

# CARGO SECUREMENT BEST PRACTICE DRAFT



CANADIAN ASSOCIATION OF OILWELL  
DRILLING CONTRACTORS



PETROLEUM SERVICES  
ASSOCIATION OF CANADA



## **Cargo Securement Best Practice**

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## **Introduction**

The Canadian Association of Oilwell Drilling Contractors (CAODC), the Petroleum Services Association of Canada (PSAC) and transportation authorities in Alberta, British Columbia (BC), and Saskatchewan, together with industry, have developed this Best Practice to address compliance with the North American Cargo Securement Standard (the "Standard") introduced in January 2005. The full Standard is available online at [http://www.ccmta.ca/english/pdf/nsc10\\_e\\_sept04.PDF](http://www.ccmta.ca/english/pdf/nsc10_e_sept04.PDF)

The Best Practice, specific to the movement of oil and gas equipment, has been designed to meet or exceed the requirements of the Standard. As a Best Practice, it does not replace the Standard, rather it is a compliment to it.

**Owners/Shippers/Carriers MUST at all times be in compliance with all the provisions of the Standard.**

### **Part 1 - General Provisions - Division 1 - Application of the Standard states:**

- (1) A carrier shall not permit a driver to operate a vehicle where the cargo transported in or on the vehicle is not contained, immobilized or secured in accordance with this Standard.
- (2) A driver shall not operate a vehicle where the cargo transported in or on the vehicle is not contained, immobilized or secured in accordance with this Standard.

**There is also a responsibility on the part of the owner/shipper to ensure that their equipment is designed and/or adapted in such a way that it meets the requirements of the Standard.**

**Part 1 - General Provisions - Division 2 – General Performance Criteria states:**

5(1) The cargo securement system shall be capable of withstanding the forces that result if the vehicle is subjected to each of the following accelerations:

- (a) 0.8 g deceleration in a forward direction;
- (b) 0.5 g deceleration in a rearward direction;
- (c) 0.5 g acceleration in either sideways direction.

5(2) The cargo securement system shall provide a downward force equal to at least 20% of the weight of an article of cargo if the article is not fully contained within the structure of the vehicle.

5(3) The load on a component of a cargo securement system that reacts to a force referred to in subsection (1) or (2), shall not exceed the working load limit of the component.

The entire Standard can be found in Appendix 2.

## Production Equipment



Photo courtesy of CAODC

### Introduction

Examples of Production Equipment Include:

- Compressors
- Pipe clusters
- Treaters

### Key Considerations

- Dimensions
- Weight
- Structural Integrity
- Centre of Gravity/Balance

### Securement Considerations

- Anchor Points
- Friction
- Securement Devices
- Containment
- Transportation Performance Criteria

Manufacturers must ensure that all new equipment is able to be shipped in compliance with the Standard. Anchor points must be present, clearly identified, with the rating clearly stated.

Existing equipment still needs to be moved. Carriers need to find ways to meet the standard (e.g. use cross chaining, lift points as tie down points, friction mats, etc. If the equipment cannot be secured so that it is safe, then it cannot move until it has been retrofitted to make compliance possible. Owners of equipment must retrofit equipment to ensure that it can be shipped in compliance with the Standard.

### **Best Practice**

Best Practice requires that manufacturers work with carriers to enable compliance. Consultation between manufacturers and carriers should take place at the design stage. Manufacturers can assist in retrofitting existing equipment. In many cases, they have the documentation to meet the specifications for overseas shipping. For example tie down points and their ratings have to be identified for overseas shipping. This same standard should be applied to transport within North America. If equipment cannot be tied down properly as is, it may require the manufacturer to provide a container to house the equipment so that it can be tied down.

The Standard specifies that by 2010, all tiedowns, or components of a tiedown must be marked by the manufacturer with respect to the working load limit. No distinction is made between new and existing equipment. Carriers will not be able to use any anchor points or tiedowns that are not clearly marked.

Refer to Appendix 1: NSC Standard 10 for the working load limits of tie down materials. You will find this information of pages 45 to 49 of the Standard.

Education and enforcement are key. Carriers shall refuse to move equipment that cannot be secured safely. There must be no exceptions.

