

# NATIONAL SWAGING MACHINE AND DIE WARNING, USE, MAINTENANCE AND APPLICATION INFORMATION

## National Four Post Swaging Machine



### ⚠ WARNING

- Misuse of swaging machine can result in serious injury or death.
- READ, UNDERSTAND, AND FOLLOW all the information in this warning document and the instructions shown in "Wire Rope End Terminations User's Manual" before operating the swaging machine.
- Swaging machine operators must be trained in accordance with the information supplied by The Crosby Group LLC. **THE SWAGING MACHINE OWNER IS RESPONSIBLE FOR THE TRAINING AND THE SAFE OPERATION OF THE SWAGING MACHINE.**
- Do not swage oversize parts.
- Only swage parts of the proper design, material and hardness.
- If misused, dies and/or die holders may break. **PROTECT YOURSELF AND OTHERS: Always stay away from the sides of the swaging machine during swaging operations and alert others in your work area.**
- Do not shim between dies.
- Do not shim die or die holder unless swaging aluminum sleeves.
- Do not use die holders that are damaged or have loose side rails or side plates.
- Tie rod nuts must be secured to the tie rods with a secondary retention system.
- Keep head, hands, and body away from moving swaging machine and die parts.
- Consult die manufacturer for correct use of their product.
- Adjust swaging machine tonnage to the Working Load Limit (WLL) tonnage shown on the die block being used. If the Working Load Limit is not legible, refer to Die height & width and corresponding Working Load Limit (See Table 1). Failure to do so can result in serious injury or death.

### Operation Safety

- NEVER use dies that are cracked, worn or abraded (galled).
- NEVER use dies that have an oversized cavity.
- ALWAYS use a matched set of dies.
- When swaging steel fittings, DO NOT SHIM DIES. Dies for steel fittings must be free to float and align one to the other.
- When swaging aluminum fittings, THE STEEL DIES MUST BE SHIMMED. Shim the side of the die to ensure the proper cavity alignment for flash removal.
- NEVER shim between the dies.
- When Swaging Crosby National fittings, use only the proper capacity swaging machine for the size of fitting used (See Swaging Capacity Chart). If the swaging machine capacity exceeds the die block Working Load Limit rating, adjust the swaging machine tonnage to the Working Load Limit shown on the die block being used. See Table 1 for die block Working Load Limit.
- Always use the correct size and type of die for the size wire rope fitting used.
- Make sure that the manufacturer's die retention locking pin, bolt, or other device is engaged and has secured the die before swaging. Make sure that the dies are straight, parallel, and perpendicular to each other before and during the swaging procedure.
- Always lubricate die faces and cavities with light weight oil.
- Progressive swaging of fittings must be done in accordance with procedure shown in "Wire Rope End Terminations User's Manual". Only open channel dies are to be used.
- Stop swaging when the cavity side of both dies touch. Observe the die closure from above and slightly to the side. The best position is to stand 45 degrees to either side of the front.
- Make sure part is swaged to the recommended after swage dimensions (See Crosby General Catalog or "Wire Rope End Terminations User's Manual", Die Guide, or Die Chart).
- If a swage fitting other than a Crosby National is used, determine adequacy of the termination by a destructive pull test.
- All swage sockets must be swaged with socket head adjacent to the socket relief (largest radius) on the die.
- For special applications or conditions, contact Crosby National (501)962-3112.

TABLE 1

Die Size (Height x Width)	Working Load Limit (WLL)*
2" x 3-1/2"	200 Ton Mark Series
2-1/2" x 4"	200 Ton National
2-1/2" x 5"	500 Ton Mark Series
4" x 7"	1,200 Ton Mark Series
5" x 7"	1,500 Ton National
6" x 12"	3,000 Ton National

\* Note: These Working Load Limits are for Crosby® National Die Blocks only. The Working Load Limits of die blocks from other manufacturers may vary.

