

6.0 Preparations

6.1 The sector mounts on the carriages shall have been previously surveyed to their correct positions in accordance with Phenix Dwg. No. 002-0510-006, Rev. A.

6.2 The carriage mounting plate bolts (1"-8) shall be torqued to 680 ft-lb.

6.3 Bolt the carriage stops to the assembly hall rails at the four corners of the carriage in the direction of Hilman Roller travel.

6.4 Remove the trunnion keeper-bars from the carriage mounting brackets.

7.0 Procedure

7.1 Sector "0" (PbSc, Lower Sector)

7.1.1 Verify that the five 1"-8 bolts attaching the lifting trunnions to the EmCal frame have been torqued to 300 ft-lb.

7.1.2 Attach the yellow 30-ton EmCal lift beam to the Sector using the 40-ton crane hook and the gray, 2'6" long, 15-ton slings. Slings to be configured for a "vertical" lift. See Figure 1.

7.1.3 Slowly lift the EmCal Sector. When the load has been taken onto the crane, unbolt the two feet from the frame so that they can be removed using a forklift. When the Sector is hanging freely from the crane it will be at roughly a 24-degree angle to vertical See Figure 1.

7.1.4 Move the Sector to the carriage and place it in its upper mounting brackets. When resting freely in the carriage, the sector will hang at roughly a 7.5-degree angle to vertical. See Figure 2-2.

7.1.5 Have at least TWO people visually verify that the EmCal trunnions are sitting properly within the mounting brackets.

7.1.6 Disconnect the beam and slings.

7.1.7 Install two swivel-eyes, minimum 3-ton capacity, in the holes drilled in the vertical towers of the carriage.

7.1.8 Remove the upper lifting trunnions which were installed in Step 7.1.1 from the frame. Install two swivel-eyes, minimum 3-ton

capacity, in the lower lifting trunnion mounting holes (one per side).

7.1.9 Install swivel eyes (4), minimum 3-ton total capacity per side, in the holes on the bottom of the EmCal frame which were previously used for attaching to the feet.

7.1.10 Attach two chainhoists, minimum 5-ton capacity each, between the two pairs of swivel-eyes installed in Steps 7.1.7 & 7.1.8. Install a 5-ton capacity sling in series with the chainhoist at each location (to help with load equalization).

WARNING:

A TOTAL FORCE OF 4.8-TONS WILL BE REQUIRED TO ROTATE A PbSc SECTOR (20-TONS) TO ITS FINAL POSITION AT 22.5-DEGREES. SEE FIGURE 5 FOR SAMPLE CALCULATION.

7.1.11 Work the two chainhoists in concert to draw the Sector forward, rotating it into its final position within the lower mounting bracket. PERSONNEL ARE NOT PERMITTED NEAR THE BACK SIDE OF THE EMCAL FRAME DURING THIS OPERATION.

7.1.12 With the Sector in its final position, attach two slings, minimum 3-ton capacity each, between the swivel-eyes installed on the bottom of the sector (Step 7.1.9) and the two carriage lifting weldments on the front face of the carriage.

7.1.13 Bolt the two keeper-bars to the back of the lower brackets. Torque the bolts (1"-8) to 100 ft-lb. NO UNNECESSARY PERSONNEL ARE TO BE PERMITTED ON THE BACK SIDE OF THE EMCAL DURING THIS OPERATION.

7.1.14 Clear all personnel from the back side of the Sector.

7.1.15 Remove the two slings which were installed in Step 7.1.12.

7.1.16 Slowly release the load from the two chainhoists and disconnect them.

7.1.17 Remove all swivel-eyes.

7.2 Sector "1" (PbSc, Vertical Sector)

7.2.1 Verify that the five 1”-8 bolts attaching the lifting trunnions to the EmCal frame have been torqued to 300 ft-lb.

7.2.2 Attach the yellow 30-ton EmCal lift beam to the Sector using the 40-ton crane hook and the gray, 2’6” long, 15-ton slings. Slings to be configured for a “vertical” lift. See Figure 1.

7.2.3 Slowly lift the EmCal Sector. When the load has been taken onto the crane, unbolt the two feet from the frame so that they can be removed using a forklift. When the Sector is hanging freely from the crane, it will be at roughly a 24-degree angle to vertical See Figure 1.

7.2.4 Move the Sector to the carriage and place it in its upper mounting brackets. When resting freely in the carriage, the sector will hang at roughly a 7.5-degree angle to vertical. See Figure 3-2.

7.2.5 Have at least TWO people visually verify that the EmCal trunnions are sitting properly within the mounting brackets.

7.2.6 Disconnect the beam and slings.

7.2.7 Install two swivel-eyes, minimum 2-ton capacity each, in the holes drilled in the forward arms of the carriage.

7.2.8 Remove the lifting trunnions which were installed in Step 7.2.1 from the frame. Install two swivel-eyes, minimum 2-ton capacity, in the lower-most lifting trunnion mounting holes (one per side).

