



ATTILA Air Transportability Test Loading Activity

DOD Focal Point for Air Transportability and Airdrop Issues

Tiedown and Restraint 102

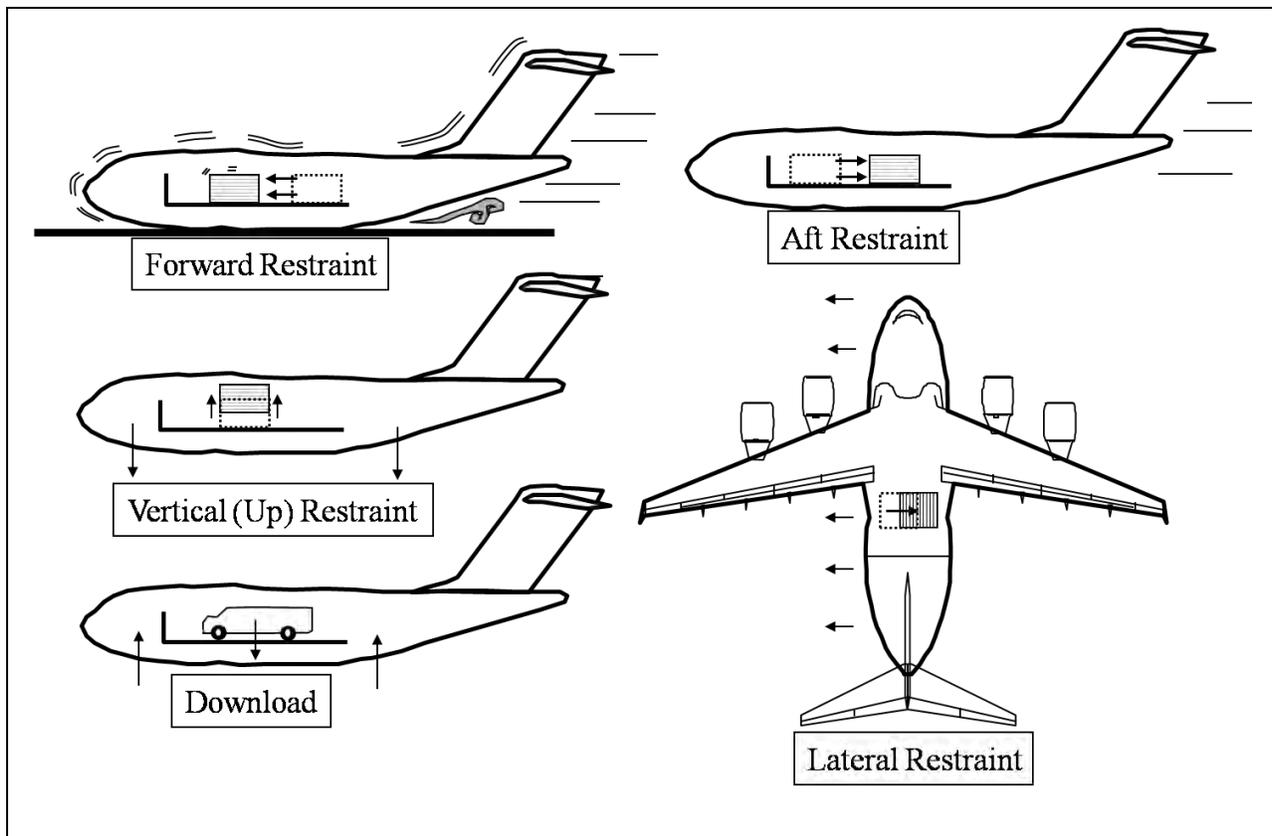
An updated tutorial on tiedown and restraint of cargo on USAF cargo aircraft

1 General.

All airlifted cargo must be restrained so it will not shift during any of the flight conditions that can normally be experienced by the aircraft. Dynamic forces caused by various flight conditions (air turbulence, rough landings, extreme flight attitudes, survivable crashes, etc.) tend to move the cargo in a forward, aft, side, or vertical direction or combinations of these directions. These forces are directly proportional to the cargo object's mass (weight) and to the rate of change in the aircraft's flight velocity. These forces are commonly expressed in units of gravitational force, signified herein by the letter "G". (FIGURE 1)

These dynamic forces may be resisted by the application of restraining static loads to equal the dynamic loads. Except for vertically down, the restraining static load is achieved through the use of nets, straps, chains, etc. attached between the cargo object and the aircraft. The amount of restraint needed in each primary direction is equal to the weight of the object multiplied by the anticipated G loads.

FIGURE 1. Restraint for various situations.



2 Aircraft systems.

There are two types of restraint systems on the aircraft. Palletized loads generally use the rail system locks. Rolling stock and bulk loads generally use the floor tiedown rings along with aircraft provided tiedown devices (FIGURE 2). Tiedown rings are also used to restrain palletized or accompanying loads when the load-carrying system, such as a pallet or trailer, cannot fully restrain the item.