## Inspection Maintenance Safety

- Make sure the swager is in good operating condition and that all gauges, indicators and controls are working properly.
- Make sure all bolts and nuts are in place and tightened to recommended torque as shown in Table A, on page 13 for new style swaging machines, and Table B on page 14 for current swaging machines.
- Load block or die base plate surfaces must be to manufacturers specifications for thickness and flatness to provide complete support of the die during swaging.
- Make sure die holder side rails are not bent, loose or damaged.
- Clean dies and die holder surfaces. Keep free of metal shavings, slag, grit, sand, floor dry, etc.
- Lubricate the four guide bushings daily with light oil.

### Die Working Load Limit Pressure Adjustment on Lower Cylinder National 500 Ton through 1500 Ton Swaging Machines

Follow this procedure to adjust swaging tonnage (pressure) on your swaging machine.

1. Install the die holder(s) or die adapter with the dies to be used.
2. Bring the dies together (without a part in the dies) until they just touch.
3. Turn the tonnage control valve, which is located on the control panel left of the tonnage gauge, counter-clockwise about (6) six turns or until knob no longer turns.
4. Now (without a part in the dies) apply pressure to the dies by pressing the foot pedal marked "up".
  - A. If the tonnage is lower than desired Working Load Limit, turn the valve clockwise while continuing to press the foot pedal marked "up" until desired Working Load Limit is reached.
  - B. If tonnage is higher than desired Working Load Limit, release pressure by pressing the pedal marked "down". Then repeat steps 2 through 4.

- Inspect the rods for corrosion. Use #000 emery cloth or steel wool to maintain a high polish surface.
- Do not increase the hydraulic system pressure above the factory preset pressure of: 6500 psi for 500 ton, 1000 ton and 1500 ton swaging machines – 5000 psi for 3000 ton swaging machine.
- Under ordinary operating conditions, drain and clean reservoir every two (2) years.
- Make certain that the hydraulic reservoir is full when the swager is in the full open position.
- Filters inside of the reservoir should be cleaned every time the reservoir is drained and cleaned. The Racine "tell-tale" suction filter should be cleaned every six (6) months.

### Die Working Load Limit Pressure Adjustment on 3000 Ton Swaging Machine

For reducing tonnage, use selector switch on front of control panel to select lower tonnage (approximately 1500 Tons) or 3000 Ton.



**WARNING**

ALWAYS USE 5 X 7 OR 6 X 12 DIES AT 1500 TON SETTING.



**WARNING**

USE ONLY 6 X 12 DIES ON TONNAGE THAT EXCEEDS 1500 TONS.

### Swaging Machine Capacity Chart for Swage Sleeves, Ferrules and Buttons

Hydraulic Swaging Machine Size	Swaging Method	Die Size (in.)	Largest Fitting Allowed to be Swaged (in.)*			
			S-505 Sleeve	S-506 Sleeve	S-510 Ferrules	S-409 Buttons
500 Ton	Full Die	Mark Series 2-1/2 x 5 4 x 5 5 x 7	1-1/2	1-1/4*	9/16*	7/8*
1000 Ton	Full Die	4 x 7 5 x 7	2-1/2	1-1/4*	9/16*	1-1/4*
1500 Ton	Full Die	5 x 7 6 x 12	3-1/2	1-1/4*	9/16*	1-1/4*
3000 Ton	Full Die	6 x 12	4-1/2	1-1/4*	9/16*	1-1/4*

