

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: Paul Giannotti	Date: 10/20/2016	Ext.: 3815	Dept/Div/Group: PO/PHENIX
Other Contact person (if different from requester): Carter Biggs			Ext.: 7515
Work Control Coordinator: Paul Giannotti	Start Date: 10/20/2016		Est. End Date: 9/1/2016
Brief Description of Work: MuTr Station 1 north and south removal and disposal			
Building: 1008	Room: IR & AH	Equipment: PHENIX MuTr Sta 1 N & Detector Subsystems	Service Provider: PHENIX Techs, Engineers & Subsystem Experts, PHENIX Electrician, C-A Carpenters and Riggers

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

<b>ESSH ANALYSIS</b>							
<b>Radiation Concerns</b>	<input type="checkbox"/> None	<input checked="" type="checkbox"/> Activation	<input type="checkbox"/> Airborne	<input type="checkbox"/> Contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> NORM	<input type="checkbox"/> Other
<input type="checkbox"/> Special nuclear materials involved, notify Isotope Special Materials Group				<input type="checkbox"/> Fissionable/Radiological materials involved, notify Laboratory Nuclear Safety Officer			
<b>Radiation Generating Devices:</b>	<input type="checkbox"/> Radiography		<input type="checkbox"/> Moisture Density Gauges	<input type="checkbox"/> Soil Density Gauges		<input type="checkbox"/> X-ray Equipment	
<b>Safety and Security Concerns</b>	<input type="checkbox"/> None		<input type="checkbox"/> Explosives	<input type="checkbox"/> Transport of Haz/Rad Material		<input type="checkbox"/> Pressurized Systems	
<input type="checkbox"/> Adding/Removing Walls or Roofs	<input type="checkbox"/> Critical Lift	<input type="checkbox"/> Fumes/Mist/Dust*	<input type="checkbox"/> Magnetic Fields*		<input type="checkbox"/> Railroad Work		
<input type="checkbox"/> Asbestos*	<input type="checkbox"/> Cryogenic	<input type="checkbox"/> Heat/Cold Stress	<input type="checkbox"/> Nanomaterials/particles*		<input checked="" type="checkbox"/> Rigging		
<input type="checkbox"/> Beryllium*	<input type="checkbox"/> Electrical	<input type="checkbox"/> Hydraulic	<input type="checkbox"/> Noise*		<input type="checkbox"/> Silica*		
<input type="checkbox"/> Biohazard*	<input checked="" type="checkbox"/> Elevated Work	<input type="checkbox"/> Lasers*	<input type="checkbox"/> Non-ionizing Radiation*		<input type="checkbox"/> Security Concerns		
<input type="checkbox"/> Chemicals/Corrosives*	<input type="checkbox"/> Excavation	<input type="checkbox"/> Lead*	<input type="checkbox"/> Oxygen Deficiency*		<input type="checkbox"/> Suspect/Counterfeit Items		
<input type="checkbox"/> Confined Space*	<input type="checkbox"/> Ergonomics*	<input type="checkbox"/> Material Handling	<input type="checkbox"/> Penetrating Fire Walls		<input type="checkbox"/> Vacuum		
Ladder Access Required: <input checked="" type="checkbox"/> Portable Ladder <input type="checkbox"/> Fixed Ladder- Status/Restrictions:							
* Safety Health Rep. Review Required		<input type="checkbox"/> Haz, Rad, Bio Material Exceed DOE 151.1-C Levels - Contact OEM				<input type="checkbox"/> Other	
<b>Environmental Concerns</b>				<input checked="" type="checkbox"/> None		<input type="checkbox"/> Work impacts Environmental Permit No.	
<input type="checkbox"/> Atmospheric Discharges (rad/non-rad/GHG)		<input type="checkbox"/> Land Use Institutional Controls		<input type="checkbox"/> Soil Activation/contamination		<input type="checkbox"/> Waste-Mixed	
<input type="checkbox"/> Chemical or Rad Material Storage or Use		<input type="checkbox"/> Liquid Discharges		<input type="checkbox"/> Waste-Clean		<input type="checkbox"/> Waste-Radioactive	
<input type="checkbox"/> Cesspools (UIC)		<input type="checkbox"/> PCB Management		<input type="checkbox"/> Waste-Hazardous		<input type="checkbox"/> Waste-Regulated Medical	
<input type="checkbox"/> High water/power consumption		<input type="checkbox"/> Spill potential		<input type="checkbox"/> Waste-Industrial		<input type="checkbox"/> Historical Environmental Hazards	
Waste disposition by: <input type="checkbox"/> Other							
Pollution Prevention (P2)/Waste Minimization Opportunity: <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes				Environmental Preferable Products Available: <input type="checkbox"/> No <input type="checkbox"/> Yes			
<b>FACILITY CONCERNS</b>				<input checked="" type="checkbox"/> None <input type="checkbox"/> Intermittent Energy Release			
<input type="checkbox"/> Access/Egress Limitations		<input type="checkbox"/> Electrical Noise		<input type="checkbox"/> Potential to Cause a False Alarm		<input type="checkbox"/> Vibrations	
<input type="checkbox"/> Credited Controls (Use USI Process)		<input type="checkbox"/> Impacts Facility Use Agreement		<input type="checkbox"/> Temperature Change		<input type="checkbox"/> Other	
<input type="checkbox"/> Configuration Management		<input type="checkbox"/> Maintenance Work on Ventilation Systems		<input type="checkbox"/> Utility Interruptions			
<b>WORK CONTROLS</b>							
<b>Work Practices</b>							
<input type="checkbox"/> None		<input type="checkbox"/> Exhaust Ventilation		<input checked="" type="checkbox"/> Lockout/Tagout		<input type="checkbox"/> Spill Containment	
<input checked="" type="checkbox"/> Back-up Person/Watch		<input type="checkbox"/> HP Coverage		<input type="checkbox"/> Posting/Warning Signs		<input type="checkbox"/> Time Limitation	
<input type="checkbox"/> Barricades		<input type="checkbox"/> IH Survey		<input checked="" type="checkbox"/> Scaffolding-req's inspection		<input type="checkbox"/> Warning Alarm (i.e. "high level")	
						<input type="checkbox"/> Electrical Inspection Required	
<b>Personal Protective Equipment</b>							
<input type="checkbox"/> None		<input type="checkbox"/> Ear Plugs		<input checked="" type="checkbox"/> Gloves, as necessary		<input type="checkbox"/> Lab Coat	
<input type="checkbox"/> Coveralls		<input type="checkbox"/> Ear Muffs		<input type="checkbox"/> Goggles		<input type="checkbox"/> Respirator*	
<input type="checkbox"/> Disposable Clothing		<input type="checkbox"/> Face Shield		<input checked="" type="checkbox"/> Hard Hat, as req'd		<input type="checkbox"/> Shoe Covers	
						<input checked="" type="checkbox"/> Safety Shoes, as req'd	
						<input type="checkbox"/> High visibility cloths/vest	
						<input type="checkbox"/> Other	
<b>Permits Required</b> (Permits must be valid when job is scheduled.)							
<input checked="" type="checkbox"/> None		<input type="checkbox"/> Cutting/Welding		<input type="checkbox"/> Impair Fire Protection Systems			
<input type="checkbox"/> Concrete/Masonry Penetration		<input type="checkbox"/> Digging/Core Drilling		<input type="checkbox"/> Rad Work Permit-RWP No			
<input type="checkbox"/> Confined Space Entry		<input type="checkbox"/> Electrical Working Hot		<input type="checkbox"/> Other Confined Space 2A certification			
<b>Dosimetry/Monitoring</b>							
<input checked="" type="checkbox"/> None		<input type="checkbox"/> Heat Stress Monitor		<input type="checkbox"/> Real Time Monitor		<input type="checkbox"/> TLD	
<input type="checkbox"/> Air Effluent		<input type="checkbox"/> Noise Survey/Dosimeter		<input type="checkbox"/> Self-reading Pencil Dosimeter		<input type="checkbox"/> Waste Characterization	
<input type="checkbox"/> Ground Water		<input type="checkbox"/> O <sub>2</sub> /Combustible Gas		<input type="checkbox"/> Self-reading Digital Dosimeter		<input type="checkbox"/> Other	
<input type="checkbox"/> Liquid Effluent		<input type="checkbox"/> Passive Vapor Monitor		<input type="checkbox"/> Sorbent Tube/Filter Pump			
<b>Training Requirements</b> (List specific training requirements)							
PHENIX Awareness, C-A Access, (where appropriate: Crane Operator, Fork lift Operator, Working at heights, Electrical Safety I, LOTO)							
<b>Work screening has identified the following as the reason for permitted work:</b>				<b>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)</b>			
<input type="checkbox"/> ESSH				WCC:		Date:	
<input type="checkbox"/> Complexity				Service Provider:		Date:	
<input type="checkbox"/> Work Coordination				Authorization to start:		Date:	
<input checked="" type="checkbox"/> 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)**

<b>Work Plan</b> (procedures, timing, equipment, scheduling, coordination, notifications, and personnel availability need to be addressed in adequate detail): See attached work plan and procedure				
Special Working Conditions Required (e.g., Industrial Hygiene hold points or other monitoring) None				
Notifications to operations and Operational Limits Requirements: None				
Post Work Testing, Notification or Documentation Required: See Attached Plan				
Job Safety Analysis Required: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Review Done: <input checked="" type="checkbox"/> in series <input type="checkbox"/> team	
<b>Reviewed by:</b> * 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	Paul Giannotti			
Safety Health Representative				
Research Space Manager				
Other				
Other				
Required Walkdown Completed				
*Primary Reviewer				

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

<b>Note:</b> 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:		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.**

<b>Worker Feedback (use attached sheets as necessary)</b>
a) WCM/WCC: Are there any changes as a result of worker feedback? <input type="checkbox"/> Yes <input type="checkbox"/> No
<b>Note:</b> 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:			

## MuTr Station 1 (North and South)

### Introduction

The Muon Tracker Station 1, or MuTr Sta. 1, is a detector subsystem on both the north and the south Muon Magnets. This detector consists of four quadrants of MuTr detectors of relatively light weight components mounted on the outside of the Muon South Magnet (MMS) facing the Interaction Point (IP) of the PHENIX experimental hall.

The PHENIX Collaboration will remove and dispose (recycle as mixed electronic equipment) this detector subsystem during the 2016 PHENIX Removal and Repurposing (R&R) shutdown after run 16. This document describes the work plan to remove and dispose of the full complement of 2 stations (north and south) for the detector. (Note: R&R of the north detector is essentially the same as for the south. Steps described below are essentially the same for north and south.)

Access to the station 1 MuTr equipment will be achieved using scaffolding as designed by PHENIX engineering from standard steel scaffolding parts. For more information on this scaffolding refer to PHENIX Document # DRL-ECD- 2011-001” “PHENIX MuTr Station 1 Work Platforms”. (copy attached)

#### 1. MuTr station 1 (north and south) removal/re-installation procedure.

(The MuTr Station 1 North and South Upgrade and Overhaul Project Plan from the 2010 shutdown is attached to this report. It has illustrations and descriptive discussion of the various tasks involved including the removal and installation of the MuTr station 1 components. This plan provides useful illustrations for some of the steps in the procedure described in the next few sections of this report.) The removal/disposal procedure for the MuTr station 1 components has been designed by PHENIX engineers in the following subsections. (Please note that the procedure to be used is essentially the same for the north and south stations 1.)

##### . 1.1 Equipment List

- . 1.1.1 ANVER vacuum lifting fixture, model # ET-100M8-MR-SP, Serial # 974808, rated load capacity 1000 lbs.
- . 1.1.2 Guide ropes, as required
- . 1.1.3 Shackles rated for a minimum of 1000 lb
- . 1.1.4 Two swivel hoist rings rated for a minimum 800 lb load
- . 1.1.5 Nylon slings rated for a minimum of 1000 lb load.

. 1.2 Preparations

- . 1.2.1 Prior to commencing the installation all equipment is to be checked for current inspection tags, and visually inspected in accordance with BNL lifting safety requirements.
- . 1.2.2 Access, work platforms and scaffolding shall be in place, inspected and approved by a competent person (in scaffold erection) prior to commencing removal of the MuTr station 1 detector subsystems and related hardware.
- . 1.2.3 Beam protection shall be in place prior to commencing removal of station 1 MuTr components. Protection shall include both a soft foam tube cover and a rigid protective cage to prevent damage to the beampipe from falling and/or moving objects and personnel.
- . 1.2.4 This procedure, access, work platforms and/or scaffolding to be used in relation with this procedure and all related work planning shall have been reviewed and approved by the CAD Experimental safety review committee (ESRC). (Note: At various times during this procedure the scaffolding will need to be reconfigured to achieve optimal access. After each such reconfiguration, the scaffolding shall be re-inspected and re-approved by a competent person (in scaffold erection) before work may proceed. A copy of the approval checkoff sheet is attached.)
- . 1.2.5 Use of the vacuum lifting fixture shall be practiced to simulate the removal of MuTr station 1 chambers, so that the PHENIX technicians involved in this task are thoroughly familiar with the proper and safe operation of this equipment. This lift shall simulate the MuTr installation using mockup equipment in an open area of the PHENIX Assembly Hall after the lifting fixture has been re-certified. The purpose of the practice lift is so that the technicians are familiar with the operation of the lift fixture in a safe an open area before attempting to use it in the tight spaces associated with the actual removal and re-installation of the MuTr chambers.
- . 1.2.6 All persons involved in the tasks described herein shall be appropriately trained for the tasks they will be performing. All persons involved shall have as a minimum CA Access training, PHENIX awareness, scaffold use training, working at heights training and beryllium use training. Persons operating the crane and lifting fixtures shall be fully trained in rigging and use of the IR cranes. Electrical work, LOTO and other training appropriate to the actual work each individual will be performing shall also be verified by the person in charge for this procedure. Appropriate PPE shall be used in accordance with BNL SBMS.

### 1.3 Removal of MuTr components

(Full scaffold in place)

- . 1.3.1 Carefully label all cables, tubing etc that will need to be removed, disconnected and/or relocated in order to remove the MuTr station 1 FEE plates and the MuTr station 1 subsystem chambers.
- . 1.3.2 Disconnect all cables, water cooling, air tubing, etc. from the MPC detector, the MuTr station 1 FEE's and the MuTr station 1 chambers, and carefully coil up the cables, hoses, tubes, etc. and secure them with cable ties or equivalent in a convenient location on the MMN until the maintenance, overhaul and upgrade of the station 1 MuTr components is completed and they have been re-installed.
- . 1.3.3 Insert a swivel hook into the front of each of the FEE plate halves, and attach guide ropes.
- . 1.3.4 Position the 1 ton crane above the upper-most half FEE plate and attach the FEE plate by the swivel hook to the crane hook using nylon slings.
- . 1.3.5 Remove the slack from the slings, and then remove the fasteners which attach the FEE plate to its mounting support, except the lower most fastener which should only be loosened enough at this time to allow the FEE plate half to rotate as it is lifted.
- . 1.3.6 Slowly lift the FEE plate half allowing it to rotate about the lowermost fastener until the center of gravity (cg) is directly below the swivel hook.
- . 1.3.7 Remove the last fastener and using the crane move the half FEE plate up and away from the beam pipe, then bring it down to the 20 ton cart to transport it out of the IR and into the assembly hall for safekeeping until the upgrade and overhaul of the MuTr chambers is complete. (Remove upper section of scaffold.)
- . 1.3.8 Similarly, attach the crane to the lower half of the FEE plate, remove slack, remove all but the lowermost fasteners, loosen the lower most fastener and lower the crane to rotate the plate to its cg balance point.
- . 1.3.9 Remove the last fastener then use the crane and guide ropes to move the FEE plate down and away from the beampipe, and then transport it out of the IR for safekeeping during the MuTr chamber upgrade and overhaul. (Re-install upper section of scaffold) (Note: MuTr station 1 chamber quadrants are located so that the centers of the quadrants are roughly at clock index positions 1:00, 4:00, 7:00 and 10:00. The quadrants are mounted using kinematic mounts. Care shall be taken during removal and re- installation not to disturb the kinematic mount settings.)
- . 1.3.10 Attach the ANVER lifting fixture to the crane hook then move it with the crane to the upper (1:00) chamber quadrant, position the suction cups to surround the

chamber cg and start the vacuum pump. When the pump stops pumping the fixture is secure. Lift the chamber quadrant off the kinematic mounts and away from the beam pipe. Move the quadrant using the crane away from the MMN and place it on the 20 to cart for transport out of the IR to the AH and then onto its overhaul and upgrade station at the RPC factory.

