

# *PSI STRAND CHUCK MANUAL*

## *TABLE OF CONTENTS*

*Introduction*

*Chapter 1 Understanding Strand Chucks*

*Chapter 2 Chuck Maintenance Room*

*Chapter 3 Types of chucks*

*Chapter 4 Stressing Systems and how they relate to Strand Chucks*

*Chapter 5 What to do when your chucks arrive*

*Chapter 6 Regular chuck cleaning*

*Chapter 7 Strand Chuck inspection*

*Chapter 8 Strand Chuck lubrication*

*Chapter 9 Stressing with the strand chuck*

*Chapter 10 When to reorder and how to store your chucks*

*Appendix A Problems & solutions*

*Appendix B Safety bulletins*

# PSI STRAND CHUCK MANUAL

## *Introduction*

*A word about SAFETY vs PRODUCTIVITY. Throughout this manual we stress safety first. No one wants to have someone hurt or killed on the job. Many times with a strand failure, not only is there a safety compromise but it will cost you money as well. Money lost due to extra OSHA inspections, rejected product, plant shutdowns, and increased insurance rates add up fast.*

*Do it right the first time! Save lives and money too!*

# Chapter 1

## Understanding Strand Chucks

Strand Chucks, also known as grippers, wedges, donuts, and lockoffs., are cylindrical metal devices used for gripping the prestress cable, commonly known as strand, while under tension. There are several strand chuck manufacturers and many different sizes, however they all work basically the same way.

Components that make up a multiple use strand chuck include a cap, spring, retaining ring, three jaw segments and a body. The strand chuck body is a round cylinder with a tapered hole through the center which allows the three jaw segments to fit inside. Each jaw segment is also tapered. The outside is smooth while the inside has many rows of sharp ridges known as teeth. The jaw teeth are what bite into the strand, keeping it from slipping through. The retaining ring is used to hold all three jaw segments together, both in and out of the chuck body. The cap and spring fit together to provide constant pressure on all three jaw segments, keeping them aligned under tension. (See diagram 1)

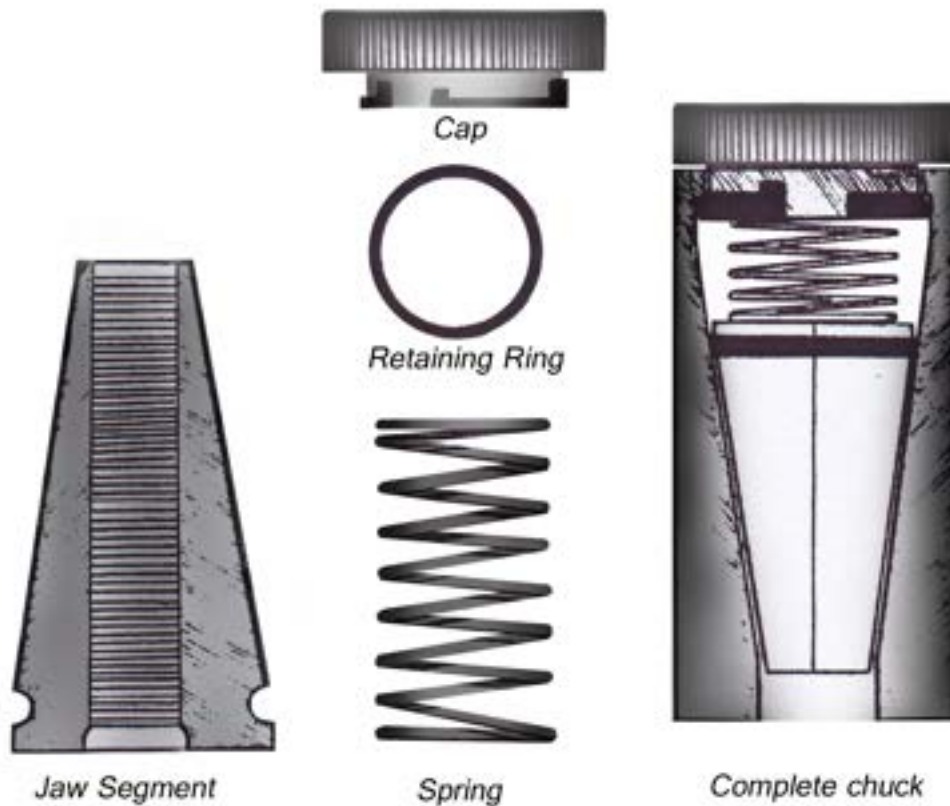


Diagram 1

## How Strand Chucks Work

*In prestressing, the objective is to pull the strand, stretching the cable to a predetermined load. Once the required level of tension is reached, the stressing ram releases the cable and the strand chuck takes over. The strand chuck now holds the tensioned strand in place without letting it slip back to its original length.*

*Strand chucks are used at both ends of the form, also known as a "bed". The end of the form in which the stressing jack is located is known as the "live end" and the opposite end of the form is the "dead end". In some cases as many as 70 to 80 chucks may be used on just one form. Many times the loads placed upon strand chucks in normal use may exceed 20,000 to 40,000 pounds of force (depending on strand size). That is enough force to cut a man in half should the strand let go or break. **AT ALL TIMES, SAFETY MUST BE THE NUMBER ONE CONCERN!***

