

EQUIPMENT BLOCKING

AR Training

DMME

Division of Mineral Mining

Updated 2012

Blocking

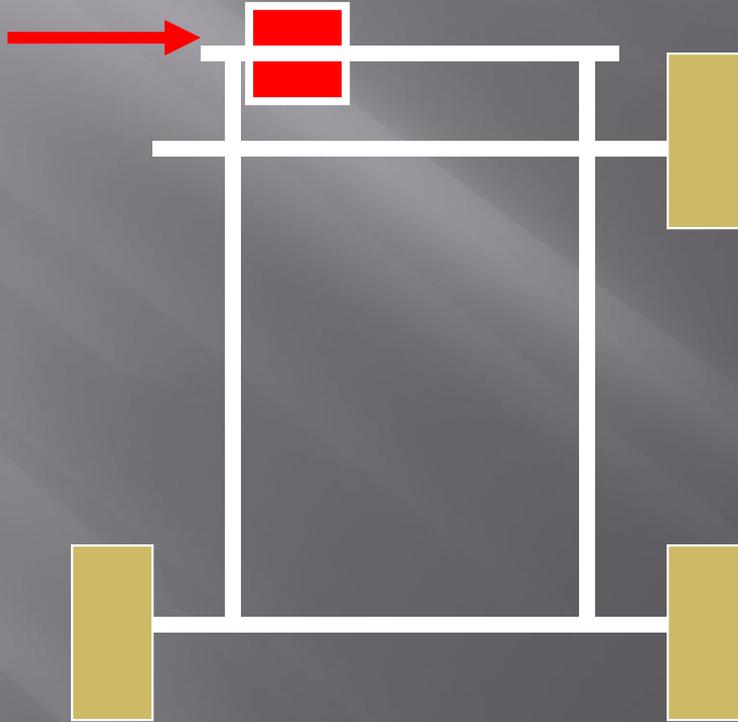
Only general safety procedures for jobs involving cribbing and blocking can be suggested. Each job presents its own problems and requires careful study and thorough planning. Most manufacturer owner's or operations manuals specifically outline blocking and cribbing procedures for the specific piece of equipment as well as recommended lifting points and practices. Blocking equipment and timbers should be selected with great care and should be the appropriate size and type for the application.

4 Points of Contact Rule

The 4 points of contact rule is simply this; you should maintain 4 points of contact with a solid surface at all times when blocking equipment in the raised position. Example: Front right frame blocked with all other tires on the ground. Most accidents involving jacks occur when individuals attempt to lift objects from a center point creating an unstable situation. Slight movements can cause an unbalance of the load, especially in cases where jacks are used that have a small contact surface.