# Coiled Tubing Operations



Photo courtesy of Sanjel Corporation

## Introduction

Examples of Coiled Tubing Equipment Include:

- Injectors
- Reels
- Accessories & Tools
- Well Control Equipment

## Key Considerations

- Containment
- Dimensions
- Weight
- Structural Integrity

## Securement Considerations

- Securement Devices
- Containment

## Securement of Injectors

The vehicles in these examples have been specifically designed to carry this equipment. The onus is on the manufacturer to ensure that performance criteria have been met. If they are properly maintained, then they should be in compliance with the Standard.

This first injector rests on a saddle and is angled towards the front of the vehicle. A locking pin is placed across the injector using the chassis to retain the injector in place.



Photos courtesy of Sanjel Corporation

The second type of injector is saddled in place at a steeper angle than the first. It is held in place using 2 pins located at the upper right hand corner.





Photos courtesy of Sanjel Corporation

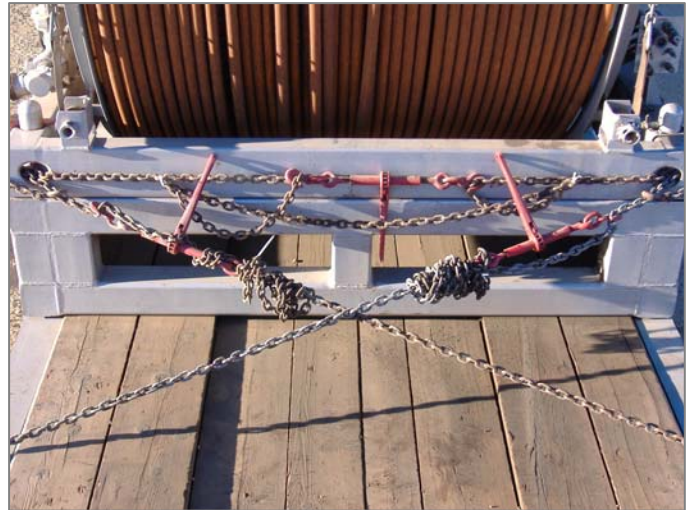
The above photos show the locking pins used to hold down the injector.

If there is any question as to whether these units can meet the 0.5 g deceleration in a rearward direction, then additional securement on the front (chains, straps and additional securement pins) would meet or exceed the requirements contained in the Standard.

## Securement of Coiled Tubing Reels

The photos on this page show a coiled tubing reel on a low boy trailer. The coiled tubing unit is bolted to a skid. The onus is on the manufacturer of the unit to ensure that it has been properly designed.

The reel has been cross chained for transport. The pins, number and strength of tiedowns must meet the requirements of the Standard. Chains must be properly placed.



Photos courtesy of Sanjel Corporation

# Vacuum Truck Operations

## Introduction

Examples of Vacuum Truck Equipment Include:

- Hoses
- Accessories & Tools

## Key Considerations

- Accessories & Hoses

## Securement Considerations

- Securement Devices
- Containment

Vacuum trucks such as the one shown here have been designed and engineered to carry specialized equipment. The onus is on the manufacturer to ensure that hoses etc. can be secured in compliance with the standard.



Photo Courtesy of Wellco

**Best Practice** requires that hoses do not extend beyond the length of the deck. That way, the pieces can be firmly secured and the hoses do not wrap around the back where they might drape over and obscure lights.



Photo Courtesy of Wellco

In this photo, the hoses drape over the back, obscuring the lights. Hoses should not extend beyond the length of the deck. If they do, they must be secured in such a way that they do not drape over the back.



Photo Courtesy of Wellco

Any items placed in with the hoses must be firmly secured. The hoses themselves are not enough to hold other items in place.

Hoses are flexible tubes, and the problem is that they can, and do flex. Hoses must be immobilized.



Photo courtesy of Wellco

This photo does not show a vacuum truck. However, it makes the point that hoses are cargo. These hoses are secured to sides by locking pins. They must not come loose. Tarp straps may be used as a secondary source of securement.

If tarp straps are used, they must be in good working order - no knots or damaged or weakened components.



Photo Courtesy of CAODC

Section 4 (2) of the Standard specifies that all components of a cargo securement system must be in good working order.