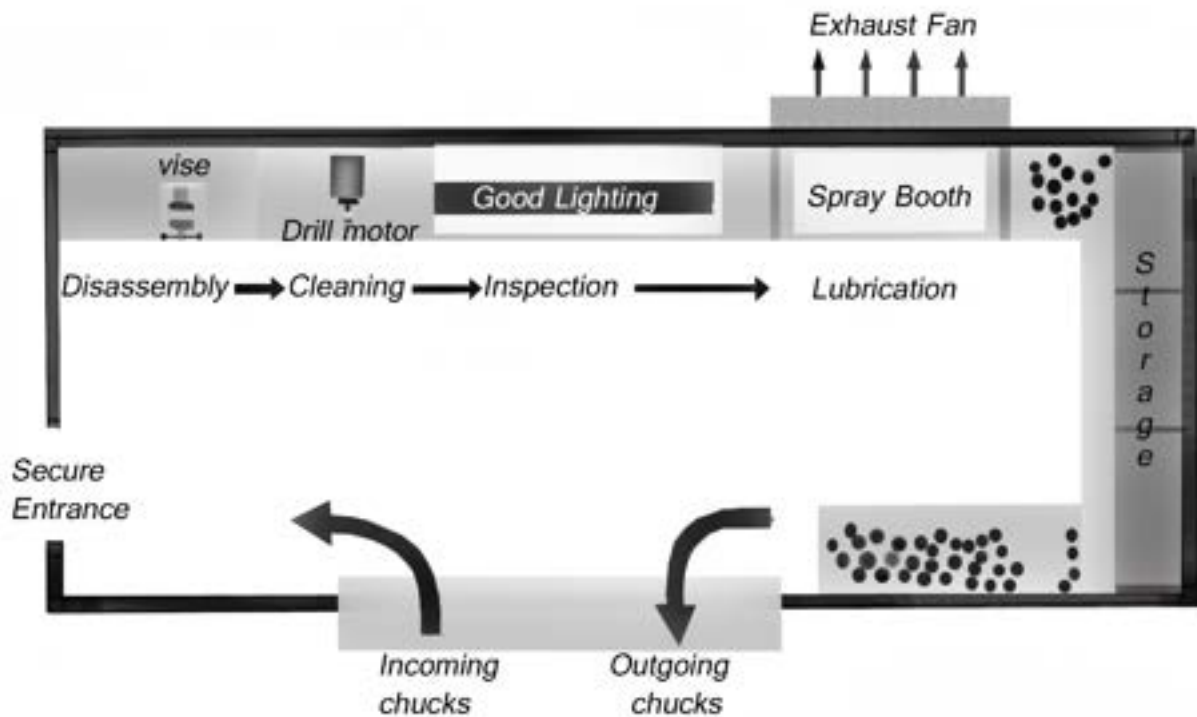
*All too often people ask, "Its just a chuck, so why are they so expensive"? Strand chucks are manufactured using high grade steel and very detailed heat treating. Each component has to meet very fine tolerances that will enable parts of **the same size and brand** to fit together with ease, yet be able to withstand the rigorous demands of prestress operations.*

*When you are dealing with the safety of the people out in the plant, strand chucks are a small price to pay!*

# Chapter 2

## Chuck Maintenance Room

The area in which the chucks are cleaned, inspected, lubricated, and stored is known as the "chuck maintenance area or room". The room should be large enough to handle the number of chucks necessary to operate the plant on a daily basis. The area should be well ventilated and free of moisture and airborne contamination such as concrete or saw dust. Make sure the maintenance area is efficiently set up so the chuck maintenance person can comfortably move around the area. The person should be able to go from one procedure to another without having to move things around.



The chuck maintenance area should be secure. You cannot have a successful chuck operation when unauthorized people are allowed to walk into the chuck area and walk out with a hand full of chucks that may or may not be ready for use. Only allow the person responsible for chuck maintenance to access the chuck room.

Know that every chuck that goes out is operationally ready to use!

*The necessary tools needed to run a successful chuck operation are as follows: a horizontal drill motor with drill chuck, a heavy duty vise, well lit work bench, exhaust fan, at least one chuck removal tool, for every size strand, and one sliding hammer to be used with the removal tool.*

*Some of the supplies needed include, chuck lubrication, of which there are several types available (see chapter 7). Retaining rings for every size of jaws used. Body and jaw cleaning brushes (see chapter 6). Safety glasses which **MUST** be worn when using the jaw and body cleaning brushes.*

*Finding the right person to do the chuck maintenance can be a challenge. The person should be willing to learn, have an understanding of why procedures must be followed, and take their job seriously. Not doing their job or cutting corners could lead to a workers injury or worse. Its better to get someone who has no prior chuck experience than someone who thinks they know all about chucks and is unwilling to change. Having a properly trained back up person is also a good idea. Do not allow a temporary fill in to substitute unless that person has the necessary training and has read this manual.*



# Chapter 3

## Types of Chucks

The most widely used strand chuck is the multiple use chuck with cap and spring. The next type of chuck is the multiple use anchor chuck. This chuck uses the same jaw assembly, however the body is much shorter and the anchor chuck has no cap & spring. The anchor chuck is used primarily on the dead end of the form (opposite of jacking end). No load transfer takes place at the dead end so the cap & spring are not necessary. The remaining chuck is a multiple use splice chuck. This chuck is used to join two pieces of strand together in the form. The splice chuck is really two chucks in one. There are two chuck bodies combined with a threaded coupling in the middle. The splice chuck uses the same jaw assemblies as is used in the multiple use strand chuck.