4 Points of Contact

**Front Frame rail
blocked with
cribbing**



Tire set on firm ground

Tire set on firm ground

Tire set on firm ground

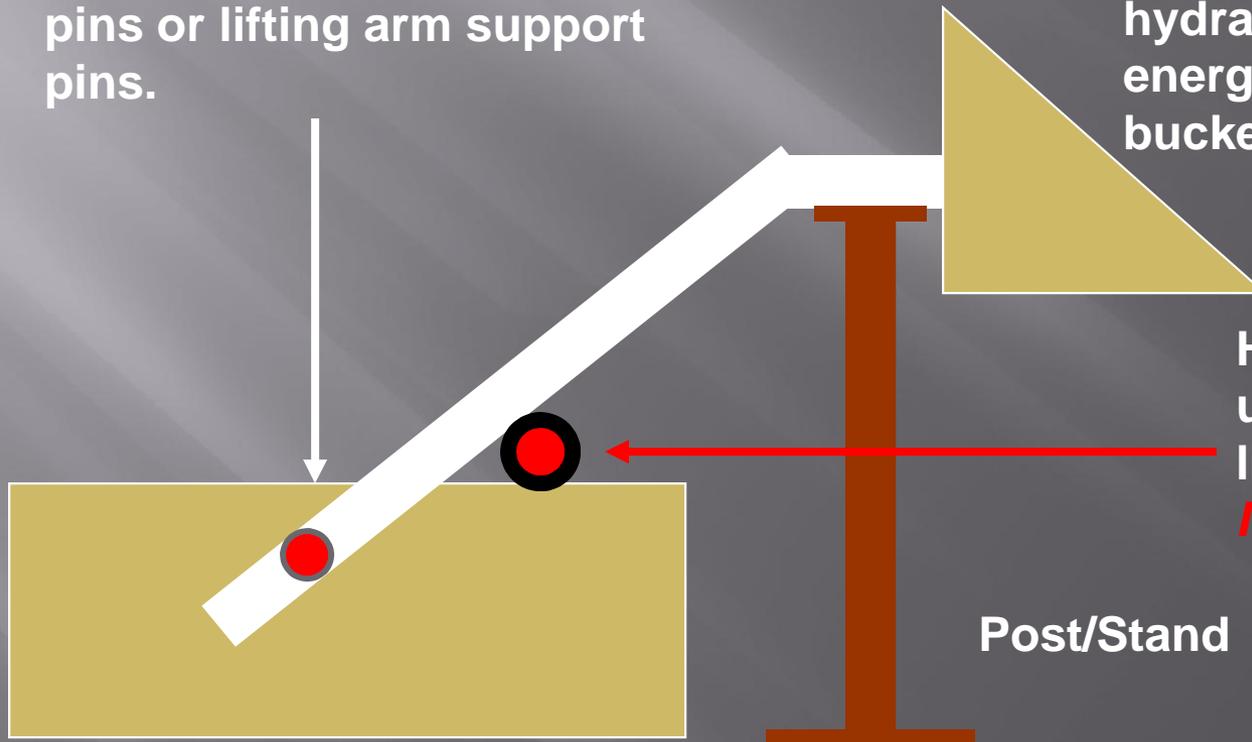
Blocking and Cribbing

When 4 points of contact cannot be maintained due to the type of lift such as lifting arms and loader buckets, you will need to use a minimum of 2 points of contact to maintain load stability.

Blocking and Cribbing 2 Points of Contact

Factory installed lift lock pins or lifting arm support pins.

Bucket should be rotated completely forward, hydraulic pressure/stored energy relieved and bucket contents emptied.



Horizontal piping used to support lifting arms.
Improper blocking!!

Post/Stand

Chocking

Prior to any lift for blocking and cribbing, the worker must chock the vehicle and block it against any hazardous motion. Chocking should be done on the downhill side of the lift. When possible, use two chocking points due to the increased weight and pressure generated by jacking or lifting the object and forcing the vehicle weight back onto the tires opposite of the lift. Care should also be taken to disconnect any starter devices to assure the equipment is not accidentally moved and that the vehicle parking brakes are set. *Tag out!*

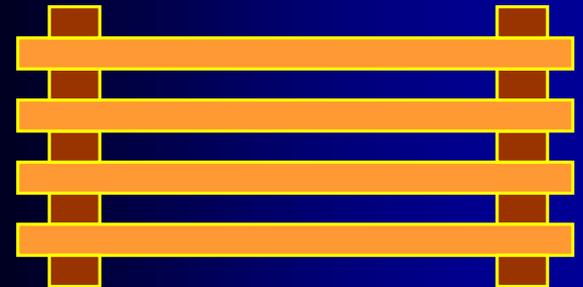
Blocking Devices

- ▣ Cribbing
- ▣ Jack stands
- ▣ Metal stands
- ▣ Pipe
- ▣ Dump bed blocking devices
- ▣ Locking pins
- ▣ Overhead cranes and cables
- ▣ Chains
- ▣ Hydraulic jacks

Cribbing

Cribbing is usually built out of large timbers similar to railroad ties. Although the size of timbers varies, they are usually about 2 inches wider than they are thick. Never use round, triangular or smooth surfaced objects to build a crib. Such materials will allow the supported load to move or shift.

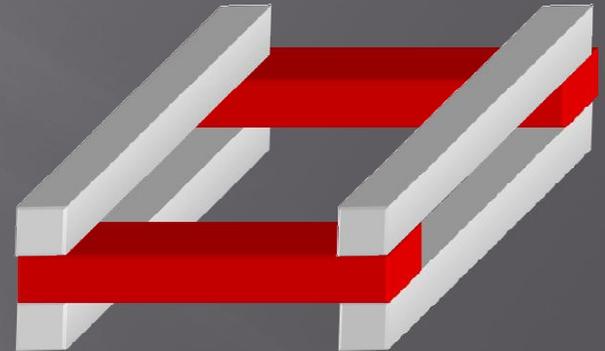
Cribbing



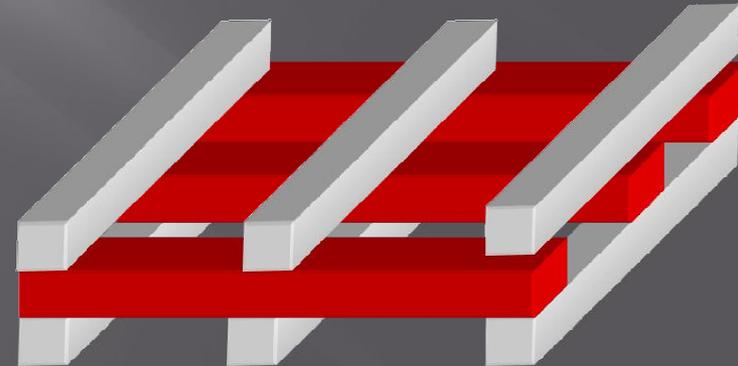
Cribbing Strength

The capacity of a crib is determined primarily by the contact area where overlying timbers contact one another. Two rows of 4-point cribs can be replaced with one row of 9-point cribs without loss of support capacity

