

Paper Roll Handling



The basic process for making paper has changed little in the last 2000 years. What has changed, is paper making technology and the way paper is handled!

1960's – Paper mills and converters are handling paper rolls with roll clamps, powered and carried by ITA class IV and class V trucks. Clamp technology is in its infancy with few models and few options. Paper damage, at this time, is not a major concern, and end users' application needs are barely being met.

1970's - The cost of paper is on the increase. Roll diameters and weights are increasing. New paper products are being introduced. Mills and converters around the world began looking at handling-related damage. The attachment industry responded by better understanding the user's damage reduction needs. Result: Significant improvements in roll clamp technology.

Today – The people who make and buy paper have a goal of zero handling-related damage. The Attachment industry responded by improving contact pad design and developing new methods for controlling clamp force. Two additional new damage reduction products are now available, rotational control and tilt control. Hyster responded by designing truck hydraulic systems, which are more compatible with specialized attachments!

Hyster has long been a dominant force in material handling for the paper industry. With the upgrades we have implemented to the S70-120XM, our truck will continue to set the standard for paper roll handling. We have developed this presentation to aid you in understanding how to build an order for a paper roll truck.

How to Build a Paper Roll Special



This presentation will be an exercise to take us through specifying a paper roll special truck.

Things you will need. Hyster tech guides. Hyster Price pages. Attachment company's sales manual. They are usually free upon request.

Some resources for attachments are as follows:

Cascade Corporation. 1-800-CASCADE (227-2233)
www.cascorp.com

Cascade has a wealth of information on the web. (i.e., attachment specs and pricing, installation instructions, service manuals, technical bulletins, and much more)

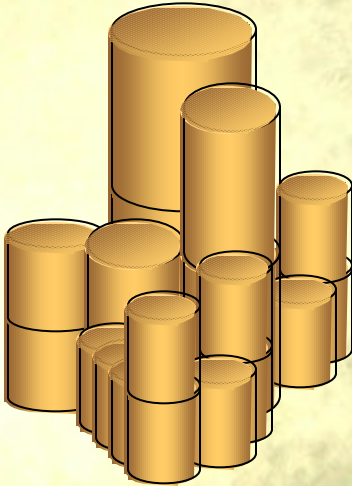
Auramo, Inc. 1-800-554-3405 www.auramo.com

Brochures and spec books available upon request.

Long Reach / Brudi 1-800-285-7000 www.long-reach.com

Brochures and spec books available upon request.

Begin With The End In Mind



What are you lifting?

- **Roll height?**
- **Roll diameter range?**
- **Heaviest roll you will be lifting?**
- **Paper type?**
- **Bilge pick-up required?**
- **Loading/unloading boxcars?**

To borrow a phrase, let's begin with the end in mind. The most important thing that we must consider in deciding on what truck and attachment to use is the load.

- What will you be lifting?
- What is the weight of the heaviest roll you will be lifting?
- What is the diameter of the paper roll?
- What type of paper is it?
- Will bilge pick-up be required?
- How will the rolls be shipped/received?(i.e., In boxcars?)

All of these questions must be answered in order to determine the correct clamp.

For this exercise, Cascade Corporation has provided us with technical assistance, information and images. Some of the information may be specific to Cascade Corporation products. This presentation is intended to provide you with a set of guidelines to help you are ask the correct questions. Make sure you work closely with whatever attachment manufacturer you are using to insure you have technically accurate information.

Clamp Selection



Swing Frame
Long & short
arm



Fixed Frame
Positioned
short arm



Fixed Frame
Fixed short arm

- **Capacity**
- **Roll Diameter Range**
- **Functional Requirements**
 - **Swing Frame**
 - Improves handling in tight stacking locations such as boxcar breakout. Allows easy lateral positioning
 - **Fixed Frame/Positioned Short Arm**
 - Good long arm profile over wide range of roll diameters
 - **Fixed Frame/Fixed Short Arm**
 - Good arm profile when handling rolls near maximum diameter

Select a clamp by load capacity and roll diameter range.

For this exercise, the rolls that we will be working with are 60" diameter and weigh 8500 lbs.

We are loading and unloading rolls from boxcars in a warehouse environment so, we will need a clamp that will allow us to separate the rolls from one another, as they will be packed very tightly together. This is called breaking out. To break the roll out, we will need a swing frame clamp. In addition to clamping and rotating, a swing frame clamp swings slightly to one side once the roll is clamped, to allow breaking out.

Using a Cascade Sales Manual, the clamp that meets these criteria for our exercise is a 90F-RCS-21C. We have chosen this clamp based on load capacity, roll diameter range, and it is a swing frame for break out.

Functional requirement notes from the manual about this clamp:

It requires a Class IV carriage. The weight of the attachment is 3,050 lbs. The clamp has a maximum operating pressure of 2300 psi. Remember that flow and pressure are important in matching a clamp to a truck and matching a truck to a clamp. Recommended flow pressure is 15 GPM. The clamp rotates at 3.2RPM@15GPM.

Paper roll clamp specifications can be found on the internet at www.cascorp.com.

Clamp Force Considerations

- **Load Description**
- **Load Handling Experience**
- **Clamp Selection / Clamp Force**
- **Contact Pad Type**
- **Truck / Attachment Hydraulic Compatibility**
- **Amount & Distribution of Force**

- **Load Description**

includes load type, size (length, width or diameter, height) weight, and load specific conditions.

- **Load Handling Experience**

How has the load been handled previously? Was it successful?

- **Clamp Selection / Clamp Force**

Select an attachment with sufficient clamp force to handle the intended load capacity.

- **Contact Pad Type**

Select a contact pad to match specific load requirements.

- **Truck / Attachment Hydraulic Compatibility**

What is lift truck system auxiliary circuit pressure?