**NOTE:** Special caution should be used when connecting splice chucks to the strand. The ends of the strand that go into the splice chuck **MUST** be cut with a cut-off saw. Do not use a torch to cut any strand that will go into a splice chuck! The heat from a cutting torch can alter the molecular structure of the strand for up to 6 inches from the cut. If you attempt to use strand cut with a torch the strand could fail at the chuck possibly causing injury or death. The ends of the strand should be clean and free of burrs. The strand **MUST** go all the way into the splice chuck body until it bottoms out against the coupling. This is the only way to ensure the jaws will fully grip the strand. (See diagram 2). The splice chuck bodies **MUST** be screwed all the way onto the coupling until no threads are left exposed.

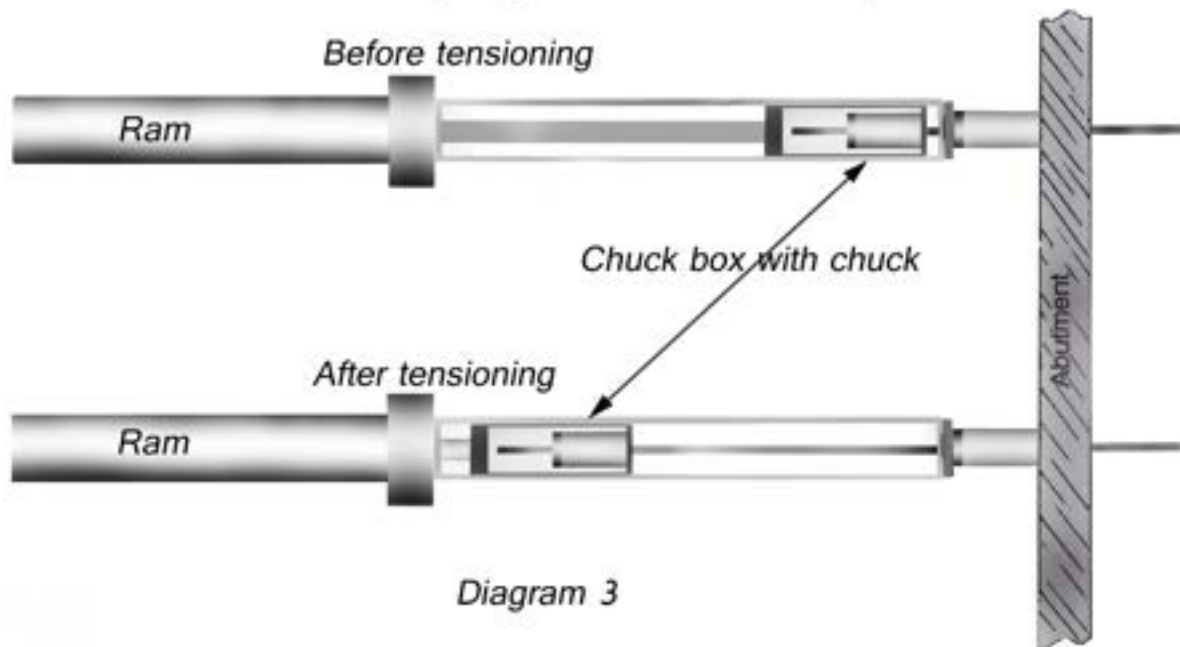


Diagram 2

## Chapter 4

### Stressing Systems & How They Relate To Strand Chucks

Hydraulic stressing systems known as "jacks" are used to pull the cables. Stressing jacks consist of a power unit and a ram. There are basically two types of rams, the center hole & open face. The center hole ram has a special set of gripper jaws that are inside the ram. When the strand is fed through a hole in the front of the ram, the gripper jaws lock onto the strand. When hydraulic pressure is applied, the jaws move toward the back of the ram pulling the strand. The open face ram is open on top exposing a rectangular box known as a "chuck box". A multiple use chuck is slipped over the strand. The strand chuck is now placed inside the chuck box. When hydraulic pressure is applied the whole chuck box moves toward the back of the ram pulling the strand. (See Diagram 3).



When stressing, the ram **MUST** be in-line with the strand both vertically and horizontally. Any off-center stressing could result in damage to your chucks or even a strand failure (See Diagram 4). The front of the ram that makes contact with the strand chuck is called the "station wear plate" This should be inspected every morning for damage or wear. Also important to inspect are the ends of the form known as the "abutment" This is where the strand chucks make contact with the form. The abutments **MUST** be smooth and flat with no high spots or ridges.