4 Point



9 Point



Suggested Load Limits for Timber Beams



Horizontal

Loads Given in Pounds Concentrated at Center of Span



Vertical

Douglas Fir Structural Grades

Size In Inches	Beam Span In Feet									
	4	6	8	10	12	14	16	18	20	24
4 x4	990	660	500	390	330	280				
4x6 Horizontal	1530	1000	750	600	500	430	370	330		
4x6 Vertical	2280	1520	1140	910	760	650	570	510	455	380
6x6	3460	2310	1730	1380	1150	990	860	770	690	570
6x8 Horizontal	4710	3140	2360	1880	1570	1340	1170	1040	940	780
6x8 Vertical	6430	4260	3180	2520	2080	1760	1520	1330	1170	940
8x8	6690	6660	4330	3440	2840	2400	2070	1810	1600	1280
8x12 Vertical	10250	10200	10160	8150	6740	5730	4970	4370	3890	3160
8x14 Vertical	12050	12000	11940	11260	9320	7940	6890	6070	5410	4410
8x16 Vertical	13820	13760	13690	13630	12310	10500	9130	8040	7180	5870
10x10	10740	10690	10640	7020	5800	4930	4270	3740	3320	2680
10x12 Vertical	12960	12900	12840	10320	8540	7260	6300	5540	4930	4000
10x14 Vertical	15220	15150	15080	14280	11810	10050	8730	7690	6860	5590

Suggested Load Limits For Planks

Loads Given in Pounds Concentrated at Center of Span

SIZE IN INCHES	SPAN IN FEET							
	4	6	8	10	12	14	16	18
	SAFE LOAD IN POUNDS							
1X6	54	33						
1X8	72	43						
1X10	90	55						
2X4	200	130	90					
2X6	300	195	100					
2X8	400	260	190					
2X10	500	325	235	180				
2X12	600	390	285	220	165			
3X10	1245	820	600	465	370	305		
3X12	1495	980	720	555	445	370	300	
3X14	1740	1145	840	650	520	430	350	290

Cribbing Safety Factor

For sufficient strength, cribbing should have a safety factor of at least 4. The natural tendency to underrate the load should be guarded against. Cribbing must be placed on a firm level foundation in order to evenly distribute and balance the load. Cribbing should not be secured in a permanent fashion.

Cribbing Construction

Various loads will cause compression on the wood material and this compression will cause a slight movement in the wood. If the wood is secured together, this may cause fracturing or cracking of the wood along the grain leading to a failure of the cribbing piece. Cribbing should be assembled at the time of use so that proper sizing and placement can be considered. All contact surfaces of cribbing should be a hardwood and not a soft fir or pine wood.

Cribbing Construction

Wood used to construct cribbing should be of a similar type of wood. If different woods are used they should have roughly the same weight bearing characteristics. If soft wood is used in cribbing construction in conjunction with a hardwood, depending on the weight placed on the crib, the soft material could roll or deform causing a crib failure. Mixed hardwood cribs will typically provide 70% of the capacity of an all oak crib. Cribs constructed from hardwoods and softwoods will perform like softwood cribs. The crib is only as strong as its weakest timber.