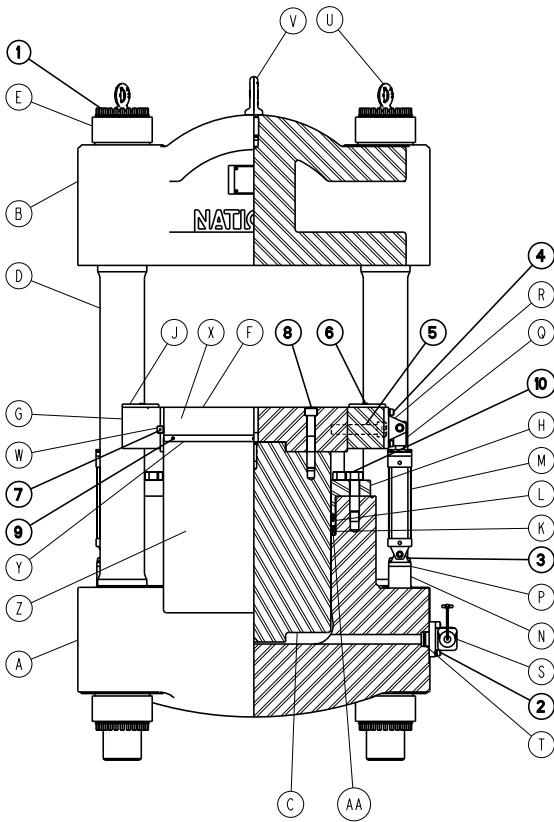
\* Largest size fitting available.

### Swaging Machine Capacity Chart for S-501 and S-502 Swage Socket

Hydraulic Swaging Machine Size	Swaging Method	Die Size (in.)	Largest Fitting Allowed to be Swaged (in.)*
500 Tons	Full Shank	Mark Series 2-1/2 x 5 4 x 7 5 x 7	3/4
	Progressive	4 x 7 5 x 7	1-1/4
1000 Tons	Full Shank	4 x 7 5 x 7	1
	Progressive	4 x 7	1-1/2
1500 Tons	Full Shank	5 x 7 6 x 12	1-1/4
	Progressive	5 x 7 6 x 12	2
3000 Tons	Full Shank	6 x 12	2
	Progressive	6 x 12	2-1/2

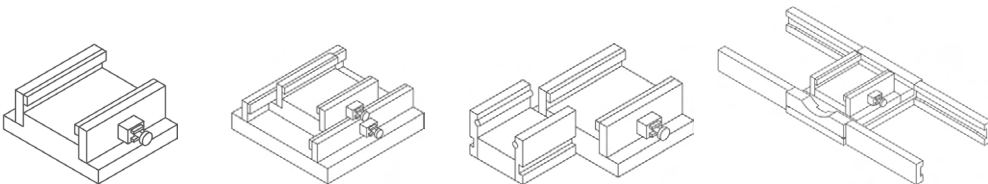
\* Largest size fitting available.

# “NEW STYLE” NATIONAL HYDRAULIC SWAGING MACHINE TORQUE MAINTENANCE INFORMATION



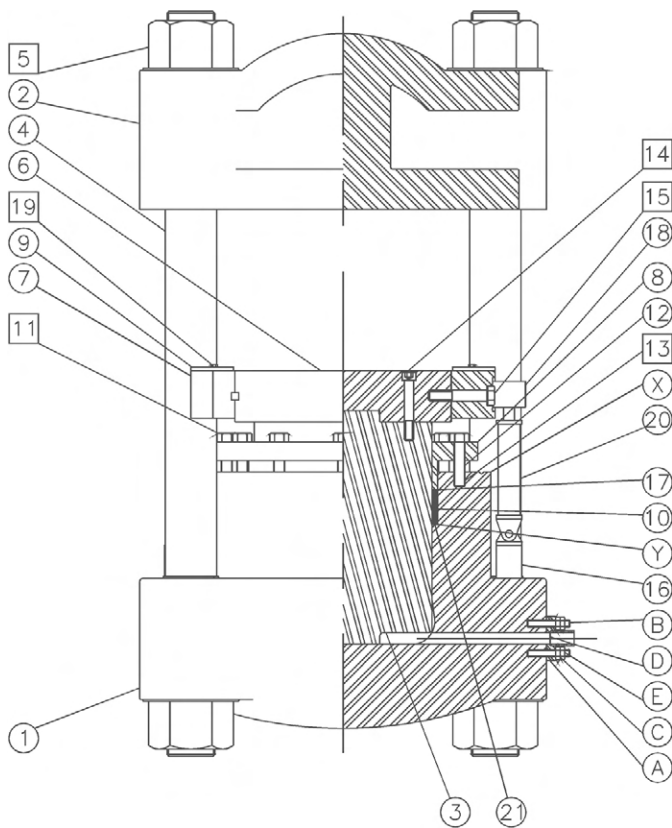
Item	No. Req'd.	Description
A	1	Cylinder
B	1	Housing Cap
C	1	Piston
D	4	Tie Rod
E	8	Tie Rod Nut
F	1	Platen
G	2	Guide
H	1	Gland
J	4	Bushing
K	1	Mono Seal
L	1	Seal Spacer
M	2	Side Cylinder
N	2	Side Cylinder Mount
P	2	Lower Bracket
Q	2	Knuckle
R	2	Upper Bracket
S	1	Check Valve
T	1	Check Valve Seal
U	4	Tie Rod Eyebolt
V	1	Cap Eyebolt
W	4	Key
X	2	Bumper
Y	2	Bumper Strip
Z	2	Rubber Skirt
AA	1	Bottom of Seal Cavity