7.2.9 Attach two chainhoists, minimum 2-ton capacity each, between the two pairs of swivel-eyes. Install a 2-ton sling in series with each chainhoist (to help equalize loads) See Figure 4.

7.2.10 Wrap a sling, minimum 2-ton capacity, horizontally around the body of the EmCal frame. The ends of the sling pass between the frame and the carriage towers, attaching to the forward arms of the carriage.

WARNING:

A TOTAL FORCE OF 1.3-TONS WILL BE REQUIRED TO ROTATE A PbSc SECTOR TO ITS INSTALLED VERTICAL POSITION.

CAUTION:

THERE IS ONLY A 4-mm CLEARANCE BETWEEN THE LOWER TWO SECTORS WHEN FULLY INSTALLED. MONITOR THIS CLEARANCE CLOSELY AS THE VERTICAL SECTOR ROTATES INTO POSITION. STOP IMMEDIATELY IF THERE IS ANY DANGER OF DIRECT CONTACT BETWEEN THE TWO SECTORS.

7.2.11 Work the two chainhoists in concert to draw the Sector forward, rotating it into its final position within the lower mounting bracket. PERSONNEL ARE NOT PERMITTED NEAR THE BACK SIDE OF THE EMCAL FRAME DURING THIS OPERATION.

7.2.12 With the Sector in its final position, tighten the sling which was installed in Step 7.2.10 so that in the event of a slip in the chainhoists, it holds the Sector securely in place.

7.2.13 Bolt the two keeper-bars to the back of the lower brackets. Torque the bolts (1"-8) to 100 ft-lb. NO UNNECESSARY PERSONNEL ARE TO BE PERMITTED ON THE BACK SIDE OF THE EMCAL DURING THIS OPERATION.

7.2.14 Clear all personnel from the back side of the Sector.

7.2.15 Remove the sling.

7.2.16 Slowly release the load from the two come-alongs and disconnect them.

7.2.17 Remove all swivel-eyes.

7.3 Sectors "2" & "3" (PbSc, Upper Sectors)

7.3.1 Transfer the Sector from the normal stands to those with rocker-feet.

7.3.2 Verify that the 1"-8 bolts attaching the triangular PbSc lifting plates to the EmCal frame have been torqued to 300 ft-lb.

7.3.3 Attach the lifting trunnions on the yellow 30-ton EmCal lift beam to the triangular attachment plates using the 40-ton crane hook. See Figure 6-1.

7.3.4 Slowly lift the EmCal Sector, rolling gently forward onto the rocker-feet (Figure 6-2). When the load has been taken onto the crane, unbolt the two feet from the frame so that they can be removed using a forklift. When the Sector is hanging freely from the crane, it will be at roughly a 55-degree angle to vertical See Figure 7-1.

7.3.5 Move the Sector to the carriage and place it in its upper mounting bracket. See Figure 7-2.

CAUTION:

THERE IS ONLY A 4-mm CLEARANCE BETWEEN THESE TWO SECTORS WHEN FULLY INSTALLED. MONITOR THIS CLEARANCE CLOSELY AS THE SECTOR ROTATES INTO POSITION. STOP IMMEDIATELY IF THERE IS ANY DANGER OF DIRECT CONTACT BETWEEN THE TWO SECTORS.

7.3.6 Lower the crane until the Sector engages its lower mounting bracket. See Figure 7-3. Ensure that the crane follows the hook in order to minimize horizontal loads.

7.3.7 Have at least TWO people visually verify that the EmCal trunnions are sitting properly within the mounting brackets.

7.3.8 Disconnect the triangular attachment plates from the EmCal frame and remove along with the lifting beam.

7.3.9 Bolt the two keeper-bars to the back of the support brackets. Torque the bolts (1"-8) to 100 ft-lb.

7.4 Sector "0" (PbGl, Lower Sector)

Note: Rigging clearances between the EmCal Sector & the Carriage Support Plates is extremely tight and may require the temporary removal of support plates or hardware in order to allow the Sector to clear.

7.4.1 Verify that the five 1"-8 bolts attaching the lifting trunnions to the EmCal frame have been torqued.to 300 ft-lb.

7.4.2 Verify that the eight 1"-8 bolts attaching the PbGl lifting plates to the EmCal frame have been torqued to 300 ft-lb.

7.4.3 Loop two 10-ton slings (20-ft.long) directly over the 40-ton crane hook and connect to the EmCal attachment plates using 17-ton, 9.5-ton, and 17-ton shackles, connected in series at the plate.

7.4.4 Attach two 10-ton slings (20-ft. long) to the 40-ton crane hook using the 2'6", 15-ton sling, choked configuration, in series with a 9.5-ton shackle. Loop the opposite end directly over the EmCal lifting trunnions.

7.4.5 Slowly lift the EmCal Sector. When the load has been taken onto the crane, unbolt the two feet from the frame so that they can be removed using a forklift. When the Sector is hanging freely from the crane, the upper support trunnion should be "leading" the lower trunnion just slightly (entire frame rotated slightly counterclockwise).