# **Drilling and Service Rig Tubulars**

## **Introduction**

Examples of Drilling and Service Rig Tubulars Include:

- Drill pipe
- Drill collars
- Tubing

## **Key Considerations**

- Containment
- Weight
- Bulkheads

## **Securement Considerations**

- Securement Devices
- Containment
- Securement Effectiveness

If not carried out correctly, the transportation of oilfield tubulars can be a challenging and high-risk endeavor. This is particularly so when dealing with mixed or miscellaneous loads. These loads, which may contain tubular products of different length and diameter, pose significant securement challenges.

## Pipe Tubs



Photo courtesy of PSAC

### Best Practice

Due to the hazardous nature of this type of cargo, loose pipe must be secured to the trailer in accordance with the requirements of the Standard. Pipe in tubs or on tables must be secured to the tub or table, and the tub or table must then be secured to the trailer in accordance with the Standard.

If a pipe tub is being used to transport pipe, the pipe should be placed in the tub with the least amount of room possible between the ends of the pipe and the bulkhead. The pipe should then be secured in the pipe tub and the pipe tub secured to the trailer in accordance with the requirements of the Standard. Four straps are required for pipe 30 feet in length. Five straps are required for pipe 30 – 35 feet in length. Unless the friction between the pipes is sufficient to immobilize the pipe during transport consideration should be given to using a bulkhead as a secondary means of containment.

### Not in Compliance

Loose items being transported on top of tubulars must be secured according the Standard. The use of a basket is recommended.



Photo courtesy of PSAC and CAODC

## Pipe Tables



Photo courtesy of PSAC and CAODC

Pipe tables, such as the one shown above are widely used throughout industry and can be transported in a manner that complies with the requirements of the Standard. One of the significant challenges with pipe tables is their width. With a width of 10 feet, it is difficult, if not impossible, to secure the centre of the table. As a secondary means of containment, pipe tables should have bulkheads to stop forward and rearward movement. The pipe must then be placed as close to the bulkhead as possible. The pipe should then be strapped to the pipe table according to the requirement for straps contained in the Standard and the table must be secured to the vehicle in accordance with requirements for skidded loads.

## Not In Compliance

This photo shows various sizes of pipe stored under the catwalk and is an example of non-compliant transportation of tubulars. However, if the owner of the equipment contained the pipe so as not to affect the stability or manoeuvrability of the load, it *could* become a compliant load.



Photo courtesy of PSAC and CAODC



Photo courtesy of PSAC and CAODC

### **Not in Compliance**

This photo illustrates the difficulty of securing pipe of different lengths. Even with the required number of straps, the pipe cannot be properly secured to this pipe rack in such a way as to prevent shifting or movement. Additionally, the lumber placed on top of the pipe is not properly contained and the pipe cannot act as a stable base for loose items to be secured to.

Owners and shippers of these types of loads should give consideration to construction of a skidded and enclosed storage container similar to a “Sea Can” in order to enable these types of loads to be transported in compliance with the Standard.

## Large Diameter Pipe

These large diameter pipes weigh approximately 11,000 pounds each. The pipe is coated so chains cannot be used. Instead,  $\frac{3}{4}$  inch rope can be used as this will penetrate frost and ice and doesn't damage the coating. The securement on this truck does not meet the Standard. To meet the 50% load requirement it needs 10 straps.



Photo courtesy of Premay Pipeline



Photo courtesy of Premay Pipeline

### Not in Compliance

In the past, 2 belts front and back were used. To meet the Standard, you need 5 belts front and back.

The wooden bunks that the pipe sits in are carpeted.



Photo courtesy of Premay Pipeline

### In Compliance

This small diameter pipe has been strapped and tarped for transport.

# Rig Moving

## Introduction

Examples of Rig Equipment Include:

- Masts (Derricks)
- Skidded and Enclosed Loads
- Skidded and Non-Enclosed Loads
- Miscellaneous and Loose Equipment

## Key Considerations

- Containment
- Weight
- Dimensions (irregular shapes)
- Housekeeping and Organization

## Securement Considerations

- Anchor points
- Securement Devices
- Containment
- Securement Effectiveness



Photo courtesy of PPSAC

## Masts



Photo courtesy of Mullen Oilfield Services

In moving a mast such as the one shown above, the issue is containment of other items. Everything inside the mast (e.g. blocks, drilling line, cables, sheaves, monkey board, etc.) has to be secured. The planks in the above photo were put in to hold lines, but they are not secure. Other non-compliance issues can result from housekeeping; ropes, etc. must be in good repair and tied properly.

