In Accordance with BS-EN 13414

SSTE PRODUCTION PROCEDURES

V 1.0

Quality Department

Steel Wire Rope Slings Manufacturing Procedure

1. PRE-MANUFACTURING PRECAUTIONS:

- Prior to the manufacturing process, the wire rope to be used shall be visually inspected for any defects and check on its condition and lubrication.
- Also all lifting accessories (Thimbles, master links, Ferrules ….etc.) Must be visually checked before manufacturing to make sure it has no defects.
- Make sure measurement tools (Vernier, ruler….etc.) used in the process are all calibrated and accurate.
- Working area shall be clean of dust or chemicals and in good condition.
- Workers must always wear the proper PPE for the job.

2. PRODUCTION PROCESS AND QUALITY CONTROL

2.1 Grade of rope

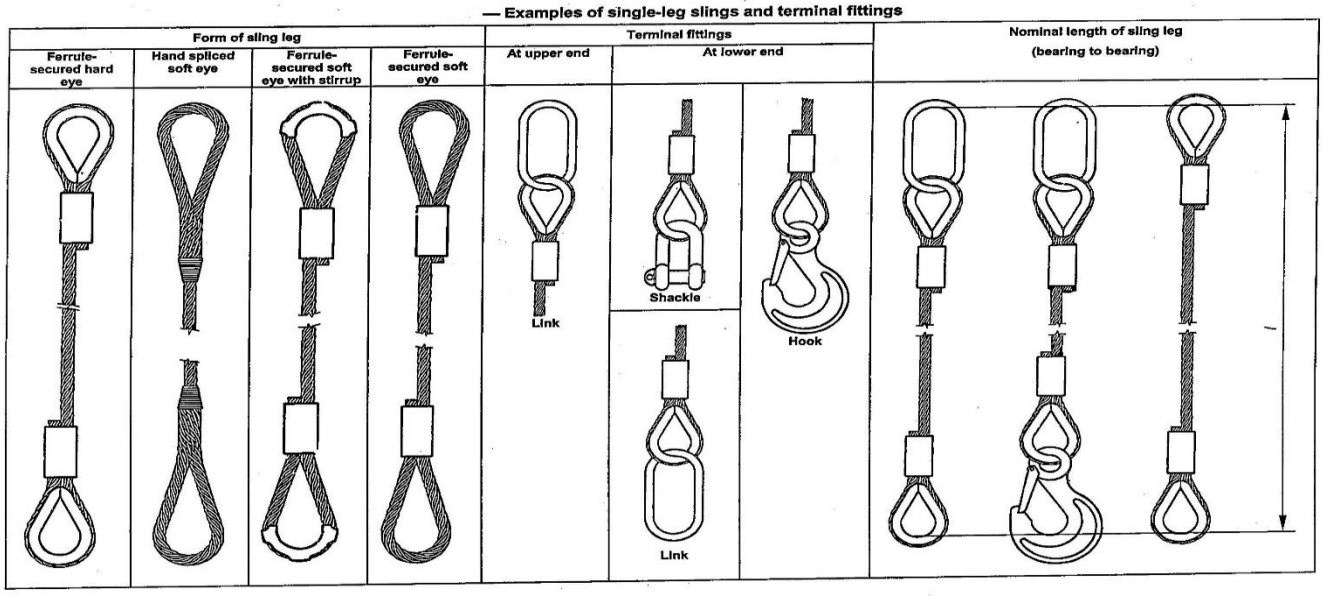
The rope grade shall be either 1770 or 1960. When rope grade 1960 is used the working load limit (WLL) shall be calculated on the basis of grade 1770.

2.2 Single-leg sling

2.2.1 Types

Single-leg slings shall be one of the types shown in the Table below, with or without terminal fittings such as links or hooks. Where a terminal fitting is used, the eye termination shall always be fitted with a thimble.

— Examples of single-leg slings and terminal fittings



2.2.2 Length

The length shall be that measured between the bearing points of the sling.

The minimum length of plain rope between the inside ends of Ferrule terminating a sling leg shall be 20 times the nominal rope diameter.

The measured length of a ferrule-secured sling shall not differ from the nominal length by more than two rope diameters or **1%** of the nominal length, whichever is the greater.

2.2.3 Working load limit **(WLL)** for a single-leg sling

Working load limit in tonnes for a single-leg sling shall be calculated as follows:

$$WLL = \frac{f_{m_{in}} \times k_T}{Zp \times g}$$

Where

$f_{m_{in}}$ Is the minimum breaking force of the rope, in kilonewtons.

k_T Is the factor which allows for the efficiency of the termination.

Zp Is the working coefficient (coefficient of utilization) and has the value = **5**

g Is the factor relating mass to force and has the value = **9.80665**

For ferrule secured terminations k_T shall be **0.9** and for spliced terminations k_T shall be **0.8**

2.3 Ferrule secured and spliced endless slings

2.3.1 Length

The length of an endless sling shall be that measured along its circumference on the centerline of the rope.

The measured circumferential length of an endless pressed sling measured under no load shall not differ from the nominal length by more than two rope diameters or **1%** of the nominal length, whichever is the greater.

The measured circumferential length of an endless spliced sling measured under no load shall not differ from the nominal length by more than four rope diameters or **2%** of the nominal length, whichever is the greater.

2.3.2 Ferrule secured

An appropriate length of rope shall be selected and formed with overlapping ends. Two ferrules appropriate to the diameter of the rope shall be pressed in accordance with ***prEN 13411-3***. The adjacent ends of the ferrules shall not be less than three times the length of the ferrule apart after pressing.

2.3.3 Spliced

The rope shall be formed into a circle such that the two ends overlap by the amount necessary for splicing. Each end shall ne spliced back into the main body of the sling. The splicing operation shall be in accordance with ***EN 13411-2***.