2.1 Aircraft tiedown ring.

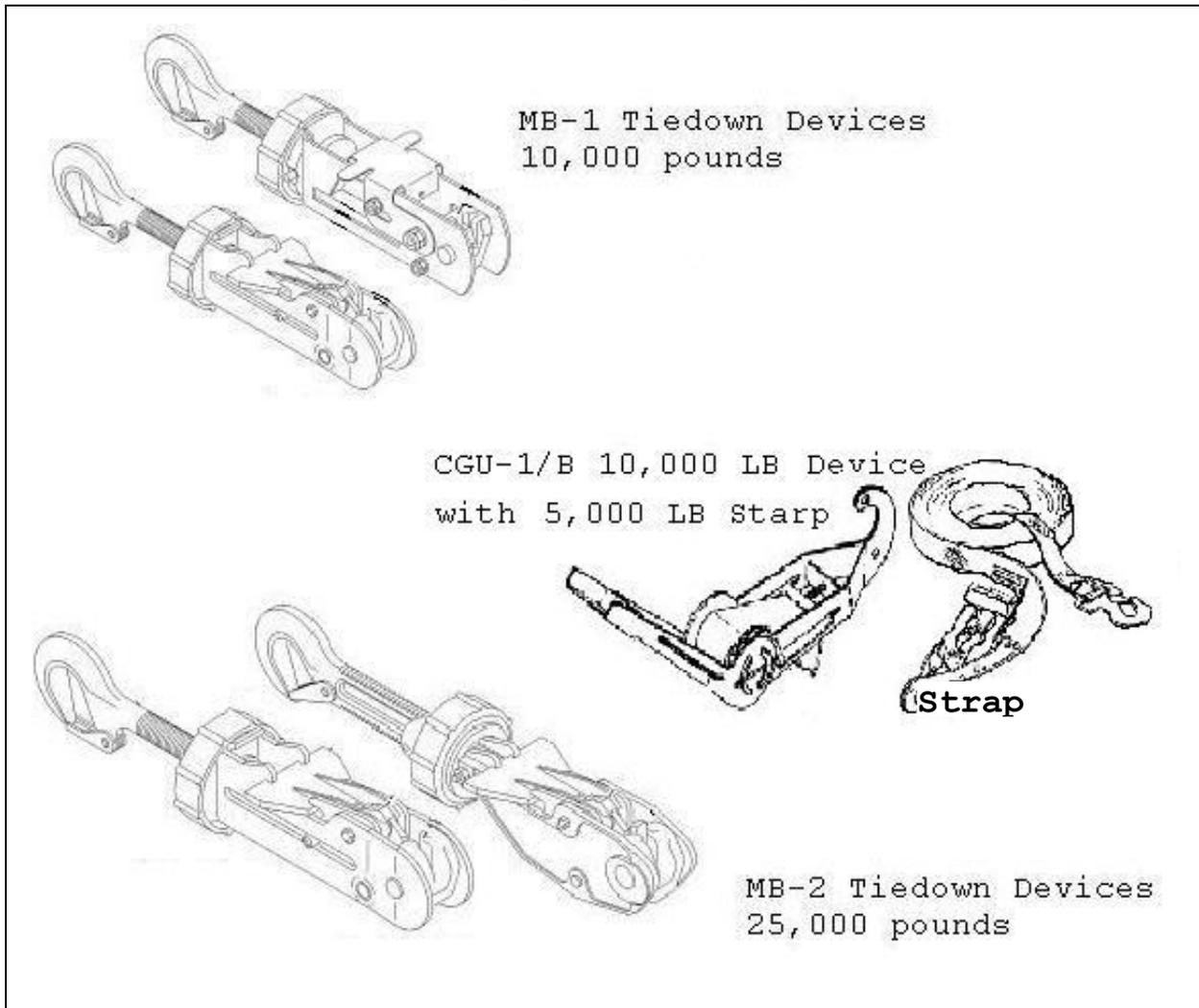
On the C-27 and C-130 the majority of tiedown rings are rated at 10,000 lbs in any direction. The C-130 ramp rings are rated at 5,000 lbs. On the C-17 and C-5, the rings are rated at 25,000 lbs. Each aircraft comes equipped with tiedown devices, chains and straps, so that the item owner does not have to provide the tiedown material. The tiedown device and its associated chains or straps are stowed separately throughout the cargo compartment. See the appendices for each type of aircraft or the appropriate T.O. 1C-XXX-9 cargo loading manual for more detail.

2.2 Tiedown devices.

All aircraft are equipped with straps and chains and their associated tensioning devices to secure the item to the airplane.

The only tiedown devices currently approved for air transport use are those currently in USAF inventory, illustrated on Figure C-9. Commercial restraint straps or chains, regardless of rating, are not approved at this time. Any nonstandard tiedown device shall be evaluated by ATTLA. Chains or metal tiedown devices shall have a minimum safety factor of 1.5 whereas fabric tiedown straps or devices such as webbing shall have a minimum safety factor of 2.

FIGURE 2. Tiedown devices.



2.3 Restraint Levels.

All cargo must be restrained to prevent movement during normal flight conditions, extreme flight conditions, and hard landings. The published limits are summarized in Table C-II. The limits for tanker aircraft (KC-135 and KC-10) are different and the KC-10 limits are in accordance with FAA rules.

If there are personnel in front of cargo the cargo item must be restrained to 9Gs forward. Lateral and vertical restraint requirements are greater for KC-135 and KC-10 aircraft. For further details on calculations see MIL-STD-1791A

TABLE II. Restraint levels for cargo.

Direction	Level	Input Condition
Forward (fwd)	3 G	Hard landing or sudden deceleration
Aft or rear	1.5 G	Sudden acceleration
Lateral (side)	1.5 G	Skidding
Up (vertical)	2 G	Extreme turbulence
Down 1	4.5g	Hard Landing
¹ Primary cargo restrained by cargo floor. Secondary cargo must be restrained by primary cargo.		

3 Principles.

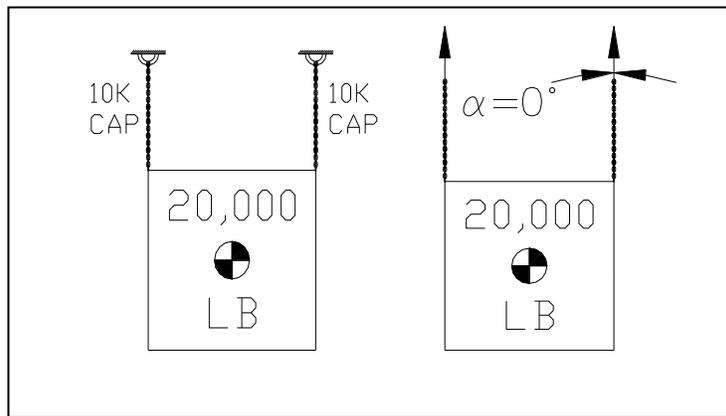
Certain fundamental principles must be observed when restraining cargo for flight. Although the details of tying down each unit of cargo vary with its bulk, weight, configuration, and position in the airplane, these basic principles of restraint are always applicable. If the principles are observed, satisfactory restraint of cargo movement can be achieved.

3.1 Basis of Analysis.

To develop sufficient strength in a tiedown, the strap, chain, or tension member must lead off in the general direction of the load to be restrained. The closer the tiedown can lie to the direction of the load, the more efficient the tiedown will be. This important point is illustrated below:

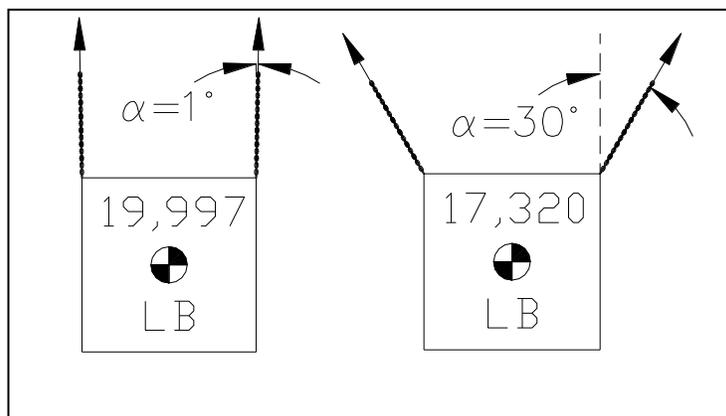
Consider a weight that is suspended by a pair of 10,000-pound capacity chains that are hanging perfectly vertical. The maximum amount of weight that can be suspended from the two chains is 20,000 pounds:

Figure 3



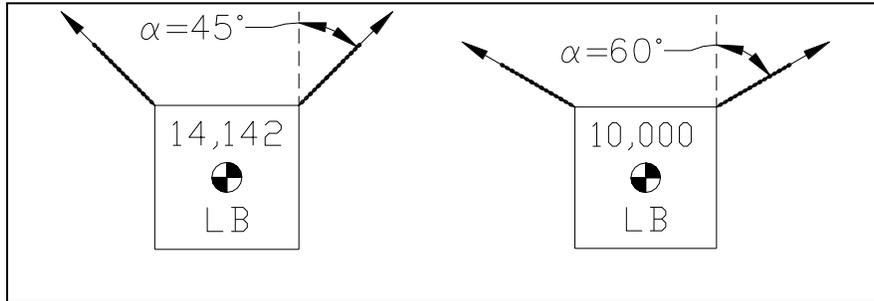
The drawings below illustrate that the amount of weight that can be suspended by the 10,000-pound capacity chains is dependent upon the angle (" α ") formed with the direction of required force:

Figure 4



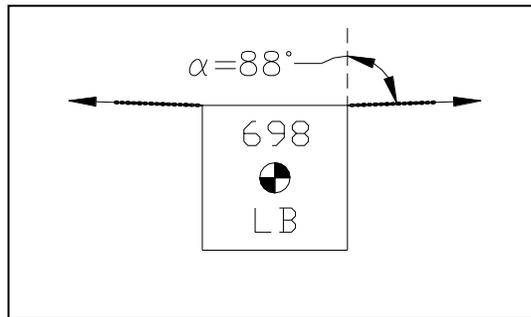
As the angle " α " increases, the vertical component of the chain strength decreases, as does the amount of weight that can be supported:

Figure 5



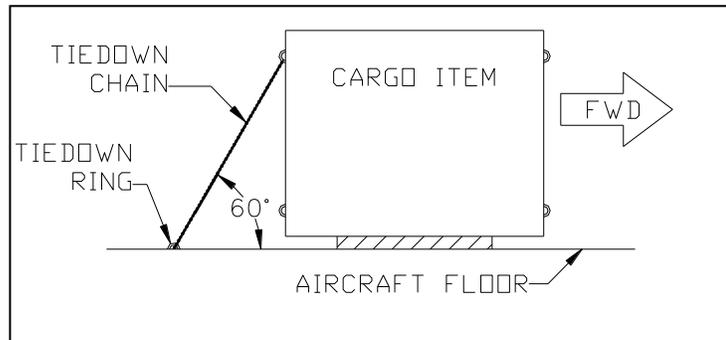
As " α " approaches 90 degrees, the amount of weight that can be supported approaches zero:

Figure 6



The above illustrations can also be visualized as a birds-eye view of a cargo item resting on the aircraft floor. The item weight would then be analogous to the restraint capability of the chain configuration used.

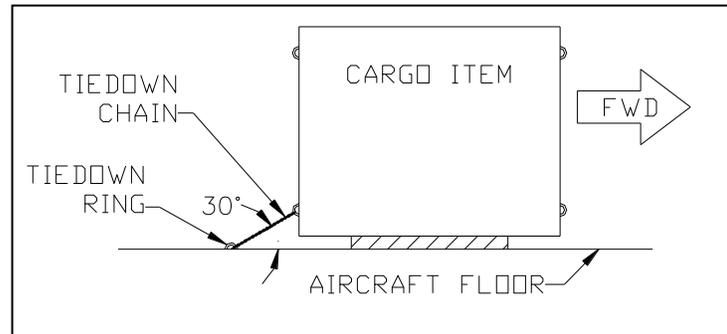
Figure 7



Assume the tiedown ring and chain hardware in Figure 7 has a working load limit of 10,000 pounds. If the chain is applied at a floor angle of 60 degrees, the strength available for restraint in the forward direction will be 5,000 pounds:

If the tiedown chain is adjusted to a shallower attachment angle, the strength available for restraint in the forward direction will increase proportionally with the decrease in floor angle. For example, if the tiedown chain is attached at a floor angle of 30 degrees as shown below, the strength available for restraint in the forward direction will increase to 8,660 pounds:

Figure 8



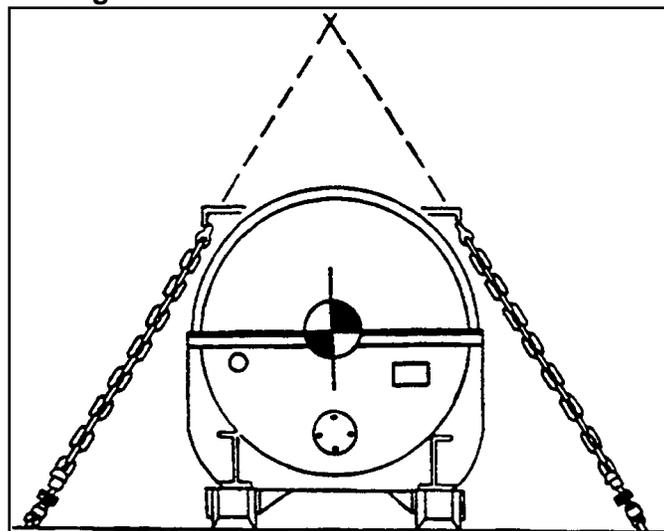
3.2 Usage Rules.

Determining types and quantities of tiedown devices to be used in restraining cargo should be based on the following:

- (1) Always secure cargo for the required amount of restraint with the minimum number of tiedown devices.
- (2) The maximum available restraint for any tiedown is determined by using the lesser rating of the following: the tiedown (floor) fittings used, the tiedown attachment points on the cargo item, or the effective strength of the tiedown device used.
- (3) Straps and chains shall not be mixed to restrain cargo in the same direction (due to different elongation characteristics). However, 10,000 and 25,000-pound rated devices with the appropriate chains may be used for a given direction of restraint.
- (4) Units of general cargo may be grouped and effectively restrained by cargo nets. Concentrated cargo units within such groupings must rest on the cargo floor or on pallets and be individually restrained by appropriate tiedown devices.
- (5) Tiedowns should be attached in a symmetrical pattern by using corresponding fittings on each side of the cargo floor centerline.
- (6) Use nylon tiedown devices on crates, boxes, or items that might crush easily. Nylon devices that are under tension loads can be easily cut; therefore, do not use nylon tiedown devices over sharp edges.
- (7) Use steel tiedown devices on heavy objects that have attachment lugs or a hard surface for the chains to wrap around.

When tiedown devices are attached to cargo, the lines of action for the tiedown devices should, if possible, intersect above the cargo center of gravity as shown below. Such a tiedown configuration reduces the tendency of cargo to overturn when subjected to combined upward and side loads.

Figure 9 CG location for effective restraint.

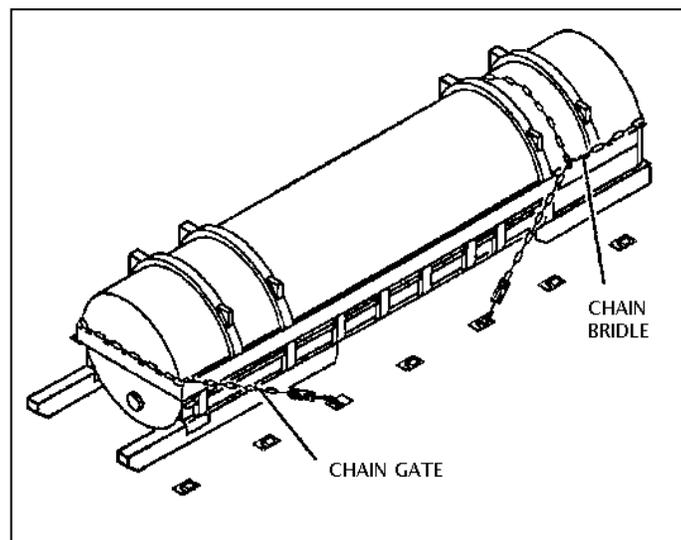


The point of attachment of a tiedown device to a cargo unit must be substantial enough to withstand the loads for which the cargo unit is being restrained. A tiedown device cannot be secured to any convenient protrusion on a cargo unit without due consideration of the protrusion's strength.