7.4.6 Move the Sector to the carriage and place it in its upper mounting brackets.

7.4.7 Have at least TWO people visually verify that the EmCal trunnions are sitting properly within the mounting brackets.

7.4.8 Install two swivel-eyes, minimum 3-ton capacity each, in the holes drilled in the vertical towers of the carriage.

7.4.9 Install two swivel-eyes, minimum 3-ton capacity each, in the 1"-8 holes drilled in the lower sides of the EmCal frame (specifically drilled for this purpose).

7.4.10 Attach two chainhoists, minimum 5-ton capacity each, between the two pairs of swivel-eyes installed in Steps 7.4.8 & 7.4.9. Install a 5-ton capacity sling in series with the chainhoist at each location (to help with load equalization).

7.4.11 Wrap a sling, minimum 6-ton capacity, horizontally around the body of the EmCal frame. The ends of the sling pass between the frame and the carriage towers, attaching to the forward arms of the carriage.

WARNING:

A TOTAL FORCE OF 5.2-TONS WILL BE REQUIRED TO ROTATE A PbGl SECTOR (21.5-TONS) TO ITS FINAL POSITION AT 22.5-DEGREES. SEE FIGURE 5 FOR SAMPLE CALCULATION.

7.4.12 Work the two chainhoists in concert to draw the Sector forward, rotating it into its final position within the lower mounting bracket. PERSONNEL ARE NOT PERMITTED NEAR THE BACK SIDE OF THE EMCAL FRAME DURING THIS OPERATION.

7.4.13 Bolt the two keeper-bars to the back of the lower brackets. Torque the bolts (1"-8) to 100 ft-lb. NO UNNECESSARY PERSONNEL ARE TO BE PERMITTED ON THE BACK SIDE OF THE EmCAL DURING THIS OPERATION.

7.4.14 Clear all personnel from the back side of the Sector.

7.4.15 Remove the sling which was installed in Step 7.4.11.

7.4.16 Slowly release the load from the two chainhoists and disconnect them.

7.4.17 Disconnect from the 40-ton crane hook. Remove the upper lifting trunnions, PbGl attachment plates, and swivel-eyes.

7.5 Sector "1" (PbGl, Vertical Sector)

Note: Rigging clearances between the EmCal Sector & the Carriage Support Plates is extremely tight and may require the temporary removal of support plates or hardware in order to allow the Sector to clear.

7.5.1 Verify that the five 1"-8 bolts attaching the lifting trunnions to the EmCal frame have been torqued.to 300 ft-lb.

7.5.2 Verify that the eight 1"-8 bolts attaching the PbGl lifting plates to the EmCal frame have been torqued to 300 ft-lb.

7.5.3 Attach the yellow 30-ton EmCal lift beam to the Sector using the 40-ton crane hook, two 10-ton slings (basketed configuration) and two 9.5-ton shackles. The slings are basketed over the lift beam, attaching to the shackle at the attachment plate, and directly to the lifting trunnion at the other end.

7.5.4 Slowly lift the EmCal Sector. When the load has been taken onto the crane, unbolt the two feet from the frame so that they can be removed using a forklift. When the Sector is hanging freely from the crane, the upper support trunnion should be "leading" the lower trunnion just slightly (entire frame rotated slightly counterclockwise).

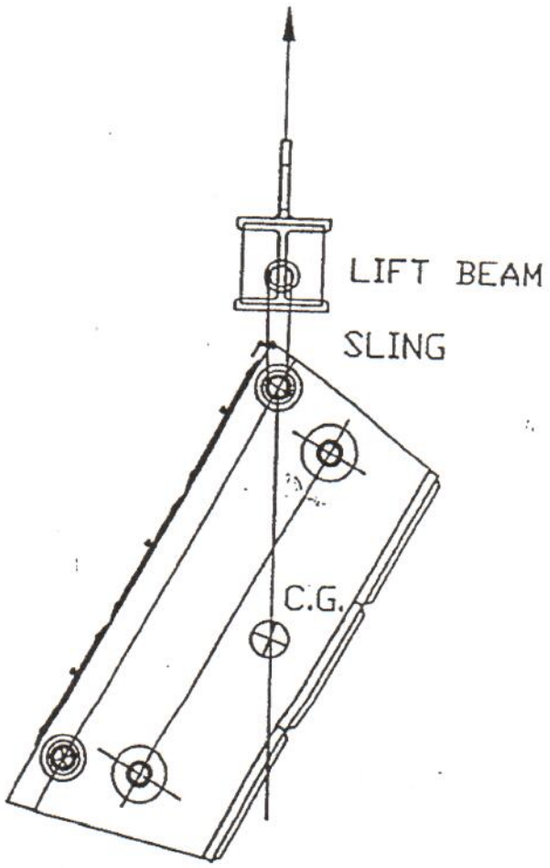
7.5.5 Move the Sector to the carriage and place it in its upper mounting brackets.

7.5.6 Have at least TWO people visually verify that the EmCal trunnions are sitting properly within the mounting brackets.