Working load limit **(WLL)** for an endless sling

The working load limit **(WLL)** in tonnes for an endless sling shall be calculated as follows:

$$WLL = \frac{f_{m_{in}} \times 2 \times 0.8}{Zp \times g}$$

Where

$f_{m_{in}}$ Is the minimum breaking force of the rope, in kilonewtons.

Zp Is the working coefficient (coefficient of utilization) and has the value = **5**

g Is the factor relating mass to force and has the value = **9.80665**

2.4 Multi-leg sling

2.4.1 Length

The length shall be that measured between the bearing points of the sling.

The measured individual leg lengths shall not differ from the nominal length of the sling by more than two rope diameters or **1%** of the nominal length, whichever is the greater.

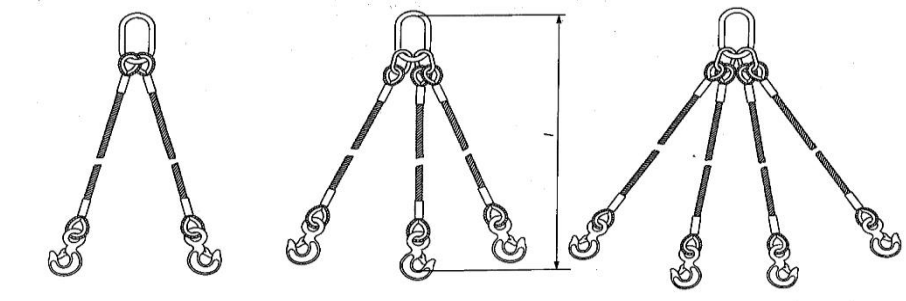
The difference in length between the individual legs of any multi-leg sling under no load shall not exceed **1.5** times the rope diameter or **0.5%** if the nominal length, whichever is the greater.

2.4.2 Formation of sling

The sling shall comprise two, three or four legs of the types specified before. The rope size, type and grade for each leg shall be the same.

The legs of two-leg slings shall be joined at their upper ends by a master link. In a three-leg sling, two of the legs shall be joined by a single intermediate master link to the master link, the third leg shall be connected via a second intermediate master link. In a four-leg sling each of the two pairs shall be joined by an intermediate master link to the master link.

Upper eyes shall always be fitted with thimbles. And if lower terminal fittings are used, the eyes shall always be fitted with thimbles. Thimbles shall conform to ***EN 13411-1***.



Multi-leg slings

2.4.3 Working load limit of a multi-leg sling

The working load limit **(WLL)** in tonnes, for a multi-leg sling with symmetrically arranged legs with each leg making the same angle with the vertical shall be calculated as follows:

$$WLL = \frac{f_{m_{in}} \times k_T \times k_L}{Zp \times g}$$

Where:

$f_{m_{in}}$ Is the minimum breaking force of the rope, in kilonewtons.

k_T Is the factor which allows for the efficiency of the termination.

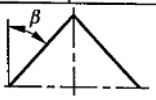
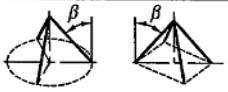
Zp Is the working coefficient (coefficient of utilization) and has the value = **5**

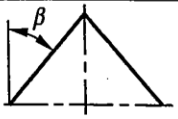
g Is the factor relating mass to force and has the value = **9.80665**

k_L Is the leg factor relating to the number of legs and the angle to the vertical.

For ferrule secured terminations k_T shall be **0.9** and for spliced terminations k_T shall be **0.8**

Working load limits for slings using fibre cored rope of classes 6x19 and 6x36, and having ferrule-secured eye terminations

	One leg sling	Two leg sling		Three and four leg sling		Endless sling
Angle to the vertical	0°	0° to 45°	over 45° to 60°	0° to 45°	over 45° to 60°	0° -
						
	Direct	Direct	Direct	Direct	Direct	Choke hitch
Nominal rope diameter mm	**Working load limits** t					
8	0,700	0,950	0,700	1,50	1,05	1,10
9	0,850	1,20	0,850	1,80	1,30	1,40
10	1,05	1,50	1,05	2,25	1,60	1,70
11	1,30	1,80	1,30	2,70	1,95	2,12
12	1,55	2,12	1,55	3,30	2,30	2,50
13	1,80	2,50	1,80	3,85	2,70	2,90
14	2,12	3,00	2,12	4,35	3,15	3,30
16	2,70	3,85	2,70	5,65	4,20	4,35
18	3,40	4,80	3,40	7,20	5,20	5,65
20	4,35	6,00	4,35	9,00	6,50	6,90
22	5,20	7,20	5,20	11,0	7,80	8,40
24	6,30	8,80	6,30	13,5	9,40	10,0
26	7,20	10,0	7,20	15,0	11,0	11,8
28	8,40	11,8	8,40	18,0	12,5	13,5
32	11,0	15,0	11,0	23,5	16,5	18,0
36	14,0	19,0	14,0	29,0	21,0	22,5
40	17,0	23,5	17,0	36,0	26,0	28,0
44	21,0	29,0	21,0	44,0	31,5	33,5
48	25,0	35,0	25,0	52,0	37,0	40,0
52	29,0	40,0	29,0	62,0	44,0	47,0
56	33,5	47,0	33,5	71,0	50,0	54,0
60	39,0	54,0	39,0	81,0	58,0	63,0
Leg factor K_L	1	1,4	1	2,1	1,5	1,6

	One-leg sling	Two-leg sling		Three and four-leg sling		Endless sling
Angle to the vertical	0°	0° to 45°	over 45° to 60°	0° to 45°	over 45° to 60°	0° -
						