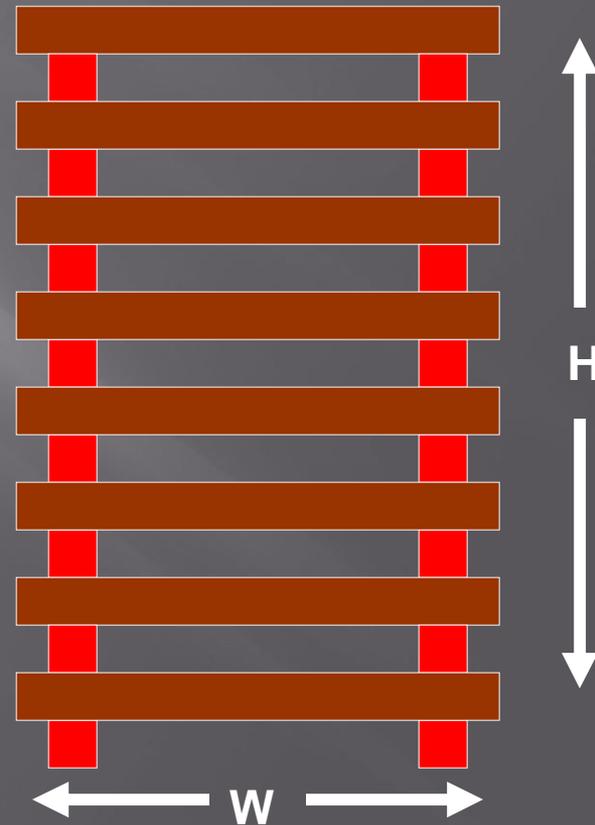
Cribbing length

Length of cribbing material should be so that the cribbing material extends no more than 12-18 inches beyond the support area. As timber length increases, the center point strength will decrease. When timber length is too short, you will have an inadequate contact and support surface for the equipment or material.

Aspect Ratio

Maintain aspect ratio between 2.5 and 5.0. Remember the 26 + 3 rule. Timber lengths should increase by 3 inches for each additional foot of crib height, starting with 26-inch timbers at a 5-foot height.

$$\text{Aspect Ratio} = H/W$$



Composite Cribbing

With the increased popularity of recycled materials, industry has developed composite cribbing materials in a wide range of sizes. These materials are more expensive than wood products, but hold the advantage of less weight and they are also chemical and oil resistant. If you use your cribbing material in a corrosive or oily environment, this may be an option worth exploring.



Cribbing Placement

- ▣ Place or locate cribbing on a firm stable platform. If placing cribbing on sand or other soft material, place a metal or large wood support plate underneath to assure proper load distribution.
- ▣ When blocking equipment with cribbing, all blocking points should contact the equipment frame or other flat stable surface to assure load stability.
- ▣ All blocked or cribbed equipment should have at least 4 points of contact with the ground to assure load stability.
- ▣ Make sure cribbing used is of the appropriate size and type to support the load. You must know the weight of the equipment to be blocked or cribbed.

Wood Posts

Posts should not be used for blocking of equipment unless the post has been fitted with an appropriate top cap and base. These top caps and base plates help stabilize and evenly distribute the load bearing surface of the post. Top caps should be at least 1.5 times and base plates used should be at least 2 times the diameter of the post used and made of a hardwood material. Top cap and base plate thickness will vary depending on the weight to be supported. Weights over 1800 pounds have the potential to seriously damage the top caps of the posts unless they are properly positioned. Posts used for blocking should be no longer than 36 inches in length due to the probability of load instability or load swaying. Vertical weights will need to be calculated carefully and the posts squarely set in order to achieve proper load stability. Uneven end cuts on posts will reduce the strength of the post due to uneven load distribution.

Jacks



When using a jack, the worker should check the capacity plate or other marking on the jack to assure the jack is rated to support the load placed on the unit. When there is no plate, capacity should be determined by contacting the manufacturer, then painting the capacity on the side of the jack. Once the intended load is lifted, the load should then be supported by jack-stands or crib blocking, especially if persons intend on working under the supported load. When selecting jack stands, select stands that exceed the intended support weight. As with cribbing, stands should be placed where they contact the frame and in a location where they come in contact with a flat stable surface.

Use of Jacks

- ❑ Set parking brake, if equipped. Chock or block equipment prior to lift. Tag out and disconnect any power/starting source.
- ❑ Inspect jacks prior to use. Any signs of damage or hydraulic fluid leakage should eliminate the jack from use until repairs can be made and the mechanical integrity can be verified.
- ❑ Make sure that the floor or ground surface where the jack is placed is level and clean and that the safe limit of floor loading is not exceeded. If the ground surface is used, the jack should be placed on substantial blocking (3/8 metal sheet or hardwood blocking at least twice the size of the jack).

Use of Jacks, cont.

- ❑ Make sure the jack is level. If the surface is not level the jack should be placed on blocks and leveled by substantial shims or wedges and placed securely so that the wedges and shims cannot be crushed or forced out of place.
- ❑ To prevent the load from slipping, no metal to metal contact should be permitted between the jack head and the load. A hardwood shim longer and wider than the face of the jack should be placed between the jack head and the contact surface of the load. Two inch wood stock is suitable for this purpose.
- ❑ Lift only on those areas of the vehicle specified by the manufacturer.