Some types of stressing jacks have a feature that allows the ram to slowly release the tension on the strand, gently transferring the load to the strand chuck. By not using the "ease-off" feature, the load transfer is sudden and can result in damage to the stressing jack gauges and the strand chucks. Such a shock to the system is known as "shock loading". For best results and safety, follow the jack manufacturer's recommendations. Also require the stressing jack operator to have a thorough working knowledge of the equipment and has read the jack owners manual.

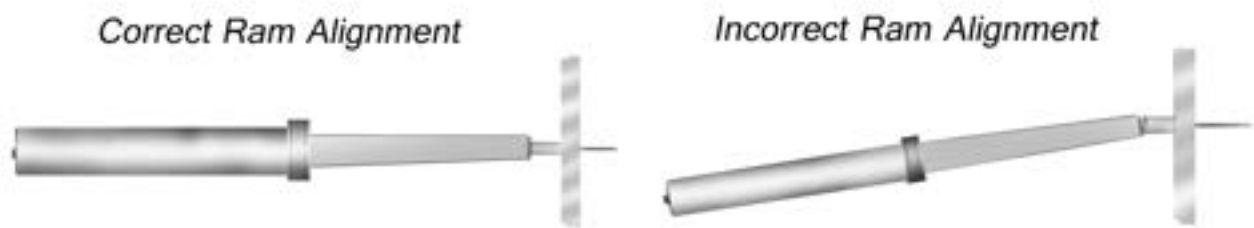


Diagram 4

## Chapter 5

### What To Do When Your Strand Chucks Arrive

*When a box of strand chucks arrive at your plant, where do they go? Do they go to the office or directly to the plant? Whoever signs for the package should first inspect the box for damage. If some of the contents have been lost or damaged have the delivery driver document the damage and save the box as this will help when filing a claim. Once the chuck maintenance person has the box, locate the packing slip. Check the contents with the packing slip to confirm the correct size and quantity were shipped. If there is a discrepancy, contact the supplier so the order can be corrected. Now you can be sure you received what you ordered. Be sure to forward the packing slip to the office for processing. If the chucks are going to be stored, leave them in the original box unless wet.*

*Strand chucks may come with a protective wax like coating to prevent corrosion. We recommend cleaning and lubricating the chucks before their initial use. Wipe the strand chucks down with mineral spirits or kerosene to remove the protective coating. Let the strand chucks dry before attempting to lubricate them.*

# Chapter 6

## Regular Chuck Cleaning

Once the strand chucks have been used, they need to be cleaned and inspected after every use. In prestress plants there is a combination of contaminants that could interfere with the chucks ability to grip the cable. Some include rain, dirt, dust, concrete paste, metal shavings, form oil, grease, paint, rust and a host of other things. When contamination gets into the chuck and is left unchecked, several things can happen. The strand chuck may lock up on the strand requiring the use of a chuck removal tool. Contamination can also cause one or more jaws to hang up in the chuck body during stressing which could lead to a strand failure. Another common problem that occurs is lubricant build up. Some chuck lubricants when used over and over create an uneven layer of buildup inside the chuck. Under load, the jaws would be riding on a rough, uneven, surface inside the chuck possibly causing the jaws to hang up. Any build up in the jaw teeth will diminish the gripping efficiency resulting in excessive strand slippage. (see diagram 5)