Item No.	No. Req'd.	Description	Torque in Ft-Lbs			
			500 Ton Swaging Machine	1000 Ton Swaging Machine	1500 Ton Swaging Machine	Maintenance Schedule
1	Varies	Tie Rod Nut Jack-Bolts	105	N/A	260	Weekly
2	4	Check Valve Bolts	100	100	100	Weekly
3	8	Lower Bracket Bolts	100	100	100	Weekly
4	8	Upper Bracket Bolts	100	100	100	Weekly
5	4	Guide Bolts	250	250	250	Weekly
6	8	Bushing Screws	15	15	15	Weekly
7	4	Key Screws	4	4	4	Weekly
8	4	Platen Bolts	525	600	700	Monthly
9	6	Bumper Apron Screws	4	4	4	Monthly
10	12	Gland Bolts	700	800	800	Monthly



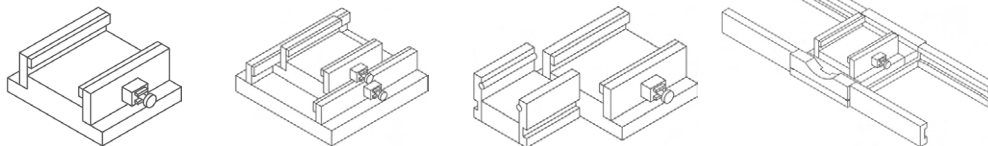
	Bolt Size Thread Form	Torque in ft./ lbs.
Die Holder Bolt Torque	1/4 20 UNC	13
	5/16 18 UNC	15
	5/8 11 UNC	211
	7/8 9 UNC	583

# NATIONAL HYDRAULIC SWAGING MACHINE TORQUE MAINTENANCE INFORMATION



Item	No. Req'd.	Description
1	1	Cylinder
2	1	Housing Cap
3	1	Piston
4	4	Tie Rod
5	8	Nut
6	1	Platen
7	2	Guide
8	1	Gland
9	4	Bushing
10	1	Packing Set
11	12	Packing Gland Nut
12	4	Packing Gland Spacer
13	12	Stud
14	4	Cap Screw
15	4	Cap Screw
16	2	Lower Bracket
17	1	Upper Bronze Ring
18	2	Upper Bracket
19	8	Machine Screw
20	2	Side Cylinder
21	1	Lower Bronze Ring
A	1	Block
B	4	Stud
C	4	Nut
D	1	Copper "O" Ring
E	4	Lock Nut
X	1	Top of Cylinder
Y	1	Bottom of Packing Cavity

Table A						
Item No.	Description	Torque in Ft. Lbs.				Maintenance Schedule
		500 Ton Swaging Machine	800 Ton Swaging Machine	1000 Ton Swaging Machine	1500 Ton Swaging Machine	
5	Tie Rod Nuts	2000	2250	2500	2500	Weekly
14	Piston Bolts	525	600	600	700	Monthly
11	Packing Gland Nuts (over spacers only) "all others hand tighten"	200	200	200	200	Weekly
15	Platen Guide Bolts	250	250	250	250	Weekly
13	Packing Gland Bolts	700	800	800	800	6 Months
	Side Cylinder Bolts	100	N/A	100	150	Weekly
19	Guide Bushing Bolts	15	15	15	15	Weekly
80 M Piston Pump Pistons		96 to 125 all Swaging Machines				