- . 1.3.11 Follow the same procedure for the next quadrant (10:00). (The scaffolding is now reconfigured to the lower level work configuration and removal of the upper level)
- . 1.3.12 Follow the same procedure to remove the lower 2 chamber quadrants.
- . 1.3.13 The removed quadrants, cables backplane, etc shall be checked for activation by BNL Health Physics. All components found to be activated shall be routed to appropriate disposal of activated materials. Materials found to not be activated shall be disposed of in the mixed metal and electronics container(s).

## 2.0 Installation Closeout

When all work described in this work permit has been completed, the PHENIX work coordinator for this set of tasks shall collect feedback from all parties. This feedback shall include critical review of any problems encountered during R&R tasks, solutions to such problems, changes to work procedures described herein during the conduct of this work, suggestions for improvements in equipment procedures and techniques and any other information deemed useful and/or relevant by the PHENIX work control coordinator. Such information shall be appropriately disseminated to the various affected/interested parties and a copy of this information shall be attached to this work permit when it is closed out.



BROOKHAVEN NATIONAL LABORATORY

ENGINEERING CALCULATION

TITLE:

PHENIX MuTr Station 1 Work Platforms

PREPARED BY: Don Lynch, P.E.

CHECKED BY: \_\_\_\_\_

**Introduction**

Access to all areas of station 1 of the Muon tracker (north & south), is required during the 2011 shutdown for the following purposes:

1. To allow MuTr experts and PHENIX technicians to perform maintenance on MuTr detector electronics (Stations 1 and 2), wherein certain electronics components (capacitors) whose presence is necessary and have a beneficial effect on the operation of the detector, are to be installed. This operation is referred to as MuTr re-capacitation in PHENIX technical group parlance. This work will be performed in the area known as the station 1 area of the Muon North Magnet (MMN). Access to this area requires elevated work platforms (Note: The same work platforms will be utilized when similar work is done in the future on station 1 and 2 of the Muon South Magnet (MMS)).
2. To allow installation of new Resistive Plate Chamber (RPC) detector subsystems and associated services. Installation of this equipment will take place in Central Magnet (CM) cavity areas (north and south) surrounding the shielding commonly referred to at PHENIX as the "flower pot" due to its shape.
3. In support of the RPC detectors in both the north and south electronics cables must be routed up the west side of the CM to dedicated electronics racks on the platform above the CM (commonly referred to at PHENIX as the "bridge"). In order to install cable routing/management trays, it is proposed to install a work platform to be suspended from the bridge.

The work platforms to be used in the station 1 area are new standard pre-engineered free standing scaffolding which replace the custom designed aluminum tube and coupler type designed for use during the 2008 and 2009 shutdowns for installation of MuTrigger FEE electronics in the station 1 north and south areas. The present work platform is similar in concept to the 2008/2009 version, but designed to suit the access requirements for the 2 projects described above. The new scaffolding will be braced to the CM and MMN (or MMS when moved to the south station 1), and will include customized safety railings to suit the irregular shape of the station 1 area.

The suspended work platform to be used on the west side of the CM is a platform designed for use in the installation of the TOF West detector during the 2005 shutdown. This platform is essentially unchanged from the original design.

**Requirements:**

The design of the scaffolds is pre-engineered as modular components which interlock and are internally braced to be self-supporting.

The work platforms herein described comply with BNL requirements as defined in the BNL SBMS Subject Area: **Walking and Working Surfaces**, section 6 **Using Scaffolds**, in particular with the explicit requirements therein and in the OSHA requirements set forth in **29 CFR 1910.28**, and **29 CFR 1926.452**.

**Station 1 Work Platforms**

Work platform design for station 1 required a custom approach for the following reasons:

- The space between the CM and the North (or south magnet) during shutdown is too small for conventional pre-engineered platforms.
- The platforms need to be modified several times during the varying tasks to be accomplished during shutdown
- The platforms need to be used on both the north and south station 1 areas, only one of which is open at a time (i.e. CM is moved south to open up station 1 north and CM is moved north to open up station 1 south. During accelerator operation runs Muon South magnet is moved north closing the south station 1.)
- The platforms need to be rigid to allow safe work in the areas which surround the delicate Beryllium beampipe.
- The platforms need to be temporary structures that must be completely removed to restore the PHENIX magnets to their run-time configuration.

Station 1 work platforms were previously erected during the 2008 and 2009 shutdowns and proved to be exceptionally well suited to perform similar tasks in these areas. The platforms proposed for the 2011 shutdown are similar but the speed rail components that had been used to join and position the load bearing aluminum pipe and the aluminum pipe itself have been replaced by steel scaffold components pre-engineered for such service. This eliminates a safety concern about using components not rated for a specific service.

The design load for this structure shall be 2 persons per level, 3 persons, maximum, total, at any one time. The pre-engineered steel frames are adequate for such loads and as such do not require additional calculations.

The scaffolding is procured from SAFWAY Scaffolding Company. The products are listed in their catalog (copy attached). The specific components used in the PHENIX station 1 application analyzed herein are indicated on the attached illustration.

**Central Magnet Suspended Work Platform**

For work on the west face of the Central Magnet (CM), it is proposed to use a custom suspended work platform, designed for use in the 2005 installation of the Time Of Flight West detector.

The custom platform is an existing purchased 16' work platform manufactured by Werner, Inc. and rated for 500 lbs. This platform will not be modified in any way and will be supported by ¾" steel threaded rod attached to 4" aluminum structural channel below the platform. The threaded rod is supported from two 16'

long 4" aluminum structural channels. Access to the Werner platform will be provided via a pre-fabricated aluminum ladder on the Werner platform secured to the bridge platform. All persons involved will have appropriate training for working at heights, fall protection and all other relevant training.

Stress in the  $\frac{3}{4}$  inch rods can be calculated as  $\frac{1}{4}$  of the maximum rated load of the platform plus the weight of the platform itself (100 lbs) divided by the stress area of the threaded rods:

Max Stress =  $600/4/.334 = 449.1$  psi which is negligible compared to the allowable stress (9000 psi).

### **Notes on configuring the work platforms**

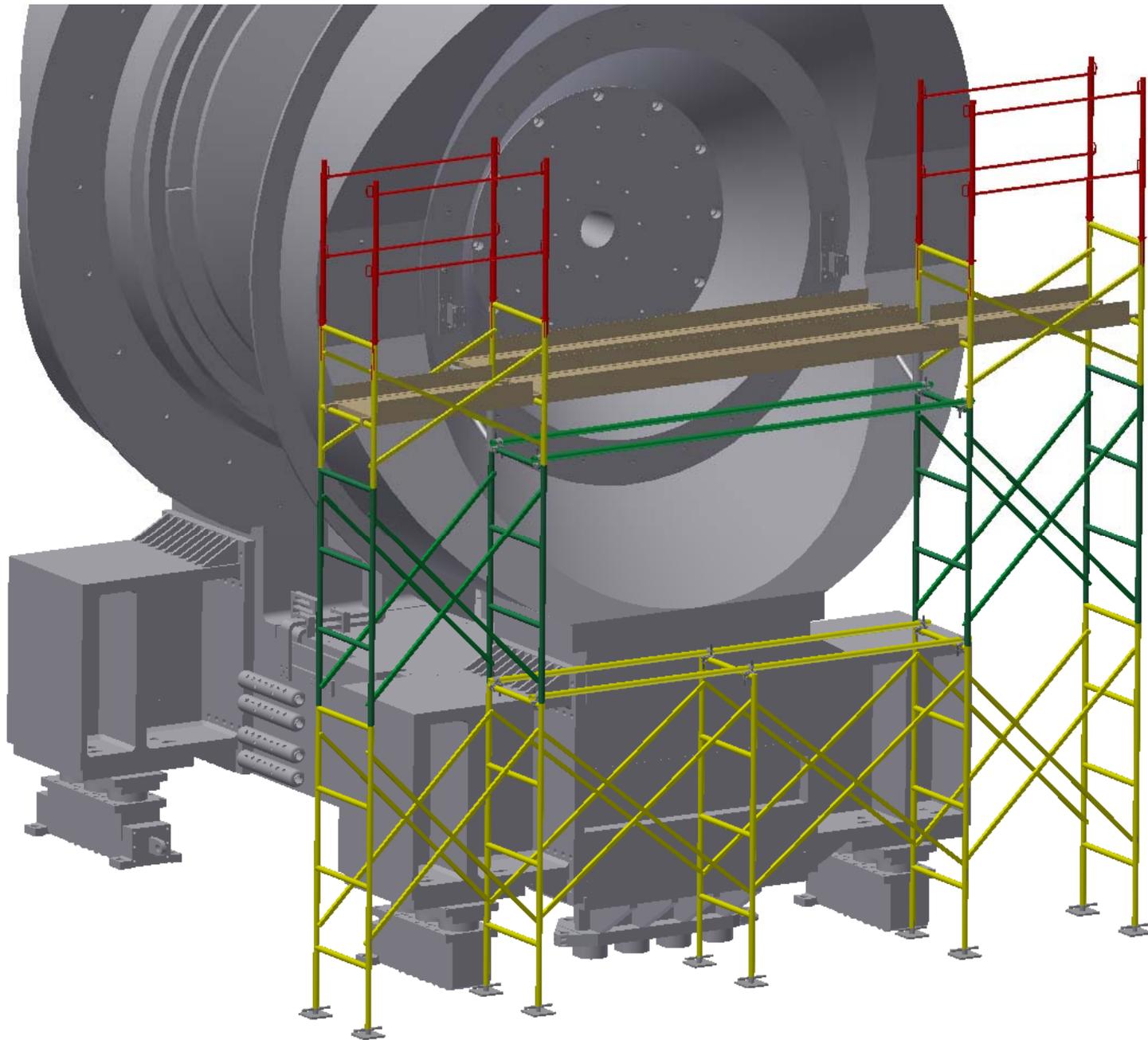
During the 2011 shutdown the station 1 and CM suspended work platforms will need to be reconfigured several times for the specific work to be performed as follows:

- (a) Upper level of station 1 for removal and re-installation of upper 2 MuTr quadrants and upper half of MuTr FEE plate. Same configuration to be used for installation of upper 5 RPC1 detectors and for installation of RPC1 utilities (signal, LV and HV cables, gas lines and utility management hardware.
- (b) Lower level of station 1 for removal for removal and re-installation of lower 2 MuTr quadrants and lower half of MuTr FEE plate. Same configurations to be used for installation of lower 3 RPC1 detectors.
- (c) CM suspended work platform top be used for installation of utilities and utility management hardware.
- (d) Both station 1 platforms and CM suspended platform are repositioned in the same way for the station 1 south RPC1 tasks. (Note: MuTr station 1 south tasks not scheduled for summer 2011. The work platforms will be needed again for summer 2012 for those tasks.)
- (e) Speed rail may be used for safety rails, only, to assure adequate fall prevention in the irregular exposed areas around the outer ends of the scaffolding.

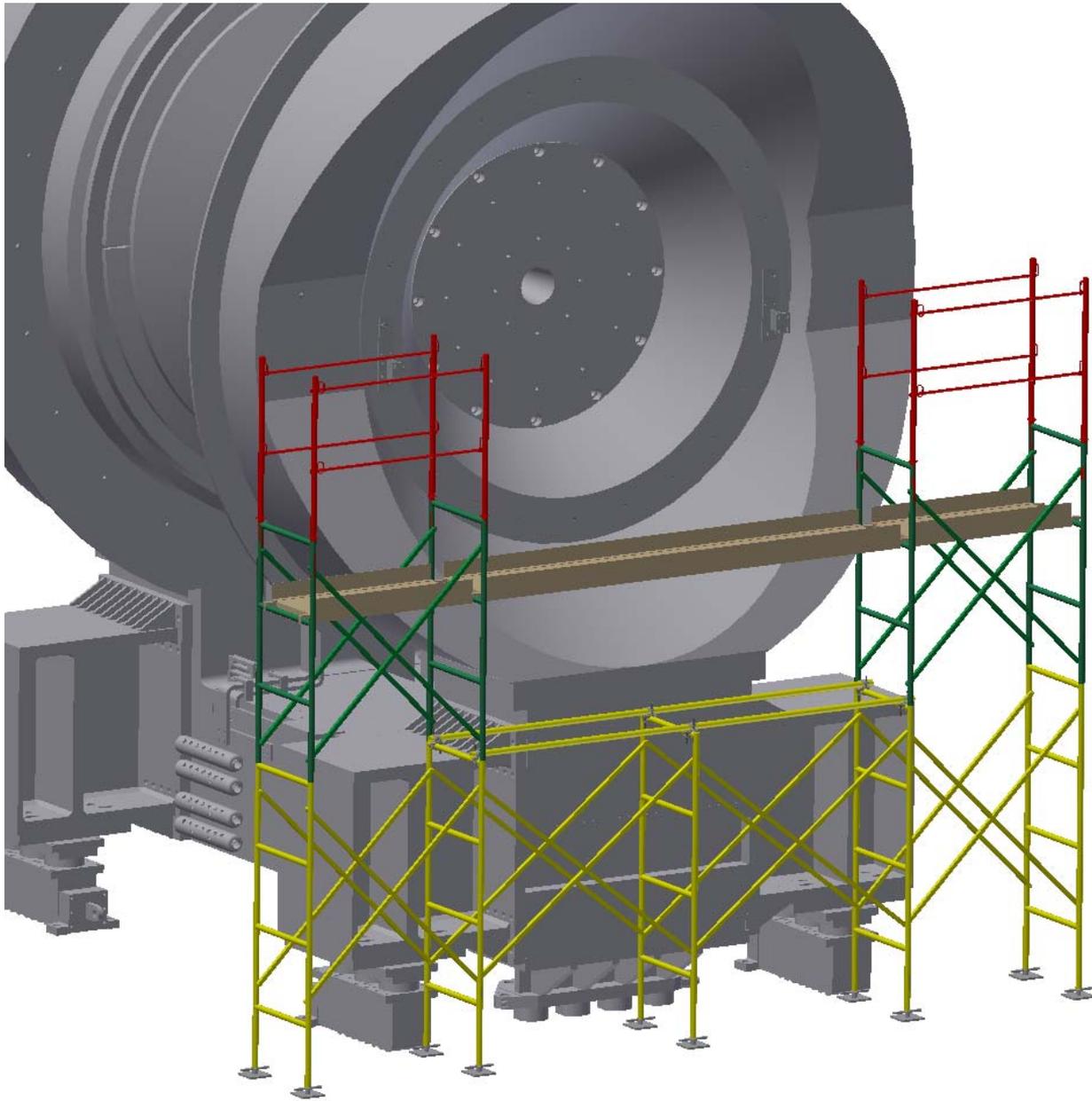
**Appendix A: SAFWAY Scaffolding Catalog**

(Attached)

**Appendix B. Illustrations**



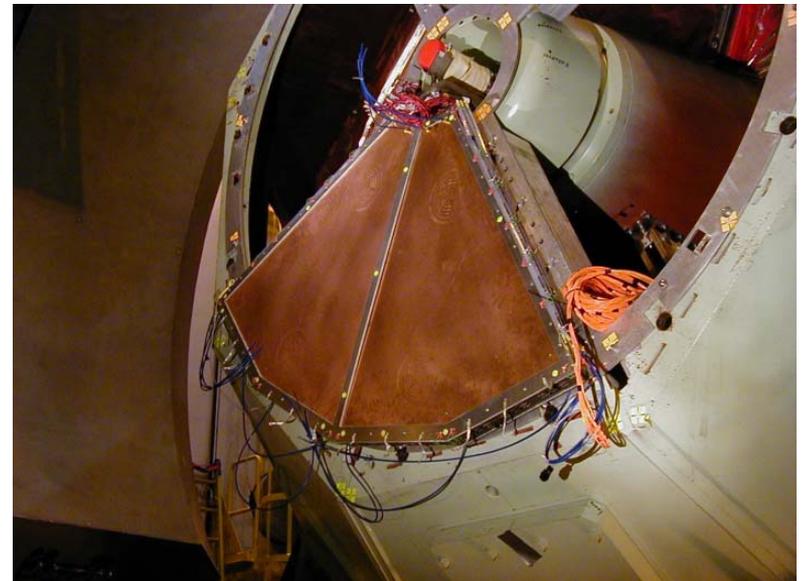
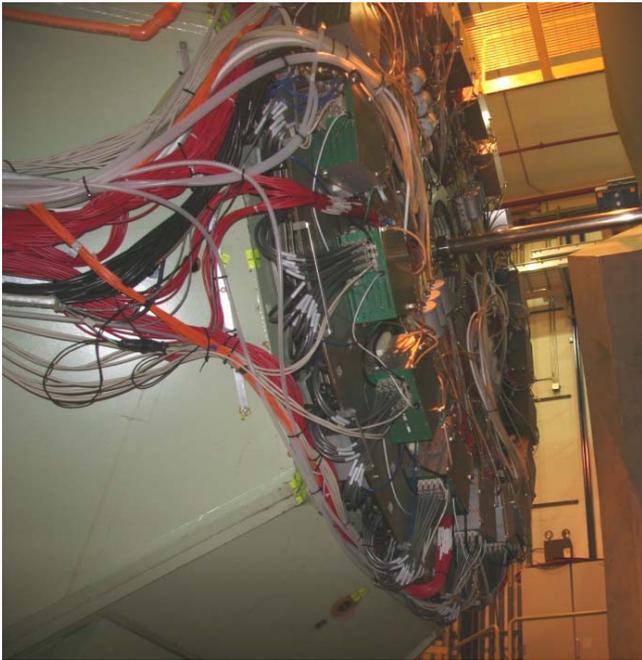
SAFWAY  
Scaffolding  
arrangement  
for upper access.  
Ladder and MMN  
not shown for  
clarity



SAFWAY  
Scaffolding  
arrangement  
for lower access.  
Ladder and MMN  
not shown for  
clarity

## Disconnect cables, water cooling, etc. (1 week, 3 people):

- drain water cooling system & disconnect ( $\sim 20$  chassis  $\times$   $2+(?)$  tubes each)
- disconnect chamber gas and seal chambers
- arcnet ( $\sim 20$ ); calibration (8)
- Clink (60)
- **Analog cables** ( $6/\text{chassis} \times 3 \text{ gaps} \times 8 \text{ octs} = 144 + \text{muTrg cables } (\sim 70?)$  )
- light sources ( $7/\text{oct} \times 8 \text{ octs} = 56$ ); MPC cables
- HV cables (24)
- grounding cables (numerous) - chamber to FEE plate, chassis-to-chassis, etc.