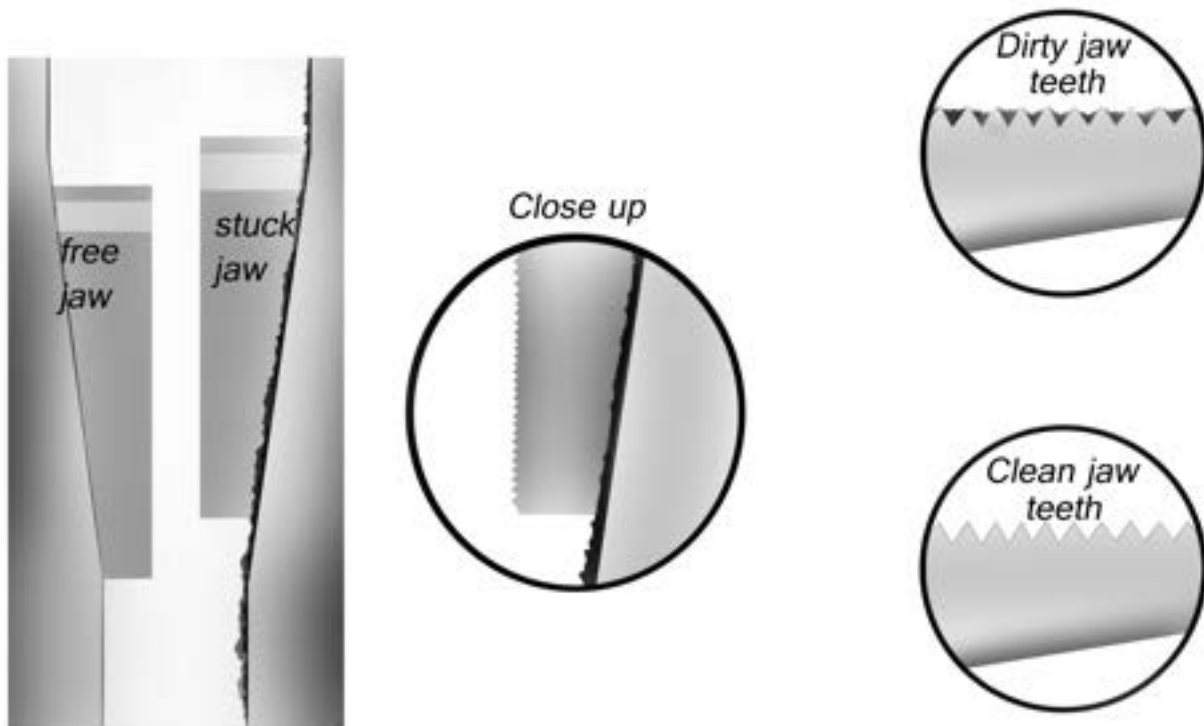


Diagram 5

Areas that need to be cleaned include the inside of the chuck body and the front and back of the jaw assemblies. Any other spots that have noticeable buildup should be cleaned as well. The most common method involves using a mounted horizontal drill motor and drill chuck which will turn a body cleaning brush or a jaw cleaning brush.

**CAUTION: Protective eye wear should be worn while using the jaw and body brushes. Gloves are also recommended.**

With the drill motor running and up to speed, insert the chuck body on to the body brush slowly and gently press the body back and forth on the brush. Do not go from side to side as this will damage the brush resulting in fewer uses. Now check the inside of the chuck body. It should be smooth and free of build up. If not, repeat the process. (see diagram 6)

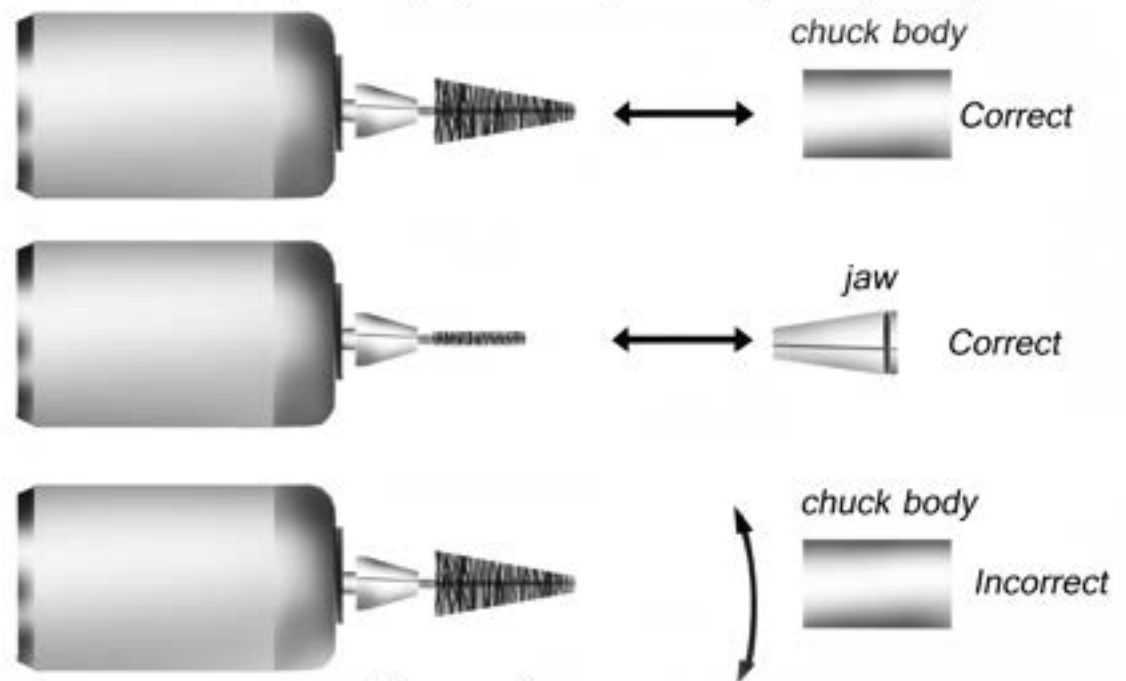


Diagram 6

When cleaning the jaw assemblies, leave the retaining ring on to keep all the jaw segments together. Use the jaw brush in the drill motor the same way as the body brushes are used. Now look at the jaw teeth. Make sure the valleys between the teeth are free of buildup. Any buildup on the outside of the jaws can be removed with a rag and mineral spirits. If the buildup on the jaws are excessive, they may need to be soaked in mineral spirits.

Another proven method of cleaning your chucks is vibratory cleaning. With this method the number one rule is **DO NOT USE** any type of man made media such as ceramic beads, or steel shot as this will dull the teeth on the jaws reducing the number of uses you will get.



# Chapter 7

## Strand Chuck Inspection

Now that the surface contamination has been cleaned off, you can see what condition your chucks and components are in. The two basic types of wear are usage wear and damage wear. Usage wear is caused by normal use in the plant, like worn down dull jaw teeth, broken or shredded retaining rings, worn chuck bodies and caps that no longer stay connected, and worn-out springs (see diagram 7).