Although all materials stretch in direct proportion to the applied load, materials have varying rates of stretch. Under tension, nylon devices stretch more readily than steel and permit the steel device to assume the majority of the load. Therefore, when two or more tiedown devices are used in the same direction, the devices shall be of similar material and equally tensioned to ensure the load is evenly distributed.

Restraint straps or chains that are simply passed over or around a unit of cargo (instead of being attached directly to it) can provide double the strength of a single restraint, provided the capacity of the fittings is equal to or greater than the strap or chain capacity. Commonly called a strap or chain gate, this type of tiedown configuration can only provide restraint in a single direction. To increase the utility of this concept, a chain bridle may be used to obtain restraint in more than one direction:

Figure 10

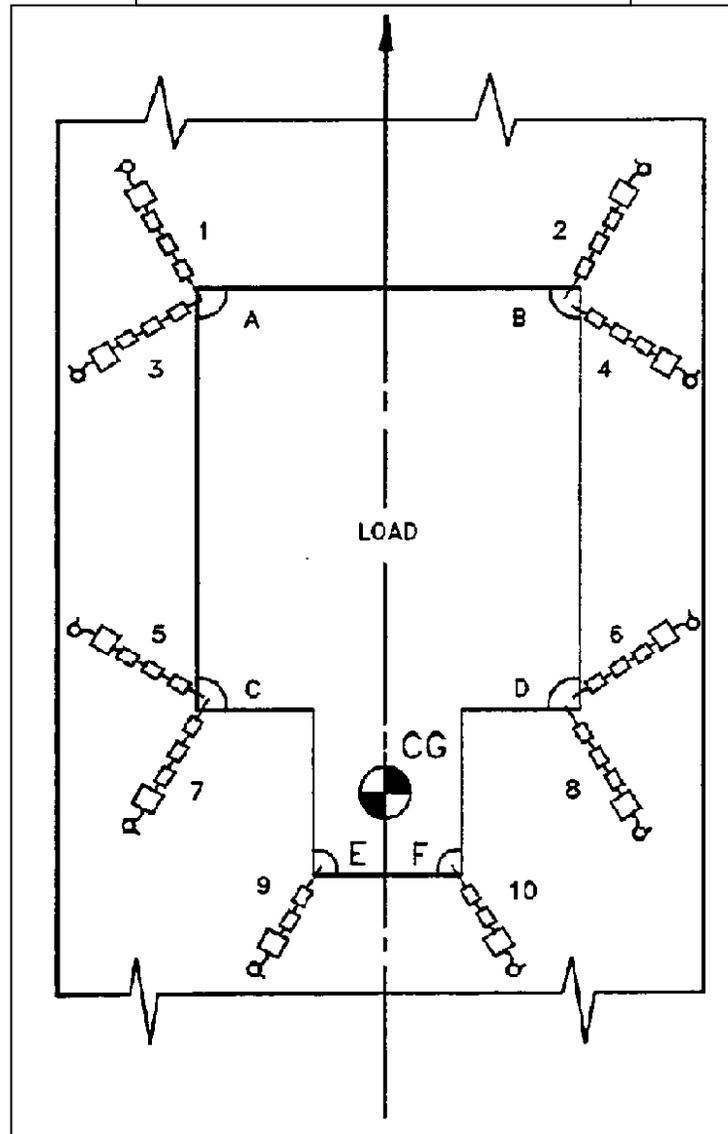


Unsymmetrical tiedowns permit load distributions that may ultimately result in tiedown device failure. Such a failure would result from the different load-deflection rates of dissimilar materials or of identical materials of different length. Any material subjected to a tension load will stretch. A longer length tiedown has more stretch potential than a shorter length tiedown. If two tiedowns of the same type and capacity are used to restrain a load in a given direction and one is longer than the other, the longer tiedown, with its greater stretch potential, will permit the shorter tiedown to assume the majority of any load that may develop. If the shorter tiedown becomes overstressed and fails, the longer tiedown would then be subjected to the full load and it, too, would likely fail. Therefore, symmetrical tiedowns should be as close to the same length as possible.

Tiedown device attachment generally follows similar patterns because of cargo floor tiedown ring layout and symmetrical restraint requirements. The following procedures shall be used when attaching tiedown devices to the cargo and to the tiedown rings on the compartment floor: (All references are to Figure 11)

1. Always compute the number of tiedown chains required. Apply aft restraint (tiedowns 1, 2, 5, and 6) in the opposite direction but at the same angle as the forward restraint (tiedowns 3, 4, 7, and 8). Use the same attachment point (points A, B, C, or D) on the cargo for attaching a forward and aft restraint chain if possible.
2. Apply restraint in a symmetrical pattern around the cargo unit being restrained. Always attach an even number of tiedowns (4 chains, or 6 chains, etc.) in pairs (1 and 2, 3 and 4, 5 and 6, 7 and 8, etc.) for forward or for aft restraint. The tiedown chains should be attached in a symmetrical pattern by connecting to opposite fittings (A opposite B, C opposite D, E opposite F) across the cargo floor centerline.
3. If the center of gravity is not located at the geometric center of the load--when possible--add an additional tiedown (tiedowns 9 and 10) on each side of the load to place the center of gravity equal distance between a pair of tiedowns.
4. Tiedown chains are normally attached to the cargo unit. Tensioning devices are attached first to the floor rings and then to the tiedown chains. Slack in the chains is removed by adjusting the tensioning device.