## Remove FEE plate & chambers; take chambers to lab (1 week, 2 techs):

- Don Lynch plan
- **FEE plates comes off in 2 halves** using crane
- **chambers in 4 quadrants** on kinematic mounts, labeled for reinstallation in same positions
- Need existing vacuum lifting fixtures (test before use) for chambers
- take **chambers to lab (where?)** - doesn't need to be very clean (not opening chambers)
- chamber gas lines sealed; gentle transport to/from lab
- **while sta-1 out, could install terminators on upstream sta-2 anodes (or even recap sta-2)?**





BROOKHAVEN NATIONAL LABORATORY

ENGINEERING CALCULATION

TITLE:

MuTr Vacuum Lifting Fixture

PREPARED BY: Don Lynch, P.E.

CHECKED BY: \_\_\_\_\_

**Introduction**

In the 2011 shutdown, the PHENIX experiment plans to perform overhaul maintenance on the Muon Tracker (MuTr) detector stations 1 North and South. The MuTr is an important component of the PHENIX experiment which has served well over the first decade of PHENIX running but has been experiencing high voltage (HV) problems of late due to systematic failures of grounding/capacitance circuits which protect the detector circuits against sensitivity to various environmental conditions (high humidity) and reduces noise problems. The original capacitance/grounding issues were corrected by removing failed capacitors. While this addresses the problem under normal environmental conditions it does not protect against all conditions. These now need to be replaced with new more robust capacitors to fix the remaining HV problems.

In order to install the new capacitors, the station 1 MuTr detectors need to be unmounted from their current installed position on the North and South Muon Magnets and worked on in a controlled environment. The current plan is to remove them from the PHENIX detector during the summer 2011 maintenance shutdown, transport them to the RPC factory (in the AGS building) for upgrade in the relatively clean environment of the factory, and re-install them into the PHENIX detector in the same location after they have been serviced. The removal and reinstallation of the MuTr station 1 detector subsystems requires the use of a vacuum lifting device. This device was purchased by the Los Alamos Lab group for the PHENIX experiment approximately 10 years ago specifically for the original installation of the MuTr station 1 detector subsystem.

This report provides updated documentation of the adequacy of this lifting fixture for the above described service. This includes a description of the equipment and its service ratings, a description of load testing to qualify the equipment for the subject lift, and a procedure for performing the actual unmounting of the existing detector and re-installation after upgrade.

In addition to this report, this lifting fixture will be subjected to a static lift test supervised and witnessed by and be inspected and certified by the BNL Lifting Safety Committee (LSC) prior to using the lifting fixture for its intended service.

## RPC3 North Half Octant Lifting Fixtures

### **1. Description of Lifting Fixture:**

The lifting fixture to be used to remove and reinstall the station 1 north and south MuTr detector is an ANVER Corporation model ET100M8-MR-SP, Serial Number 974808 purchased by LOS Alamos National Laboratory specifically for the installation of the MuTr Station 1 detector subsystem. The original apparatus has not been modified with the exception of replacing the original vacuum pads and hoses this year. The original equipment was rated for a 1000 lb load and came with a certificate of test to a load of 125% of rated capacity dated load and tested per ANSI/ASME B30, 20-1993. A copy of the Certificate of Test is attached. A copy of the ANVER Vacuum Material Handling Equipment Operation, Maintenance and Parts Manual is available from PHENIX engineering for review on request.

The original installation of the MuTr station 1 north took place in 2000. An installation procedure was prepared and this procedure, which is currently inactive in the PHENIX document files, is available for reference.

### **2. Physical Description of MuTr Station 1 North and South Detector Subsystem**

The MuTr detector subsystem consists of an octagonal array of cathode strip chambers with structurally supported by NOMEX honeycomb panels with Glass/Epoxy skins. The structural support for unit station 1 sectors comprises 2 octants of the detector into a quadrant for handling and installation purposes. The smooth skins provide good adhesion for the vacuum lifter cups. Each quadrant weighs 125 lbs.

In addition to the detector quadrants there are 2 semicircular aluminum plates which hold the front end electronics (FEE's) for the station 1 detectors. Removal of the FEE plates is required in order to access the detector chambers, but removal of the chambers is accomplished using standard rigging equipment and does not require use of the vacuum lifter.

The detector quadrants and FEE plates are mounted to the North Muon Magnet (MMN) using 2 aluminum semi-circular brackets referred to as "split ring adapters". These adapters provide mounting and alignment features for the detectors and FEE plates. The split ring adapters and kinematic mounts on these adapters are to remain in place on the MMN with their alignment adjustments undisturbed while the FEE plates and detector quadrants are removed, upgraded and re-installed.

The north and south detectors are essentially identical.

Additional information about the station 1 detector design is available on request.

### **3. Stress analyses for the vacuum lifting fixture**

The vacuum lifting fixture is a commercially designed and procured device which is rated to lift 1000 lbs. As such, no stress analyses by BNL personnel is required. As indicated above, the lifting fixture will be re-certified by BNL lifting safety personnel at 125% rated loading prior to using the fixture to remove and install the MuTr station 1 detector quadrants.

#### **4. MuTr station 1 (north and south) removal/re-installation procedure.**

(The MuTr Station 1 North and South Upgrade and Overhaul Project Plan is attached to this report. It has illustrations and descriptive discussion of the various tasks involved including the removal and installation of the MuTr station 1 components. This plan provides useful illustrations for some of the steps in the procedure described in the next few sections of this report.) The removal/installation procedure for the MuTr station 1 components has been designed by PHENIX engineers in the following subsections. **(Please note that the procedure to be used is essentially the same for the north and south stations 1.)**

##### **4.1 Equipment List**

- 4.1.1 ANVER vacuum lifting fixture, model # ET-100M8-MR-SP, Serial # 974808, rated load capacity 1000 lbs.
- 4.1.2 Guide ropes, as required
- 4.1.3 Shackles rated for a minimum of 1000 lb
- 4.1.4 Two swivel hoist rings rated for a minimum 800 lb load
- 4.1.5 Nylon slings rated for a minimum of 1000 lb load.

##### **4.2 Preparations**

- 4.2.1 Prior to commencing the installation all equipment is to be checked for current inspection tags, and visually inspected in accordance with BNL lifting safety requirements.
- 4.2.2 Access, work platforms and scaffolding shall be in place, inspected and approved by a competent person (in scaffold erection) prior to commencing removal of the MuTr station 1 detector subsystems and related hardware.
- 4.2.3 Beam protection shall be in place prior to commencing removal of station 1 MuTr components. Protection shall include both a soft foam tube cover and a rigid protective cage to prevent damage to the beampipe from falling and/or moving objects and personnel.
- 4.2.4 This procedure, access, work platforms and/or scaffolding to be used in relation with this procedure and all related work planning shall have been reviewed and approved by the CAD Experimental safety review committee (ESRC). *(Note: At various times during this procedure the scaffolding will need to be reconfigured to achieve optimal access. After each such reconfiguration, the scaffolding shall be re-inspected and re-approved by a competent person (in scaffold erection) before work may proceed.)*
- 4.2.5 Use of the vacuum lifting fixture shall be practiced to simulate the removal of MuTr station 1 chambers, so that the PHENIX technicians involved in this task are thoroughly familiar with the proper and safe operation of this equipment. This lift shall simulate the MuTr installation using mockup equipment in an open area of the PHENIX Assembly Hall after

the lifting fixture has been re-certified. The purpose of the practice lift is so that the technicians are familiar with the operation of the lift fixture in a safe an open area before attempting to use it in the tight spaces associated with the actual removal and re-installation of the MuTr chambers.

- 4.2.6** All persons involved in the tasks described herein shall be appropriately trained for the tasks they will be performing. All persons involved shall have as a minimum CA Access training, PHENIX awareness, scaffold use training, working at heights training and beryllium use training. Persons operating the crane and lifting fixtures shall be fully trained in rigging and use of the IR cranes. Electrical work, LOTO and other training appropriate to the actual work each individual will be performing shall also be verified by the person in charge for this procedure. Appropriate PPE shall be used in accordance with BNL SBMS.

### **4.3 Removal of MuTr components**

(Full scaffold in place)

- 4.3.1** Carefully label all cables, tubing etc that will need to be removed, disconnected and/or relocated in order to remove the MuTr station 1 FEE plates and the MuTr station 1 subsystem chambers.
- 4.3.2** Disconnect all cables, water cooling, air tubing, etc. from the MPC detector, the MuTr station 1 FEE's and the MuTr station 1 chambers, and carefully coil up the cables, hoses, tubes, etc. and secure them with cable ties or equivalent in a convenient location on the MMN until the maintenance, overhaul and upgrade of the station 1 MuTr components is completed and they have been re-installed.
- 4.3.3** Insert a swivel hook into the front of each of the FEE plate halves, and attach guide ropes.
- 4.3.4** Position the 1 ton crane above the upper-most half FEE plate and attach the FEE plate by the swivel hook to the crane hook using nylon slings.
- 4.3.5** Remove the slack from the slings, and then remove the fasteners which attach the FEE plate to its mounting support, except the lower most fastener which should only be loosened enough at this time to allow the FEE plate half to rotate as it is lifted.
- 4.3.6** Slowly lift the FEE plate half allowing it to rotate about the lowermost fastener until the center of gravity (cg) is directly below the swivel hook.
- 4.3.7** Remove the last fastener and using the crane move the half FEE plate up and away from the beam pipe, then bring it down to the 20 ton cart to transport it out of the IR and into the assembly hall for safekeeping until the upgrade and overhaul of the MuTr chambers is complete.

(Remove upper section of scaffold.)

- 4.3.8** Similarly, attach the crane to the lower half of the FEE plate, remove slack, remove all but the lowermost fasteners, loosen the lower most fastener and lower the crane to rotate the

plate to its cg balance point.

- 4.3.9** Remove the last fastener then use the crane and guide ropes to move the FEE plate down and away from the beampipe, and then transport it out of the IR for safekeeping during the MuTr chamber upgrade and overhaul.

(Re-install upper section of scaffold)

(Note: MuTr station 1 chamber quadrants are located so that the centers of the quadrants are roughly at clock index positions 1:00, 4:00, 7:00 and 10:00. The quadrants are mounted using kinematic mounts. Care shall be taken during removal and re-installation not to disturb the kinematic mount settings.)

- 4.3.10** Attach the ANVER lifting fixture to the crane hook then move it with the crane to the upper (1:00) chamber quadrant, position the suction cups to surround the chamber cg and start the vacuum pump. When the pump stops pumping the fixture is secure. Lift the chamber quadrant off the kinematic mounts and away from the beam pipe. Move the quadrant using the crane away from the MMN and place it on the 20 ton cart for transport out of the IR to the AH and then onto its overhaul and upgrade station at the RPC factory.

- 4.3.11** Follow the same procedure for the next quadrant (10:00).

(The scaffolding is now reconfigured to the lower level work configuration and removal of the upper level)

- 4.3.12** Follow the same procedure to remove the lower 2 chamber quadrants.

#### **4.4 Re-installation of MuTr components**

At this point in time upgrade and overhaul of MuTr station 1 chambers has been completed and the chamber quadrants are in the PHENIX AH ready for re-installation.

(The scaffolding is now reconfigured to the lower level work configuration with removal of the upper level)

- 4.4.1** Place the 7:00 chamber quadrant on the 20 ton cart in the horizontal position with the kinematic mounts facing down and transport the quadrant on the cart from the AH to the IR.
- 4.4.2** Attach the vacuum lifting fixture to the crane and position it above the chamber quadrant with the suction cups surrounding the cg. Turn on the vacuum pump. When the pump stops the load is secure. Attach guide ropes as appropriate.
- 4.4.3** Carefully lift the chamber, rotate it to the vertical position and position it on the kinematic mounts for the 7:00 chamber. Fasten the chamber in place then relieve the suction and separate the lifting fixture.
- 4.4.4** Repeat for the 4:00 chamber.

(Reconfigure scaffolding to the full scaffold by restoring the upper level.)

- 4.4.5** Repeat the chamber lifting procedure for the 10:00 and 1:00 chambers.

(Reconfigure the scaffolding to the lower level work configuration.)

- 4.4.6** Move the FEE plate halves from their temporary storage spot to the IR.

- 4.4.7** Insert a swivel hook into the lower FEE plate and attach it to the crane using slings. Attach guide ropes.

- 4.4.8** Lift the lower FEE plate to its approximate install position and position it so that the lower most fastener can be loosely attached. Using the crane lift and rotate the FEE plate to its final position.

- 4.4.9** Attach and tighten all fasteners.

(Reconfigure scaffolding to the full scaffold by restoring the upper level.)

- 4.4.10** Insert a swivel hook into the upper FEE plate and attach it to the crane using slings. Attach guide ropes.

- 4.4.11** Lift the upper FEE plate to its approximate install position and position it so that the lower most fastener can be loosely attached. Using the crane lift and rotate the FEE plate to its final position.

- 4.4.12** Attach and tighten all fasteners.

- 4.4.13** Check all MuTr station 1 cables, hoses and tubing. Replace damaged or worn parts with identical new components.

- 4.4.14** Restore/replace all MuTr station 1 cables/hoses/tubing to the pre-upgrade configuration, taking care to route all cables/hoses/tubing as neatly/compactly, efficiently as possible.

## **4.5 Work Planning**

This procedure, after review and approval by CAD ESRC, shall be incorporated into an enhanced work permit to be prepared for the MuTr upgrade/overhaul project.

# Sectional Scaffold

## Product Selection Guide



**SEC**



[www.safway.com](http://www.safway.com)



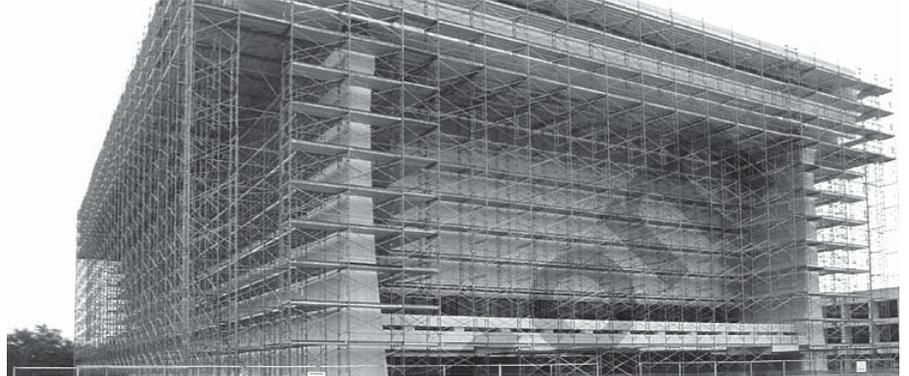
Since 1936, Safway® brand scaffold has been the industry standard. From Systems™ to Sectional, Tube & Clamp to SafMax®, Motorized access to QuikDeck™, Safway has a full line of products designed to work for any project.