	Direct	Direct	Direct	Direct	Direct	Choke hitch
Nominal rope diameter mm	**Working load limits** t					
8	0,750	1,05	0,750	1,55	1,10	1,20
9	0,950	1,30	0,950	2,00	1,40	1,50
10	1,15	1,60	1,15	2,40	1,70	1,85
11	1,40	2,00	1,40	3,00	2,12	2,25
12	1,70	2,30	1,70	3,55	2,50	2,70
13	2,00	2,80	2,00	4,15	3,00	3,15
14	2,25	3,15	2,25	4,80	3,40	3,70
16	3,00	4,20	3,00	6,30	4,50	4,80
18	3,70	5,20	3,70	7,80	5,65	6,00
20	4,60	6,50	4,60	9,80	6,90	7,35
22	5,65	7,80	5,65	11,8	8,40	9,00
24	6,70	9,40	6,70	14,0	10,0	10,6
26	7,80	11,0	7,80	16,5	11,5	12,5
28	9,00	12,5	9,00	19,0	13,5	14,5
32	11,8	16,5	11,8	25,0	17,5	19,0
36	15,0	21,0	15,0	31,5	22,5	23,5
40	18,5	26,0	18,5	39,0	28,0	30,0
44	22,5	31,5	22,5	47,0	33,5	36,0
48	26,0	37,0	26,0	55,0	40,0	42,0
52	31,5	44,0	31,5	66,0	47,0	50,0
56	36,0	50,0	36,0	76,0	54,0	58,0
60	42,0	58,0	42,0	88,0	63,0	67,0
leg factor K_L	1	1,4	1	2,1	1,5	1,6

NOTE 1 The working load limits (WLLs) given in Table 4 are based on the assumption that soft eyes of single-leg slings are used over bearing points having diameters not less than twice the nominal diameter of the rope.

2.5 Terminal fittings

The working load limit of any master link shall be at least equal to that of the sling.

The working load limit of any intermediate link fitted to three-leg or four-leg sling shall be at least equal to 1.6 times the (WLL) of one of the legs suspended from it.

Where shackles are used they shall conform to ***EN 13889***.

Where forged steel lifting hooks with latch – *Grade 8*, Forged steel self-locking hooks – *Grade 8*, Links – *Grade 8*, Forged steel lifting hooks with latch – *Grade 4*,Links – *Grade 4* are use, they shall conform to ***EN 1677***.

2.6 Pressing the ferrule

Pressing of the ferrule and removal of the fins shall be in accordance with the ferrule manufacturer's instructions.

The ferrule is to be pressed only in a hydraulic or pneumatic press by means of cold working.
NOTE Ferrule sizes 2,5 to 5 may also be pressed using hand tools.

The contact and inner surfaces of the pressing tools shall be clean and lubricated. The pressing tools shall not be misaligned.

In the case of a square ended oval ferrule the major axis of the ferrule shall coincide with the direction of pressing. At the end of the pressing operation the contact faces of the tools shall meet. The position of the rope end shall be checked and shall be in accordance with the ferrule manufacturer's instructions, taking into account the particular requirements for oval ferrules with tapered ends.

2.7 After pressing of the ferrule

At each set-up of the pressing tools, the pressed ferrule shall be dimensionally checked to verify that it is within the pressed diameter and length limits specified by the ferrule manufacturer's designer.
Each pressed ferrule shall be checked for diameter to verify that it is within the diameter limits specified by the manufacturer.
Each pressed ferrule shall be inspected to ensure that the ferrule is free from any flaws and surface defects.
For turn-back eyes the position of the tail end shall be checked to ensure compliance with the FSET manufacturer's instructions.

2.8 Instructions to be provided by the ferrule-secured system designer

The ferrule-secured system manufacturer shall provide instructions on at least the following:
a) Preparation of the rope end;
b) Details of the rope(s) for which the system is designed;
c) Matching of the ferrule material and size to the rope diameter and type;
d) Positioning of the rope end;
e) Procedure for ferrule-securing, i.e. pressing the ferrule;
f) Alignment, condition and maintenance of the tooling;
g) Procedure for removal of fins;
h) Dimensional requirements of the pressed ferrule;
i) Marking limitations of the ferrule; and
j) Temperature limits of the ferrule secured system.

2.9 Ferrule Material

The material selected by the ferrule manufacturer shall be non-alloy carbon steel or aluminum and shall conform to the same specification as that used by the ferrule-secured system designer when satisfying the type tests. Non-alloy carbon steel shall be a fully-killed non-ageing normalized steel. Aluminum shall be in condition F according to ***EN 515***.

2.10 Ferrule Marking

Each ferrule shall be marked with its size and the ferrule manufacturer's name or mark except in the case of ferrules for use with ropes smaller than 8mm diameter where the marking can be on the package.

2.11 Matching of ferrule to wire rope

Selection of the correct ferrule is to take account of:

Measured rope diameter;

Rope type (and core);

Nominal metallic cross-sectional area factor of the rope.

Determine the rope details from the documentation supplied with the rope, see ***EN 12385-1*** and ensure that the rope is within the scope of the ferrule-secured system as detailed by the ferrule-secured system designer. Follow the ferrule-secured system designer's instructions to select the appropriate ferrule size, taking into account the nominal or measured diameter of the rope, whichever is applicable.