Jack Stands/Metal Pipe Stands

- ▣ When utilizing jack or metal pipe stands, it is preferable that you utilize RATED equipment that complies with the minimum standards set forth in the ANSI standard B30.9.
- ▣ All equipment should have the safe working load of the device clearly affixed to the side of the device.
- ▣ All equipment must be inspected prior to each use to ensure it is in good condition.

Jack Stands/Metal Pipe Stands, cont.

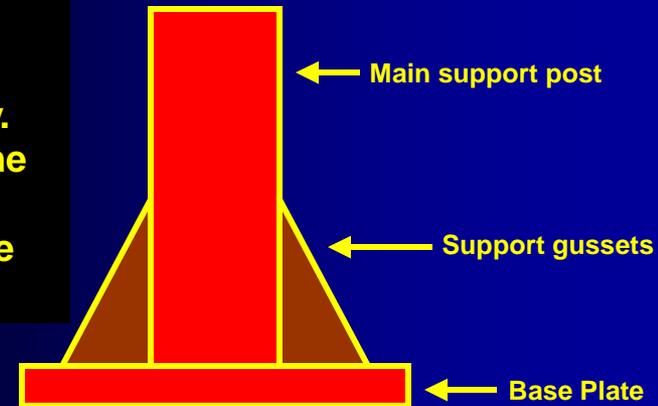
- ▣ If the company opts to build their own stands for support, it is advised that they design their stands with the following criteria in mind:
 - ▣ Substantial construction.
 - ▣ Constructed from suitable materials.
 - ▣ Designed for the intended weight and service environment.
 - ▣ Have at least the industry standard 4:1 safety factor.
 - ▣ Design approved or reviewed by a mechanical engineer for structural integrity.
 - ▣ *Assembled by a certified or competent welder.*
 - ▣ Load tested prior to service work to assure structural integrity and clearly labeled so users know what the load rating is for the particular device.

Piping

The operator needs to realize that the selection of the appropriate type and size of pipe is critical. All piping used should be a schedule 80 with a minimum diameter of 2 inches. The diameter will depend on the weight to be supported and do not forget to figure in a 4:1 safety factor. All piping used for stands should have a substantial base and top cap that should be at least twice the diameter of the pipe used for the stand. Stands that cradle the load are preferable over a flat support surface. Both upper and lower plates should be gusseted for additional support.

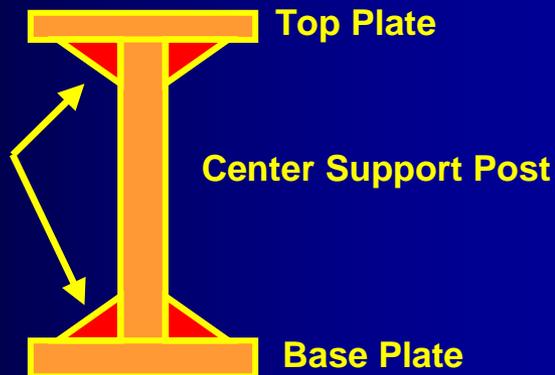
Jack or Fixed Stands

Example of a stand or support post that was constructed without a top plate. This is the common type of stand built in industry today. When using these stands be sure to use some type of blocking material to prevent metal slippage and assure that there is an adequate contact surface against the equipment.



Jack or Fixed Stands

Gussets placed on the upper and lower support plates to increase strength. 4 gussets should be used for each support.