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All drawings in this guide are for illustrative purposes only. This guide is intended for general information purposes only. Because of the many variables which affect the performance of the product line, some of the information in this brochure may not apply. For specific applications, contact Safway.

Note: All scaffolds shall be erected, modified and dismantled only under the supervision of a Competent Person. Erection, use, maintenance and disassembly must conform to current manufacturer's instructions as well as all federal, state, provincial and local regulations. Copies of complete Safety Guidelines for these and other products are available from Safway without charge.



## Our sectional steel scaffold has been manufactured with "engineered quality" since 1936.

Safway Services was the first designer of sectional steel scaffolds. To meet your needs, we have a nationwide network of branches and distribution centers with years of application and installation experience, all backed by an Engineering Department second to none.

### Quality Construction

High strength steel tubing with .095" wall thickness and an outside diameter of 1.69" is used on all legs.

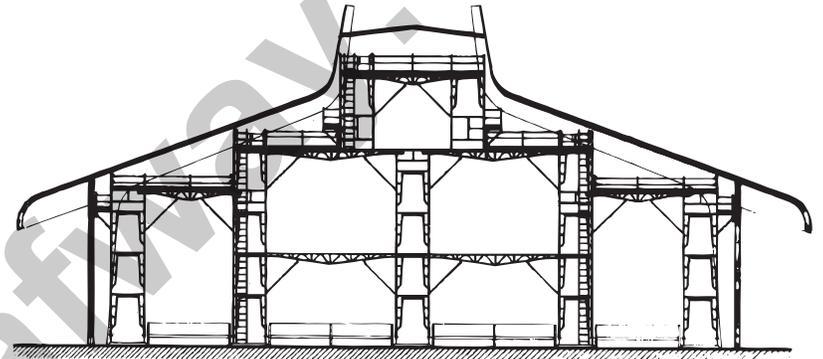
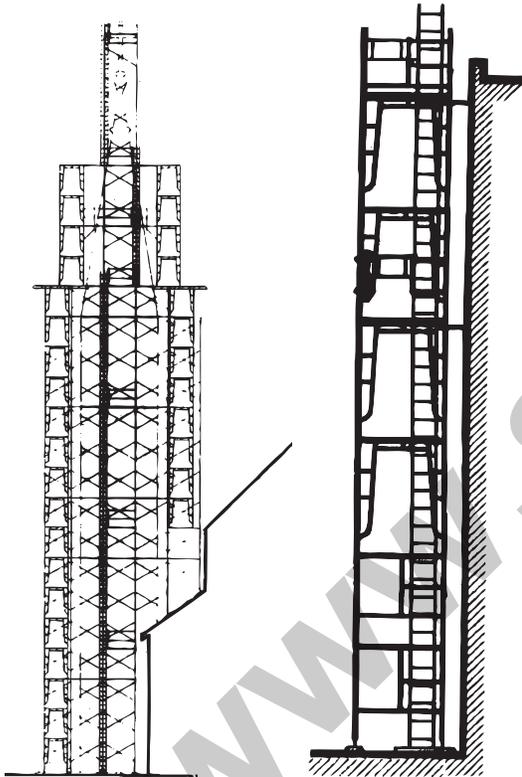
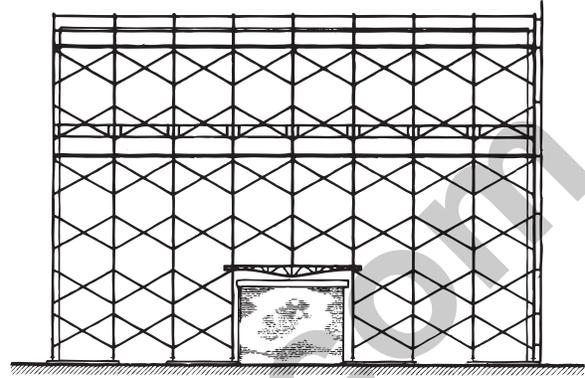
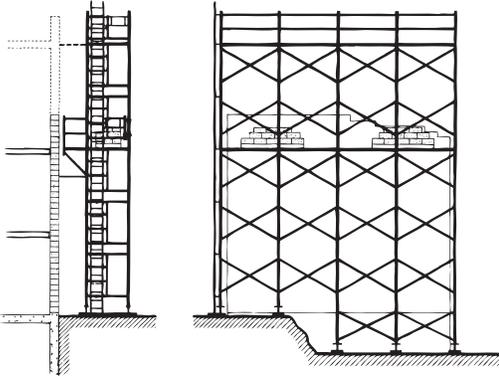
Extra care is taken to provide coped fitted pieces before welding. Combined with certified welders, this concern for quality ensures rigid construction.

Prior to painting, surfaces are cleaned and etched with a phosphatized coating to ensure a long lasting paint adhesion.

### Engineered Advantages

Coupling pins are precision fabricated with beveled ends for easy insertion into the scaffold frames during assembly. They also contain holes that line up with holes in the legs of the frames, allowing frames to be vertically fastened together or to guardrail posts. The 1" collar in the middle of the coupling pin assures even load distribution to the frame below. This entire coupling pin is zinc plated with a di-chromate coating for long life.

Cross braces are constructed of high strength galvanized tubing connected by shear bolts. A washer separates the tubing for ease of handling and maintenance. Cross braces come in various lengths which are plainly marked on either end for quick sorting and erecting.



Threaded studs or our drop latch type "Quick Locks" are available for securing cross braces to the frame.

To suit any project, a wide variety of frames are available, including: narrow section, walk through, masonry, sidewalk canopy and integral prefabricated access frames.

In addition, a rolling tower base frame increases the base width of the tower without the need for extra components.

Safway® stairways provide an efficient way for personnel movement as well as the transportation of tools and equipment to and from scaffold work platforms. Complete assembly includes guardrails, easy rise stairs and landing

area. Side brackets and ladders are a practical and functional way to supplement your access needs.

Putlogs are an integral and economical part of many scaffold installations and are often used in developing additional platform space. Putlogs serve as additional supports and provide a method to span openings and obstacles.

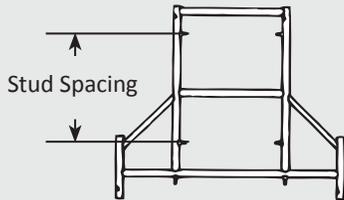
For quick and efficient height adjustments, screw jacks can provide 1" adjustments with just four turns. Their design minimizes jamming from sand and dirt on the job.

Safway® aluminum platform planks come in three different lengths and are more durable than wood planks.

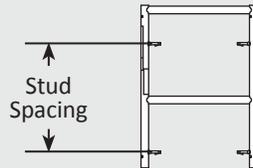
# Sectional Frames

## Narrow Sections (2' Wide)

Part No.	Width	Frame Height	Stud Spacing	Weight
LSB-1	4'	3' 6¼"	2'	31 lbs.
LS-3	2'	3'	2'	16 lbs.
LS-5	2'	5'	4'	25 lbs.
LS-6	2'	6' 4"	4'	33 lbs.



LSB-1



LS-3



LS-5

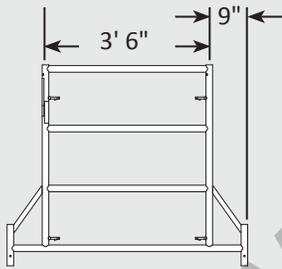


LS-6

## End Frames

Part No.	Description	Width	Frame Height	Stud Spacing	Weight
FEB*	Base Frame	5'	4' 10"	3'	42.8 lbs.
FE30	End Frame	3' 6"	2' 6"	2'	19.6 lbs.
FE45	End Frame	3' 6"	3' 9"	3'	31.0 lbs.
FE5	End Frame	3' 6"	5'	4'	41.5 lbs.
FE6	End Frame	3' 6"	6' 4"	4'	48.5 lbs.

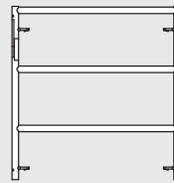
\*FEB Base Frame total width is 5'.



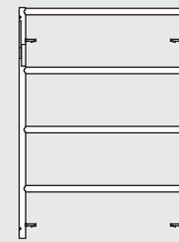
FEB



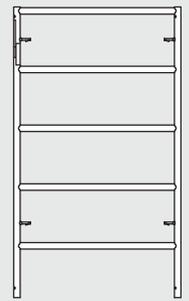
FE30



FE45



FE5



FE6

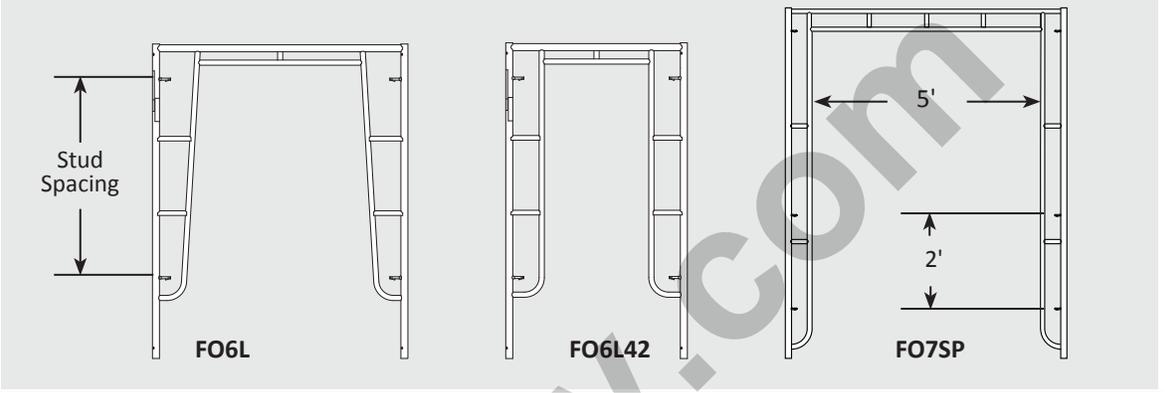
# Sectional Frames

## Walk Through Frames

Part No.	Description	Width	Frame Height	Stud Spacing	Weight
FO6L**	Open End Frame	5'	6' 4"	4'	46 lbs.
FO6L42	Open End Frame	3' 6"	6' 4"	4'	43 lbs.
FO7SP	Sidewalk Canopy Frame	6'	7' 6"	4' / 2'	60 lbs.

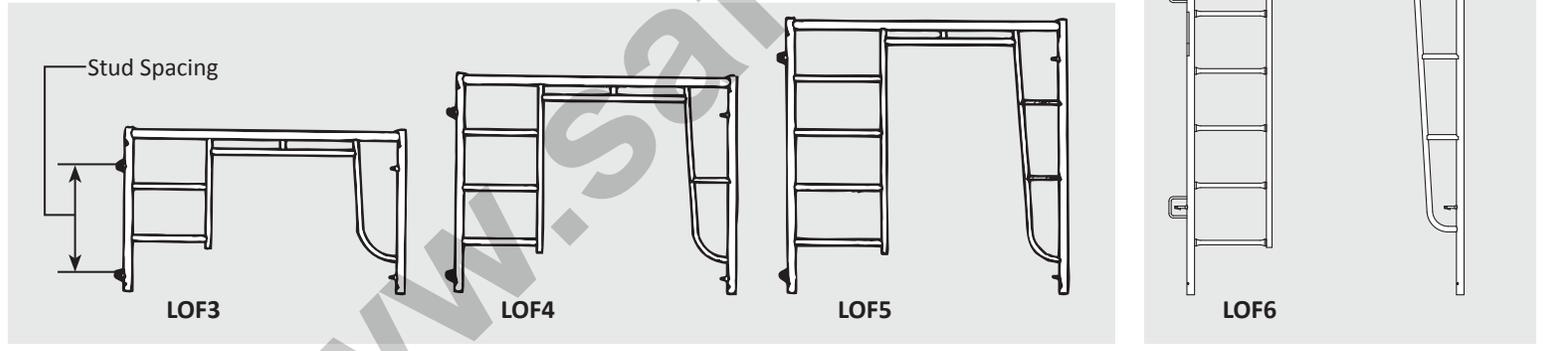
\*\*FO6L also available in 3' and 4' widths.

**WARNING**  
 THE FM, FO AND LS SERIES OF FRAMES ARE NOT TO BE USED FOR ACCESS TO SCAFFOLD PLATFORMS. IF SAFE ACCESS IS NOT AVAILABLE FROM THE BUILDING STRUCTURE, ADDITIONAL ACCESS COMPONENTS ARE REQUIRED. SEE PAGE 15.



## Walk Through Frames with Access

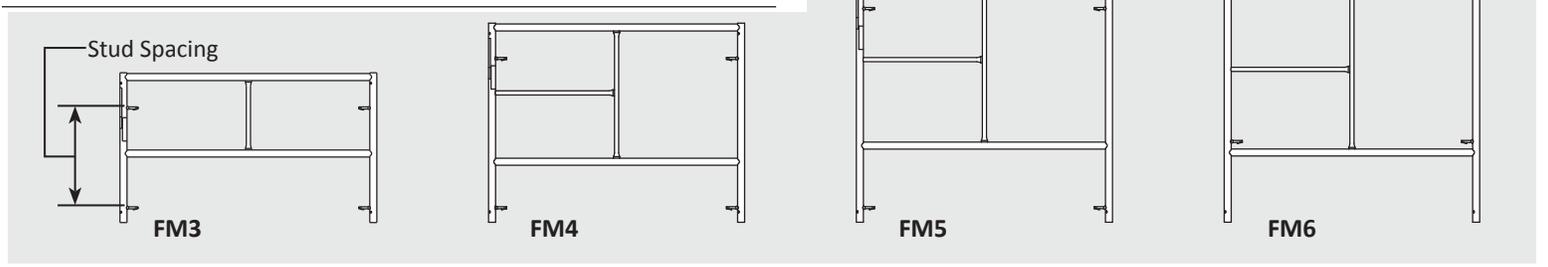
Part No.	Width	Frame Height	Stud Spacing	Weight
LOF3	5'	3'	2'	29 lbs.
LOF4	5'	4'	3'	36 lbs.
LOF5	5'	5'	4'	43 lbs.
LOF6	5'	6' 4"	4'	53 lbs.



## Mason Frames

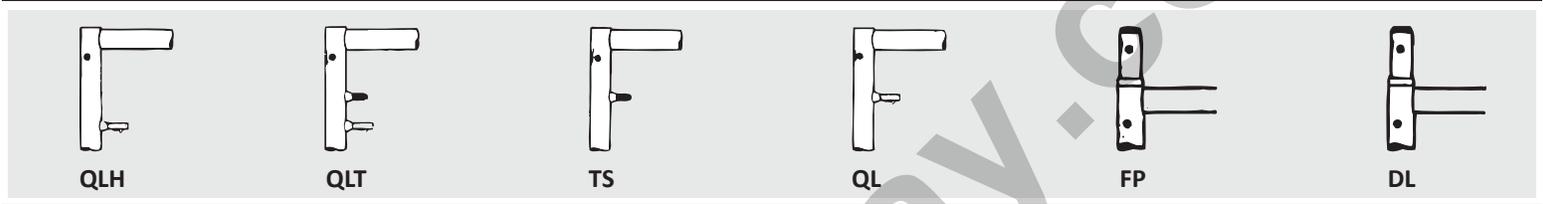
Part No.	Width	Frame Height	Stud Spacing	Weight
FM3	5'	3'	2'	27 lbs.
FM4	5'	4'	3'	34 lbs.
FM5	5'	5'	4'	37 lbs.
FM6	5'	6' 4"	4'	43 lbs.

Also available in 3' and 4' widths.