Table A.2 – Ferrule size numbers

Rope diameter			Ferrule size number (see A.6)			
			Case 1	Case 2	Case 3	Case 4
			single layer round strand ropes with FC and cable laid ropes	single layer round strand ropes with IWRC and rotation-resistant round strand ropes	single layer round strand ropes with IWRC, rotation-resistant ropes and parallel-closed ropes	spiral strands
Nominal	Measured					
d	from	to				2 ferrules
mm	mm	mm	$C \geq 0{,}283$	$C \leq 0{,}487$	$0{,}487 < C \leq 0{,}613$	AC $C \leq 0{,}613$ AC
2.5	2.5	2.7	2.5	3	-	-
3	2.8	3.2	3	3.5	-	-
3.5	3.3	3.7	3.5	4	-	-
4	3.8	4.3	4	4.5	-	5
4.5	4.4	4.8	4.5	5	-	6
5	4.9	5.4	5	6	-	6.5
6	5.5	5.9	6	6.5	-	7
	6	6.4			7	
6.5	6.5	6.9	6.5	7	8	8
7	7	7.4	7	8	9	9
8	7.5	7.9	8	9	9	10
	8	8.4			10	
9	8.5	8.9	9	10	10	11
	9	9.5			11	
10	9.6	9.9	10	11	11	12
	10	10.5			12	
11	10.6	10.9	11	12	12	13
	11	11.6			13	
12	11.7	11.9	12	13	13	14
	12	12.6			14	
13	12.7	12.9	13	14	14	16
	13	13.7			16	
14	13.8	13.9	14	16	16	18
	14	14.7			18	
16	14.8	15.9	16	18	18	20
	16	16.8			20	
18	16.9	17.9	18	20	20	22
	18	18.9			22	
20	19	19.9	20	22	22	24
	20	21			24	
22	21.1	21.9	22	24	24	26
	22	23.1			26	
24	23.2	23.9	24	26	26	28
	24	25.2			28	

Table A.2 – Ferrule size numbers (continued)

Rope diameter			Ferrule size number (see A.6)			
			Case 1	Case 2	Case 3	Case 4
			single layer round strand ropes with FC and cable laid ropes	single layer round strand ropes with IWRC and rotation-resistant round strand ropes	single layer round strand ropes with IWRC, rotation-resistant ropes and parallel-closed ropes	spiral strands
Nominal	Measured					
d	from	to				2 ferrules
mm	mm	mm	$C \geq 0{,}283$	$C \leq 0{,}487$	$0{,}487 < C \leq 0{,}613$	AC $C \leq 0{,}613$ AC
26	25.3	25.9	26	28	28	30
	26	27.3			30	
28	27.4	27.9	28	30	30	32
	28	29.4			32	
30	29.5	29.9	30	32	32	34
	30	31.5			34	
32	31.6	31.9	32	34	34	36
	32	33.6			36	
34	33.7	33.9	34	36	36	38
	34	35.7			38	
36	35.8	35.9	36	38	38	40
	36	37.8			40	
38	37.9	37.9	38	40	40	44
	38	39.9			44	
40	40	42	40	44	48	48
44	42.1	43.9	44	48	48	48
	44	46.2			52	52
48	46.3	47.9	48	52	52	52
	48	50.4			56	56
52	50.5	51.9	52	56	56	60
	52	54.6			60	
56	54.7	55.9	56	60	-	-
	56	58.8			-	-
60	58.9	59.9	60	-	-	-
	60	63		-	-	-

2.12 Ferrules after pressing

The dimensions of ferrules on pressed assemblies are to comply with Table A.3

Table A.3 — Dimensions of pressed ferrules (see figure A.1)

Ferrule size number	External pressed size d_1 nominal mm	tolerance mm	d_2 min mm	Parallel length l_1 [1] mm	l_2 [1] mm	r [1] mm
2,5	5		-	12	3,75	-
3	6		-	14	4,5	-
3,5	7	+ 0,2	-	16	5,25	-
4	8	0	-	18	6	-
4,5	9		8	20	6,75	4,5
5	10		9	23	7,5	5
6	12		11	27	9	6
6,5	13		12	29	9,75	6,5
7	14	+ 0,4	13	32	10,5	7
8	16	0	14,5	36	12	8
9	18		16,5	40	13,5	9
10	20		18	45	15	10
11	22	+ 0,5	20	50	16,5	11
12	24	0	22	54	18	12
13	26		24	59	19,5	13
14	28	+ 0,7	25	63	21	14
16	32	0	29	72	24	16
18	36		32	81	27	18
20	40	+ 0,9	36	90	30	20
22	44	0	39	99	33	22
24	48		43	108	36	24
26	52	+ 1,1	46	117	39	26
28	56	0	50	126	42	28
30	60	+ 1,4	53	135	45	30
32	64	0	56	144	48	32
34	68		59	153	51	34
36	72		63	162	54	36
38	76	+ 1,6	66	171	57	38
40	80	0	69	180	60	40
44	88	+ 1,9	75	198	66	44
48	96	0	81	216	72	48
52	104	+ 2,1 0	87	234	78	52
56	112	+ 2,3 0	93	252	84	56
60	120	+ 2,4 0	99	270	90	60

[1] Approximate dimensions

3. SLINGS MANUFACTURING PROCESS:

Eyes of sling legs shall be formed by using hand splicing or mechanical splicing using ferrules conforming to ***BS EN 13411-3***. Such eyes shall be soft eyes or reinforced with thimbles as per customers requirement.

The width of the eye shall be approximately half of its length. In order to protect the bearing surface of the soft eye.

For the thimble reinforced eyes these thimbles shall be of galvanized ordinary, reeving or solid type appropriate for the size of rope used.

Minimum Length: To provide adequate flexibility and to allow splicing, the effective length of a single part sling shall not be less than 70 times the rope diameter. The actual length of a sling shall not differ from the nominal length by more than two rope diameters or I percent of the nominal length whichever is greater, the measurement shall be taken without applying any load.

3.1 Splicing operation

3.1.1 The splicing operation shall only be carried out by qualified splicers.

3.1.2 The splice shall be as one of the descriptions below:

- The splice shall have at least five tucks for each strand, at least three of them with the whole strand;
- The splice shall be made three full strands with four tucks and other three full strands with five tucks comprising.

Note 1: Depending on the rope size, rope construction and the splicing method, more tucks per strand than given above can be necessary.

Note 2: To get a smooth run-out of the splice, it can be advantageous to make the last tuck or the last two tucks with the half of the wires cut out of the strands.