	Bolt Size Thread Form	Torque in ft./lbs.
Die Holder Bolt Torque	1/4 20 UNC	13
	5/16 18 UNC	15
	5/8 11 UNC	211
	7/8 9 UNC	583

## Die Information

### CAUTION

- **Improper die selection could result in significant loss of efficiency in the termination.**

National dies and die holders are made solely for swaging properly designed fittings on wire rope, and any other uses are prohibited.

The swaging operation results in a high degree of cold metal flow. The movement that occurs between the fitting and the dies will cause wear of the dies. Therefore, to prolong the life of the dies, it is important to always lubricate die faces and cavities between each pass with a light weight oil or high pressure grease.

When scores appear in the die cavities, the dies should be removed from service.

### **NEVER EXCEED THE WORKING LOAD LIMIT OF DIES OR DIE HOLDERS.**

All National Standard dies 1/4" through 1" include an open channel die cavity and a tapered die cavity in the same die block.

### **Dies for S-505 Standard Steel Sleeves (Flemish Eyes)**

#### *Die sizes for 1/4" through 1"*

Swaging 1/4" through 1" Standard Steel S-505 sleeves on Flemish Eye terminations requires the use of the taper cavity only. Refer to page 24 of the *Wire Rope End Termination User's Manual* for proper die selection.

#### *Die sizes for 1-1/8" and above*

Swaging 1-1/8" and larger Standard Steel S-505 sleeves on Flemish Eye terminations requires using 2 sets of open channel dies (1st stage and 2nd stage) for each size. Beginning with the 1st stage die and finishing with the 2nd stage die will achieve proper after swage dimensions. Dies for S-505 Sleeves 1-1/8" and larger are single cavity with open channel. Refer to page 24 of the *Wire Rope End Termination User's Manual* for proper die selection.

#### Using S-505 Sleeves with Metric Ropes

Although Crosby National S-505 Standard Steel sleeves are designed to be used with most metric ropes, there are selected "intermediate" sizes of metric ropes that when swaged in standard National dies utilizing Crosby National S-505 sleeves do not achieve required after swage dimensions and efficiencies. To ensure all S-505 sleeves achieve the required efficiency when used with metric ropes, Crosby provides special National swaging dies to be used in conjunction with selected size metric ropes. These new dies will produce the required efficiencies and after swage dimensions.

The table found on Page 25 of the *Wire Rope End Termination User's Manual* identifies the new dies that are required to properly swage the selected intermediate size wire ropes not covered in the standard product offering found on Page 24 of the manual.

*Dies for 6mm through 26mm (except 12mm, 20mm and 24mm)*

Swaging on 6mm through 26mm metric ropes for Flemish Eye slings requires the selection of the proper S-505 Standard Steel sleeve and the use of the tapered cavity only. Refer to page 24 of the *Wire Rope End Termination User's Manual* for proper sleeve and die selection.

*Dies for 12mm, 20mm and 24mm*

Swaging on 12mm, 20mm and 24mm metric ropes for Flemish Eye slings requires the selection of the proper S-505 Standard Steel sleeve and the use of both the open cavity and tapered cavity in special dies. Refer to page 25 of the *Wire Rope End Termination User's Manual* for proper sleeve and die selection.

*Dies for 28mm and larger*

Swaging on 28mm and larger metric ropes for Flemish Eye slings requires the selection of the proper S-505 Standard Steel sleeve and the use of 2 sets of open channel dies (1st stage and 2nd stage) for each size. Beginning with the 1st stage die and finishing with the 2nd stage die will achieve proper after swage dimensions. Dies for S-505 sleeves 28mm and larger are single cavity with open channel. Refer to page 24 of the *Wire Rope End Termination User's Manual* for proper sleeve and die selection.