7.5.7 Bolt the two keeper-bars to the back of the lower brackets. Torque the bolts (1"-8) to 100 ft-lb.

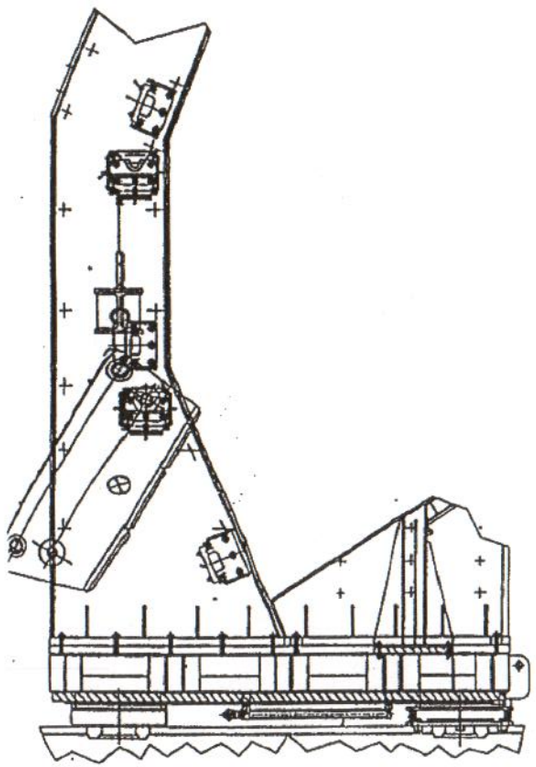
7.5.8 Disconnect the beam and slings.

7.5.9 Remove the upper lifting trunnions and PbGl attachment plates which were installed in Steps 7.5.1 & 7.5.2.

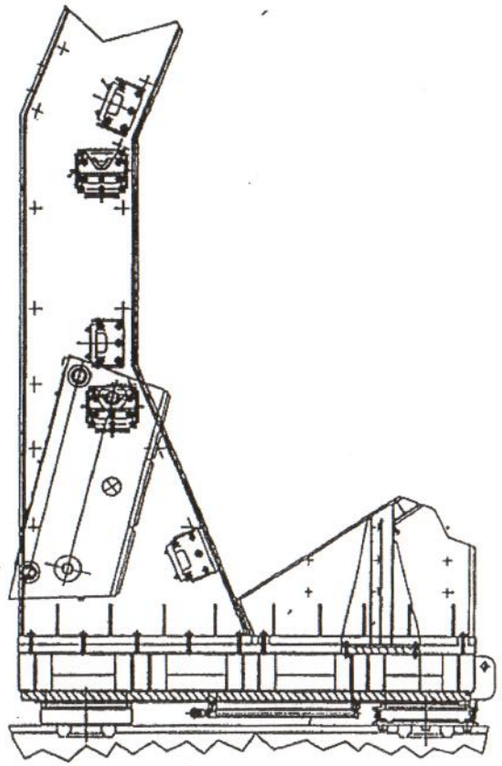


LIFT WITH SLING FOR LOWER SECTOR INSTALLATION

FIGURE 1

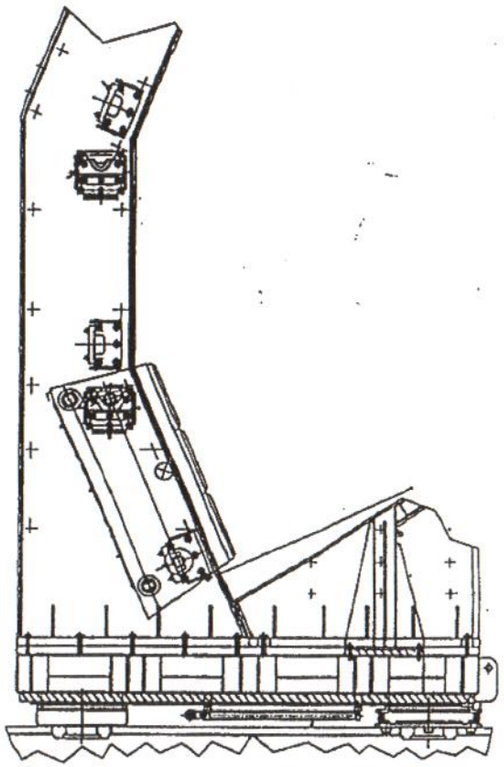


(2-1)