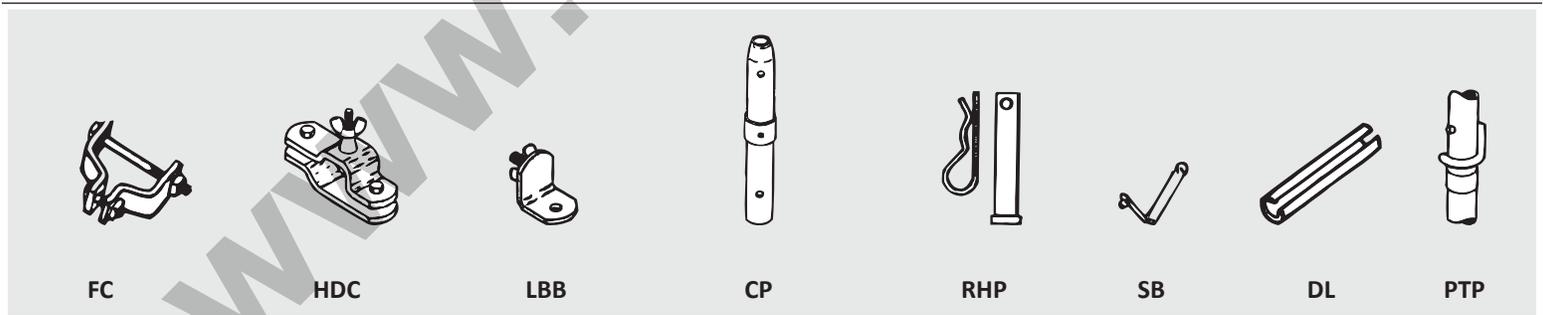
## Frame Locking Devices

Part No. Suffix	Description
QLH	Frame with Quick Lock only, located 8½" from top of frame. Add QLH after frame part number.
QLT	Combination with Quick Lock 2½" below threaded stud. Add QLT after frame part number (increases frame weight 0.5 lbs.).
TS	Threaded stud with tapered lead-in, located 6" from top of frame.
QL	Frame with Quick Lock only, located 6" from top of frame. Add QL after frame part number.
FP	Frame with fixed coupling pins using snap button. Add FP after frame and lock designation (i.e. FM5 QLH FP).
DL	Frame with fixed coupling pins using spring pins. Add DL after frame and lock designation (i.e. FM5 QLH DL).



## Frame Components

Part No.	Description	Weight	Height
FC	Frame Clamp	1.75 lbs.	
HDC	Horizontal Diagonal Clamp	1.5 lbs.	
LBB	"L" Brace Bracket	0.5 lb.	
CP	Coupling Pin	1.25 lbs.	
RHP	Rivet & Hair Pin (100/pkg)	7 lbs.	
SB	Snap Button (100/pkg)	5 lbs.	
DL	Spring Pin (100/pkg)	4 lbs.	
PTP	Pig Tail Pin (100/pkg)	25 lbs.	¾" x 2"



For clamping adjacent legs

Required for stacking one frame on top of another. Collar separates frame legs by 1" and must be considered in figuring scaffold heights.

# 8 Sectional Components

## Cross Braces – 2' Stud Spacing

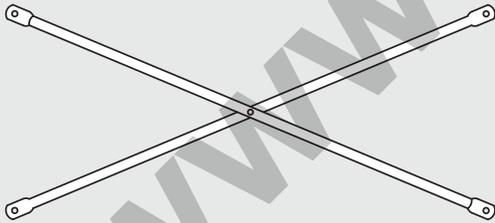
Stud Centers			2'	3'	3' 6"	4'	5'
Brace No.	Weight	Length/Dimen.					
B 52	8.25 lbs.	5' x 2'	5'	4' 5 <sup>21</sup> / <sub>32</sub> "	4' 1 <sup>1</sup> / <sub>8</sub> "	3' 7 <sup>1</sup> / <sub>4</sub> "	2'
B 62	9.75 lbs.	6' x 2'	6'	5' 6 <sup>25</sup> / <sub>32</sub> "	5' 3 <sup>3</sup> / <sub>16</sub> "	4' 10 <sup>3</sup> / <sub>4</sub> "	3' 10 <sup>7</sup> / <sub>16</sub> "
B 72	11 lbs.	7' x 2'	7'	6' 7 <sup>5</sup> / <sub>8</sub> "	6' 4 <sup>5</sup> / <sub>8</sub> "	6' 1"	5' 3 <sup>1</sup> / <sub>2</sub> "
B 82	11.25 lbs.	8' x 2'	8'	7' 8 <sup>5</sup> / <sub>32</sub> "	7' 5 <sup>19</sup> / <sub>32</sub> "	7' 2 <sup>1</sup> / <sub>2</sub> "	6' 6 <sup>21</sup> / <sub>32</sub> "
B 102	14.5 lbs.	10' x 2'	10'	9' 8 <sup>31</sup> / <sub>32</sub> "	9' 6 <sup>15</sup> / <sub>16</sub> "	9' 4 <sup>9</sup> / <sub>16</sub> "	8' 10 <sup>21</sup> / <sub>32</sub> "

## Cross Braces – 3' Stud Spacing

Stud Centers			2'	3'	3' 6"	4'	5'
Brace No.	Weight	Length/Dimen.					
B 53	8.5 lbs.	5' x 3'	5' 5 <sup>3</sup> / <sub>4</sub> "	5'	4' 8"	4' 2 <sup>15</sup> / <sub>16</sub> "	3'
B 63	10 lbs.	6' x 3'	6' 4 <sup>27</sup> / <sub>32</sub> "	6'	5' 8 <sup>11</sup> / <sub>16</sub> "	5' 4 <sup>5</sup> / <sub>8</sub> "	4' 5 <sup>21</sup> / <sub>32</sub> "
B 73	11 lbs.	7' x 3'	7' 4 <sup>3</sup> / <sub>16</sub> "	7'	6' 9 <sup>5</sup> / <sub>32</sub> "	6' 5 <sup>3</sup> / <sub>4</sub> "	5' 8 <sup>15</sup> / <sub>16</sub> "
B 83	13.75 lbs.	8' x 3'	8' 3 <sup>23</sup> / <sub>32</sub> "	8'	7' 9 <sup>9</sup> / <sub>16</sub> "	7' 6 <sup>5</sup> / <sub>8</sub> "	6' 11 <sup>3</sup> / <sub>16</sub> "
B 103	15.25 lbs.	10' x 3'	10' 3"	10'	9' 10 <sup>1</sup> / <sub>16</sub> "	9' 7 <sup>3</sup> / <sub>4</sub> "	9' 2"

## Cross Braces – 4' Stud Spacing

Stud Centers			2'	3'	3' 6"	4'	5'
Brace No.	Weight	Length/Dimen.					
B 44	7.75 lbs.	4' x 4'	5' 3 <sup>1</sup> / <sub>2</sub> "	4' 9 <sup>17</sup> / <sub>32</sub> "	4' 5 <sup>5</sup> / <sub>16</sub> "	4'	2' 7 <sup>3</sup> / <sub>4</sub> "
B 54	9.25 lbs.	5' x 4'	6' 1"	5' 7"	5' 4 <sup>11</sup> / <sub>32</sub> "	5'	4'
B 64	10 lbs.	6' x 4'	6' 11 <sup>1</sup> / <sub>16</sub> "	6' 6 <sup>11</sup> / <sub>16</sub> "	6' 3 <sup>21</sup> / <sub>32</sub> "	6'	5' 2 <sup>11</sup> / <sub>32</sub> "
B 74	12 lbs.	7' x 4'	7' 9 <sup>23</sup> / <sub>32</sub> "	7' 5 <sup>13</sup> / <sub>16</sub> "	7' 3 <sup>5</sup> / <sub>32</sub> "	7'	6' 3 <sup>7</sup> / <sub>8</sub> "
B 84	13 lbs.	8' x 4'	8' 8 <sup>19</sup> / <sub>32</sub> "	8' 5 <sup>3</sup> / <sub>32</sub> "	8' 2 <sup>3</sup> / <sub>4</sub> "	8'	7' 4 <sup>31</sup> / <sub>32</sub> "
B 104	15.75 lbs.	10' x 4'	10' 7"	10' 4 <sup>7</sup> / <sub>8</sub> "	10' 2 <sup>1</sup> / <sub>4</sub> "	10'	9' 6 <sup>15</sup> / <sub>32</sub> "



B

# Sectional Components

## Horizontal Braces (Gooser Braces)

Part No.	Description	Length	Weight
GHB4	Horizontal Brace	4'	9.1 lbs.
GHB5	Horizontal Brace	5'	10.2 lbs.
GHB6	Horizontal Brace	6'	15 lbs.
GHB7	Horizontal Brace	7'	12.7 lbs.
GHB8	Horizontal Brace	8'	13.8 lbs.
GHB10	Horizontal Brace	10'	16.2 lbs.



GHB / GHDB

## Horizontal Diagonal Braces (Gooser Diagonal Braces)

Part No.	Description	Weight
GHDB7	Horizontal/Diagonal Brace for 5' x 7' tower	14.5 lbs.
GHDB8	Horizontal/Diagonal Brace for 5' x 8' tower	15.5 lbs.
GHDB10	Horizontal/Diagonal Brace for 5' x 10' tower	17.5 lbs.
GHDB37	Horizontal/Diagonal Brace for 3' x 7' tower	10.8 lbs.
GHDB427	Horizontal/Diagonal Brace for 3' 6" x 7" tower	13.6 lbs.
GHDB47	Horizontal/Diagonal Brace for 4' x 7' tower	13.9 lbs.
GHDB48	Horizontal/Diagonal Brace for 4' x 8' tower	11.8 lbs.

## Straddle Tresses

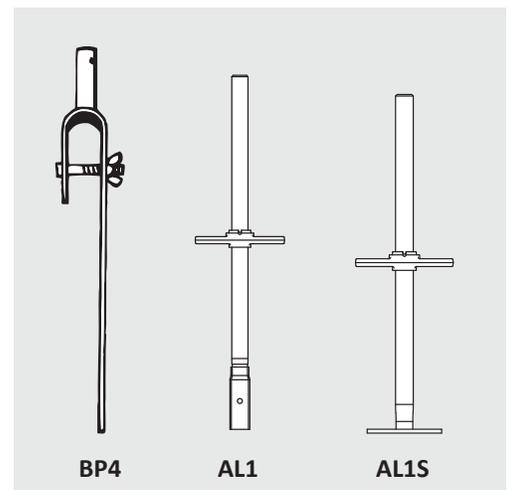
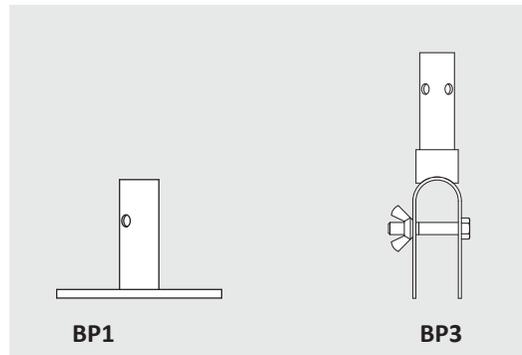
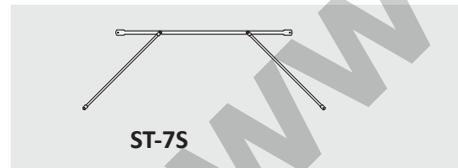
Part No.	Description	Length	Stud Center	Weight
ST-7S	Straddle Trestle	7' (Single horizontal bar)	4'	18 lbs.
ST-10	Straddle Trestle	10'	4'	24 lbs.

## Screw Jacks

Part No.	Description	Adjustment	Weight
AL1	Screw Jack (with socket)	18"	14.25 lbs.
AL1S	Screw Jack (with base plate)	18"	16 lbs.

## Base Plates

Part No.	Description	Weight
BP1	Base Plate - fixed	4.3 lbs.
BP3	Base Plate - curved	2.75 lbs.
BP4	Base Plate - curved, long flange	5.25 lbs.



# 10 Sectional Components

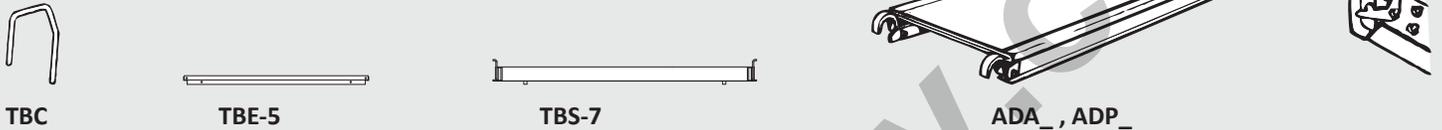
## Toeboards

Part No.	Description	Length	Weight
TBC	Toeboard Clip	--	0.3 lbs.
TBE-5	End Toeboard	5'	9.8 lbs.
TBS-7	Side Toeboard	7'	26.8 lbs.

## Platform Planks

Part No.	Description	Length	Width
ADA_, ADP_	Scaffold Deck	7', 8', 10'	19¼"

Decks are available as all aluminum extrusion or plywood deck with aluminum frame. Weight varies by length, deck type & manufacturer.



## Side and End Brackets

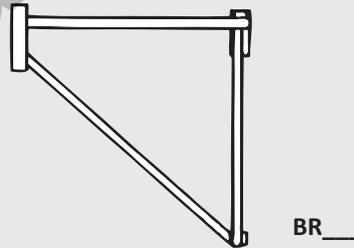
Part No.	Description	Width	Weight
BR20L	Side Bracket	20"	8.5 lbs.
BR24L	Side Bracket	24"	10.5 lbs.
BR30S	Side Bracket	30"	22.1 lbs.
BR20E	End Bracket	20"	8 lbs.
BR30E	End Bracket	30"	20.7 lbs.

### ⚠ WARNING

SIDE AND END BRACKETS ARE DESIGNED TO SUPPORT PEOPLE ONLY. MATERIALS ARE NOT TO BE PLACED ON PLATFORMS SUPPORTED BY BRACKETS.

BRACKETS ARE NOT TO BE USED ON ROLLING TOWERS.

ALL BRACKETS INTRODUCE OVERTURNING AND/OR UPLIFT FORCES. THESE FORCES MUST BE EVALUATED AND COMPENSATED FOR WHEN BRACKETS ARE USED. CONSULT SAFWAY FOR ADDITIONAL INFORMATION.



## Hoist Arm

Part No.	Description	Weight
H-3T	Hoist Arm Top	25.0 lbs.
H-3B	Hoist Arm Upright	17.5 lbs.

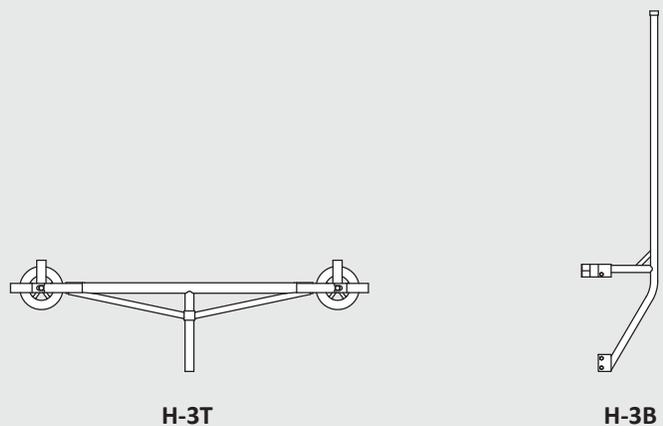
### ⚠ WARNING

MAXIMUM HOIST CAPACITY: 100 LBS. LIFT MATERIAL VERTICALLY ONLY. DO NOT USE TO LIFT PEOPLE.

ALL HOISTS INTRODUCE OVERTURNING AND/OR UPLIFT FORCES WITHIN THE SCAFFOLD ON WHICH THEY ARE MOUNTED. THESE FORCES MUST BE EVALUATED AND COMPENSATED FOR WHEN USING HOISTS.

SCAFFOLD MUST BE TIED, GUYED OR OTHERWISE STABILIZED AT EACH HOIST LOCATION. ALL FRAMES MUST BE LOCKED TOGETHER TO PREVENT UPLIFT WHEN HOISTS ARE USED.

CONSULT SAFWAY FOR ADDITIONAL INFORMATION.