Important: If the specific size metric rope required is not listed on page 24 of the *Wire Rope End Termination User's Manual* refer to Intermediate Metric Die Chart on page 25 of the manual for proper sleeve and die selection.

*Dies for QUIC-PASS® Swaging System – 1/4" through 1-1/2"*

The QUIC-PASS® swaging system allows "Flemish style" wire rope terminations to be swaged in only two passes. This is accomplished while maintaining currently published efficiency ratings and utilizing National Swage S-505 Standard "COLD TUFF"® Steel Sleeves.

The special design of the QUIC-PASS® dies allows the swaging process to be completed in just two passes, resulting in a 50-75% reduction in the number of passes required with conventional swaging systems. Unlike standard round dies, the QUIC-PASS® dies close completely with each pass, resulting in an increase in overall swaging process efficiencies (the job can be performed quicker), a reduction in the complexity of swaging (the concern for excess flashing between dies has been eliminated) and a reduction in training time needed for operators (more user friendly).

The finished sleeve has a "Hex" appearance that provides a QUIC-CHECK® look to determine if the termination has been swaged and provides a flat surface that allows for ease of I.D. stamping on the finished sleeve. Refer to page 24 of the *Wire Rope End Termination User's Manual* for proper die selection.

### Dies for S-501 & S-502 Swage Sockets

Swaging all S-501 & S-502 Swage Sockets requires the use of single cavity die. This is a special die designed with a relief for swage sockets and extra length to swage the full length of the shank. Refer to pages 36 and 37 of the *Wire Rope End Termination User's Manual* for proper die selection.

#### Swage Sockets for Spiral Strand Rope

Our tests indicate that if the spiral strand is 1 x 19 or greater, and the ultimate strength does not exceed Table 4 of ASTM A586, you can use dies for size swage sockets up to the 1-1/4". For sizes greater than 1-1/4" the following table will apply:

If the strand is of greater strength than Table 4 or has less metallic area, we must recalculate the design and test for adequacy.

### Dies for S-506 Turnback Sleeves

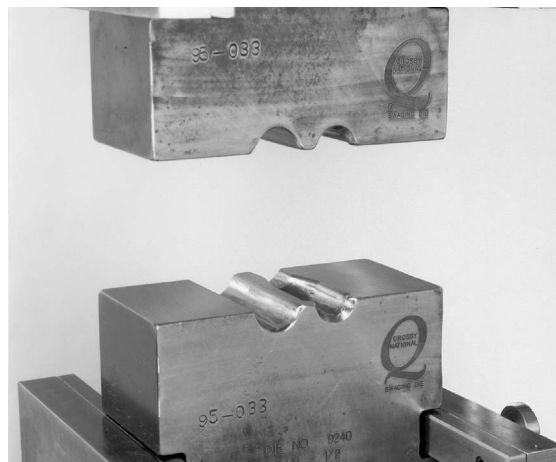
Turnback eye terminations using 5/16" through 1" S-506 Sleeves utilize the S-505 Standard Steel Sleeve die (1st Stage open channel die only). The 1-1/4" S-506 Sleeve utilizes the 1-3/8" socket (S-501 and S-502) die. Refer to page 46 of the *Wire Rope End Termination User's Manual* for proper die selection.

### Dies for S-409 Buttons

Buttons are swaged in open channel dies. Refer to page 42 of the *Wire Rope End Termination User's Manual* for proper die selection.

Specific recommended swaging practices can be found in each product section of this brochure. The proper die selection and the recommended maximum after swage dimensions are referenced in the section of this brochure that contains the product you are swaging. This information can also be found in The Crosby General Catalog (See Section "Wire Rope End Terminations"), the National Swage Die Guide, or by referring to the National Swage Die Chart.

Dies and die adapters to fit other type swaging machines are available upon request (Refer to page 19).



Two Cavity Die



Never use dies that are cracked, worn or abraded (galled).