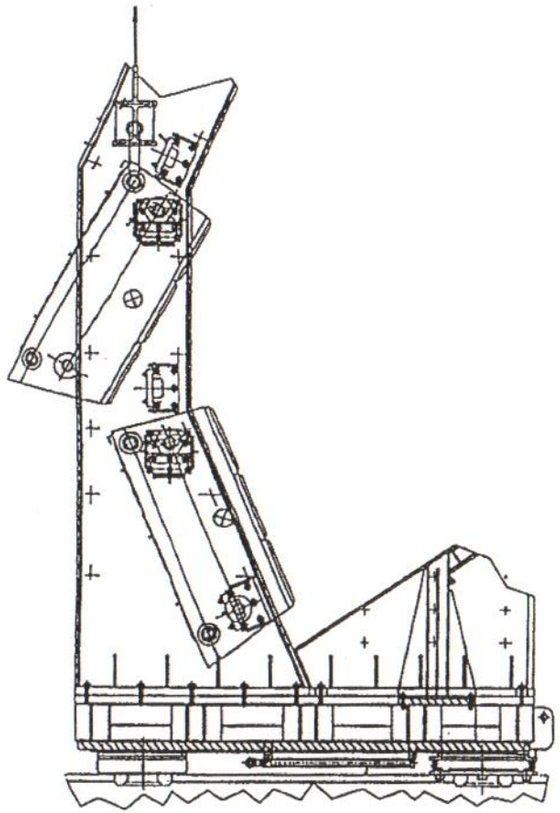
(2-2)

INSTALLING FIRST SECTOR IN CARRIAGE.

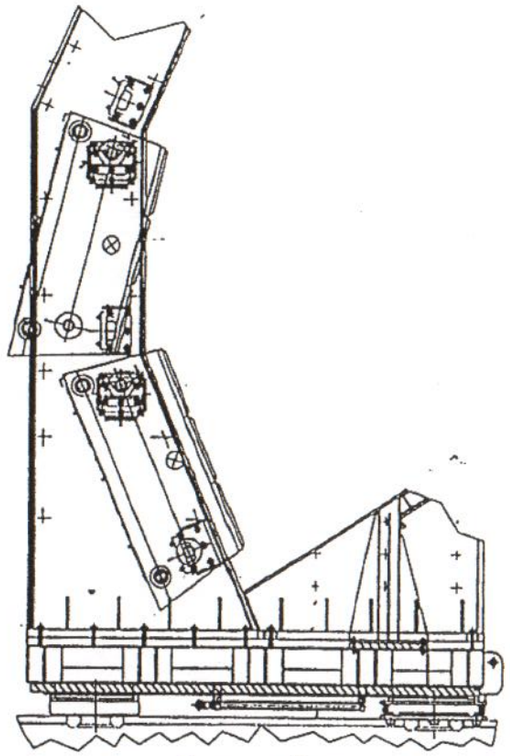


(2-3)

FIGURE 2

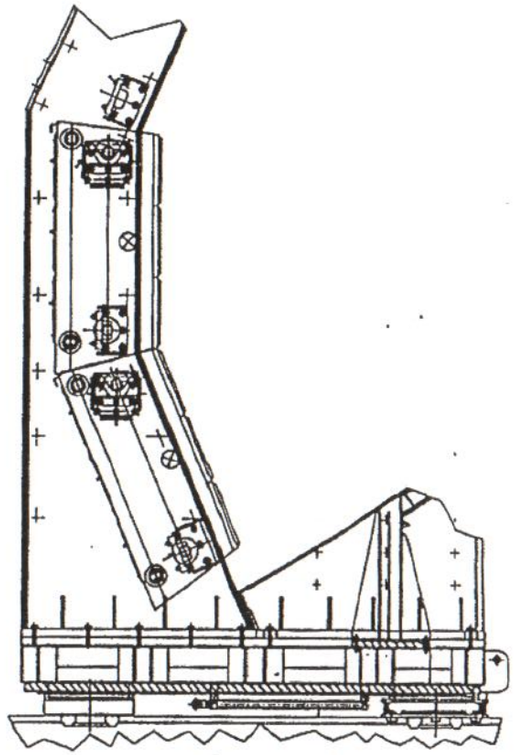


(3-1)



(3-2)

INSTALLING SECOND SECTOR
IN CARRIAGE.



(3-3)