## Putlogs

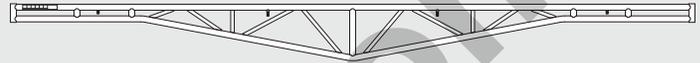
Part Number	Description	Length	Weight	Maximum Allowable Center Concentrated Load*	Maximum Allowable Uniform Load*
P8	Putlog	8'	30.9 lbs.	950 lbs.	1900 lbs.
P12	Putlog	12'	45.7 lbs.	675 lbs.	1350 lbs.
P16	Deep Truss	16'	70.8 lbs.	1125 lbs.	2250 lbs.
P22	Deep Truss	22'	96.3 lbs.	750 lbs.	1500 lbs.

CAUTION: Do not overload putlogs. Consult Safway for additional loading information.

\*At maximum span



P12



P16

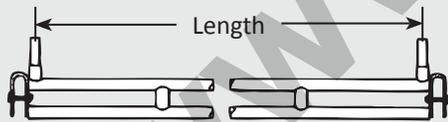
## Putlog Spreader and Accessories

Part Number	Description	Weight	Length
PS5**	Putlog Spreader	24 lbs.	5'
PH1	Putlog Hanger	3.7 lbs.	
PH2	Hanger	5.6 lbs.	
PH3	Guardrail Post Socket	2.3 lbs.	
PH4	Guardrail Post Socket (long flange)	5.6 lbs.	
PH5	Putlog Diagonal Knee Brace with clamps	15.4 lbs.	
PH6	Single Putlog Suspension Hanger	5.8 lbs.	
PH7	Double Putlog Suspension Hanger	8 lbs.	
BCA	Adjustable Beam Clamp	14.2 lbs.	

\*\*PS42 also available.

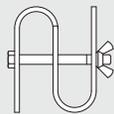
## Casters

Part Number	Description	Weight	Wheel Diameter	Height to Frame Length	Caster Locks	Swivel Locks	Rolling Load Capacity	Swivel Radius*
C-8R	Rubber Wheel Caster	11 lbs.	8"	9 <sup>5</sup> / <sub>16</sub> "	Yes	Yes	650 lbs.	6 <sup>3</sup> / <sub>8</sub> "
C-8S	Steel Wheel Caster	15 lbs.	8"	9 <sup>11</sup> / <sub>32</sub> "	Yes	Yes	1000 lbs.	5 <sup>15</sup> / <sub>16</sub> "



PS5

Used when scaffolds are placed on putlogs over clear spans



PH1

Parallel to frame horizontal

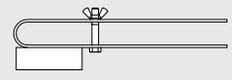


PH2

Any angle to frame horizontal



PH3



PH4



PH5



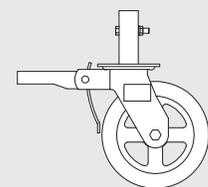
PH6



PH7



BCA



C-8R

# 12 Frame and Cross Bracing Estimating Chart

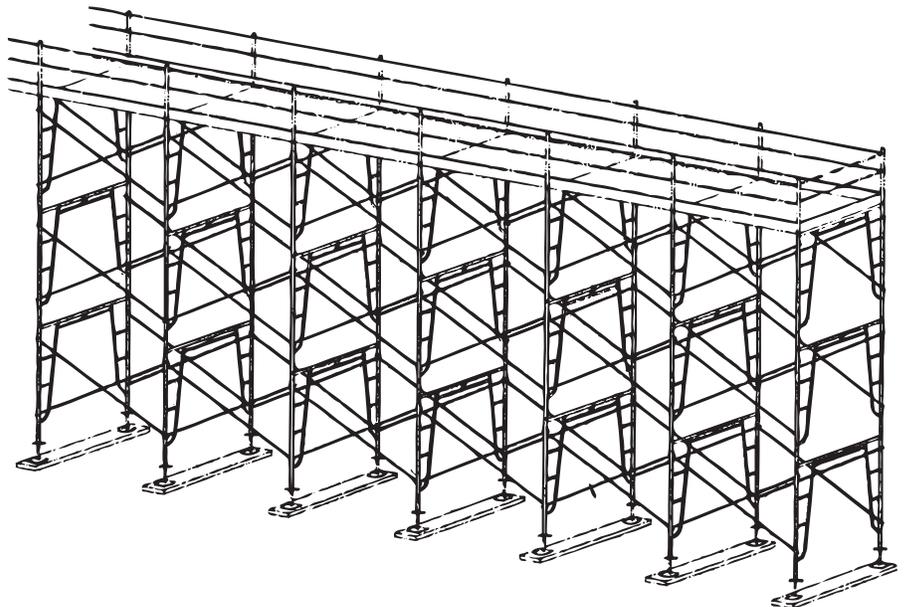
## Frames and Cross Braces Required for Various Height and Length Scaffolds<sup>(1)</sup>

No. High	Full Height <sup>(2)</sup>			Quantity Required per Length (based on 7' and 10' spacing)														
	5' Frame	6' 4" Frame		7' 10'	14' 20'	21' 30'	28' 40'	35' 50'	42' 60'	49' 70'	56' 80'	63' 90'	70' 100'	77' 110'	84' 120'	91' 130'	98' 140'	105' 150'
1	6'	7' 4"	Frames	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
			Braces	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
2	11' 1"	13' 9"	Frames	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32
			Braces	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
3	16' 2"	20' 2"	Frames	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
			Braces	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
4	21' 3"	26' 7"	Frames	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64
			Braces	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
5	26' 4"	33' 0"	Frames	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
			Braces	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
6	31' 5"	39' 5"	Frames	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96
			Braces	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180
7	36' 6"	45' 10"	Frames	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112
			Braces	14	28	42	56	70	84	98	112	126	140	154	168	182	196	210
8	41' 7"	52' 3"	Frames	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128
			Braces	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240
9	46' 8"	58' 8"	Frames	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144
			Braces	18	36	54	72	90	108	126	144	162	180	198	216	234	252	270
10	51' 9"	65' 1"	Frames	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160
			Braces	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300
11	56' 10"	71' 6"	Frames	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176
			Braces	22	44	66	88	110	132	154	176	198	220	242	264	286	308	330
12	61' 11"	77' 11"	Frames	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
			Braces	24	48	72	96	120	144	168	192	216	240	264	288	312	336	360
13	67'	84' 4"	Frames	26	39	52	65	78	91	104	117	130	143	156	169	182	195	208
			Braces	26	52	78	104	130	156	182	208	234	260	286	312	338	364	390
14	72' 1"	90' 9"	Frames	28	42	56	70	84	98	112	126	140	154	168	182	196	210	224
			Braces	28	56	84	112	140	168	196	224	252	280	308	336	364	392	420
15	77' 2"	97' 2"	Frames	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240
			Braces	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450

Note 1: Access systems, guardrails, tie offs, screw jacks, coupling pins and numerous other components may be required for a complete scaffold. For specific applications, contact Safway.

Note 2: Heights include 12" of screw jack at bottom of scaffold.

Proper access must be provided.

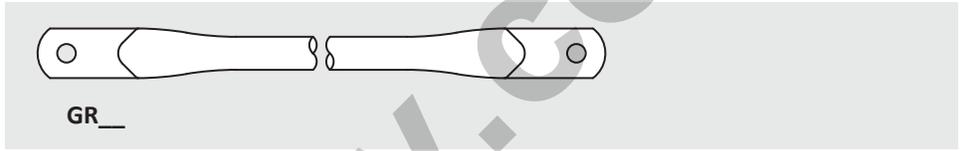


## Guardrails

Part No.	Description	Length	OD Tube	Weight
GR2	Guardrail	2'	1"	1.5 lbs.
GR23	Guardrail	2' 2¾"	1"	1.75 lbs.
GR3	Guardrail	3'	1"	2.25 lbs.
GR4	Guardrail	4'	1"	3 lbs.
GR5	Guardrail	5'	1"	3.25 lbs.
GR6	Guardrail	6'	1"	4.5 lbs.
GR7	Guardrail	7'	1"	5 lbs.
GR8	Guardrail	8'	1.25"	9 lbs.
GR10	Guardrail	10'	1.25"	11 lbs.

Guardrails attach to "G" locks.

**⚠ WARNING**  
 UNLOCKED OR MISSING GUARDRAILS  
 CAN CAUSE SERIOUS INJURY! LOCK SLIDE  
 MUST BE DOWN! FACE GUARDRAIL  
 LOCKS TOWARD PLATFORM!

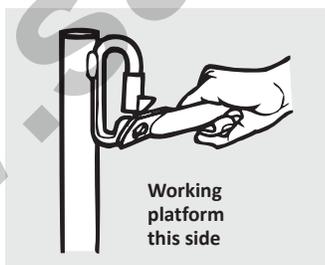
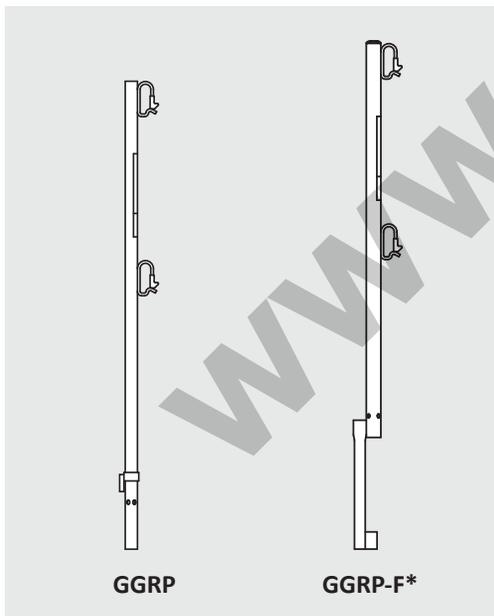


## Guardrail Posts

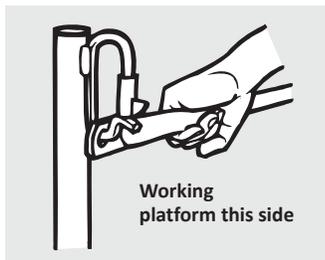
Part No.	Description	OD Tube	Weight
GGRP	"G" Lock Guardrail Post, Male	1.44"	8.75 lbs.
GGRP-F*	"G" Lock Guardrail Post, Female	1.69"	9.25 lbs.
CGGRP	Corner "G" Lock Guardrail Post, Male	1.44"	10 lbs.
CGGRP-F*	Corner "G" Lock Guardrail Post, Female	1.69"	9.25 lbs.

Male post fits into frame leg. Female post fits onto a coupling pin.

\*Will not fit LOF style frames.



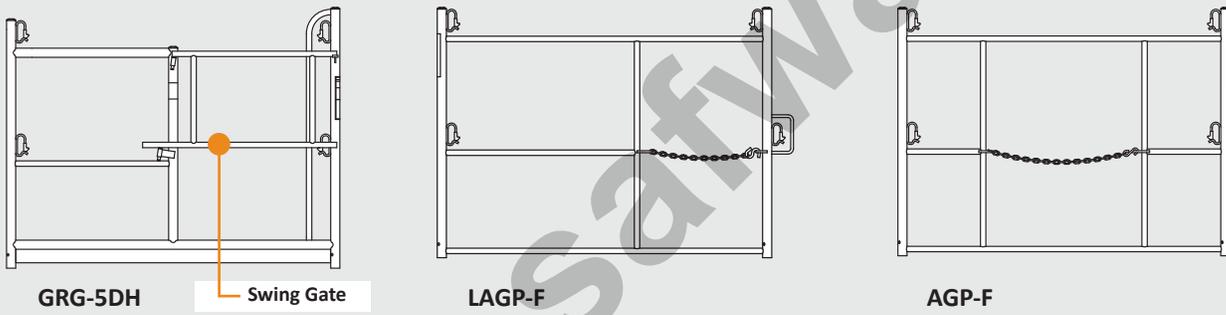
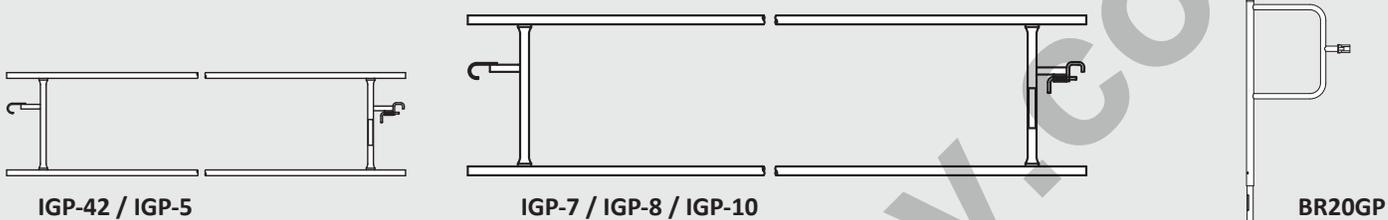
Guardrail "G" opens with slight pressure. Sleeve tab must be facing as shown.



Ensure that sleeve has dropped after guardrail is installed.

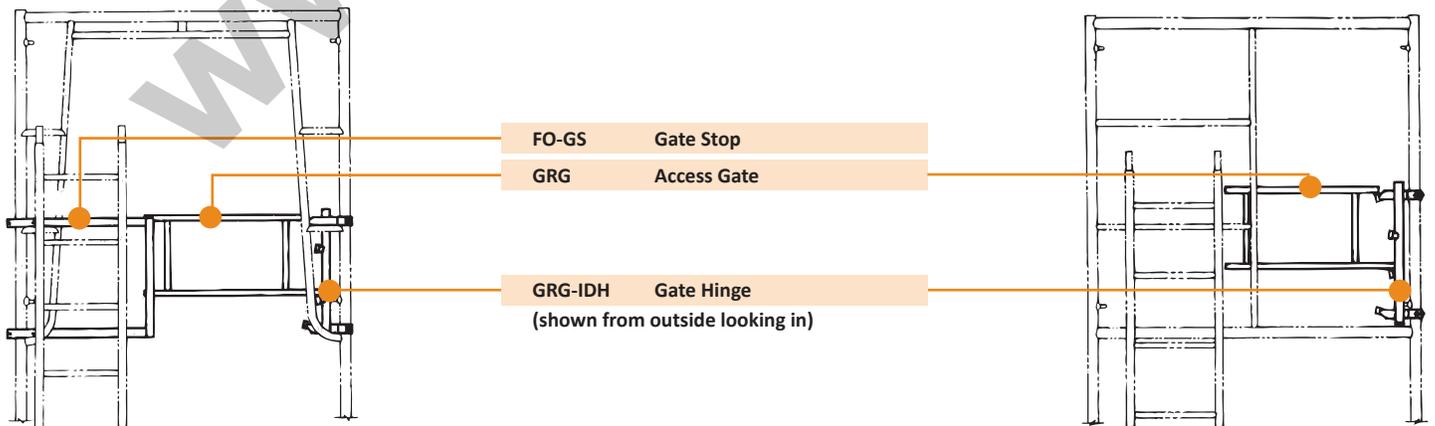
**Gates and Panels**

Part Number	Description	Length	Height	Weight
IGP-42	Intermediate End Guardrail Panel for FOGL42 and FOGL3	2' 10"	21"	13.3 lbs.
IGP-5	Intermediate End Guardrail Panel for FO & LOF Frames, 5'	4' 4"	21"	15.7 lbs.
IGP-7	Intermediate Guardrail Panel for FO & LOF Frames, 7'	7'	21"	24.5 lbs.
IGP-8	Intermediate Guardrail Panel for FO & LOF Frames, 8'	8'	21"	26.9 lbs.
IGP-10	Intermediate Guardrail Panel for FO & LOF Frames, 10'	10'	21"	36.9 lbs.
GRG-5DH	Guardrail Gate for FO & FM Style Frames with SAU Ladder System	5'	45 $\frac{7}{8}$ "	51.3 lbs.
LAGP-F	Access Gate Panel for LOF Frames	5'	45 $\frac{7}{8}$ "	30 lbs.
AGP-F	Access Gate panel for RT Frames	5'	45 $\frac{7}{8}$ "	30 lbs.
BR20GP	Bracket Guard Panel		43 $\frac{1}{2}$ "	15.4 lbs.