3.1.3 The wire ends of the spliced strands should be covered with a suitable serving at the option of the purchaser.

3.1.4 Marking & Calculations for Forming Mechanical Spliced Flemish Style Eyes:

-For *Standard Eyes (7 lay):* Pull amount or tail is equal to 3.75 X diameter (d) of rope. Throat amount is equal to 40 X diameter (d) of rope.

- For Standard Thimble Eyes: Pull amount is equal to 3.75 X diameter (d) of rope.

Throat amount is equal to 15 X diameter (d) of rope.

-For Eyes *Larger than Standard Eyes: Pull* amount or tail is equal to 3.75 X diameter (d) of rope.

Throat amount is equal to 5 X width of eye to be formed.

Note: All standard eyes have a width of ½ the length

3.1.5 Protruding wires

Any protruding wires must be addressed; for example by serving, reinsertion of the tails back into the rope, or by covering with heat shrink wrapping. Where used, serving or wrapping shall not cover the three full strand load carrying tucks.

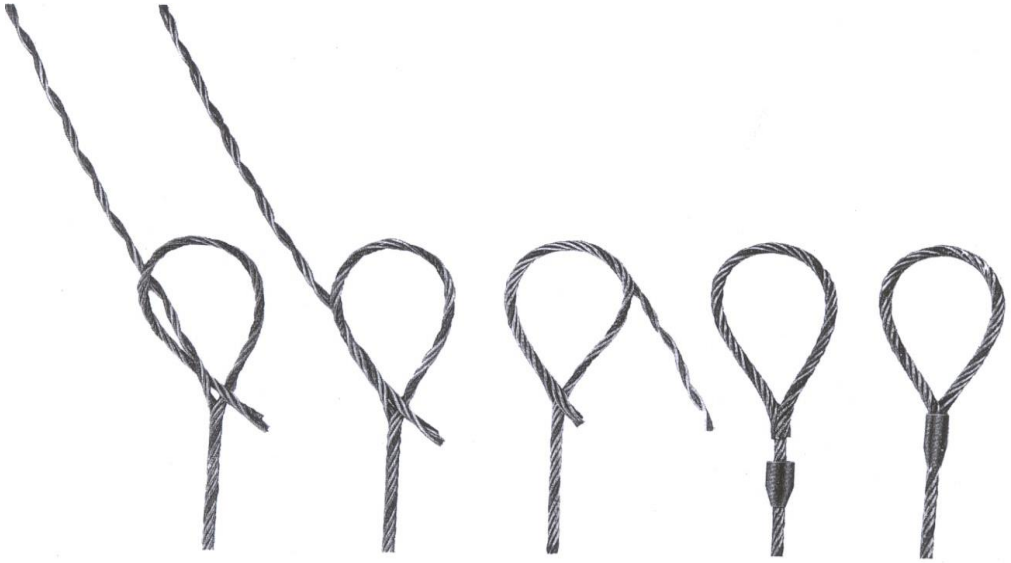
The splice shall be visually inspected to ensure that the tails of the tucks do not protrude outside of the rope.

3.1.6 Ropes with a steel wire rope core

Where the rope has a steel wire rope core, the core shall be unlaid at the end of the loop where splicing starts and be spliced with the outer strands for three tucks. The tail ends of the strand from the core shall not protrude from the splice.

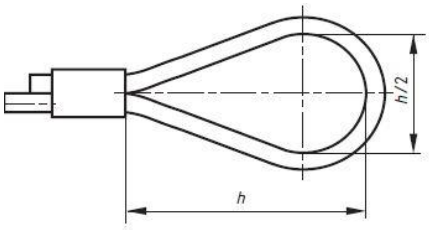
3.1.7 Splicing operation steps:

3.1.7.1 Flemish eye splicing



The outer strands of the rope shall be divided into two equal groups. The core shall be assigned to one of these groups. The length of rope divided shall depend on the size of eye to be formed. Both groups of strands shall then be re-laid together in opposing directions.
No individual strands shall protrude from the rope in the eye.
The positioning of the strand ends and the removal or retention and placing of the core shall be in accordance with the ferrule-secured system manufacturer's instructions.
When the ferrule is slid into position it shall not displace the strands. The strand ends shall be evenly distributed around the intact wire rope within the ferrule.
Positioning of the ferrule before pressing shall be such that the distance between the base of the thimble and the ferrule shall be "approximately" two times the nominal rope diameter after pressing. In the case of a thimble with a pointed end this distance shall be approximately 1,5 times the nominal rope diameter after pressing. The peripheral length of a soft eye for a sling shall be at least four times the rope lay length.
The peripheral length of a soft eye for a crane hoist rope shall be at least six times the rope lay length.

3.1.7.2 Turn-back eye splicing



The eye shall be formed by passing the rope end through the ferrule to form the required eye size and then by passing the end of the rope back through the ferrule.
In the case of rope severed by a heat process the annealed portion of the rope shall not be positioned within the ferrule.
The length (*h*) of a soft eye from the ferrule to the bearing point of the eye shall be at least fifteen (15) times the Nominal rope diameter.
NOTE: the width (h/2) of the eye with the rope under no load should be approximately half of its length.

3.2 Swaging (Pressing) operation:

The cold swaging of sleeves on wire rope is a severe processes requiring considerable movement of the steel in the fitting. The steel in the fitting is forced under great pressure to flow into the crevices between the wires and strands of the wire rope and, at the same time, to elongate parallel to the wire rope. It is for these reasons that the swaging must be done in multiple pressings. Dies should be in good condition and must be properly lubricated. The swaging process must also be done in multiple pressings to eliminate excessive" fleshing". The term "flashing" is used to describe the material that extrudes or is squeezed out into the area between the die faces. If "excessive" flashing has been created it will not be eliminated in additional pressings. The "excessive" flash will most likely be folded back in the next pressing and will develop into a definite and permanent mark in the material and possibly a crack. To avoid this situation, the following basic procedure is recommended: Apply lubricant. Such as light oil, to both die blocks. Swaging dies must be inspected periodically. Any scores or nicks should be polished out.