Attachment relief valve – requirements and selection

Parasitic loss – the hydraulic energy consumed by the hydraulic system without creating a working benefit. The drain of parasitic loss creates heat and slows attachment speed.

- **Amount & Distribution of Force**

Clamp Requirements

What does the clamp require to operate?

- **Hydraulic Flow and Pressure requirements**
- **Number of Hydraulic Functions**
- **Pad Material Selection**

Hydraulic flow and pressure requirements

- a) The 90F clamp requires a minimum of 10 GPM (gallons per minute), maximum of 20 GPM, and 15 GPM recommended.
- b) Look at the type of clamp. This clamp is a Swing Frame Positioned Short Arm Clamp. It requires three hydraulic functions; clamping, swinging, and rotating. From the clamp specifications we see that, for rotation, it runs at 3.2rpm @ 15 GPM.
- c) Pad material selection for the clamp varies depending upon the type of paper. **Consult the attachment manufacturer to select the right pad material.**

All Paper is not Created Equal Clamp Force Ratio

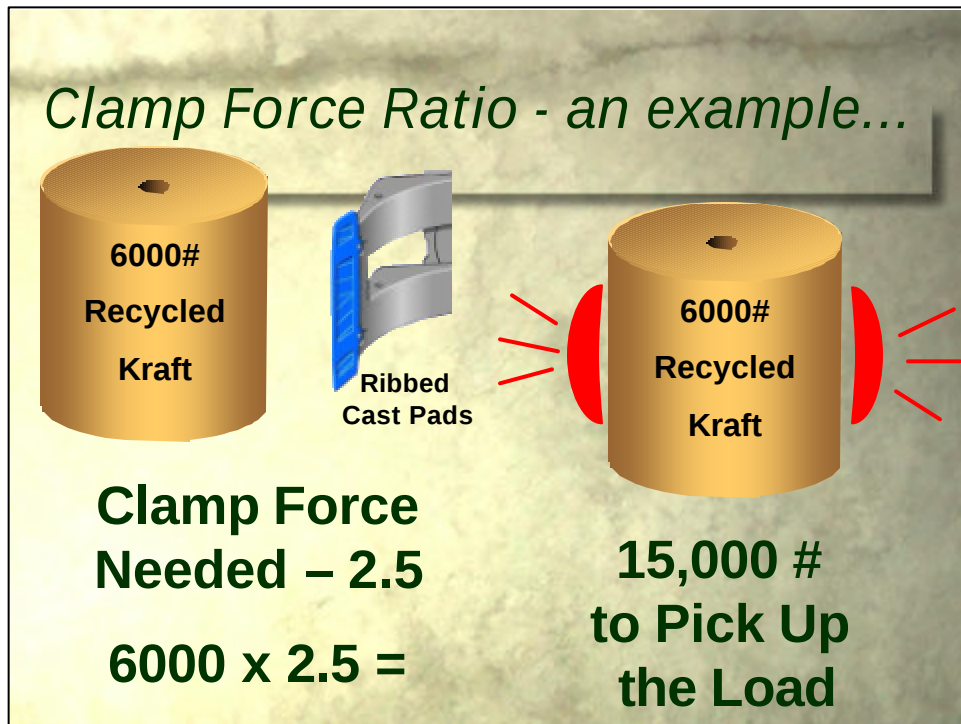
Clamp Force to Load Weight Ratio
(Roll Weight x Factor = Clamp Force)

	Cast Pattern Pads	Poly/Rubber Pads
✓ Newsprint	1.8	1.6
✓ Liner Board	2.5	2.0
✓ Bleached White	2.0	1.8
✓ Virgin Kraft	2.0	1.8
✓ Bond	2.5	2.2
✓ Card Stock	2.5	2.2
✓ Fine Paper	2.5	2.2
✓ Slick Coated Paper	3.0	3.0
✓ Magazine Stock	3.0	3.0
✓ Recycled Kraft	2.5	2.5
✓ Milk Carton Stock	N/R	4.0

How do you determine the amount of force required to clamp and lift a roll of paper? Clamp force to load weight ratio will vary depending upon the type of pad on the clamp. There is a clamp pad factor, or ratio, for each pad and type of paper.

In this slide, we show the clamp pad factors, or ratios, for a number of different paper types in two pad type categories. These numbers are required to determine the amount of clamp force needed to lift a roll of paper. Multiply the weight of the roll times the factor to determine the amount of force necessary to clamp and hold the load.

Note: Cast pattern pads are not recommended for milk carton stock.



In the example shown, ribbed cast pads are used for this 6000 pound roll of recycled kraft paper. For that type paper the clamp force ratio for a ribbed cast pad is 2.5. $6000 \times 2.5 = 15,000$ lbs. of clamp force is necessary to clamp and rotate the roll.

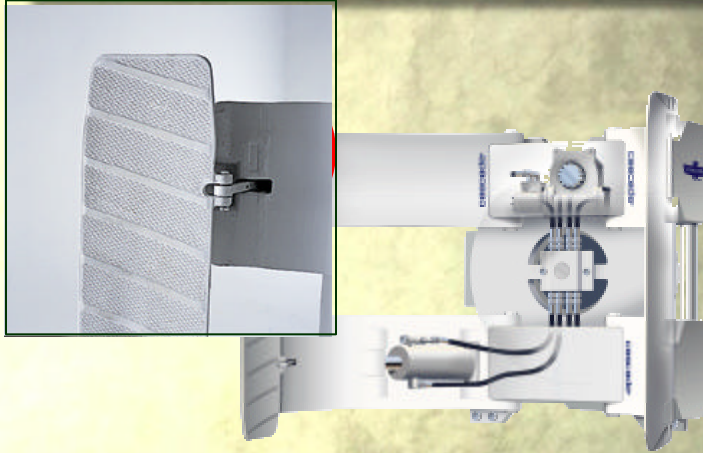
Why is it important to understand the principles of clamp force?