Single Cavity Die

# After Swage Inspection Procedures

## ⚠ WARNING

- Read, understand, and follow these instructions before using the National QUIC-PASS® Swaging System.
- Improper after swage dimensions can result in sling failure resulting in property damage, serious injury or death.
- Always gauge or measure the after swage dimensions to ensure proper sling performance.
- Using National Swaging System with ropes and termination styles other than shown in these procedures may reduce the performance of the termination and lead to premature failure.
- When using rope constructions other than shown in this procedure, the termination must be destructive tested and documented to prove adequacy of the assembly to be manufactured.
- The QUIC-PASS® Swaging System is designed only for “Flemish Eye” terminations using National S-505 Standard Steel Sleeves.
- The QUIC-PASS® Swaging System is not designed for Cable-Laid wire rope slings or fiber core wire rope.

### Checking Swaging Dimensions

One of the important considerations in producing a quality termination is the overall diameter of the fitting after the swaging process is complete. Since all dies wear, and the swaged fitting used in terminations have spring back, the results of swaging should be checked periodically to determine the wear condition of the die as well as to ensure the fitting is swaged to proper dimensions.

#### Key Facts About After Swage Dimensions:

1. In addition to worn dies, not achieving the proper after swage dimension can also be due to the die not being fully closed during swaging. Dies showing excessive wear should be replaced.
2. The effective swaging that dies can accomplish stops when the die lands touch each other. Any continued swaging adds needless wear and strain on the dies and swaging machine.
3. By placing a light oil on the die faces and in the cavity, the dies will be lubricated as well as protected.
4. The oozing of the oil from the faces of the dies as they touch will indicate when the dies have closed. At this point, stop the swaging cycle.
5. Additional swaging adds needless wear and strain to the dies and swaging machine.
6. Never use dies that are cracked, worn or abraded (galled).
7. The Crosby Group does not recommend the checking of die dimensions as an acceptable method of determining the quality of a swage sleeve, button, ferrule, or socket.
8. It is our recommendation that the checking of the after swage dimension of the swaged fitting is the most accurate indicator of a properly swaged termination. Measuring the die cavity only is not an acceptable process control check.
9. If the die cavity wears, the dies are not closed completely during swaging. If an inadequate number of presses are used, it could be quickly identified by checking the after swage dimension of the part.
10. Swaging Machine not producing sufficient tonnage will affect after swage dimensions.

### No-Go Gauge Information

To assist in checking the after swage dimensions of the fitting, the Crosby Group provides the National No-Go Gauges. When used correctly the National No-Go Gauges can determine if the fittings were swaged to the proper diameter. We would recommend that all Crosby products or product swaged in Crosby dies be checked with the proper gauge to determine the acceptability of the swaging process.

- Gauges are made of hardened alloy steel and machined to strict tolerances.
- Gauge can be used to verify that all fittings have been swaged properly.
- After swage dimensions not within the maximum limits may result from worn dies or improper swaging techniques.
- Other type gauges are available upon request.
- National No-Go Gauges are available for a variety of products (See Table 1).
- **No-Go Gauges and QUIC-PASS® No-Go Gauges are not interchangeable.**

Table 1	
Fitting and Size	Part No.
505 Sleeve 1/4 - 7/8	1095512
505 Sleeve 1 - 1-1/2	1095521
505 Sleeve 1-3/4	1095530
505 Sleeve 2	1095549
505 Sleeve 2-1/4	1095558
505 Sleeve 2-1/2	1095587
505 Sleeve 2-3/4	1095576
505 Sleeve 3	1095565
505 Sleeve 3-1/2	1095594
505 Sleeve 3-3/4	1095601
505 Sleeve 4	1095610
501/502 Socket 1/4 - 1	1095647
501/502 Socket 1-1/8 - 1-3/4	1095656
501/502 Socket 2	1095665

### Using No-Go Gauges

When swaged properly, the gauge will go up and down (see Figure 1) and around the full length of the fitting (see Figure 2). For the proper after swage dimensions, see the section in this publication for the specific product you are swaging.