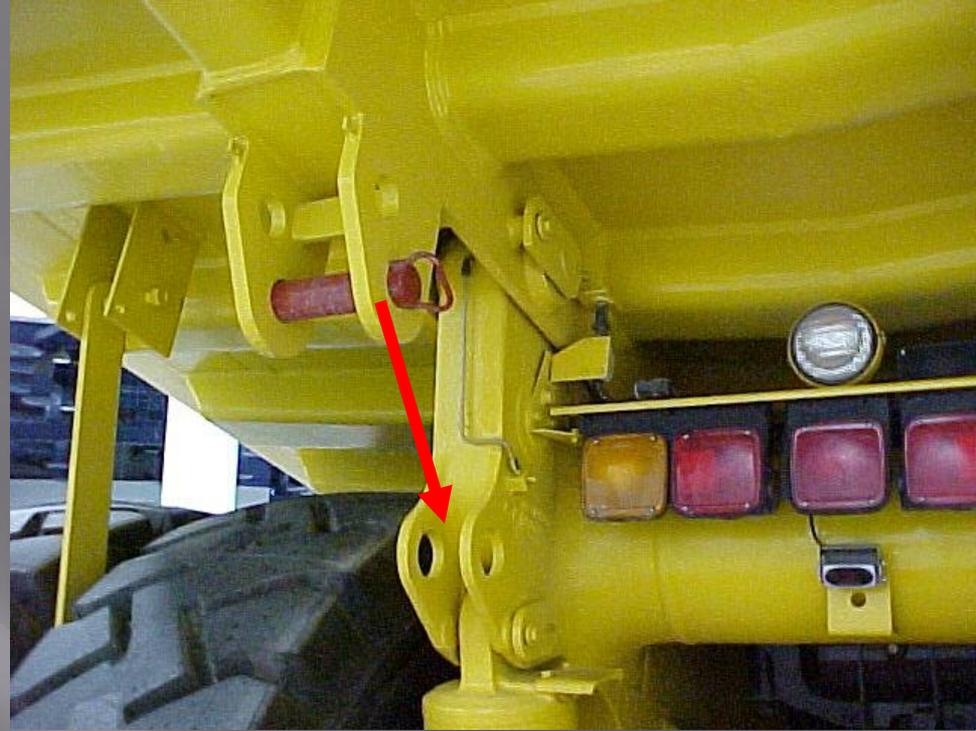


Overhead Cranes, Cables and Chains

Overhead cranes and mobile cranes with associated lifting devices should only be used to position the intended load for blocking. This should also apply to any hydraulic devices used for lifting purposes. At no time should these devices be considered the primary form of blocking for working on equipment in the raised position. All lifting devices used should be of adequate strength and size to handle the load placed on them. Once the load is lifted to the proper location and height, the load should be securely blocked to prevent uncontrolled free fall. This should be done by utilizing methods previously discussed.

Dump Bed Locking Devices

Dump bed locking devices were commonly installed on mobile equipment after 1980. All bed locking devices that are installed by the manufacturer are rated for the load of the dump bed if both locking devices are used. It is common to see the use of only one of these devices at a time. This practice has the potential to create an unbalanced load which may facilitate failure of the device depending on the application. If these devices become damaged and need to be replaced, they must be replaced with the manufacturer specified replacement material or parts in order for these devices to function properly. If both locking devices or one of the locking devices must be removed for any reason, then the operator must use supplemental supports of equal or greater strength to secure the load in the raised position. These supports must be placed in such a manner as to prevent the accidental release of the raised component. Hydraulic check valves should not replace or substitute for the use of blocking devices.