It's important because a clamp may be structurally capable to lift a roll of a given weight, but it may not exert enough clamp force to hold a specific type of paper. For example, a smaller clamp might have the weight capacity to lift a 6,000 lb. roll of paper, but if it is slick paper, such as magazine stock, the smaller clamp may not actually have enough clamp force to hold the roll without slipping.

Clamp force specs are generally not published, so you will have to get this information from your attachment field rep. The fact that you understand clamp force issues will only enhance your credibility with the customer.

Contact Pads...

How's that grab you?



Contact pads are designed especially for certain paper types. Pad surfaces will vary among manufacturers. The pads that we show in the slides that follow are Cascade pads. Other manufacturers may have similarly surfaced pads, but some of these will be Cascade-specific. When you get to the point that you are ready to specify the pad, be sure to consult the attachment manufacturer. The main point that we want to emphasize here, is that there is pad for every paper.

The Right Pad for the Right Job

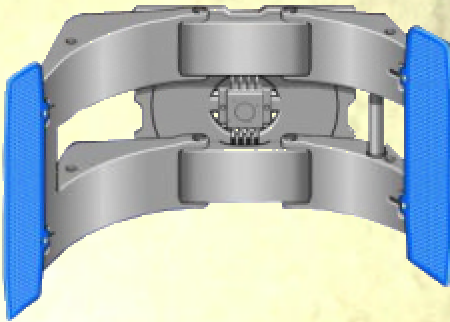


There are many different types of contact pads designed for different types of paper. Different types of paper will require different gripping surfaces. Choosing the right pad is essential in preventing product damage.

The slides that follow will provide a brief description of some of the contact pads that are available, the paper types for which they are suited, and design features of the pad.

Remember; pad types will vary among manufacturers. Be sure to consult the attachment manufacturer to get the right pad type for the paper your customer is working with.

Cast Pattern Pads



- **General purpose for most paper types**
- **Diagonal ridges**
- **Not recommended for slick stock**

Paper types:

This is an excellent general purpose pad for most paper types including, newsprint, kraft, and fine paper.

Design features:

Diagonal ridges in the pad surface provide a multi-purpose gripping surface. Orientation of ridges provides excellent friction in horizontal and vertical positions.

Application information:

Available in any size or pad radius.

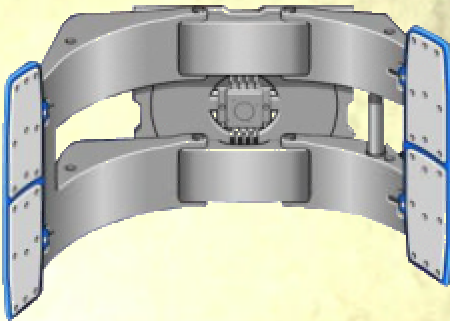
Not recommended in applications with high recycled content approaching maximum clamp capacity.

Not recommended for slick stock.

Suitable for virgin or medium recycled kraft in average capacity applications.

Ribbed cast pad suggested for heavy recycled linerboard.

Bolt-on Rubber



- **Milk carton stock, slick coated paper, newsprint**
- **Non-marking rubber pads**

Paper types: Milk carton stock, slick coated paper, newsprint or any other paper requiring increased friction to reduce necessary clamp force.

Design features: Non-marking rubber pads (black or white) are easy to replace. Available in various durometers (a measurement of rubber hardness)

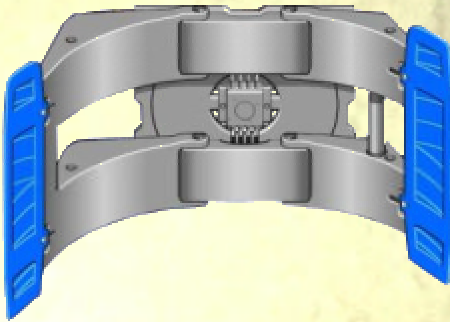
Application information: Standard durometer is 65 (black rubber is more durable than white)

Friction generally increases as durometer decreases.

Durability increases as durometer increases.

Resilience or ability to conform to different radiuses increases as durometer decreases.

Ribbed Cast



- **Recycled kraft papers**
- **Cast-in ribs**
- **Decreased pressure**
- **Limited to standard size and diameter roll**

Paper types: Recycled kraft papers

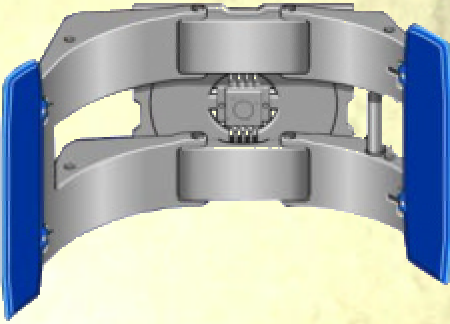
Design features: Cast-in ribs provide increased friction compared to standard cast pad.

Application information:

Allows decrease in clamp hydraulic pressure

Limited to standard size and diameter roll

Bonded Urethane



- **Calendar stock, milk carton stock, fine papers and newsprint**
- **5/16" thick urethane**
- **Excellent friction**
- **Various hardnesses**

Paper types: Calendar stock, milk carton stock, fine papers, and newsprint

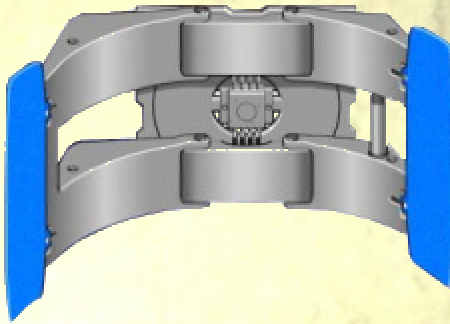
Design features: 5/16" thick layer of durable urethane bonded to a special pad casting with a perimeter edge to protect the urethane when wedging between loads. Urethane is an excellent pad surface for use on difficult-to-handle papers. The domed oval surface helps prevent suction cup action in humid climates, increases friction and resiliency of urethane.