Dies showing excessive wear should be replaced. As an aid in determining if the sleeve has been swaged to acceptable limits and also indirectly to judge the condition of the die, the maximum OD of the **fitting after swaging list on** the table. This maximum OD dimension takes into account die tolerance, die wear, and material spring-back.

3.3 Swaging Instruction for Flemish Eye Steel Sleeves

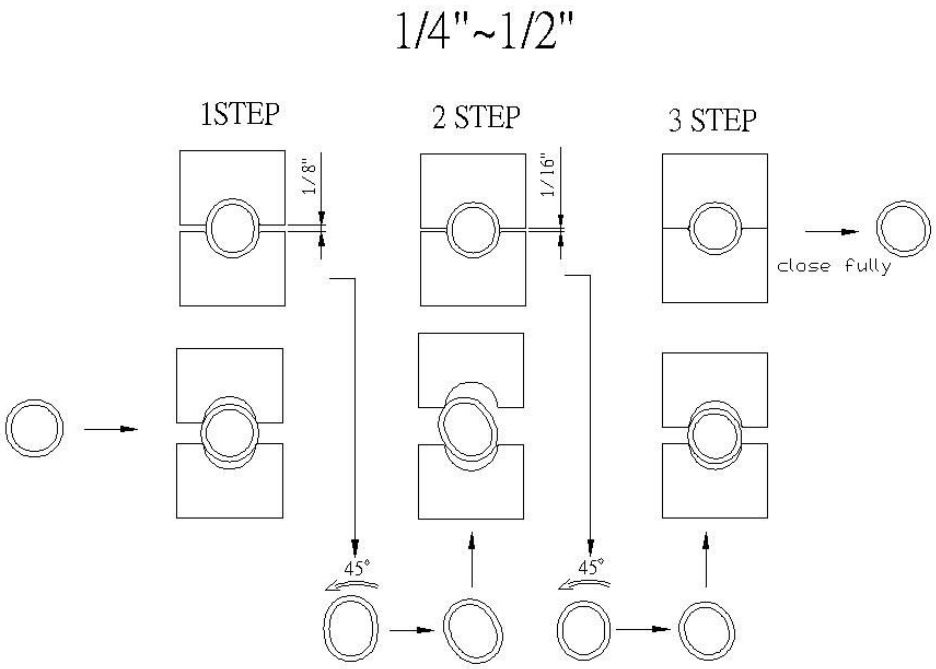
"½ ~ "¼Sleeves

1st swaging – allow dies to remain open apprx. 1/8".Rotate fitting 45° (1/8 return).

2nd swaging – allow dies to remain open apprx. 1/16" rotate fitting 45° (1/8 turn) back to original position.

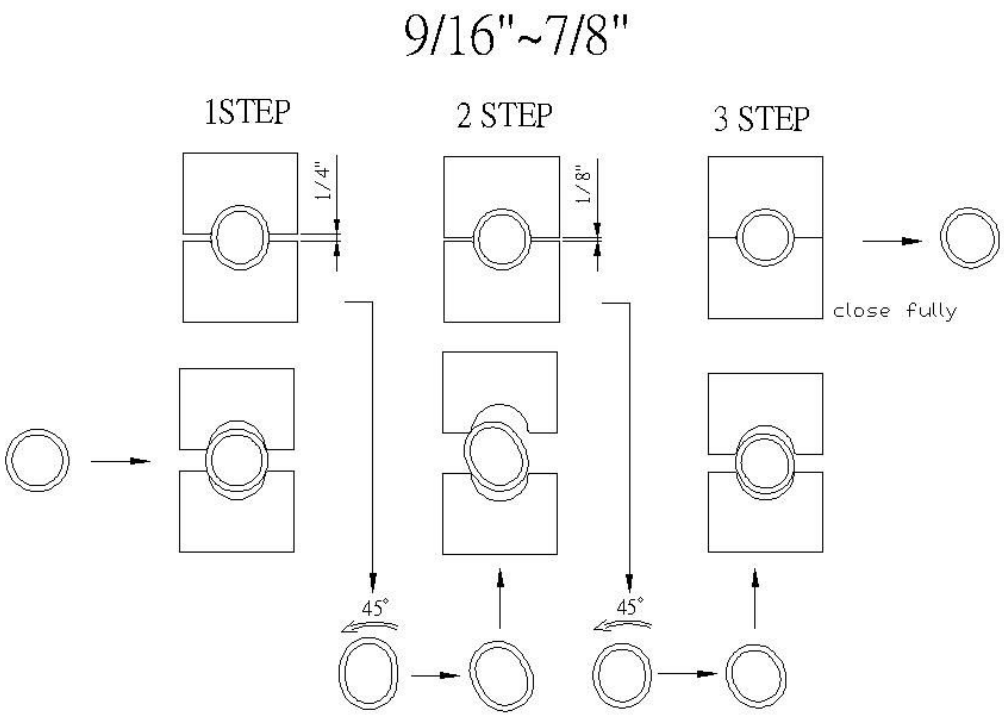
3rd swaging – close dies fully.

4th swaging – may be required to provide smooth finish.