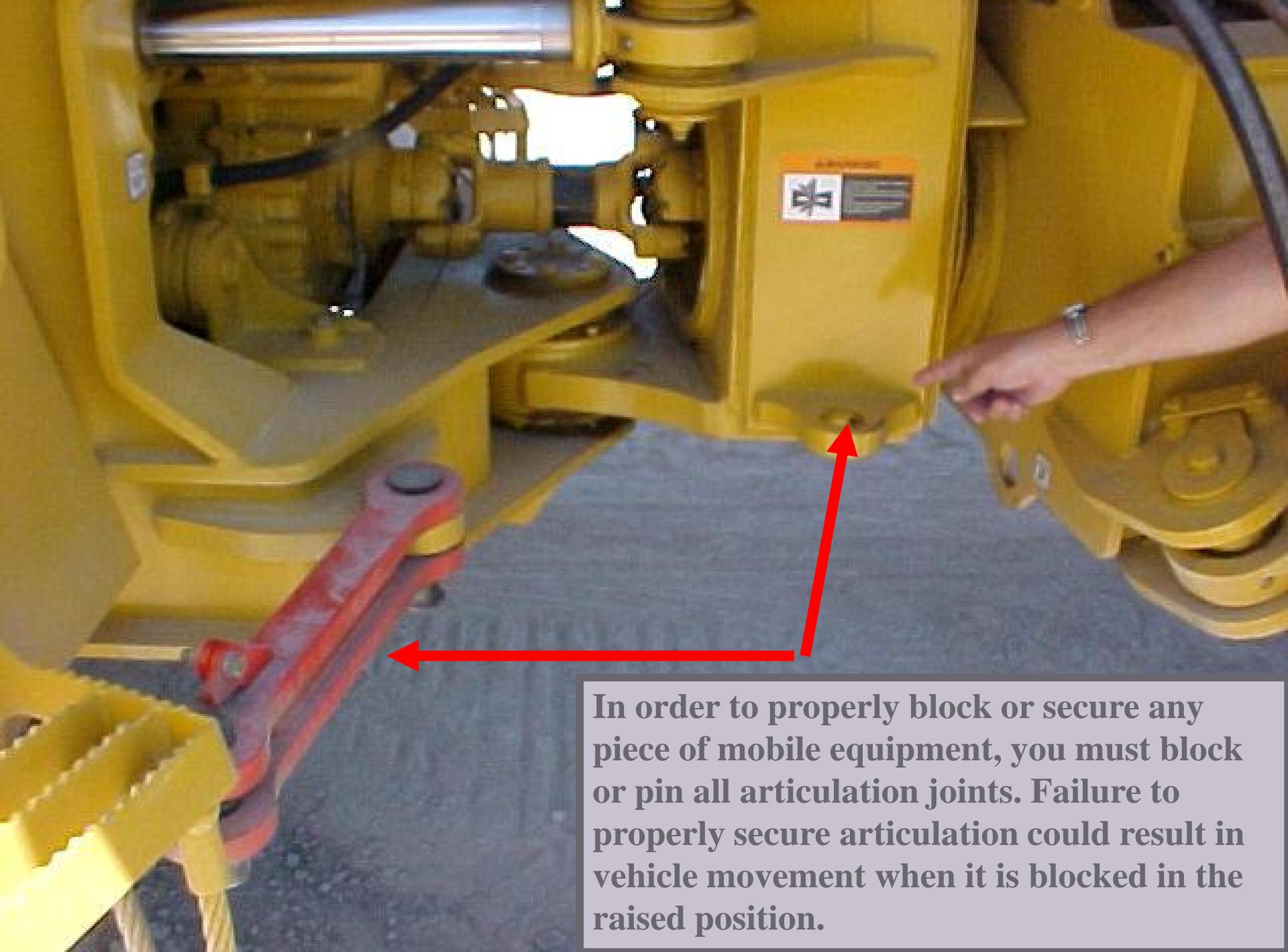


Pin Lock Device

Locking Pins

Similar to some dump bed locking devices, these pins are usually designed to be placed under or through the lifting arms of mobile equipment in the raised position. Typically, the manufacturer will have two of these devices for each piece of equipment. As with other locking devices, both pins need to be used in order to prevent improper load distribution, which may lead to a failure of the support. Many workers choose not to use these devices due to the set positioning of the lifting arms. The worker will instead place a piece of 2 inch pipe or round stock under the lifting arm and then lower the lifting arms down onto the support. This practice should be discouraged due to the probability of the support slipping out under load. An adjustable cradle type stand should be used in place of the pipe or round stock for load support.





In order to properly block or secure any piece of mobile equipment, you must block or pin all articulation joints. Failure to properly secure articulation could result in vehicle movement when it is blocked in the raised position.