Application information: Used when a resilient surface is beneficial to decrease roll damage by allowing the pad to conform to the roll.

Excellent frictional characteristics

Available in various durometers (65 durometer is standard and recommended for most applications) Friction increases with lower durometer. Durability increases with higher durometer.

Spray Metal



- **Multi-purpose pad for most types of paper**
- **Stainless steel grit surface**

Paper types: Multi-purpose pad for most types of paper, especially those sensitive to imprinting.

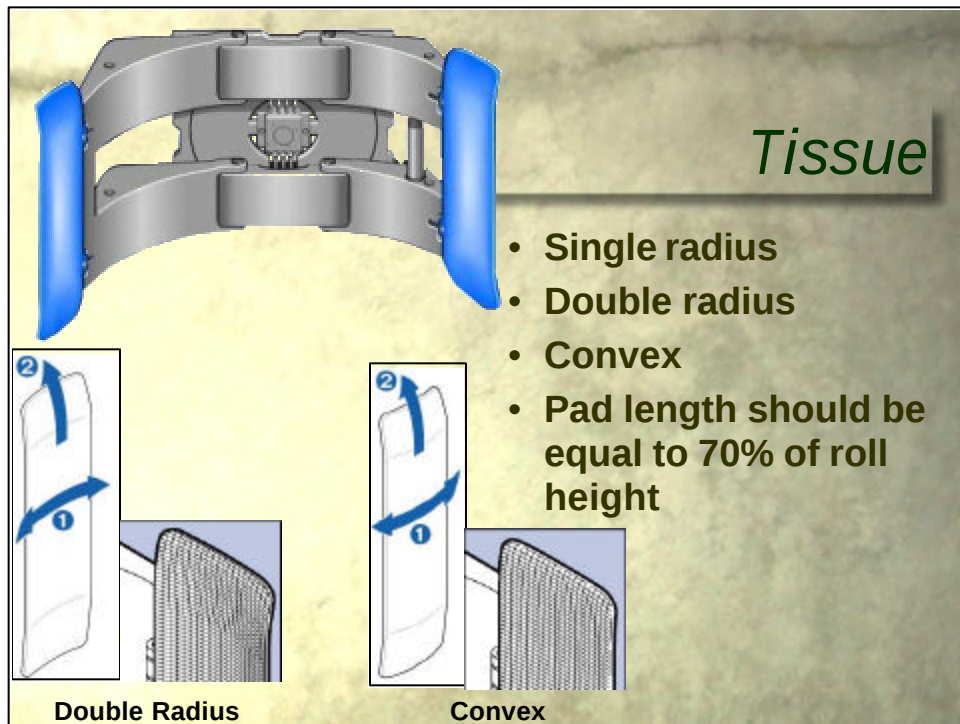
Design features: Stainless steel grit surface provides excellent friction. Does not have any raised textured surfaces that would potentially mark paper sensitive to imprinting.

Application information: Excellent surface for non-standard pad sizes

Surface can be applied to any size or radius pad.

Steel backing plate can be repaired if bent.

Pad available in any size.



As a general rule tissue pad length should be 70% of the height of the roll.

Single radius pads are designed for large rolls of hard tissue or toweling.

Double radius pads have two different curvatures to the pad. The first is the normal concave shape of the pad. The second radius starts at the ends of the pad and curves outward, away from the surface of the roll. The second radius reduces the risk of tearing when the pads compress into the roll upon grabbing. This type of pad is used primarily for wet strength tissue.

Convex pads are used on extremely large rolls of soft tissue such as facial tissue. With a concave pad, the edges of the pad indent into the sides of the roll. The convex pad provides a rounded surface rather than a cupped surface to the roll being handled and eliminates the problem of roll indentation. There are two curves to the convex pad as well. With each curve, the edges of the pad are curved away from the roll.

Truck Selection



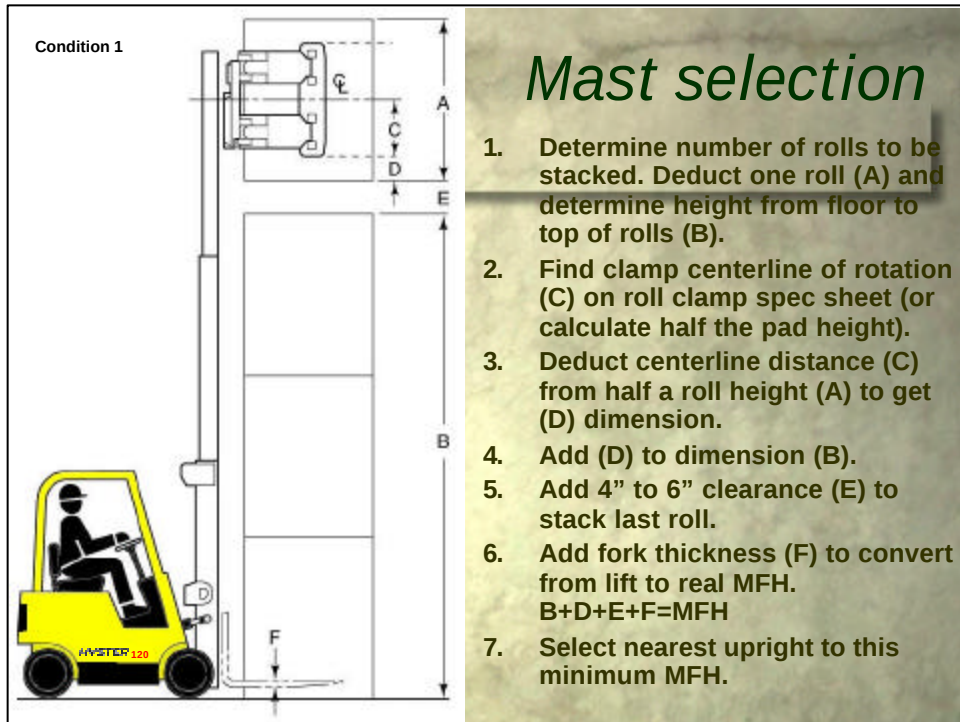
- Load weight + attachment weight = required capacity
- Application needs
- Application restrictions