If a mast is on a flat deck it must be secured to the Standard (chained every 10 feet). There are no exceptions.

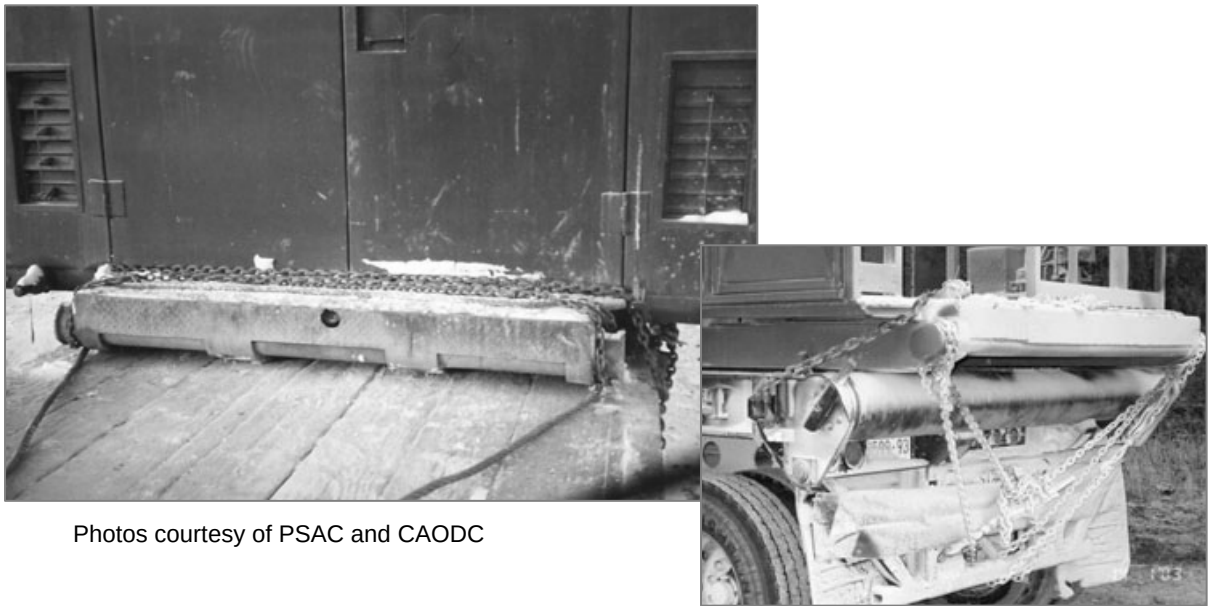


Photo courtesy of PSAC

For drilling and service rig moves, most equipment can be classified into the following categories:

- Skidded and enclosed loads (e.g. pump houses, light plants, etc.)
- Skidded and non-enclosed loads (e.g. mud tanks, centrifuges, etc.)
- Non-Skidded and non-enclosed loads (e.g. matting, junk boxes, etc.)

### **Skidded and Enclosed Loads (e.g. pump houses, light plants, etc.)**



Photos courtesy of PSAC and CAODC

### **Compliance Standards**

The key issues are size and weight and anchor points. For example, based upon 45,000 kg (100,000 lbs) net weight, the required amount of securement devices to comply with forward motion is nine 1" chains rated at 5,090 kg.

Refer to the Standard in Appendix 1 for the default working load limits of chains (Part 3 on page 45 of the Standard). Part 4: Manufacturing Standards includes the working load limits of chain assemblies which can be found on page 43 of the Standard.



Photo courtesy of PSAC

### **In Compliance**

This photo is an example of a best practice. The neck of the trailer is being used as a bulkhead. The neck of the trailer must therefore comply with Division 5 requirements for front end structures.

- 24 (1) The height of the front end structure of the vehicle shall not be shorter than the shorter of
  - (a) the height at which it prevents the cargo from moving forward, and
  - (b) 122 centimeters above the deck.
- (2) The width of the front end structure of a vehicle shall not be narrower than the narrower of
  - (a) the width of the vehicle, and
  - (b) the width at which it prevents the cargo being transported from moving forward.