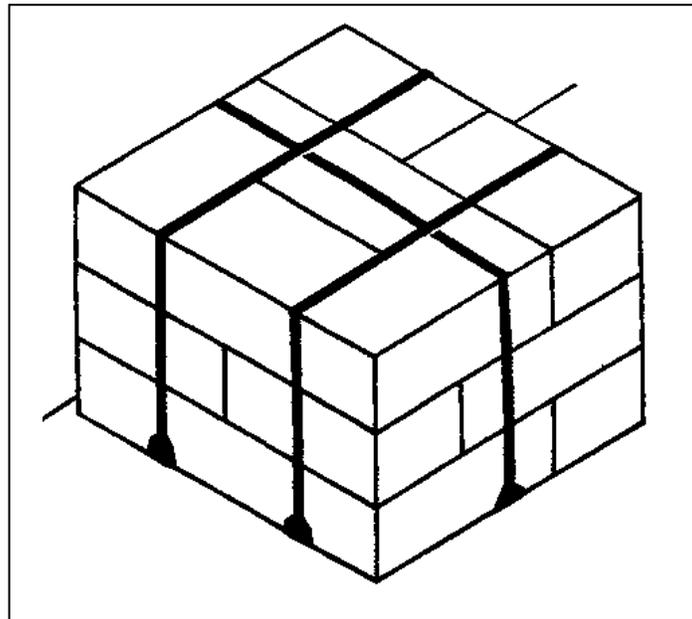
Figure 11



3.3 Bulk Cargo.

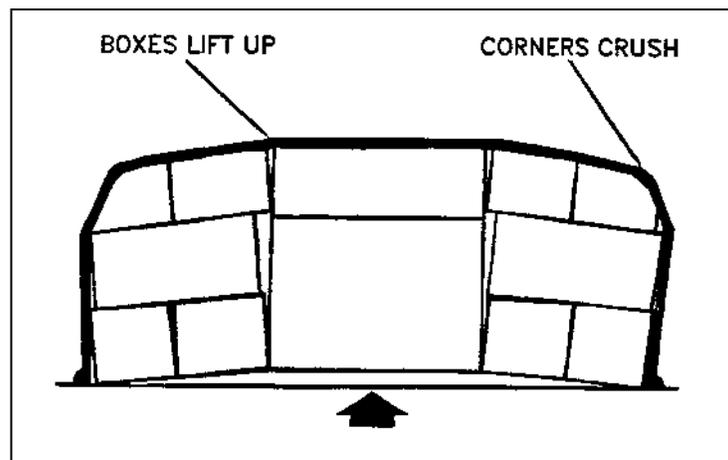
Cargo shall be tied down in such a manner that the load will be prevented from moving or changing shape. In the case of non-rigid cargo such as stacked boxes, it is important that the stack be prevented from collapsing or shifting. Inadvertent shifting of a single box within the load could loosen all the tiedowns. In the following example, tiedown is satisfactory for upward restraint, but not for sideward or forward/aft restraint.

Figure 12



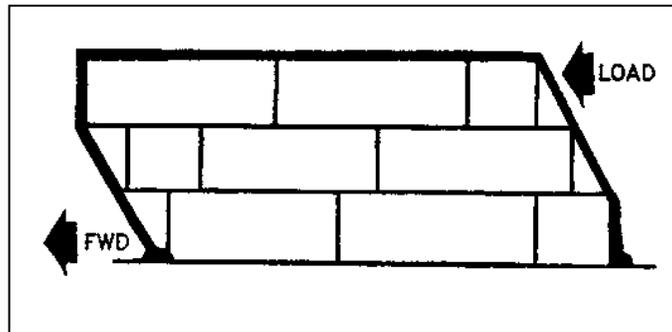
If the tiedowns are very long across the top of the load, a severe upward force will permit the cargo to move as shown below. Hence, the length of ties across the top of a load should be kept as short as possible. Alternatively, such cargo is commonly stacked in an “igloo” shape to begin with.

Figure 13



For forward or aft restraint, the type of tiedown shown in Figure 14 will not prevent the cargo shifting except for the friction forces introduced. Neglecting friction, the tiedown cannot begin to restrain the load until it has shifted so that the tiedowns begin to go in the same direction as the force.

Figure 14

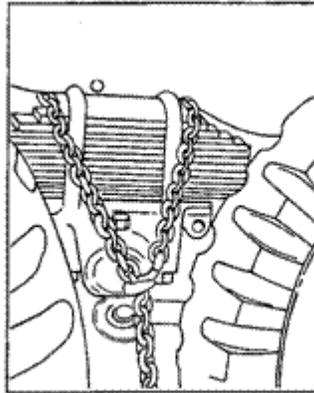


3.4 Rolling Stock.

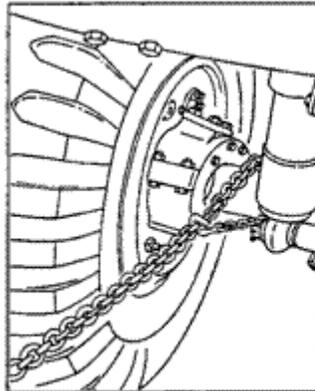
Inspect axles and other structures for the presence of hydraulic lines or electrical cables before attaching tiedown chains around these hidden areas.

Less than one half of the total restraint required should be achieved through application of tiedowns to the axles or other un-sprung parts of vehicular suspensions. Rationale: The sprung part of a vehicle (upper body and chassis) will exhibit excessive movement under dynamic loading if the vehicle is primarily restrained through only the lower un-sprung components such as wheels or axles. It is highly desired that all restraint be achieved through tiedown of the vehicle frame.

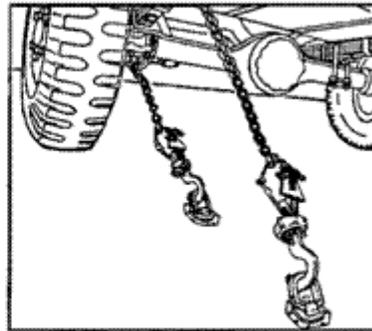
FIGURE 15.
Restraining
around
structures.



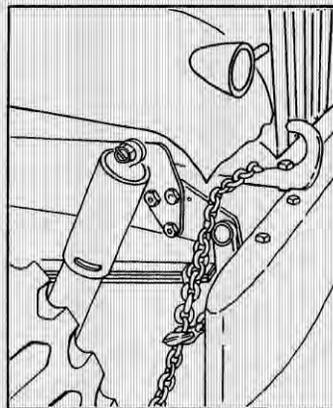
AROUND EQUALIZER TRUNNION BAR
AND OVER SPRING



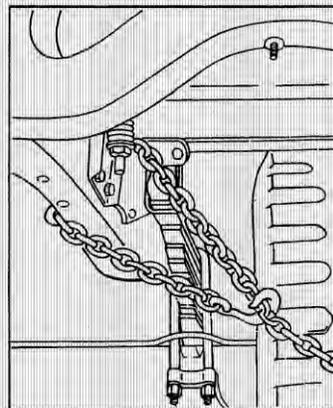
AROUND AXLE



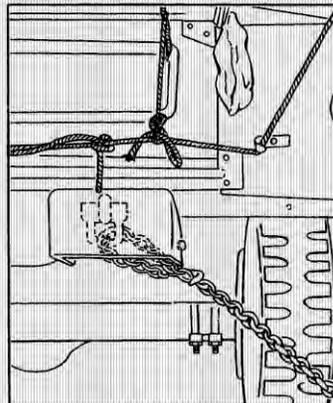
MB-1 TIEDOWNS ATTACHED TO FLOOR FITTINGS