FIGURE 3

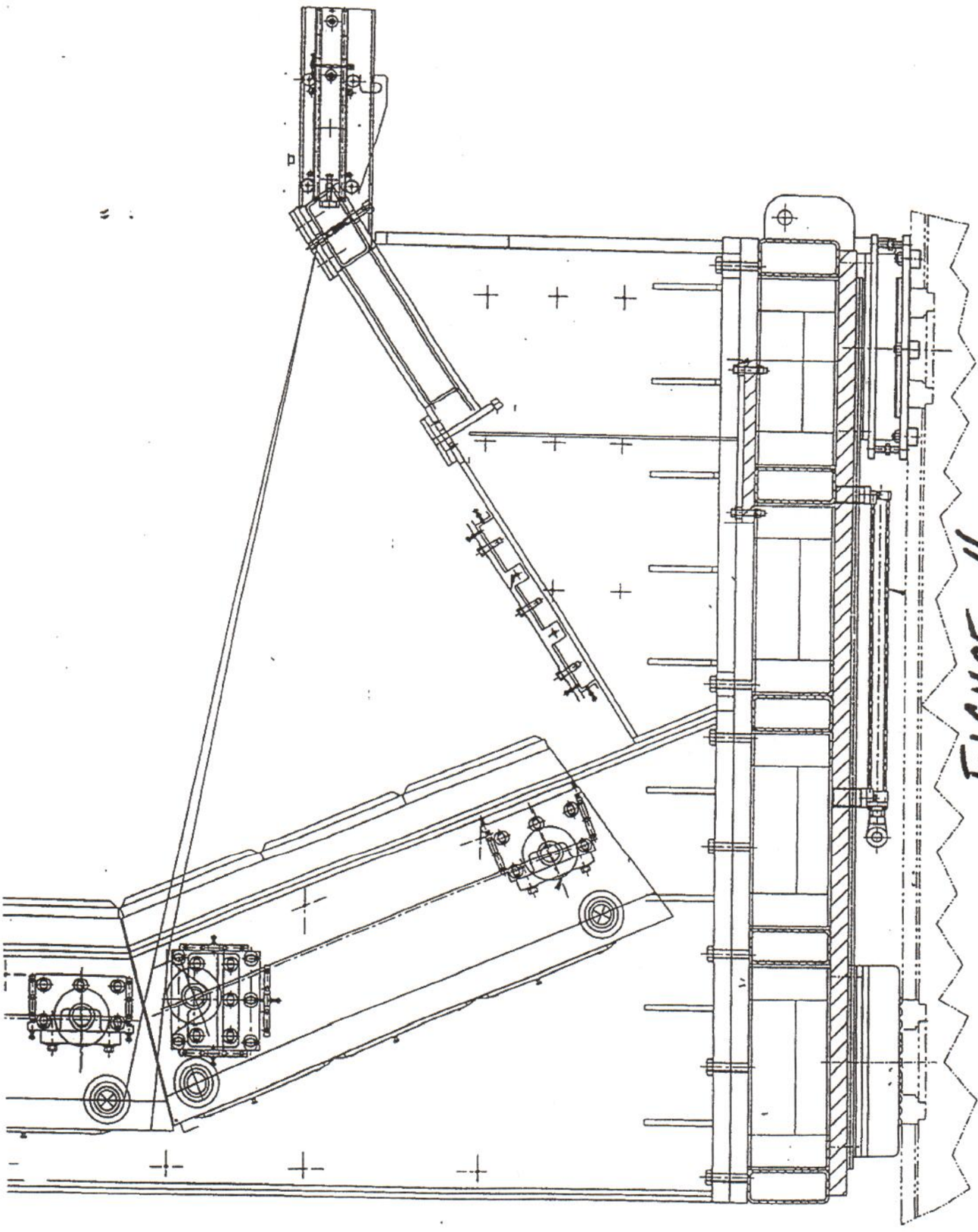


FIGURE 4 –

EMCAL SECTOR - C.G. LOCATION FROM
MEASUREMENTS ON SECTOR W0.