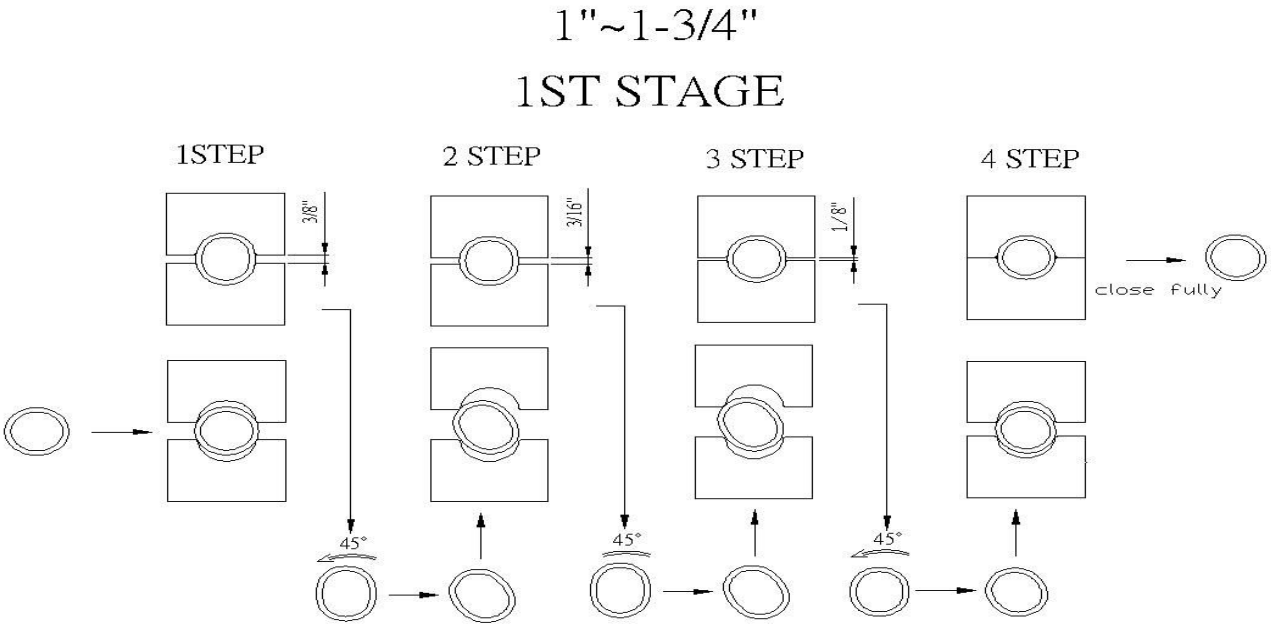
9/16 ”8/7 ~ ”Sleeves

Same procedure as above – allow die to remain open approx. ¼” on first swaging, approx.1/8” on second swaging. Rotate fitting 45° (1/8 turn) between each swaging. Close dies fully on 3rd swaging and 4th finish with swaging if necessary.



1 ”¾ 1 ~ ”Sleeves

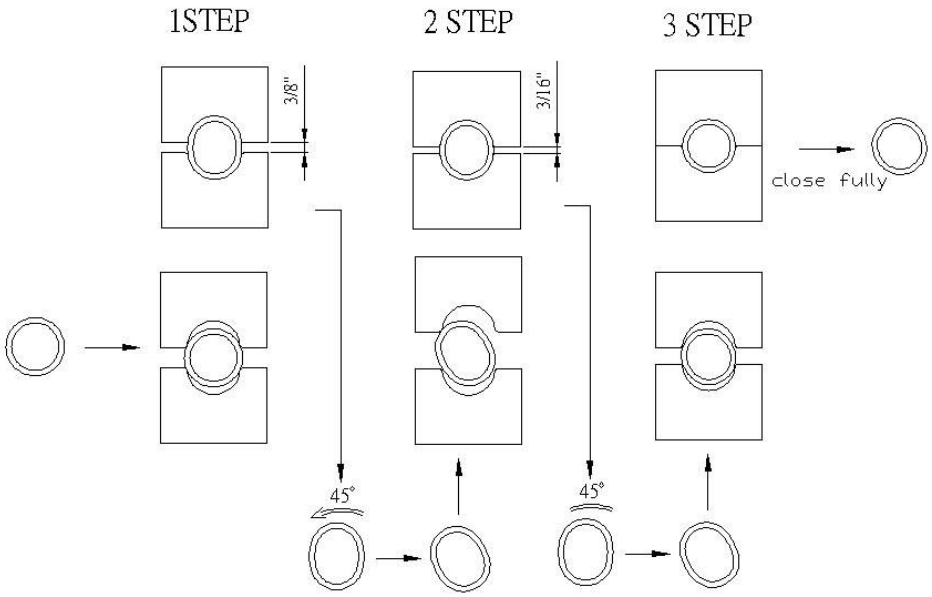
Use open channel dies as the 1st stage to form the sleeve before 2nd stage swaging in tapered dies. Swage each fitting at least three times in open channel dies. Allow dies to remain open 3/8” for the first swage and 3/16” on the second swage. However, should sharp flashing occur, the dies should be allowed to remain approx. 1/8” on the third swage. Rotate sleeve 45°between each swage.



Change to tapering dies. When 1, 1-1/8” and 1-1/4” sleeves are swaged in tapering dies, allow dies to remain open 3/8” on the first swage and 3 /16” on the second swage. If sharp flashing does not occur, dies may be closed on the third swage. A fourth swage is required to provide a smooth finish. For 1-3/8”, 1-1/2” and 1-3/4” sleeves, allow dies to remain open ½” on the first swage, 3/8” on second swage, and 3/16” on the third swage. On fourth swage dies may be closed if no large flash occurs. A fifth swage may be required to provide a smooth finish. Rotate the sleeve 45°between each swage. Dies must be fully closed.