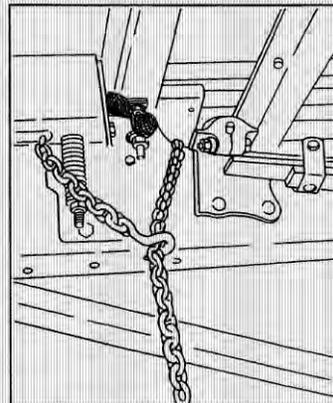
AROUND FRAME, AFT OF BUMPER



AROUND FRAME



AROUND REAR LIFTING CLEVISES



OVER FRAME AND UNDER CROSS MEMBER

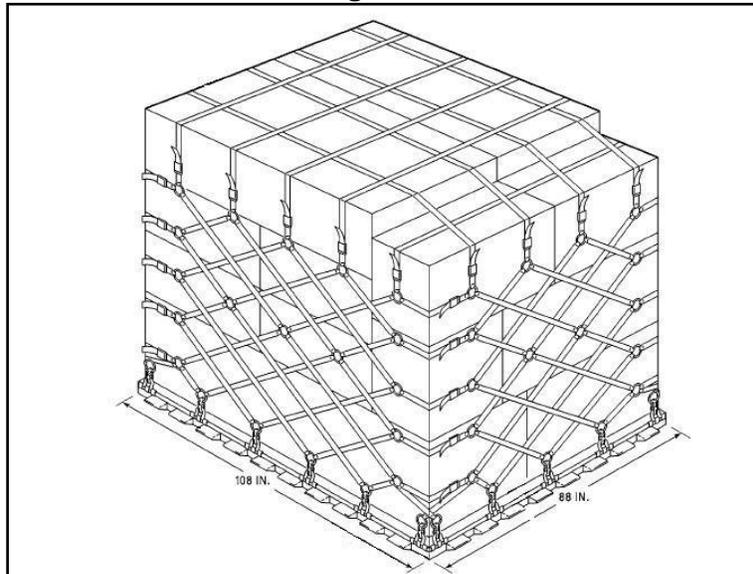
3.5 Palletized cargo.

Restraint of palletized cargo is usually accomplished by restraining to pallet side rings. Large or heavy cargo may also be restrained to the aircraft floor.

3.5.1 Restraining cargo to the pallet.

Cargo is typically restrained to the pallet side rings as shown in Figure 16. Cargo may be covered by a cargo net or restrained directly to the side rings. The 463L pallet side rings are rated at 7500 pounds each, and the rings for Type V and Type VI (DRAS) platforms are rated at 10,000 pounds each.

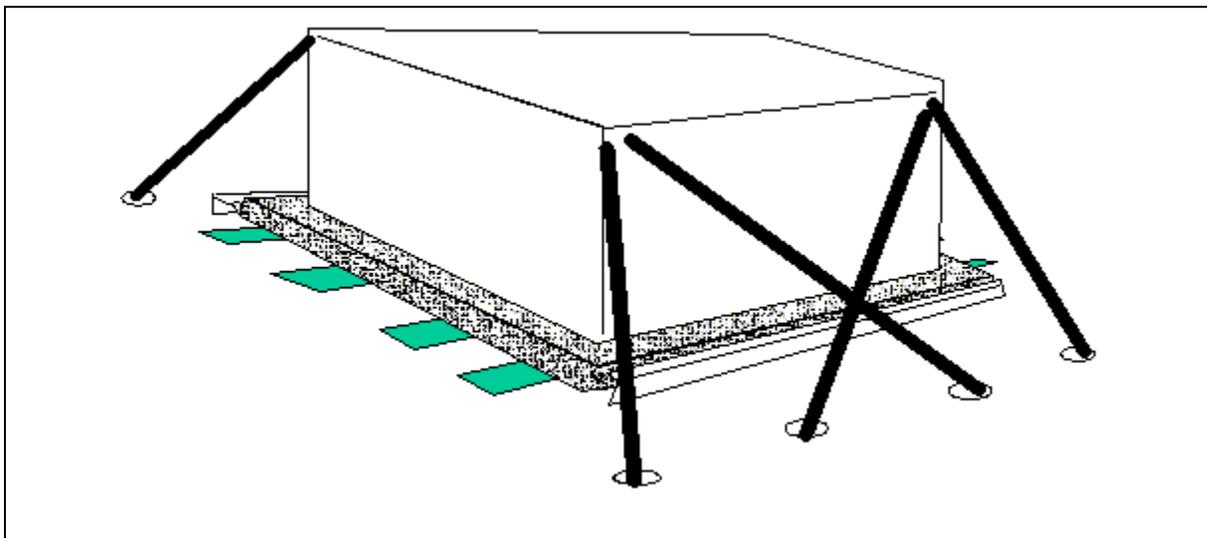
Figure 16



3.5.2 Palletized cargo to aircraft floor.

Cargo may also attach directly to the aircraft tiedown rings if the pallet/platform cannot provide sufficient restraint to the item or if the pallet is only used as a means of transport in and out of the aircraft. Pallets oriented such that the width does not engage the aircraft rail system are also restrained to the cargo floor. The pallet/platform itself, if it is in the rail system, will usually engage the rail locks to restrain the pallet while the item is restrained to the floor (Figure 17).

FIGURE 17. Palletized cargo restrained to aircraft floor rings.



4 Analysis Methods

Effective and efficient use of available aircraft hardware requires certain considerations in the design and/or analysis of restraint methods.

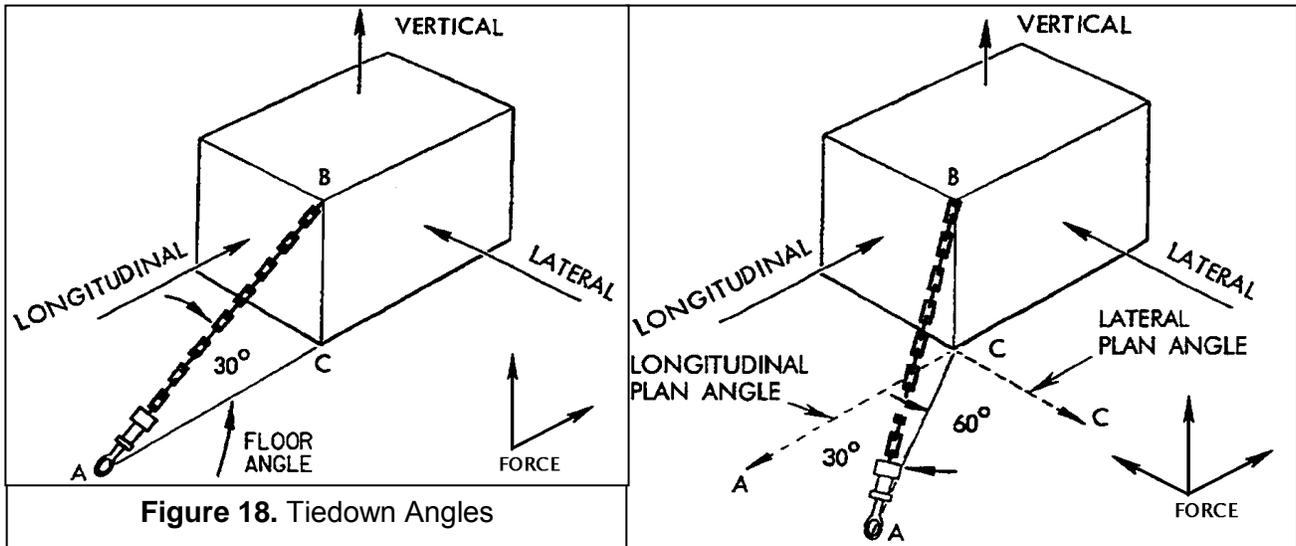
4.1 Effect of Angles.