Best practice requires that the cargo has to be firmly up against the neck of the trailer which is acting as a bulkhead. There must be no gap.

Additionally, the front end structure needs to conform to the strength requirements of the Standard (Division 5).



Photo courtesy of PSAC

Length and weight are the main issues to consider In transporting this type of mud pump. The overhang at the back means that a 45 degree angle for cross chaining cannot be achieved. The Standard requires anchor points every 5 feet for loads over 40 feet in length. This type of load might have to be retro-fitted with rated anchor points.

The issue with this type of load is that if it exceeds 40 feet in length, it may require rated anchor points every 5 feet unless it is properly secured at each end so as to meet the required G forces stated in the Standard.



Photo courtesy of PSAC

In order to be in compliance, owners and shippers must secure items inside the buildings. They must ensure that any items that are not secured inside the buildings would not affect the stability and maneuverability of the vehicle in the event they shift during transportation. Anything with enough weight or mass sufficient to affect stability and maneuverability has to be fully secured as per the Standard. If there is any question about whether or not the loose objects would affect stability, then best practice requires that they be secured.

The Standard states that the driver must “ensure that the cargo does not interfere with the driver’s ability to drive the vehicle safely” (Subsection 1). If the load is a closed, sealed unit, it may be difficult to determine whether or not the items inside the unit will affect the stability and maneuverability of the vehicle.

The Standard specifies that the driver must inspect the cargo and the cargo securement system unless the cargo is sealed or loaded in a manner that makes it inaccessible.

Subsections (2) and 3) do not apply to a driver where

- (a) the cargo is sealed in a vehicle and the driver has been ordered not to open it to inspect the cargo, or
- (b) the vehicle is loaded in a manner that makes the cargo, or portions of the cargo, inaccessible.

### **Best Practice**

Since the driver is still required under Subsection (1) to ensure that the cargo does not interfere with his or her ability to drive the vehicle safely, the driver should “get it in writing”. If the building has been sealed and the driver has been ordered not to open it, those orders should be in writing. If the vehicle has been loaded so that the cargo or portions of the cargo are inaccessible, the driver should ask the shipper to provide written confirmation that the all of the cargo has been secured in compliance with the Standard.

## Skidded and Non-enclosed Loads

In order to be in compliance the sub should be butted up against the bulkhead to help stop forward movement. The skid must be secured to the trailer according to the Standard.



Because this is open, everything inside must be immobilized. In the photo shown here, all the loose items have been chained but are not adequately secured. A better solution would be a container of some kind as it is difficult (and time consuming) to chain a number of small, irregular items to ensure that they cannot move.



Some skidded non-enclosed loads tend to be “junk” loads – lots of miscellaneous items. In order to bring these loads into compliance with the Standard, they must be either covered in such a manner that nothing can be lost from the load, or sides must be added to the load to prevent anything from being lost from the load. In the past, tarps were used to cover and contain loads such as these.



Photos courtesy of PSAC and CAODC

Tarps are not acceptable for these types of loads as they are not strong enough to secure the weight of many of the items.

Loads can be transported without a cover, provided that the walls of the container are higher than any part of the load and that the load itself is of sufficient weight to remain within the container. The load shown below needs to be screened to secure it within the container.



### Not In Compliance



Photos courtesy of PSAC and CAODC

### Best Practice

Another option for drilling contractors to consider is the use of “Sea-Cans” on skids when shipping miscellaneous equipment such as that shown on the previous page. These containers are used for shipping on ocean going container ships and have the structural strength to meet the requirements of the Standard.

## Non-Skidded Non-Enclosed Loads

These loads are often problematic in terms of compliance with the Standard, because the equipment being moved was not designed or constructed with transportation securement in mind. The equipment was designed for a specific field use, and as such, will not easily meet the requirements of the Standard.

If the items being transported are the same shape and size (e.g. mats), they can be secured together. If they are different shapes and sizes, they must be independently secured.