- a) What capacity will we need? The load weight (8500 lbs.) + the attachment weight (3050 lbs.) = 11,550 lbs. So, we know that we will need at least a 12,000 lb. truck.

Note: Some very large diameter rolls can increase the load center and require an even larger capacity truck.

- b) We know that we are unloading boxcars, so we want the shortest wheelbase available in the weight class to achieve the smallest turning radius.
- c) We're operating indoors so we know we want a cushion truck.
- d) $a+b+c = S120XMSPRS$.

Note: Applications Engineering has a procedure in place called Truck Capacity Request(TCR). If you call Applications Engineering with the load size and proposed attachment, they can help you make sure that you are specifying the correct capacity truck.



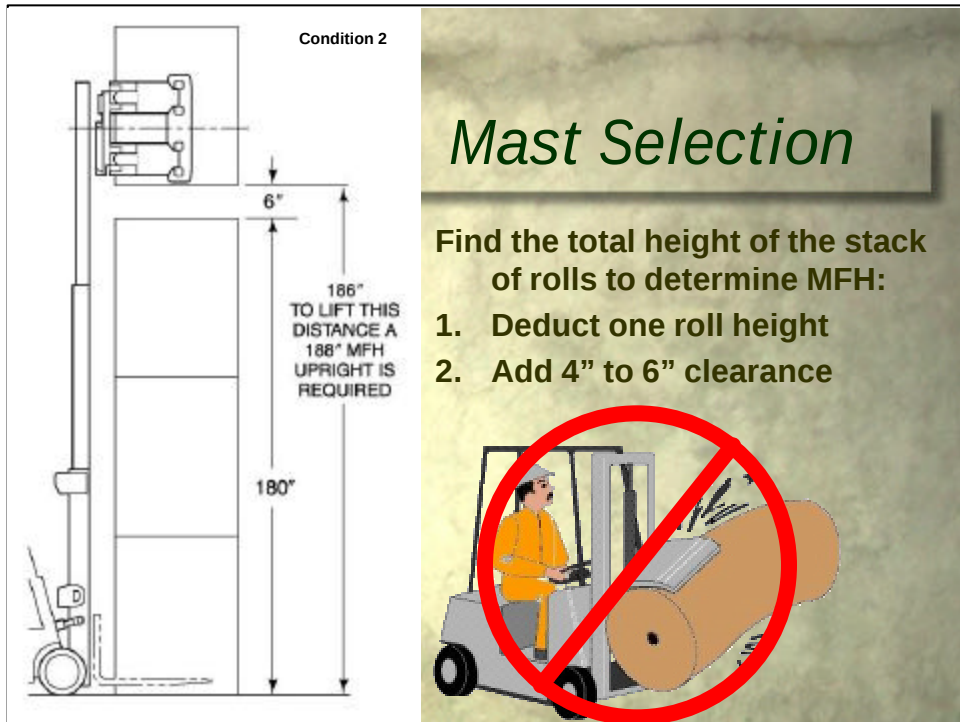
In this example the rolls are clamped in the center for good balance and rotation.

EXAMPLE

- (A) Roll height = 60"
- (B) Roll Column = 180"
- (C) Centerline of clamp rotation = 20.95"
- (D) Exposed portion of roll = 9.05"
- (E) Stacking clearance = 6"
- (F) Std. Truck fork thickness = 2"

$$180" (B) + 9.05" (D) + 6" (E) + 2" (F) = 197.05 \text{ MFH}$$

Note: Select nearest upright which will provide required lift.



In this example, it is sometimes possible to gain a few inches of MFH by clamping the roll at the bottom, and carefully lifting vertically. When using this method, remember not to rotate a roll that has been picked up off center. If the clamp is rotated, it may overload the rotator gears and could cause premature failure. It can also cause roll damage. A very long roll can even create enough off-center loading to cause a truck tip-over. **Always set the roll down and re-clamp in the center before rotating.**

Example:

Stack 60" high rolls four high.

Total stack height = 240"

$240" - 60" = 180"$

$180" + 6" \text{ clearance} = 186"$

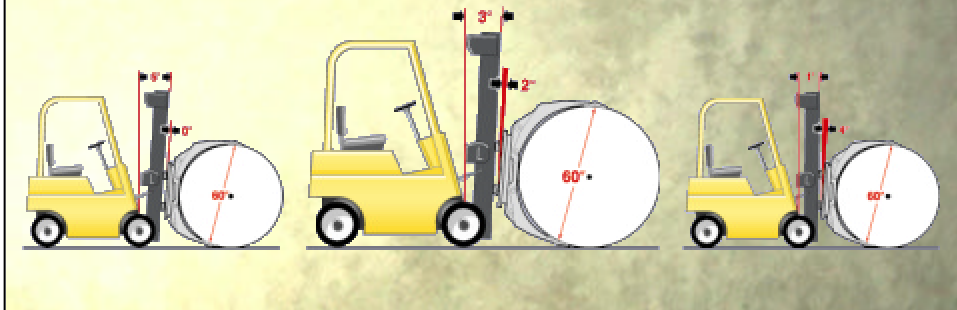
$186" + 2" \text{ fork thickness} = 188" \text{ MFH.}$

Note: Select nearest upright which will provide required lift.