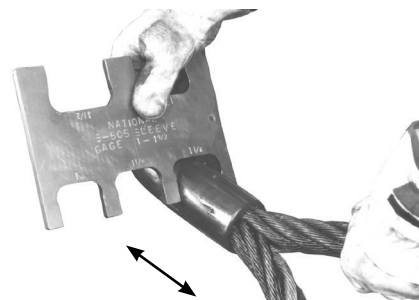


Figure 1

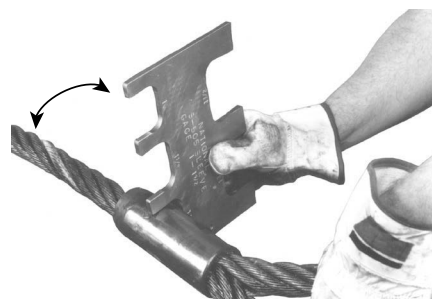


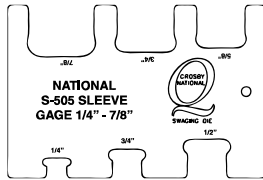
Figure 2

## QUIC-PASS® No-Go Gauges

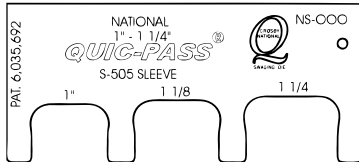
As a further aid, QUIC-PASS® No-Go gauges are available for checking the sleeve's dimensions after swaging is complete.

- Gauges are made of hardened alloy steel and machined to strict tolerances.
- Gauge can be used to verify that all sleeves have been swaged properly.
- "After Swage" dimensions not within the maximum limits may result from worn dies or improper swaging techniques.

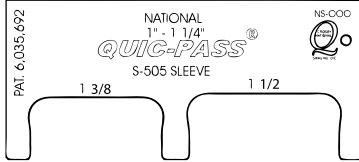
QUIC-PASS® No-Go Gauges	
Sleeve and Size	Stock No.
No-Go Gauge for S-505 1/4" - 7/8"	1923705
No-Go Gauge for S-505 1" - 1-1/4"	1923712
No-Go Gauge for S-505 1-3/8" - 1-1/2"	1923714



Stock No.  
1923705

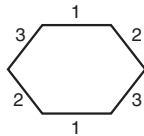


Stock No.  
1923712



Stock No.  
1923714

Use a National QUIC-PASS® No-Go Gauge to check the after swage dimensions to ensure that it has been swaged to the proper dimension. When swaged properly, the gauge will slide up and down the full length of the sleeve on all three sets of opposing flats.



## QUIC-PASS® Maximum After Swage Dimensions

Size (in.)	Maximum "After Swage" Dimension (in.)
1/4	0.565
5/16 - 3/8	0.769
7/16 - 1/2	1.016
9/16 - 5/8	1.247
3/4	1.475
7/8	1.738
1	1.955
1-1/8	2.170
1-1/4	2.405
1-3/8	2.610
1-1/2	2.835

## Important Safety Information

- Crosby does not recommend a "Texas Tuck" style termination with Crosby National S-505 "COLD TUFF®" Standard Steel Sleeves.
- Only Crosby National S-505 "COLD TUFF®" Standard Steel Sleeves are recommended when using the QUIC-PASS® Swaging System.
- National S-505 Standard Steel Sleeves, when used with the QUIC-PASS® Swaging System, are only recommended for use with one (1) part 6 X 19 or 6 X 37, IPS or XIP (EIP), XXIP (EEIP), RRL, IWRC rope.
- The condition of the swaging machine can cause sleeve "After Swage" size not to be within the proper dimensions. Example: worn bushings, loose tie rods, loose die holders, misaligned platens, worn pins, worn linkage, etc.
- Swaging dies being worn, damaged, misused, or undersized can cause sleeve "After Swage" size not to be within the proper dimension.
- Swaging die holders excessively worn, damaged, misused or loose can cause sleeve "After Swage" size not to be within the proper dimension. Only use QUIC-PASS® dies and die holders inspected and properly secured in National swaging machines.
- Always refer to Warning and Application information found in the Crosby General Catalog and Wire Rope End Terminations User's Manual.