Photo courtesy of PSAC

## Best Practice

The mat has to be secured separately to the trailer, and then the equipment must also be secured to the trailer according to the Standard. Although BC enforces this requirement, Alberta has not been enforcing it. Alberta accepts equipment on top of the mat to be secured to the mat. If the driver anchors the chain to the trailer, it helps meet the 3.04 and the 50% rules. The problem with some of this type of equipment is getting enough securement on it to contain the mass. The industry is starting to custom build skids and containers for some pieces of equipment. This will make it much easier to transport in compliance with the Standard.



Photos courtesy of PSAC

The spreader tied on top of the mats meets the requirements of the Standard as the weight of the spreader holds the mats down. However, because the spreader is an irregular shape, it would be better to exceed the requirements of the Standard in this case.

**Best Practice** would be to secure the mats to the trailer first and then secure the spreader to the trailer.

Note: Training is needed to ensure that web slings are used properly. Edge protectors are required on the spreader.

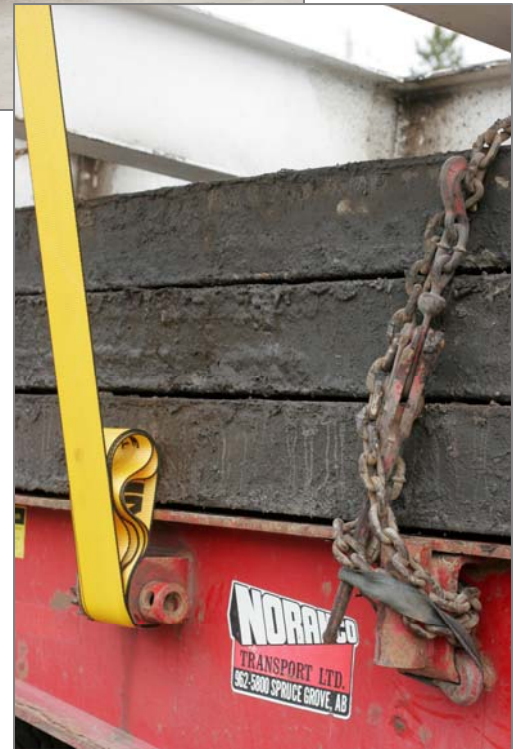




Photo courtesy of Nabors

### **Not in Compliance**

On this catwalk, everything has to be independently secured or contained in order to meet the Standard. There are not enough anchor points on the catwalk to secure every loose item. An equipment skid would help.

The bottom of the catwalk is not a pipe tub. The pipe shoved in here cannot be properly contained and therefore must be removed or boxed in.

All the lines need to be secured.



Photo courtesy of Nabors

### **Non-Skidded and Non-Enclosed “Junk Loads”**

The primary concerns with these loads are loose pieces that do not fit anywhere else. In the past, loose equipment, such as flare lines, planks, valves, etc, have been stacked or piled wherever they would fit during rig moves. However, these types of loads will no longer be acceptable and all additional or loose equipment will have to be independently secured or added to a different load where it can be secured.

#### **Not in Compliance**

It is basically impossible to properly secure loads of planks when all the pieces are different lengths and widths.

#### **Best Practice**

Loads like this should be fully contained (in a bin or basket) or refused.



Photo courtesy of PSAC

#### **In Compliance But Not Best Practice**

In this photo, the pieces of lumber are piled more neatly in a rack and attempts have been made to secure them to the trailer. However, there is some question as to whether they are immobilized. If there is any possibility that they may work loose in transit, then they need to be put in a better container. The boards are not stacked very well; enclosing the entire skid would help.



Photo courtesy of PSAC

## Securement of Tools and Loose Pieces

### Best Practice

A tool box such as the one shown here means that all tools are contained and immobilized within the vehicle. Problems arise when vehicles are not equipped with a tool box like this, or when the tools are not properly placed within the box.



Photo courtesy of Sanjel Corporation

### In Compliance

The hammers shown here are in compliance with the Standard as they cannot slide. They could bounce up, but they would have to bounce up about 1.5 feet (0.5 m) to come out. This arrangement meets the Standard; a net or tarp placed over the top would exceed the requirements of the standard.



Photo courtesy of Sanjel Corporation

Posts or pins can be used to secure equipment as long as the securement device is of sufficient height and strength. Use the rule of “flush or higher”. This rule requires that pins or posts must be at least as high, if not higher, than the equipment being secured.