Mounting Angles

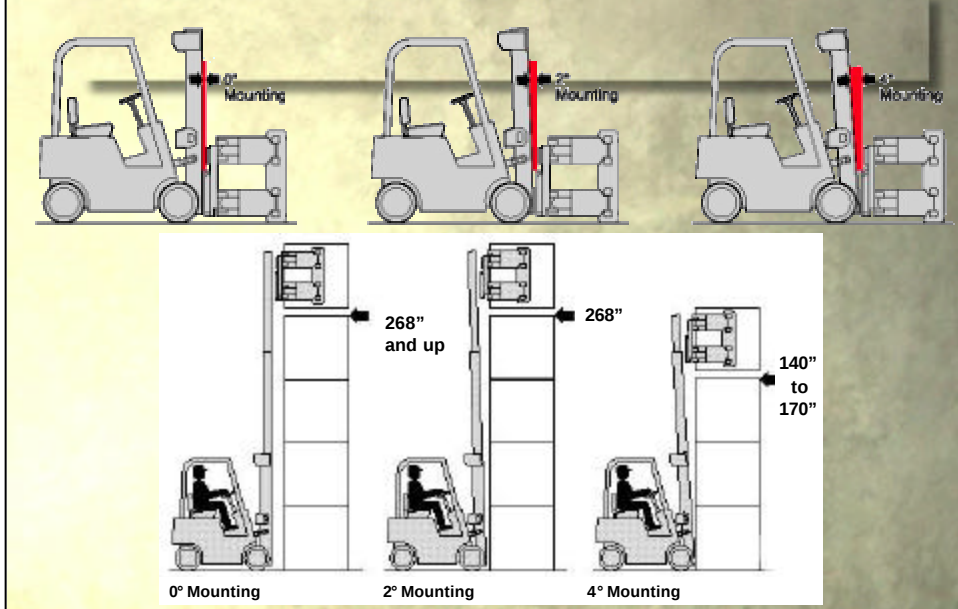
Bilge Pick Up

- Long & Short Arm PRC
- Consideration - Mounting Angle



To pick up rolls in the bilge position (lying on the floor on the side of the roll) requires a minimum of five degrees forward tilt. Without at least five degrees the short arm of the clamp, which will be on the bottom, will reach the roll first and push the roll away from the truck. Five degree forward tilt may be accomplished though the mast, attachment, or a combination of the two. Greater than five degrees of forward tilt is actually preferred for bilge pick up. The reason is that it makes it easier for the operator to get the center line of the roll positioned in the clamp. The S70-120XM masts are equipped with five degree forward tilt standard. The mast meets the minimum requirements for bilge pick up. The Cascade 90F clamp is mounted with a two degree forward tilt. Bilge pick-up can then be achieved with three degree forward mast tilt, or the operator can achieve a full seven degrees of forward tilt, making it easier to position the roll.

Mounting Angles

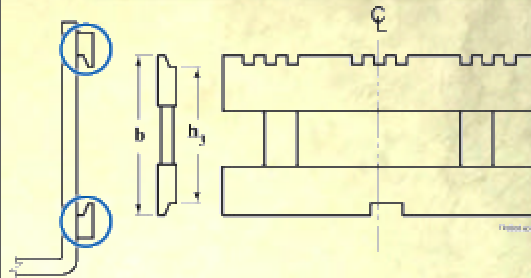


A four degree attachment mounting is great for bilge pick up , because it only requires one degree forward mast tilt. That combination, however has height restrictions. The illustration above shows that a four degree mounting angle runs the base of the mast into the bottom of the stack at heights of 140" to 170".

A zero degree mounting angle is essential when lifting to heights of greater than 268". While keeping the mast vertical, it aligns the center of the roll with the center of the stack. This configuration is not good for bilge pick up, however, as it requires five degree forward mast tilt.

A two-degree mounting angle is a good compromise. It aligns the center of the roll with the center of the stack at 268" with the base of the mast almost touching the stack. It only requires three degrees of forward mast tilt for bilge pick up, but it is restricted to lift heights of 268". For stacks above 268", use a zero-degree mounting angle on the clamp, and keep the mast vertical.

Carriage Selection

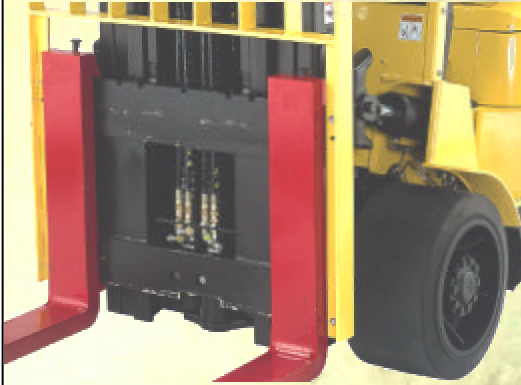


- Below are ITA specs for hook-type carriages. The B measurement is especially important to insure that the attachment fits the carriage.

	Class II	Class III	Class IV	Class V
b ref	16.00"	20.00"	25.00"	28.67"
h3 Min	14.96"	18.69"	23.44"	26.64"
h3 Max	15.00"	18.75"	23.50"	26.70"
Capacity Min. (lbs.)	2000	5501	10,001	17,501
Capacity Max. (lbs.)	5500	10,000	17,500	24,000

S70-120XM comes with Class III and Class IV carriages depending on truck capacity.