Good



Bad



Good



Bad

Diagram 7

*The chuck body is almost perfectly round inside. When the chuck body is struck with enough force to put a deep indentation in it the chuck body can be knocked out of round. The next time the chuck body is used, the chuck will lock up on the strand even worse than before. Now even more force is required to free the chuck which will increase the chuck body damage. This will continue until the chuck body becomes unusable. Even worse; if you strike a chuck body and the damage is deep enough a small microscopic crack could start. Over time and further abuse the crack could enlarge to the point where the chuck body can no longer handle the load and fails. A chuck body failure can result in the body exploding under pressure throwing shrapnel and releasing the strand. If you see a worker striking a strand chuck stop them! They are jeopardizing the safety of all who work around the forms.*

*Never apply heat to the strand chuck to get it to release. Concentrated heat can weaken the chuck body causing a chuck body to fail. In the event a strand chuck is locked up on the strand, cut the cable releasing the chuck and return the chuck and cable to the chuck room for proper removal. (See Chapter 10).*

*Burned through teeth*

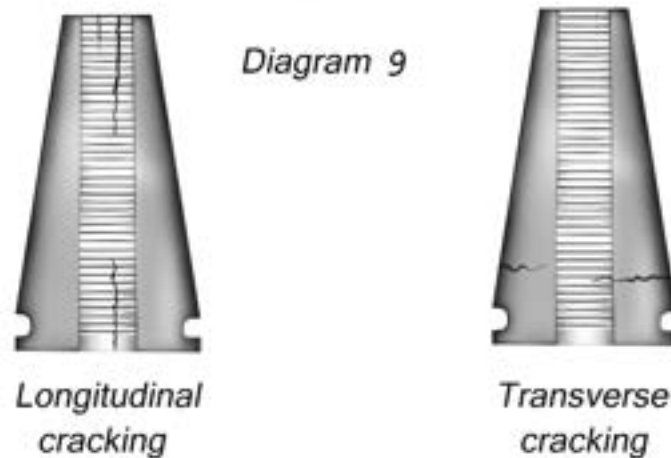


*Diagram 8*

*Other damage can show up in the jaw assemblies. Jaws that have burned through teeth (See diagram 8) have had the strand slip through the chuck with enough force to erase the teeth where the strand contact was made. Many times this can be a sign of shock loading the strand (See Chapter 4). Other causes may include dirty jaws, contamination on the strand or using the wrong strand size. Any time you find jaws with teeth missing, those jaws should be discarded.*

Another form of wear is jaw cracking. The **MOST** serious type of cracking occurs across the jaw horizontally. This is known as transverse cracking. (See Diagram 9). Some causes include improper heat treating by the manufacturer, and mixing different brands of jaws. Should this type of cracking occur, contact your supplier immediately. Stop production until the source of the cracking can be identified. With this type of cracking an uncommanded strand release is possible.

A more common type of cracking is longitudinal or tip cracking. While not as severe as transverse, tip cracking will lessen the life expectancy of your jaws. There are many factors that can cause tip cracking such as over-stressing, jaw offset, the wrong size strand, ram misalignment, shock loading, and mixing brands. This type of cracking does not pose a hazard to workers and jaws with very fine tip cracking can even continue to be used. However your jaws should be inspected after every use and should be discarded should the cracks enlarge.



# Chapter 8

## Strand Chuck Lubrication

Lubrication is just as important as cleaning and inspections. Having a thin layer of lubrication between the inner wall of the chuck body and the outer wall of the jaw assembly will enable all three jaw segments to move together up and down inside the chuck body. **REMEMBER** the more efficient your chucks perform, the more uses you will get out of them. The time it takes to lubricate them far outweighs the time wasted trying to get them apart after stressing.

There are several different types of chuck lubricants available that work well. Some include -graphite or molly spray, teflon spray, and powdered graphite. Use which ever lubricant that works best for you. Just remember it has to perform well under extreme compressive loads. Some types of common lubricants will actually act more like a glue when put under heavy compressive loads. Remember to follow the recommended instructions.

All types of graphite, or molly sprays must be dry before re-assembling your chucks, otherwise they will stick. Strand chucks should always be lubricated in the chuck maintenance room so components will have a chance to dry and also limit the amount of dust and airborne contamination that might stick to them during the drying process. Do not lubricate your chucks out at the form as they may not have time to dry and may become contaminated.

When lubricating the outside of the jaw assembly should be dusted or sprayed taking care not to expose the jaw teeth to any lubricant. The inside of the chuck body should also be lubricated. Once dry you can drop the jaw assemblies into the chuck body and, secure the cap.



# Chapter 9

## Stressing With The Strand Chuck

During the form setup, there are several important precautions that should be followed. The first is protecting the strand. When drawing the strand through the form try and avoid letting the strand drag through or lay in the mud or dirt. Dirty or muddy strand can contaminate the strand chucks when they are attached. **AT NO TIME** should the strand ever be exposed to any kind of welding, cutting torch, or weld splatter. Just one tiny weld splatter can cause a strand to break under load. Avoid kinking the strand and try and avoid too much form oil getting on the strand. Not only can this cause chuck slippage, it could also effect the concrete adhering to the strand.