### **In Compliance**

A pegging system such as the one shown here prevents any sliding. As long as they are manufactured to meet the criteria, properly maintained and used, they can help ensure compliance with the Standard. Problems may occur if workers are in a hurry, or if it is dark. They might miss the pegs, and then the cargo would be loose.



### **Best Practice**

This pegging system is within an enclosed box, ensuring that anything placed on the pegs will stay there.



### **Not In Compliance**

The snipes shown here are not sufficiently contained. They would not have to bounce up very high to come out of the bottom restraint, slide sideways and fall off. To avoid problems, use something (e.g. a pin or clip) to lock them in.



Photos courtesy of Sanjel Corporation

### **Not In Compliance**

The pails in the top photo are not in compliance. They are not sufficiently secured or restrained.

A cargo net over the top of them would help bring them into compliance.



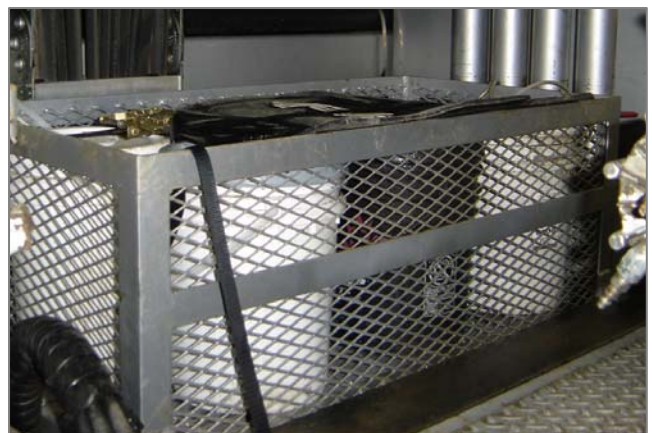
### **In Compliance**

The pails in the photo to the right are in compliance. They are in a cage that is higher than the tops of the pails



### **Best Practice**

The photo below illustrates best practice. Not only are the pails in a cage that is higher than the tops of the pails, but there is also a cover on the cage to ensure that nothing will bounce out.



Photos courtesy of Sanjel Corporation

## **In Compliance**

### **But Not Best Practice**

Best Practice requires that cargo be both contained within a structure and immobilized. It is not enough just to have loose cargo below the sides of the truck. This may meet the minimum of the Standard but it is not sufficient for the best practice.



Photo courtesy of Sanjel Corporation

## **In compliance**

This photo shows the centre of a coil tubing truck that is being used to hold a number of loose items. If the items are closely enough packed that each item cannot move, then this may be in compliance. However, this is a gray area and open to interpretation.



Photo courtesy of Sanjel Corporation

The Interpretation section of the Standard defines *contained* with respect to cargo as:

- (i) the cargo fills a sided vehicle
- (ii) every article is in contact with or close to a wall or other articles, and
- (iii) the cargo cannot move or tip

**Best Practice** would be to use a cage. The cage must be high enough to fully contain whatever is placed inside it.



Photos courtesy of Sanjel Corporation

The cage shown on the left has been improved by making it higher. This means that items will be fully contained.

### **Best Practice**

These chains are secured on hooks that are long enough to contain the chains. In addition, a clip ensures that they cannot bounce off.



Photo courtesy of PSAC

In the Standard, Division 3, General Requirement 9 states:

*Cargo shall be firmly immobilized or secured on or within a vehicle by structures of adequate strength, blocking, bracing, dunnage or dunnage bags, shoring bars, tiedowns or a combination of these.*

In order to be in compliance, cargo securement systems must meet this requirement.

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| Rick Schlamb    | Shaw Pipe Protection                   |
| Gene Gauthier   | Sloanberg Bros Trucking Ltd            |
| Pat Diemert     | Swanberg Bros. Trucking                |
| Trent Smith     | Toromont Energy Systems                |
| Bruce Wilson    | Trican Well Service                    |
| Dennis Permann  | Universal Compression                  |
| Greg Baker      | Universal Compression                  |
| Andrew Hall     | Wellco Entergy                         |
| Claude Duval    | Wellco Entergy                         |
| Bryan Howree    | Winalta Transport                      |