TURBO 4x4

310SE

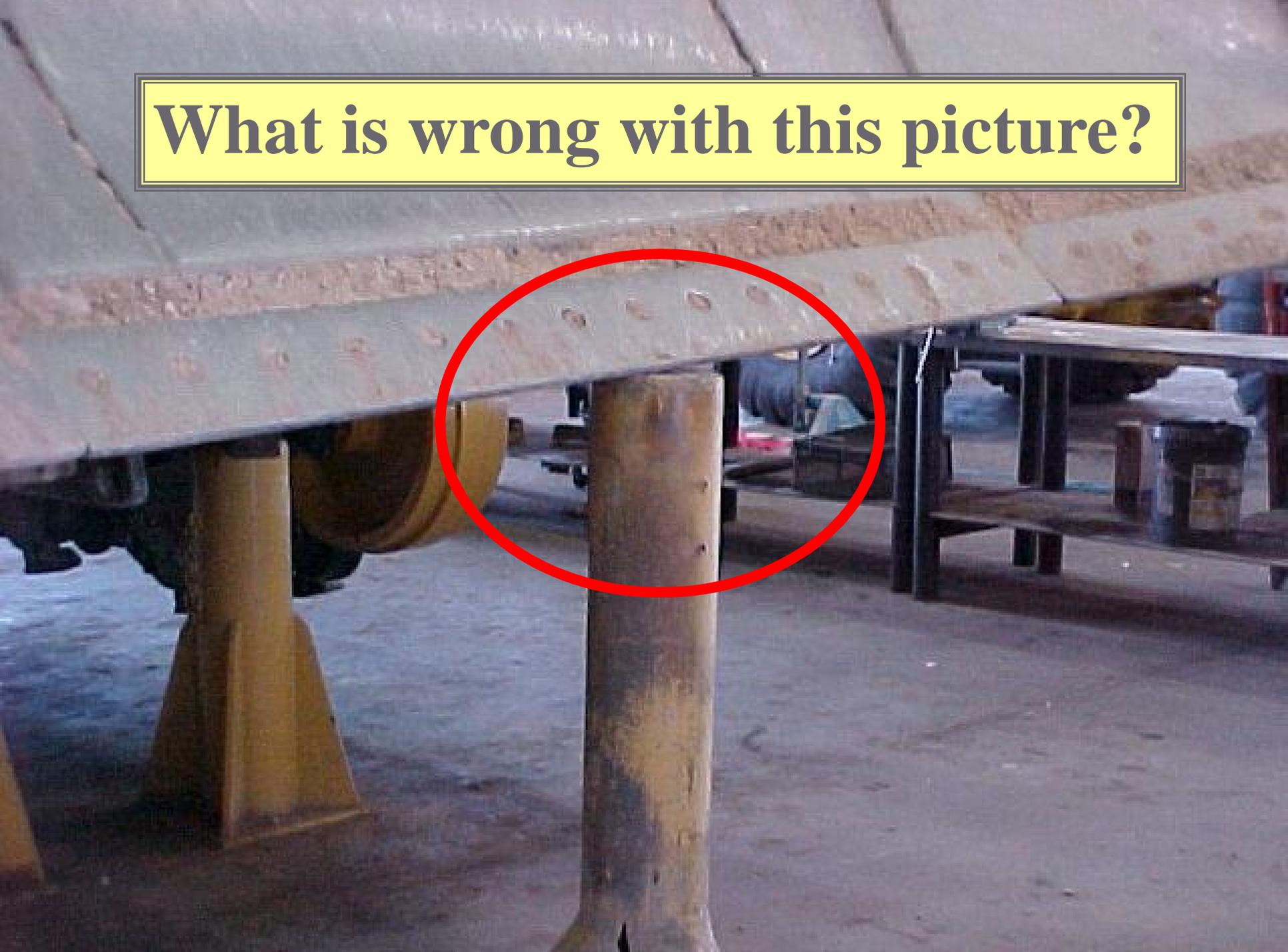
Lift Cylinder Locking Device



Primary Lift Cylinder Locking Device



What is wrong with this picture?





All buckets, forks or attached implements should be rotated all the way forward and rested on a firm surface if possible when blocking equipment. At no time should an individual rely on the lift cylinders or the bucket as a blocking device even if check valves have been installed.





Example of an operator cribbing an engine in place while performing repairs. Two points of contact?

Guidelines for Blocking and Cribbing

- ▣ Park equipment on flat stable ground if possible.
- ▣ Set parking brake and chock.
- ▣ Know the weight of the equipment to be cribbed or blocked.
- ▣ When using cribbing, use cribbing of the appropriate size and type for the weight of the equipment.

Guidelines for Blocking and Cribbing, cont.

- ▣ Tag out and disconnect batteries or starting devices on blocked equipment to prevent accidental movement or starting. Cable end locking devices are available.
- ▣ Use manufacturer designed blocking pins or devices if provided.
- ▣ Consult manufacturer's operations manual for recommended blocking and lifting points.

Guidelines for Blocking and Cribbing, cont.

- ▣ Inspect cribbing and blocking material for:
 - Cracking
 - Splintering
 - Excessive oil or grease buildup
 - Nails, screws etc.
 - Bent top and base plates as well as supports
 - Bent or missing lock pins
 - Charred
 - Cribbing should never be painted or stained

Guidelines for Blocking and Cribbing, cont.

- Place cribbing on flat stable ground if possible, provide a substantial base material to adequately distribute the weight of the blocked or cribbed equipment. If you are unable to position the vehicle on level ground then you will need to level the initial layer of cribbing or base plate with wedges or tapered material.
- If using jack stands and jacks, use approved load rated equipment that meet ANSI requirements.
- Use cradle type jack stands vs. flat top plate type stands where called for.

Guidelines for Blocking and Cribbing, cont.

- ▣ Maintain 4 points of contact on mobile equipment and 2 points of contact on attached implements and hydraulic devices.
- ▣ Block or pin articulation points to prevent movement when blocked or cribbed in a raised position.
- ▣ When repairing articulation points, securely block both sides of the articulation point to prevent accidental movement.

Guidelines for Blocking and Cribbing, cont.

- ▣ When cribbing large heavy pieces of equipment, the worker should take the time to crib as they go. Should an accidental failure occur, this may prevent or minimize possible injury to employees and damage to equipment. This technique should also be used when it is necessary to elevate equipment in order to perform maintenance work.
- ▣ Never rely on hydraulic check valves or overhead cranes to provide proper blocking.

Guidelines for Blocking and Cribbing, cont.

- ▣ Treat cribbing and blocking as any other task that would require appropriate task training. An individual's knowledge should be evaluated by a competent person prior to beginning work. Take the time to properly train employees.