PULL IN FORCE "F" CALCULATED BY SUMMING MOMENTS
ABOUT PIVOT PIN. - 17.62 X P = 73 X F

P = 20 TONS

F = 0.241 X P = 4.8 TONS

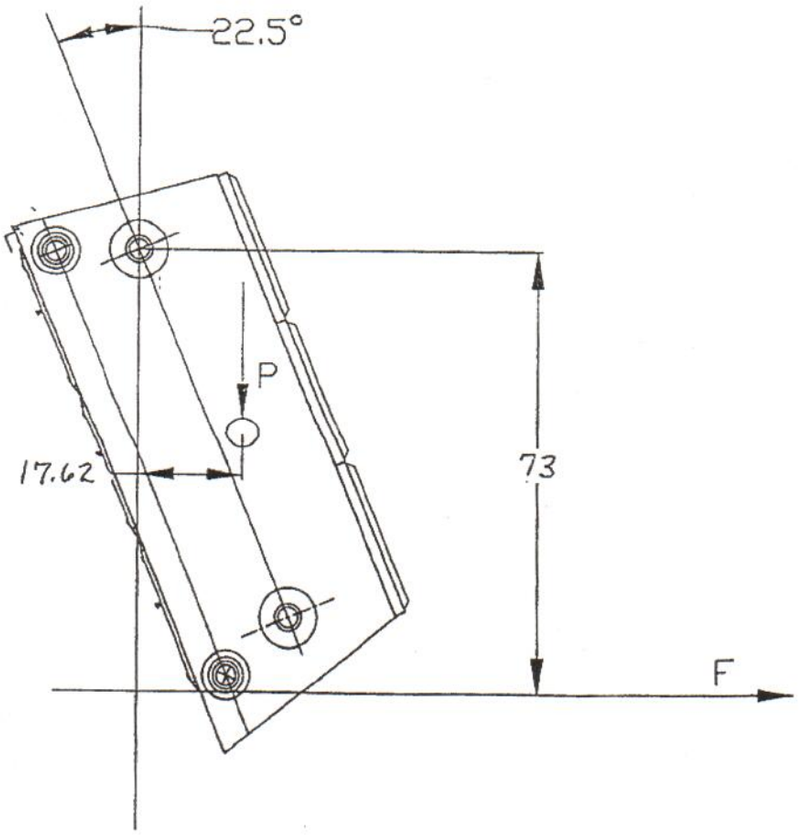
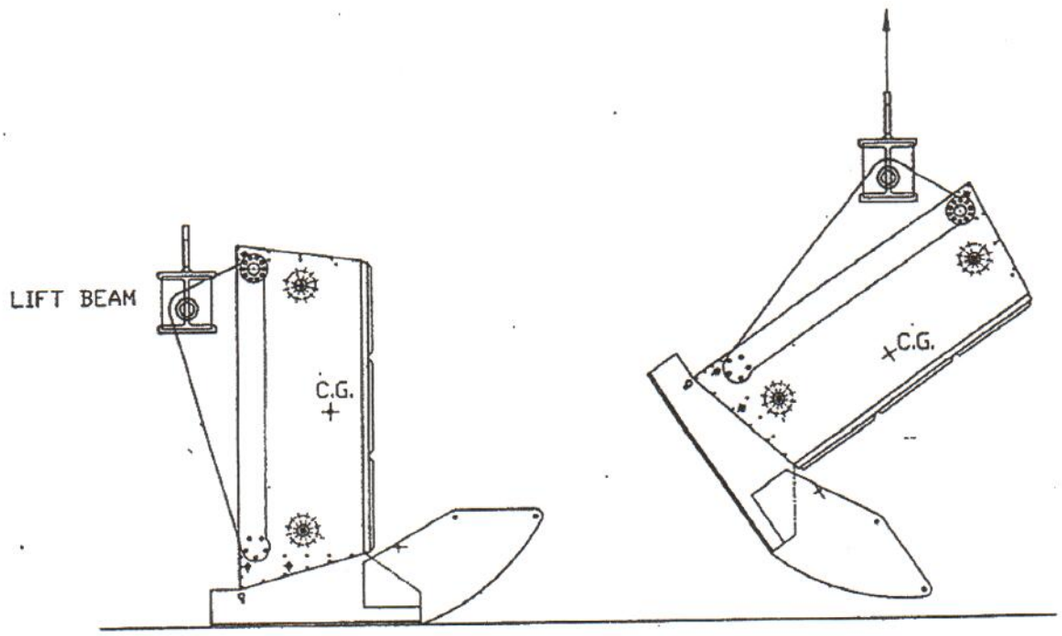