Every tiedown device is capacity rated based on its ability to withstand a force exerted parallel to, and in the opposite direction of, its line of application (standard pull test). While it is possible to attach tiedowns to act in the same way, it is not efficient to do so since attachment in such a manner provides restraint against movement in only one direction. Separate-acting tiedowns would have to be applied to resist movement in the other directions to fully restrain the item. The total number of tiedowns needed to fully restrain a heavy object in this manner would be prohibitive.

By attaching a tiedown device at some angle to the direction of anticipated movement, it is possible to apply restraint in more than one direction, depending on the angle of pull. By varying the angle of pull, one tiedown device can provide simultaneous restraint in three directions.

Usually, attachment to the cargo is made at some point above the cargo floor. When attached as shown below, part of the rated capacity of the tiedown is available to prevent longitudinal movement of the item and part is available to provide restraint in the vertical (up) direction but no restraint is provided in the lateral direction.

The tiedown shown below will provide simultaneous restraint in all three directions (longitudinal, vertical, and lateral) and illustrates the most desirable and efficient configuration for each tiedown used. If only two of the three directions can be achieved, supplemental restraint will be required using separate tiedowns. Full restraint of the item below would be obtained by attaching tiedown devices symmetrically, in pairs, to the opposite corners/ends of the cargo item.



There are three angles formed by a tiedown chain that is attached to a load at a point above the cargo floor:

- (1) The floor angle (sometimes called the vertical angle) is the angle between the chain and the floor.
- (2) The longitudinal plan angle is the angle between the chain and a line that runs fore and aft in the cargo compartment through the attachment point on the load.
- (3) The lateral plan angle is the angle between the chain and a line that runs laterally across the cargo compartment through the attachment point on the load.

Tiedown chains attached at floor and plan angles of 30 degrees provide the best compromise for adequate restraint of the cargo in all directions. Frequently, it will not be possible to use the 30-degree angles and other arrangements will be necessary.

Increasing the floor angle while keeping constant plan angles will provide a higher value of vertical restraint but will reduce the amount of longitudinal and lateral restraint. Keeping the same floor angle but increasing one of the plan angles (thus decreasing the other plan angle) will not affect the vertical restraint but will change the quantities of longitudinal and lateral restraint.

Assuming that the tiedown is the weakest link in the system and using the optimum 30-degree angles (see 5-2-2 and 6-2), a 5,000-pound capacity tiedown strap (CGU-1B) will provide 3,750 pounds of longitudinal restraint, 2,500 pounds of vertical restraint, and approximately 2,150 pounds of lateral restraint at attachment point B. Similarly, a 10,000-pound capacity (MB-1) chain will provide 7,500 pounds of longitudinal restraint, 5,000 pounds of vertical restraint, and approximately 4,300 pounds of lateral restraint. A 25,000-pound capacity (MB-2) chain will provide 18,750 pounds of longitudinal restraint, 12,500 pounds of vertical restraint, and approximately 10,800 pounds of lateral restraint when ideal angles can be achieved.

It is unlikely that the results above will be achieved in practice because it will not always be possible to achieve ideal chain angles. Tiedowns that are applied at other than the ideal angles

will produce different (proportional) amounts of longitudinal, vertical, and lateral restraint. The amount of available restraint for such tiedowns should be calculated by using the tiedown angle ratio method (see below).

4.2 Calculating Required Tiedown.

An initial estimate of the number of tiedown chains or straps needed to restrain a unit of cargo should always be computed before a proposed tiedown configuration is attempted. A method that usually produces a good estimate is outlined below:

- (1) Determine the gross shipping weight of the item as it will be loaded onto the aircraft (including any stowed gear).
- (2) Multiply the weight in Step 1 by 3.0 to determine the forward restraint requirement (see section 2-2).
- (3) Divide the result in Step 2 by 7,500 if 10,000-pound capacity chains will be used or by 18,750 if 25,000-pound capacity chains will be used* (see section 6-4).
*Note: If the attachment points on the cargo item or the floor tiedown rings on the aircraft are weaker than the capacity of the chain that is being used, divide the result in Step 2 by the weakest capacity.
- (4) Round up the result from Step 3 to the next EVEN whole number (chains should always be attached in pairs). The result will be an estimate of the number of chains that will be needed to restrain the cargo item to 3.0 G's forward.
- (5) Example: A 30,000-pound vehicle is to be airlifted on a C-17. An additional 2,375 pounds of crew gear will be stowed inside the vehicle prior to loading. There are 2 attachment points on each end of the vehicle, plus 2 additional points down each side of the vehicle, for a total of 8 points, each rated at 65,000 pounds capacity.

Step 1: $30,000 + 2,375 = 32,375$ lb. (gross shipping weight)

Step 2: $32,375 \times 3.0 \text{ G} = 97,125$ lb. (restrain to 3.0 G forward)

Step 3: $97,125 \div 18,750 = 5.2$

Step 4: Rounding up to the next even number gives a total of 6 (3 pairs) 25,000-pound capacity chains that will be required for forward restraint.

Note: If 10,000-pound capacity chains will be used, the results would be: $97,125 \div 7,500 = 12.95$. In this case, a total of 14 (7 pairs) 10,000-pound capacity chains would be required for forward restraint.

- (6) Repeat the process for aft, vertical, and lateral (left and right) directions. Generally, the total number of chains required to achieve forward and aft restraint will also provide enough vertical and lateral restraint; if not, additional chains should be added in pairs until the required amount of vertical and lateral restraint is achieved.

Use the initial estimate to determine a proposed tiedown configuration. The tiedown angle ratio method (see 4.3 and Figure 19) should then be used to calculate the exact amount of restraint

that is available from each device in the proposed configuration. Results should be checked against the restraint requirements of Table II to ensure that the item has been properly restrained to requirements.

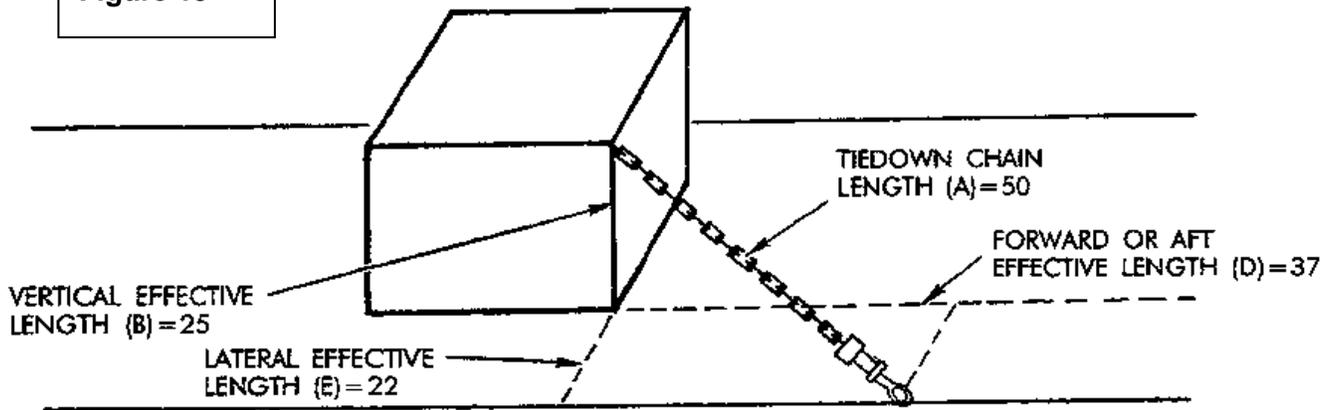
4.3 Calculating Available Tiedown.