Carriage Selection



Standard S120XM carriage shown with forks and load backrest

You will not need:

- **Sideshifter**
- **Load Backrest**
- **Forks**

You will Need

- **Side thrust bearing group (Standard on S120XMS-PRS)**

The side thrust bearing group is necessary when adding an attachment. The additional weight of the attachment creates torsional forces which can cause movement of the carriage within the mast channels. The side thrust bearing group reduces the movement of the carriage and increases the lateral stability of the load. The benefit is superior load control.

Hydraulic Accumulator



- Dampens load shocks during travel
- Reduces clamp force requirements
- Reduces product damage that can result from slippage
- Factory-equipped accumulators come pre-charged at 3000 psi.
- Your service department will need to adjust the pressure.
- The S120XMS-PRS comes standard with a 1 quart hydraulic accumulator.

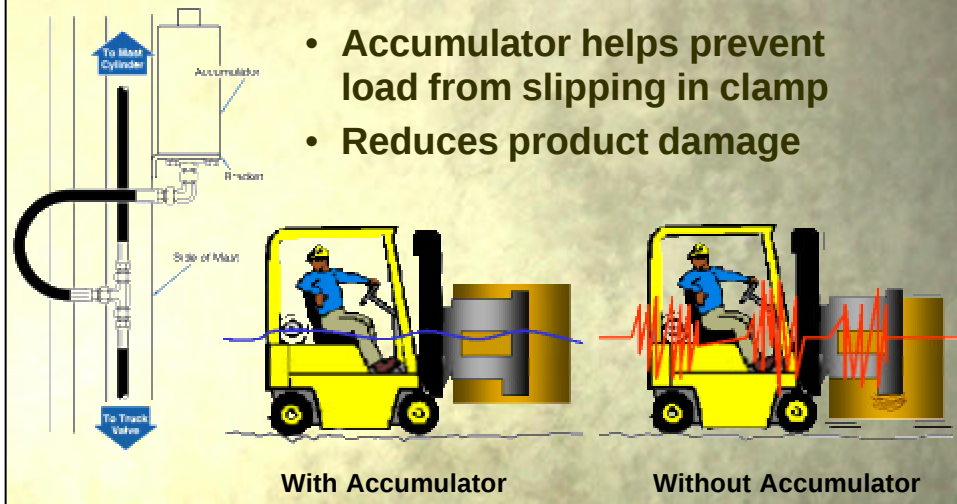
A hydraulic accumulator serves to dampen load shocks during travel. This reduces damage to the paper roll caused by slippage.

Accumulators come from the factory charged at 3000 psi. Your service department will have to adjust the pressure in the accumulator to maximize shock absorption of the load by the accumulator.

Be sure to check price pages to insure you are using the correct size accumulator for the capacity of the truck.

Note: If you are re-fitting a truck at your dealership or in the field, the accumulator may not come pre-charged and will require a charge kit.

Hydraulic Accumulator

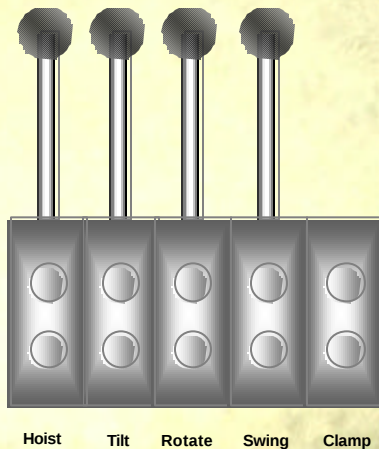


Hydraulic accumulators cushion the load so that the surface of the ground does not affect the ability of the clamp to hold the load. The accumulator helps to keep the load from slipping in the clamp, thereby reducing costly product damage. An accumulator in the hoist cylinder can reduce shock to the load by as much as 35%, depending on loading conditions.

How accumulators work:

Nitrogen gas occupies the space above the piston. Hydraulic oil occupies the space below the piston. When shock to the hydraulic system occurs, fluid from the hoist circuit flows into the accumulator compressing the gas. The shock is then absorbed reducing the risk of damage. Note that the accumulator works on the hoist circuit; not the clamp circuit.

Hydraulic Control Valve



- **Five-function valve**
- **Truck has two hydraulic functions**
- **Attachment has three hydraulic functions**
- **Five functions controlled by four levers**

The attachment has three functions; clamp, swing, and rotate. The truck requires two hydraulic functions; lift/lower and tilt. The total combined number of functions adds up to five, so we know that a five-function valve is required.

You should note that one function is specifically designed for clamp attachments. This is a detented circuit, which means that once the valve is opened, it will retain its position until it is manually released.

Five functions are controlled by four levers. Hoist, tilt, and rotation are controlled by individual levers. The swing and clamp function are controlled by the same lever with the secondary function being controlled by an “H” pattern in the lever actuation.

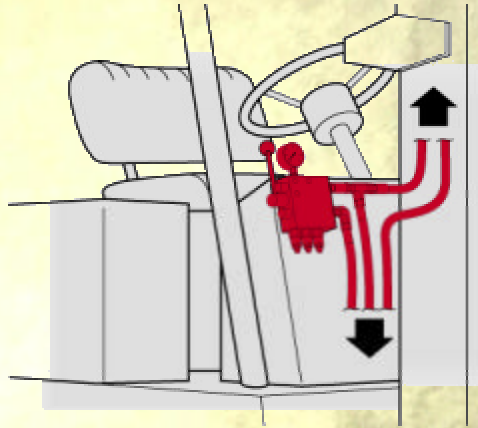
Hose Groups

How does the hydraulic oil get to the carriage?

- **Truck will require a five function hose group**
- **Two truck functions; three attachment functions**

Consult your price pages for hose group options. This clamp will require a five-function hose group. The most specified will determine which five-function hose group you will choose.