**MAKE SURE** no strands are crossed in the bed and everything is aligned before applying a load to the form.

Once the strand is in place, it's now time to attach the chucks on the strand. On the live end the strands should come out far enough beyond the abutment so the stressing ram can be attached. On the dead end the strand only needs to come out far enough to attach the strand chucks. Check the strand for contamination and remove before attaching the chuck. Remember when the chuck slides on to the strand, what ever was on the strand may now be inside the jaws.

When placing chucks on the strand, start at the dead end and slide chuck all the way up the strand until the chuck makes contact with the abutment. When using anchor chucks it will be necessary to push the jaws all the way into the chuck body ( See diagram 10).

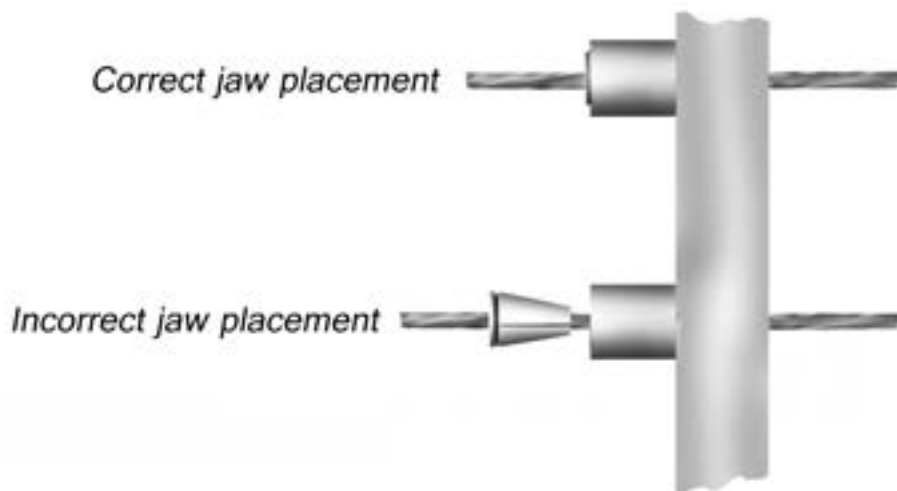


Diagram 10

Once the strand chucks are all in place, remove the caps and make sure the jaw segments are all in line with each other. If a chuck is found with the jaws off set, remove the chuck and re attach it and check the jaws again. If the jaws continue to be mis-aligned remove that chuck and replace it. Confirm that all the caps are locked into place. Now the stressing can begin. **REMEMBER** to follow all the stressing jacks manufacturer's instructions and recommendations.

**WARNING:** During the tensioning process, all unnecessary personnel should leave the stressing area. The persons operating the stressing jack should stay behind an approved barricade or cage. **REMEMBER:** Until the concrete is poured that form should be treated like a loaded gun!

After the proper curing process has taken place, the form can be stripped. Before the product can be removed, all the strand chucks must be cut loose. This is known as detensioning the form. The most common method involves cutting the strand loose with a torch. Most forms are equipped with a detensioning box or area located at each end of the form. (See Diagram 11).