**Intermediate Level Guardrail Gate Assembly**

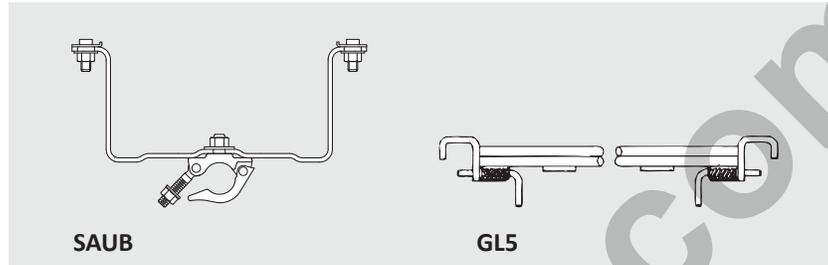
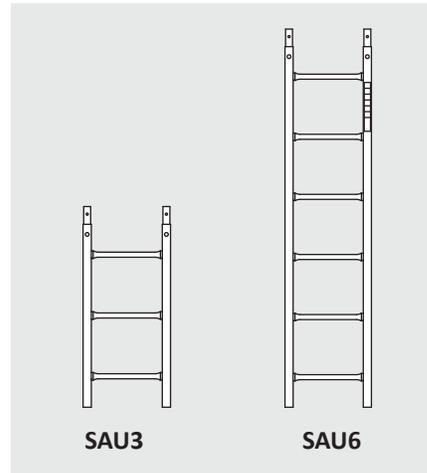
Part Number	Components	Used With	Weight
FO-IG	FO-GS, GRG and GRG-IDH	FO Frame	34.8 lbs.
FM-IG	GRG and GRG-IDH	FM Frame	16 lbs.



## Ladder Units and Components

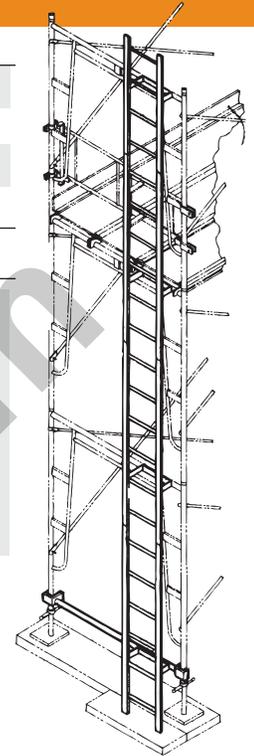
Part No.	Description	Weight	Width	Rung Spacing
SAU3*	Access Ladder Unit, 3'	10.7 lbs.	17¼"	12"
SAU6*	Access Ladder Unit, 6'	18.0 lbs.	17¼"	12"
SAUB	Access Ladder Bracket	5.7 lbs.		
GL5	Starter Horizontal	8 lbs.		

\*Must be installed with SAUB brackets. Two brackets are required on base ladder section; one on each additional section.



**SAUB**  
Will attach to SAU ladder sections at any elevation and clamp to either a standard scaffold leg or header bar. Will also attach to Tube & Clamp tubing. Provides 7" toe clearance.

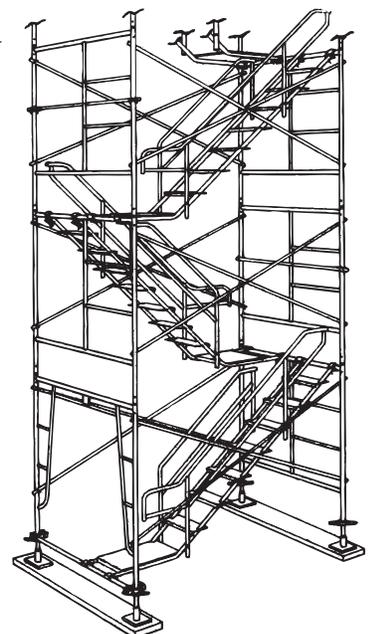
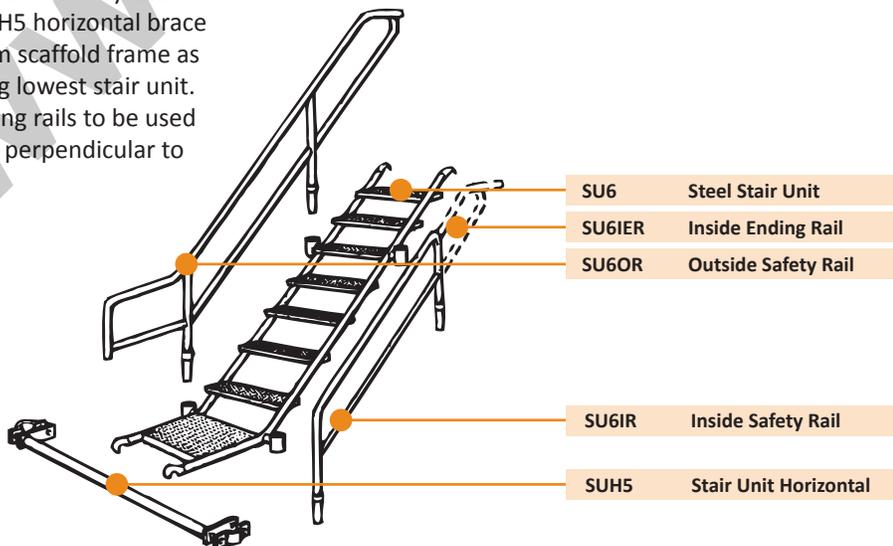
**GL5**  
Used at bottom of access ladder units and as base for landing platform assembly. Is equipped with pads to locate and clamp SAUB bracket to GL-5. Used with FO style frames only.



## Steel Stair Units and Safety Rails

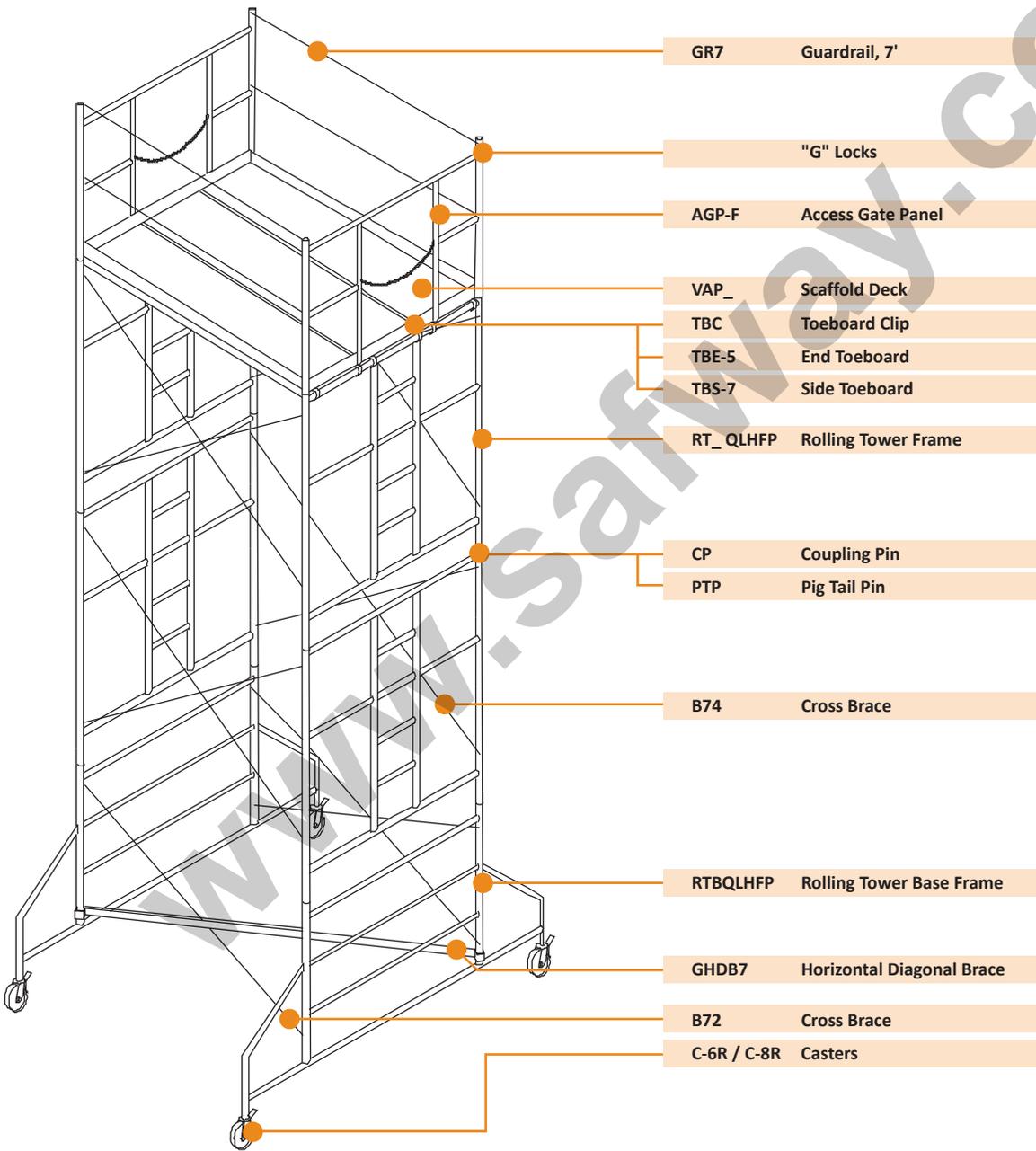
Part No.	Description	Weight
SU5	Steel Stair Unit for use with 5' frames on 7' spacing	68.2 lbs.
SU6	Steel Stair Unit for use with 6' 4" scaffold frames on 7' spacing	75.9 lbs.
SUH5	Stair Unit Horizontal	10.25 lbs.
SU5IER	Inside Ending Rail for SU5	33 lbs.
SU5IR	Inside Safety Rail for SU5	16.9 lbs.
SU5OR	Outside Safety Rail for SU5	30.8 lbs.
SU6IER	Inside Ending Rail for SU6	27.9 lbs.
SU6IR	Inside Safety Rail for SU6	20.4 lbs.
SU6OR	Outside Safety Rail for SU6	33 lbs.

Provides an interior stairway with scaffold bays. SUH5 horizontal brace is used on bottom scaffold frame as base for attaching lowest stair unit. Note: Inside ending rails to be used for exit/entrance perpendicular to frame.



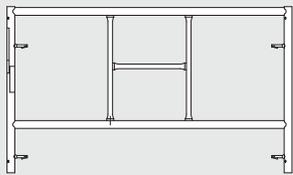
The Rolling Tower System with our Rolling Tower Base Frame provides extra stability that is cost-effective. Previously, extra stability required extra components such as outrigger attachments, extra casters and cross braces, plus the added labor to assemble these components.

The convenience of the base frames, access frames and fabricated planks gives you the lowest cost, most quickly erected, stable rolling tower with its base dimensions in the industry. Wall surfaces are now within an arm's reach and are as easy to work on as the overhead jobs.

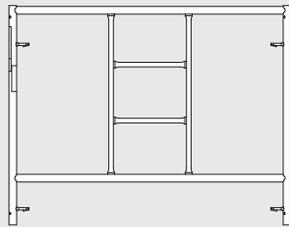


## Rolling Tower Frames

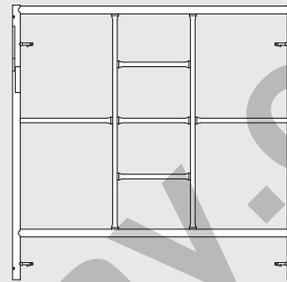
Part No.	Description	Height	Stud Spacing	Width	Weight
RT3QLHFP	Rolling Tower Frame	3'	2'	5'	31 lbs.
RT4QLHFP	Rolling Tower Frame	4'	3'	5'	36.5 lbs.
RT5QLHFP	Rolling Tower Frame	5'	4'	5'	44.5 lbs.
RT6QLHFP	Rolling Tower Frame	6' 4"	4'	5'	52 lbs.
RTBQLHFP	Rolling Tower Base Frame	3' 5"	2'	7'	47 lbs.
RTO-1	Detachable Outrigger	3' 4"	2'	2' 6"	20 lbs.



RT3QLHFP



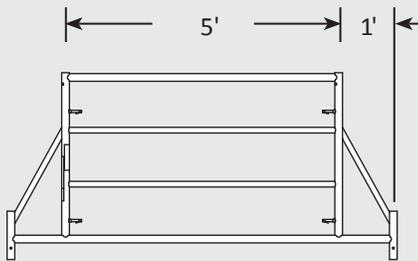
RT4QLHFP



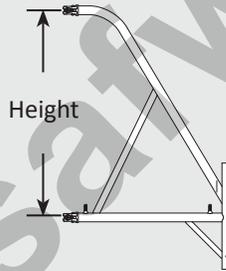
RT5QLHFP



RT6QLHFP



RTBQLHFP



RTO-1

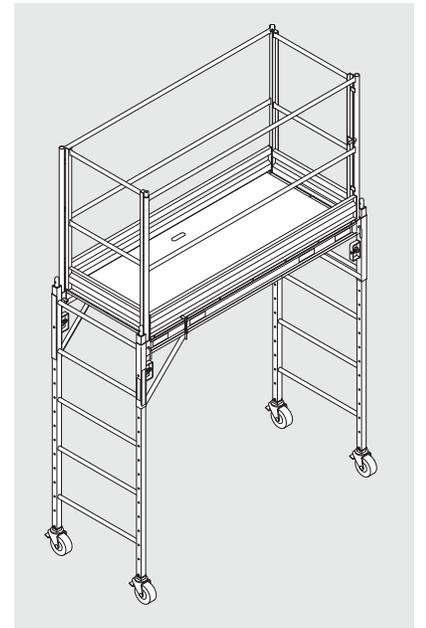
## Mobile Work Platform (Order Kit SWP)

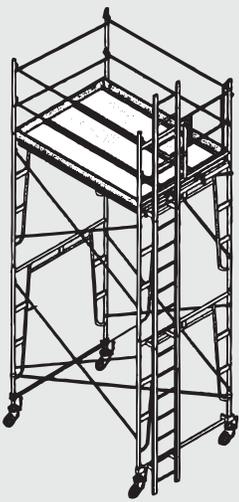
Part No.	Quantity	Description	Weight (each)
SWPF6	2	6' end ladder frames	26 lbs.
SWPPS	2	Side braces	22 lbs.
SWPP	1	Plywood platform	30 lbs.
SWPCS5R	4	Swivel caster w/ locks	6 lbs.
SP	4	Snap Pins	0.1 lbs.

## Guardrail Panel Assembly (Order Kit SWPGRA)

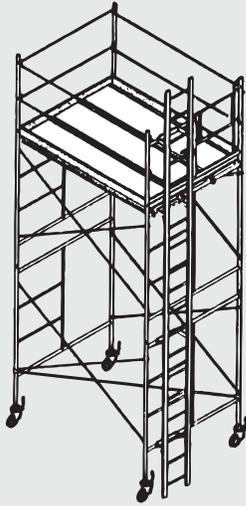
Part No.	Quantity	Description	Weight (each)
SWPGRP	2	6' guardrail panel	36 lbs.
SWPHP	4	Hinge Pins	0.1 lbs.