Hydraulic Pressures



TR2153

Three-position Pressure Regulator Valve

- Hydraulic pressures of truck and attachment must match
- Optional hydraulic pressure regulator
- Pressure adjustments for different paper types

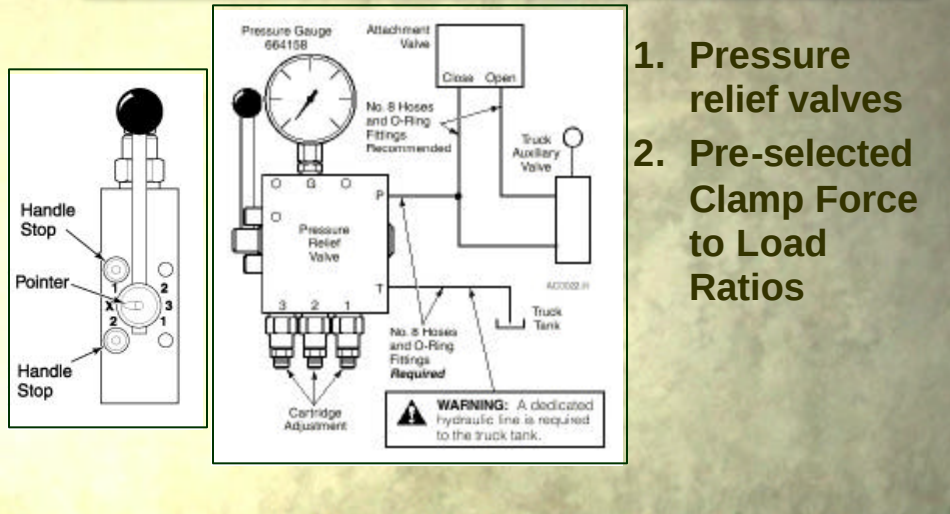
The truck's auxiliary hydraulic system has an operating pressure of 2250 psi. Consult the sales manual to determine maximum pressure for the clamp.

In our exercise, the 90F-RCS-21C clamp we are using runs at 2300 psi, so the truck and clamp pressures are matched. If the two are not matched, you will need to choose an optional hydraulic pressure regulator and gauge from the price pages.

Operating pressure may also have to be adjusted depending upon the type of paper being handled. For example, if a light tissue paper was being handled in which no crushing of the roll is allowed, the pressure should be adjusted using the optional three-position pressure gauge.

Controlling Clamp Force

Hydraulic Pressure Regulator



1. Pressure relief valves
2. Pre-selected Clamp Force to Load Ratios

Hydraulic clamping force or pressure applied during clamping varies according to load density and other physical characteristics of the load. Pressure regulators permit using the minimum amount of hydraulic pressure to satisfactorily clamp the load.

A three position pressure regulator and gauge is available in the Hyster price pages for the paper roll special.

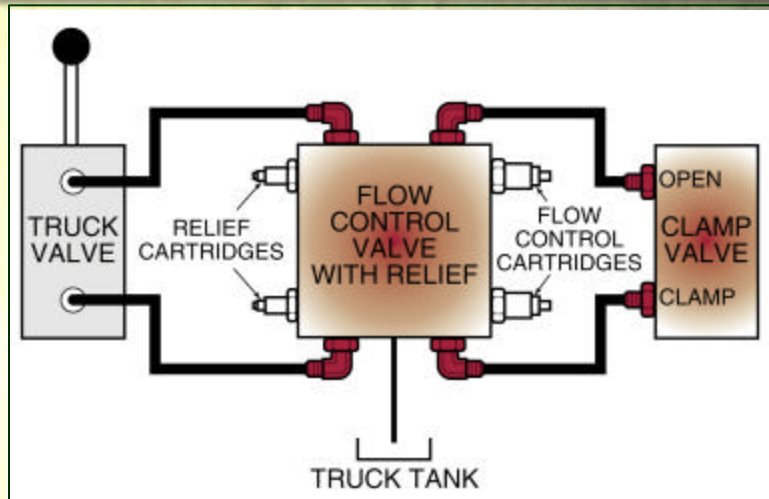
Other methods of controlling pressure are available and vary among attachment manufacturers. They may include:

Pressure relief valves limit pressure and stabilize the clamping force of attachment arms.

Weight based proportional clamp force/pressure control.

Control is achieved by clamping the load with a predetermined threshold pressure. During initial lift, the hoist speed is decelerated and additional clamp force added as the hoist cylinder base pressure increases. The final clamp force applied is determined by the pre-selected Clamp Force to Load Ratio.

Hydraulic Flow Rate Matching Hydraulic Systems



Hydraulic incompatibility is the major source of problems for attachments. Ask your service department for the hydraulic flow rate for the standard truck. In this case it is 23.5 GPM. The clamp we have selected clamps and rotates at 15 GPM.

In applications in which clamping and rotating of capacity loads is frequent or heavy, the excess flow could cause added heat gain, which can shorten the life of hydraulic components. In these types of applications, the truck should be fitted with a Hydraulic Flow Control Valve. (See clamp manufacturer's accessories.) This will enable you to reduce the flow rate to match the requirements of the clamp.

A low-pressure tank line kit for return oil may also be recommended.

Summary

- **Load considerations – size and weight of roll, type of paper, type of wrapping, etc.**
- **Clamp requirements – hydraulic pressures and flow rates**
- **Truck selection**
- **Mast selection**
- **Carriage selection**
- **Hydraulic accumulator**
- **Hydraulic control valves**
- **Hose groups**

Special thanks to Cascade Corporation

- For providing information, graphics and technical assistance in developing this presentation.

For more information
about attachments call
1-800- CASCADE or
visit the web at
www.cascorp.com