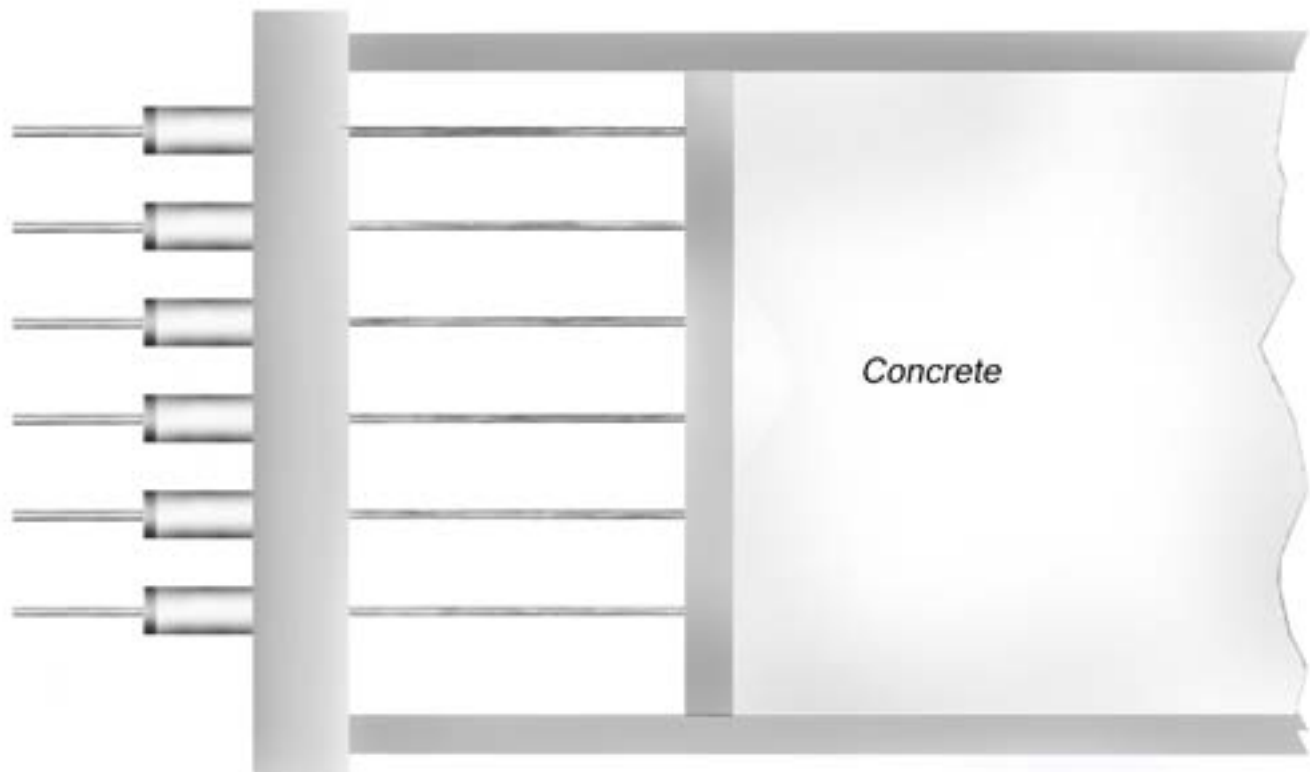


Diagram 11

The detensioning area allows a cutting torch to reach the bare tensioned strand. The cutting torch should have a "rose bud" tip for heating the cable not cutting it. **DO NOT** heat the strand in one spot. Instead wave the torch head back and forth on the cable slowly heating it until it breaks. While the strand is being heated most of the tension will relax so when the strand finally breaks it is at a much lower load than just cutting the strand. Cutting the strand closer to the chuck will help keep the strand from unwinding making it easier to remove from the abutment.

**CAUTION:** The torch operator must always wear eye protection.

Once the chuck has been cut loose, remove the strand and take the chucks to the chuck room for cleaning. If the chuck is locked up on the strand **DO NOT BEAT THE CHUCK!** Just put the chuck with the strand in a bucket and bring them back to the chuck room as well.

Any chuck that is jammed on to the strand should be put in a vise and use a removal tool and sliding hammer to release the jaws. (See Diagram 12) The removal tool will fit over the strand and slide into the hole in the bottom of the chuck making contact with the jaws inside. Once the removal tool is struck the front of the tool will impact the jaws breaking them loose. A sliding hammer should always be used in conjunction with the removal tool. Trying to use a regular hammer will put an uneven shock onto the tool possibly cracking the tip. The sliding hammer will hit the removal tool evenly and not damage it.

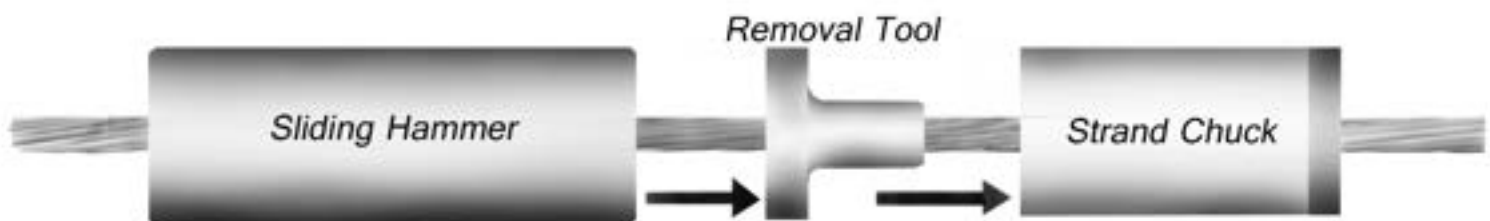


Diagram 12



# Chapter 10

## When To Re-Order and How To Store Your Strand Chucks

*There is no chuck manufacturer out there that can accurately tell a customer how many uses they will get from a strand chuck, or chuck components because of the many different variables, such as the ones discussed in the previous chapters. By practicing the suggested procedures in this manual, the chuck maintenance persons job will be a lot easier when it comes time to re-order more chucks or parts.*

*Remember even if you place the order today it might take up to a week before your parts arrive. Try and have back up chucks and parts on hand to avoid costly over night shipping.*

*With a typical strand chuck, the retaining ring must be replaced most often. So always keep a good supply of retaining rings in stock for every size chuck you use. The next item will be your jaws Always keep a few dozen jaws available. Remember If the correct procedures are not followed a set of jaws could be ruined after just one use. Have plenty of springs on hand as they will need to be replaced as needed. Try and keep a spare case of chuck lubricant and a spare box of jaw cleaning & body cleaning brushes as well. If you can't clean and lubricate your chucks you can't use them!*

*Is your project coming to an end? Will you need to store your chucks? Whether its short term or long term storage the chucks should be cleaned and inspected. No sense in storing damaged or worn out chucks. Cleaning them now will be a lot easier than cleaning them later.*

*If storage is short term, go ahead and lubricate and store them in a secure, dry place until needed. If the storage is going to be long term, spray the chucks with a light oil or dip them in diesel fuel. This will help control any corrosion that might occur. Now box them up and store them in a dry, secure area. Mark each box with the size and type of chuck.*

**NOTE:** *If chucks are stored long term they may need to be re-cleaned and lubricated before the next job starts.*