Mobile Work Platform, 6' high: a convenient, easy-to-use utility scaffold

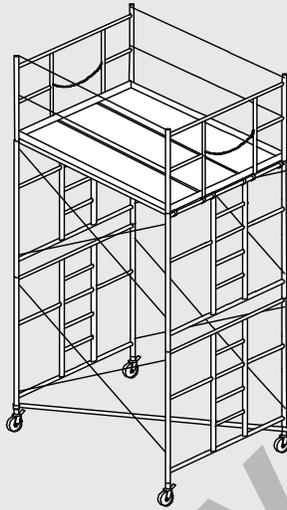




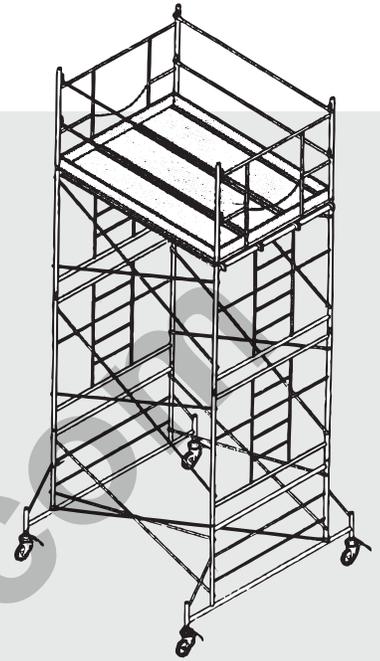
13' 7" high: Open End Frame Rolling Tower with ladder attached



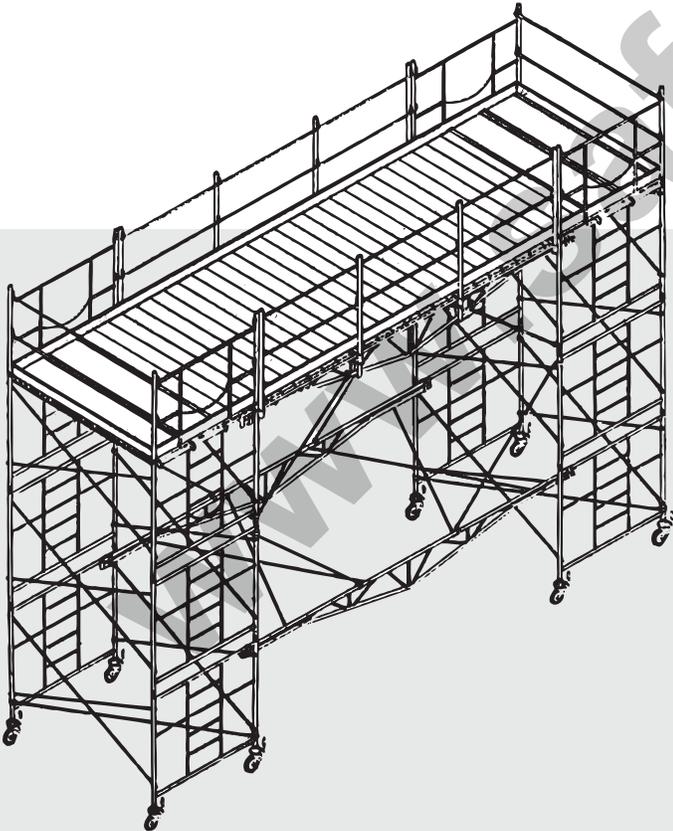
13' 7" high: Mason Frame Rolling Tower with ladder attached



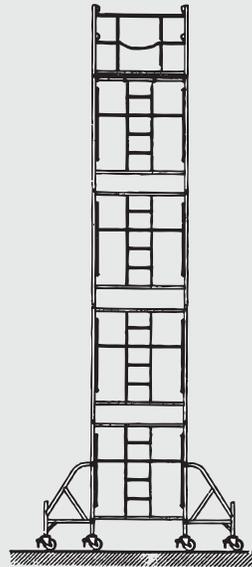
13' 7" high: Rolling Tower Frame Tower



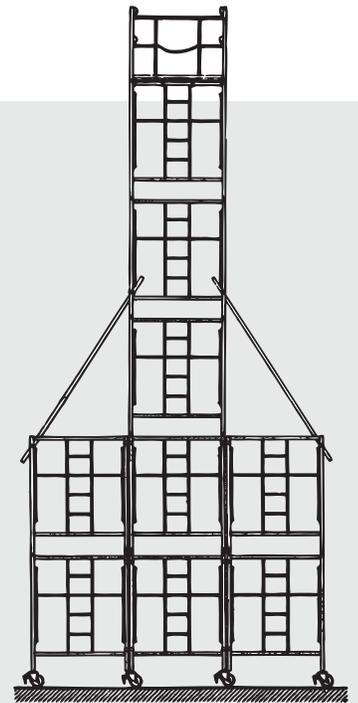
17' 2" high: Rolling Tower Frame Tower with the Rolling Tower Base Frame



20' high x 10' deep x 25' wide: Rolling Tower using RT Frames and Putlogs. This massive rolling tower would move over obstacles 14' 6" wide by 5' high such as seating areas in churches and auditoriums.



26' 4" high: Rolling Tower with RT Frames and Rolling Tower Base Frame



32' 9" high: Rolling Tower with a 15' wide x 10' deep base using RT Frames

SEC

# Sectional Scaffolds

## Safety Guidelines

Scaffold safety is everyone's responsibility. Everyone's safety depends upon the design, erection, use and dismantling of scaffold by **Competent Persons only**. Inspect your scaffold before each use to see that the assembly has not been altered and is safe for your use.



### WARNING

**SERIOUS INJURY OR DEATH CAN RESULT FROM YOUR FAILURE TO FAMILIARIZE YOURSELF AND COMPLY WITH ALL APPLICABLE SAFETY REQUIREMENTS OF FEDERAL, STATE, PROVINCIAL AND LOCAL REGULATIONS AND THESE SAFETY GUIDELINES BEFORE ERECTING, USING OR DISMANTLING THIS SCAFFOLD.**

### Safety must come first!

Safway® equipment is designed and manufactured with the user in mind. The safety that goes into each piece of equipment, however, cannot offset carelessness on the part of the erector or the user. **Follow these safety guidelines in order to prevent injury** to the users of Safway equipment.

Scaffold design must include analysis of load carrying members by properly qualified personnel. Safway component load capacity and weight information is available from Safway. Scaffolds must be erected, used, moved and disassembled only under the supervision of Competent Persons.

### I. Erection Of Sectional Scaffolds

#### A. Prior To Erection - All Scaffold Assemblies

1. Job site must be inspected to determine ground conditions, strength of supporting structure, fall arrest anchor points, proximity of electric power lines, overhead obstructions, wind conditions, and the need for overhead or weather protection. These conditions must be evaluated and adequately addressed.
2. Frame spacing and sill size can only be determined after the total loads to be imposed on the scaffold and the weight of the scaffold have been calculated.
3. Stationary scaffolds more than 125 ft. in height must be designed by a professional engineer.
4. All equipment must be inspected to see that it is in good condition and is serviceable. Damaged or deteriorated equipment must not be used.



### WARNING

**NOT ALL SPECIES AND GRADES OF LUMBER CAN BE USED AS SCAFFOLD PLANK. WOOD PLANKS USED FOR SCAFFOLDS MUST BE GRADED AS SCAFFOLD PLANK BY AN APPROVED GRADING AGENCY OR SPECIFICALLY MANUFACTURED FOR SCAFFOLD USE.**

5. Scaffold plank must be inspected to see that it is graded as scaffold plank, is sound and in good condition, and is free from saw cuts, cracks, notches, splits, delaminations and holes.
6. A fully qualified and Competent Person can deviate from these guidelines only if it can

be shown that the resulting scaffold design complies with applicable codes and generally accepted scaffold engineering practices.

7. The scaffold assembly must be designed to comply with federal, state, provincial and local requirements.

#### B. Erection Of Fixed Scaffold



### WARNING

**FALL ARREST EQUIPMENT ATTACHED TO SCAFFOLD MAY NOT PREVENT SERIOUS INJURY OR DEATH IF A FALL OCCURS.**

Scaffold must be erected, moved or disassembled only under the supervision of Competent Persons. Safety equipment including safety glasses and hard hats must be worn by all persons erecting, moving, dismantling or using scaffolds.

1. All scaffold legs require the use of a base plate **and** a mudsill or other adequate firm foundation. Base plates must be in firm contact with the sills/foundation and frame legs and should be centered on the sills. Be especially careful when scaffolds are to be erected on soft or frozen ground. Any part of a building or structure used to support the scaffold must be capable of supporting the load to be applied.
2. Compensate for uneven ground by using screw jacks and base plates, and sills if required by ground conditions. **Do not use** unstable objects such as blocks, loose bricks, and similar objects or materials.
3. Plumb and level scaffold. Be sure scaffold stays plumb and level as erection progresses.
4. Ties, guys, bracing and/or outriggers may be needed to assure a safe, stable scaffold assembly. The height of the scaffold in relation to the minimum base width, wind loads, the use of brackets or cantilevered platforms, and imposed scaffold loads determines the need for sway and stability bracing. The following general guidelines apply:
  - a. A scaffold must always be secured when the height of the scaffold exceeds 4 times the minimum base width. See Footnote 1.
  - b. Ties must be placed as near as possible to horizontal members. The bottom tie must be placed no higher than 4 times the minimum scaffold base width. Subsequent vertical tie placement will depend upon the scaffold width. Scaffolds 3 ft. and narrower must be tied at vertical intervals no more than 20 ft. apart. Scaffolds wider than 3 ft. must be tied at vertical intervals no more than 26 ft. apart. The uppermost tie should be placed as close to the top as possible and, in no case, more than 4 times the minimum base width from the top. See Footnote 1.
  - c. Horizontal ties must be placed at the ends of the scaffold runs and at no more than 30 ft. horizontal intervals in between.
  - d. Ties must be installed as the erection progresses and not removed until scaffold is dismantled to that height.
  - e. Side brackets, cantilevered platforms, pulleys, hoist arms, enclosed scaffolds, sloped surfaces, and windy conditions introduce overturning and uplift forces which must be considered and compensated for. These situations require additional bracing, tying or guying.
  - f. Circular scaffolds erected completely around or within a structure may be restrained from tipping by use of "stand off" bracing members.
  - g. A free standing tower must be guyed at the intervals outlined above or otherwise restrained to prevent tipping or overturning.
5. Outrigger frames or outrigger units can be used to increase the minimum base width. If used on a free standing tower, they must be installed on both sides of the tower.
6. Work platforms must be fully decked with platform units in good, sound condition. Platform units may be individual scaffold grade wood planks, fabricated plank, fabricated scaffold decks or fabricated scaffold platforms.
  - a. Scaffold platforms and walkways must be at least 18 in. wide.
  - b. Each end of each plank must overlap its support by a minimum of 6 in. or be cleated.
  - c. Each end of each platform 10 ft. long or less must overhang its supports by no more than 12 in. Each end of each platform longer than 10 ft. must overhang its supports by no more than 18 in. Larger overhangs must be guarded to prevent access to the overhang. Materials must not be stored on overhangs. Do not stand on platform overhangs.
  - d. Each plank on a continuous run scaffold must extend over its supports by at least 6 in. and overlap each other by at least 12 in.
  - e. Spans of 2 in. by 10 in. nominal scaffold grade plank must never exceed 10 ft. No more than one person must stand on an individual plank at one time. Loads on planks must be evenly distributed and not exceed the allowable loads for type of plank being used.
  - f. Secure platform units to scaffold to prevent uplift caused by high winds or other job site conditions. Use latches, if supplied by platform manufacturer, or other suitable means.
7. Guardrails must be used on all open sides and ends of scaffold platforms. Both top and midrails are required. Local codes specify minimum heights where guardrails are required. Use at lower heights if falls can cause injury.
8. Toeboards must be installed whenever people are required to work or pass under a scaffold platform. When materials are to be stacked higher than the toeboard, screening is required from the toeboard or platform to the top guardrail.

9. Access must be provided to all work platforms. If access is not available from the structure, access ladder units or stairways must be provided. When access ladder units are provided, a rest platform must be installed at vertical intervals of 35 ft. or less. Attachable ladder units must extend at least 3 ft. above platforms. Install access ladder units as scaffold erection progresses.
10. Use fabricated decks or cleated plank to minimize platform interference in access areas.
11. **Do not** store materials on side or end bracket platforms.
12. Cantilevered platforms must be specifically designed for that purpose, the frames pinned to prevent uplift and adequate ties provided to prevent overturning.
13. Materials must never be placed on cantilevered platforms unless the assembly has been designed to support material loads by a qualified person. These types of platforms cause overturning and uplift forces which must be compensated for.
14. After erecting scaffold, be sure screw jacks are in firm contact with frame legs.
15. Special care must be taken when putlogs are used:
  - a. Putlogs must only be mounted using putlog hangers, with all bolts and nuts installed and tightened.
  - b. Putlogs must overhang their supports by at least 6 in.
  - c. Lateral bracing and kneebracing are both required for putlog spans greater than 10 ft.
  - d. Putlogs used as side or end brackets require special mountings and special bracing.
16. **Do not** install platforms between free standing towers.
17. Material hoists and derricks should not be mounted on a scaffold unless the scaffold is specifically designed for that purpose.
18. **Check the entire scaffold assembly before use.** Thoroughly inspect the completed assembly to see that it complies with all safety codes, all fasteners are in place and tightened, it is level and plumb, work platforms are fully decked, guardrails are in place, and safe access is provided.

### C. Erection Of Rolling Scaffolds

The following additional precautions apply to the erection of rolling towers:

1. Height of the rolling tower must not exceed 4 times its minimum base width, or 40 ft., whichever is lower. See Footnote 1.

**⚠ WARNING**  
**THE LOAD RATING OF THE CASTERS USED WILL LIMIT THE SIZE, CONFIGURATION, AND LOAD CAPACITY OF THE ROLLING TOWER.**

2. Secure all casters to frame legs or screw jacks with a nut and bolt or other secure means.
3. Screw jacks must not increase the height of the scaffold by more than 12 in. Towers must be kept level and plumb at all times.
4. Horizontal diagonal bracing must be used at the bottom and top of rolling towers where the top work platform is more than 9 ft. above the surface. When rolling towers are to be erected

higher than 9 ft., the first brace must be no more than 2 ft. above the casters, the others at no greater than 21 ft. intervals above. Fabricated planks with hooks may be used as diagonal braces.

5. All frames must be fully cross-braced.
6. Platform units with hooks, or cleated planks, must be used on rolling towers.

## II. Use Of Sectional Scaffolds

### A. All Scaffolds

1. Before you use the scaffold, a Competent Person must: inspect the scaffold assembly to be sure it has not been altered, is assembled correctly, is level and plumb, all base plates are in firm contact with sills, all bracing is in place and securely tightened, all platforms are fully decked, all guardrails are in place, safe access is provided, it is properly tied and/or guyed, there are no overhead obstructions, there are no energized electric power lines within 10 ft. of the scaffold assembly, and correct any deficiencies prior to use.
2. Use only proper access. Do not climb cross braces. Do not climb any scaffold component unless it is specifically designed for that purpose. Do not stand on platform overhangs.
3. Climb safely!
  - a. Face the rungs as you climb up or down.
  - b. Use both hands.
  - c. Do not try to carry materials while you climb.
  - d. Be sure of your footing and balance before you let go with your hands. Keep one hand firmly on frame or ladder at all times.
  - e. Clean shoes and rungs to avoid slipping.
4. **Do not** work on slippery platforms.
5. **Do not** overload platforms with materials. Special care must be taken when putlogs are used.
6. **Do not** store materials on platforms supported by putlogs. They are designed for personnel only.
7. **Do not** extend working heights by standing on planked guardrails, boxes, ladders or other materials on scaffold platforms.
8. **Do not** loosen, detach or remove any component of a scaffold assembly except under the supervision of a Competent Person. Components that have been removed must be replaced immediately.
9. **Do not** erect scaffold on wagons, trucks or other wheeled vehicles.
10. Stand only within the platform area; do not try to extend work area by leaning out over guardrailing.

### B. Use Of Rolling Towers

All of the above precautions plus:

1. **Do not ride manually propelled rolling scaffold. No one must be on a rolling tower while it is being moved.**
2. Lock all casters before getting on a rolling tower. Casters must be locked at all times the scaffold is not being moved.
3. **Do not** bridge between rolling towers.

4. Remove all materials from scaffold before moving a rolling tower.
5. Be sure floor surface is clear of obstructions or holes before moving scaffold.
6. Be sure there are no overhead obstructions or energized electric power lines in the path when moving a rolling tower.
7. Rolling towers must only be used on level surfaces.
8. Move rolling towers from the base level only. **Do not pull or push** from the top.

## III. Dismantling Scaffolds

The following additional precautions apply when dismantling a scaffold:

**⚠ WARNING**  
**IT MAY BE NECESSARY TO ADD PARTS TO A SCAFFOLD BEFORE IT CAN BE DISMANTLED SAFELY.**

1. **Prior to removal or loosening** of any component, consider the effect the removal of the component, or the loosening of a joint, will have on the strength of the remaining assembly.
2. Check to see if scaffold has been altered in any way which would make it unsafe. If so, reconstruct where necessary before beginning the dismantling process.
3. Use only proper access. Do not climb cross braces or vertical members. Do not climb scaffold components unless they are specifically designed for that purpose.
4. Do not remove ties until scaffold above has been removed.
5. Visually inspect each plank to be sure it is supported on both ends and is safe to stand or work on.
6. Do not accumulate removed components or equipment on the scaffold.
7. Lower components in a safe manner as soon as dismantled. Do not throw components off scaffold.
8. Stockpile dismantled equipment in an orderly manner.
9. Remove scaffold components immediately after detaching from scaffold.

Understanding and following these safety guidelines will increase your personal safety and the safety of your fellow workers.

**Footnote 1:** California and some other states require a height-to-minimum base width ratio of three to one (3:1). Refer to the governing codes for your job location.

**Footnote 2:** Additional instructions and information are available from Safway regarding:

- Training & software resources
- Competent Person training
- Step-by-step erection and disassembly videos
- Individual & group training CD programs
- Safety guidelines for each product line
- Material management & utilization software
- Equipment estimating & drafting software

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