FIGURE 5



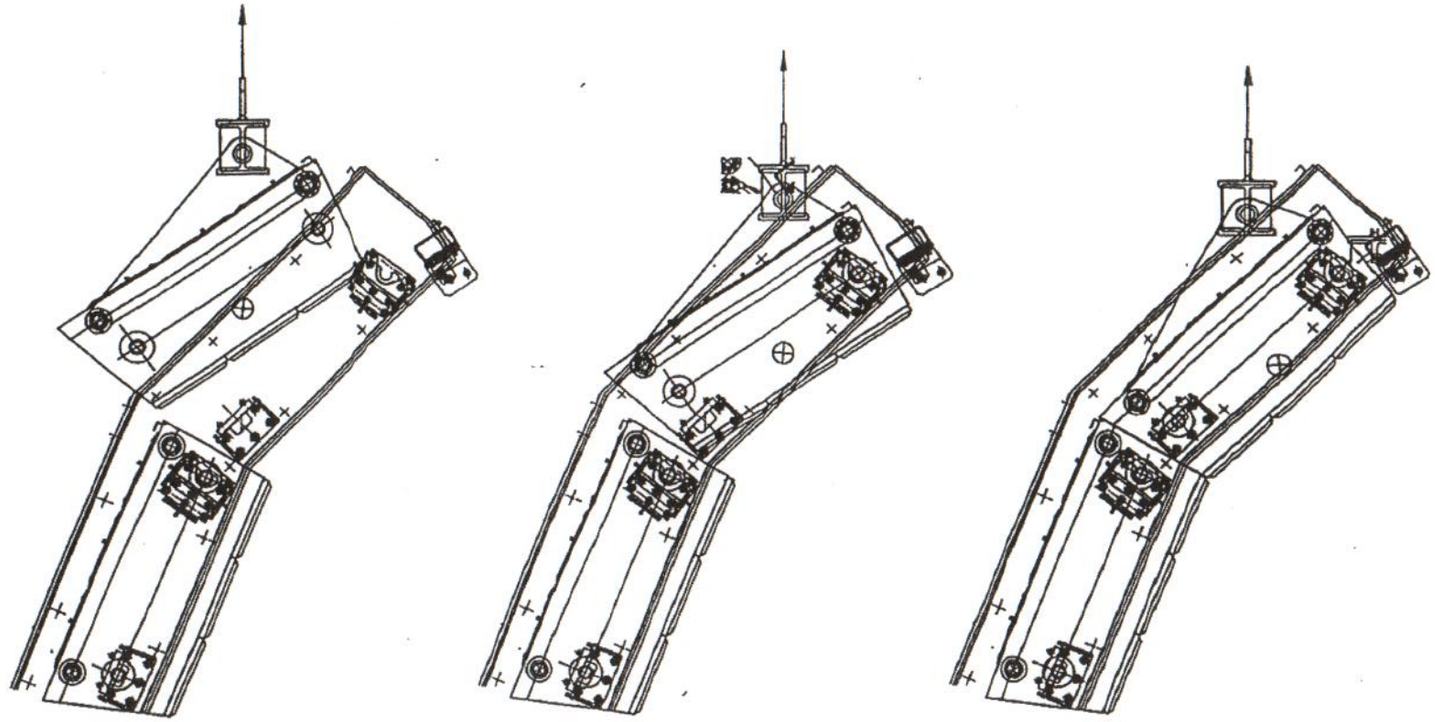
EMCAL SECTOR ON STAND
WITH ROCKER PLATES AND
ATTACHMENT PLATES

6-1

EMCAL SECTOR ON STAND
WITH ROCKER PLATES AND
ATTACHMENT PLATES

6-2

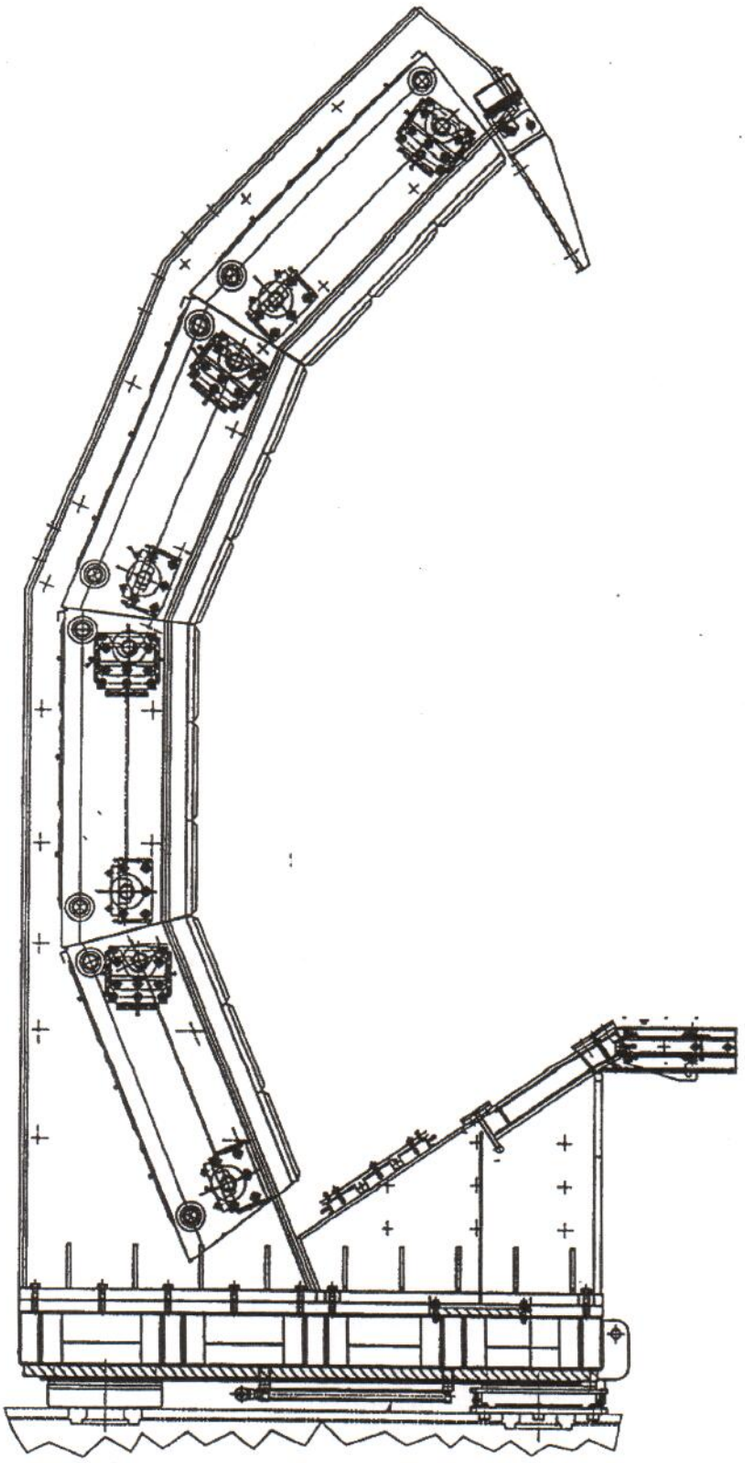
FIGURE 6



7-1 7-2 7-3

INSTALLING FOURTH (TOP)
SECTOR IN CARRIAGE.

FIGURE 7



ALL SECTORS INSTALLED IN CARRIAGE.

FIGURE 8