The tiedown angle ratio method, illustrated by the example problem shown on Figure 19, is used to calculate the actual amount of restraint available from any given tiedown. The method shown is the same method used by USAF loadmasters when they restrain cargo aboard the aircraft.

When calculating the amount of restraint that is available for any given tiedown, consideration shall be given to the weakest component in the tiedown loop, i.e. the chain, device, floor ring, pallet ring, or cargo item attachment point that has the smallest capacity rating. For example, an MB-1 (10,000-pound capacity) chain and device attached to a 463L pallet ring is limited by the 7,500-pound capacity of the pallet ring. Similarly, if an MB-2 (25,000-pound capacity) chain and device were attached to a cargo item attachment point that has a rated capacity of 15,000 pounds, the maximum amount of restraint available to the MB-2 chain and device would be limited to the 15,000-pound capacity of the attachment point. (This assumes the floor ring attachment point is rated at more than 15,000 pounds capacity. If the floor ring attachment point were rated at less than 15,000 pounds capacity, then the floor ring attachment point would become the limiting factor.)

When multiple tiedowns are attached to floor rings that are in the same lateral row (i.e. pulling on the same floor bulkhead), the amount of vertical restraint may be limited. Example: four MB-1 devices attached to floor fittings in the same lateral row may each provide forward and aft restraint to their maximum capacity but the amount of vertical restraint available per floor ring may be limited. The vertical restraint reduction varies depending on the aircraft, and depending on the number of other devices attached to the same lateral tiedown row. Consult the respective aircraft loading manual (T.O. 1C-XXX-9) to determine the extent to which vertical restraint is reduced when multiple tiedowns are attached to the same lateral row of floor rings.

Figure 19



THIS FIGURE ILLUSTRATES A METHOD OF DETERMINING RESTRAINT PROVIDED BY A CARGO TIEDOWN. AS ILLUSTRATED, TIEDOWN RATIOS CAN BE DETERMINED BY DIVIDING THE DIRECTIONAL DISTANCE IN WHICH RESTRAINT IS REQUIRED BY THE CHAIN (OR STRAP) LENGTH. THIS RATIO IS THEN MULTIPLIED BY THE STRENGTH OF THE TIEDOWN, DEVICE, OR ATTACHMENT POINT ON THE CARGO, WHICHEVER IS LESS, TO FIND THE EFFECTIVE RESTRAINT RECEIVED FROM THE TIEDOWN PATTERN USED.

EXAMPLE: (Note: Quantities used are from the example above)

1) FIRST, MEASURE THE TIEDOWN CHAIN LENGTH (A) FROM THE ATTACHMENT POINT ON THE CARGO TO THE TIEDOWN FITTING ON THE CARGO FLOOR (50 INCHES). YOU WILL USE THIS MEASUREMENT IN EACH CALCULATION.

2) **CALCULATING THE VERTICAL RESTRAINT:**

a) FOR DETERMINING VERTICAL RESTRAINT, MEASURE THE VERTICAL DIMENSION (B) FROM THE ATTACHMENT POINT ON THE CARGO TO A POINT DIRECTLY BENEATH IT ON THE CARGO FLOOR (25 INCHES).

b) DIVIDE THE VERTICAL DIMENSION (B) BY THE TIEDOWN CHAIN LENGTH (A) TO DETERMINE A RATIO:

$$\frac{25}{50} = 0.50 \text{RATIO}$$

c) MULTIPLY THIS RATIO BY THE RATED STRENGTH OF THE TIEDOWN CHAIN OR THE RATED STRENGTH OF THE TIEDOWN FITTING ON THE CARGO OR THE RATED STRENGTH OF THE TIEDOWN FLOOR FITTING, WHICHEVER IS LESS:

$$0.50 \times 10,000^* = 5,000 \text{POUNDS} \quad \leftarrow \text{VERTICAL RESTRAINT RECEIVED FROM TIEDOWN}$$

3) **CALCULATING THE FORWARD OR AFT RESTRAINT:**

a) FOR DETERMINING FORWARD OR AFT RESTRAINT, OBTAIN A FORWARD OR AFT DIMENSION (D) BY MEASURING FROM A POINT DIRECTLY BENEATH THE ATTACHMENT POINT ON THE CARGO ALONG A LONGITUDINAL AXIS TO A POINT LATERAL TO THE TIEDOWN FITTING BEING USED ON THE CARGO FLOOR (37 INCHES).

b) DIVIDE THE FORWARD OR AFT DIMENSION (D) BY THE TIEDOWN CHAIN LENGTH (A) TO DETERMINE A RATIO:

$$\frac{37}{50} = 0.74 \text{RATIO}$$

c) MULTIPLY THIS RATIO BY THE RATED STRENGTH OF THE TIEDOWN CHAIN OR THE RATED STRENGTH OF THE TIEDOWN FITTING ON THE CARGO OR THE RATED STRENGTH OF THE TIEDOWN FLOOR FITTING, WHICHEVER IS LESS:

$$0.74 \times 10,000^* = 7,400 \text{POUNDS} \quad \leftarrow \text{FWD OR AFT RESTRAINT RECEIVED FROM TIEDOWN}$$

4) **CALCULATING THE LATERAL RESTRAINT:**

a) FOR DETERMINING LATERAL RESTRAINT, OBTAIN A LATERAL DIMENSION (E) BY MEASURING FROM A POINT DIRECTLY BENEATH THE ATTACHMENT POINT ON THE CARGO, ALONG THE CARGO FLOOR, TO THE ROW OF TIEDOWN FITTINGS BEING USED (22 INCHES).

b) DIVIDE THE LATERAL DIMENSION (E) BY THE TIEDOWN CHAIN LENGTH (A) TO DETERMINE A RATIO:

$$\frac{22}{50} = 0.44 \text{RATIO}$$

c) MULTIPLY THIS RATIO BY THE RATED STRENGTH OF THE TIEDOWN CHAIN OR THE RATED STRENGTH OF THE TIEDOWN FITTING ON THE CARGO OR THE RATED STRENGTH OF THE TIEDOWN FLOOR FITTING, WHICHEVER IS LESS:

$$0.44 \times 10,000^* = 4,400 \text{POUNDS} \quad \leftarrow \text{LATERAL RESTRAINT RECEIVED FROM TIEDOWN}$$

* NOTE: THIS QUANTITY SHOULD ALWAYS REPRESENT THE WEAKEST LINK IN THE SYSTEM. IF THE RATED STRENGTH OF THE CHAIN OR EITHER ATTACHMENT POINT BEING USED IS LESS THAN 10,000 POUNDS, THE RATIO SHOULD BE MULTIPLIED BY THE WEAKEST RATED STRENGTH.