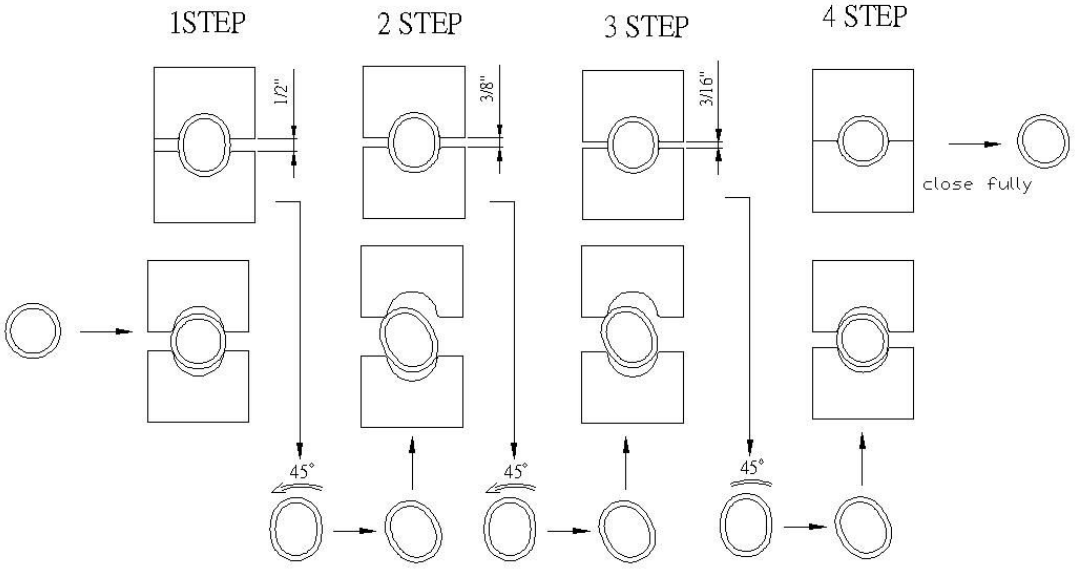
1"~1-1/8"

2ND STAGE



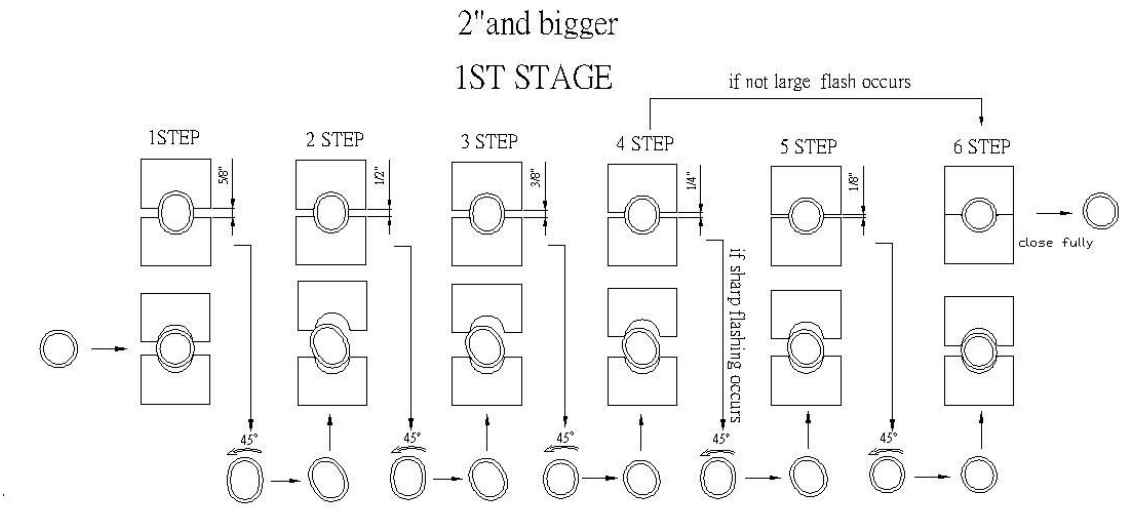
1-1/8"~1-3/4"

2ND STAGE

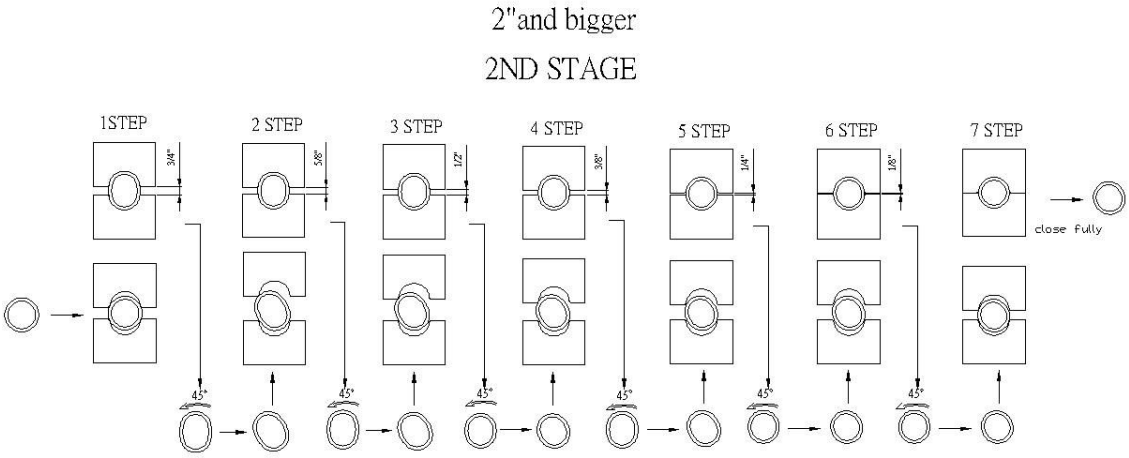


2 ”and bigger sleeves

Open channel dies are used for both the 1st stage and 2nd stage. Each fitting has to be swaged at least five times in the 1st stage die. Allow the die to remain open approx. 5/8” on the first swage, ½” on the second swage, 3/8” on the third swage, ¼” on the fourth swage and close on the fifth swage. However, if sharp flashing occurs, allow the dies to remain open 1/8” on the fifth swage. Then close the dies when there is no longer a sharp flash. Rotate the sleeve 45°between each swaging operation.

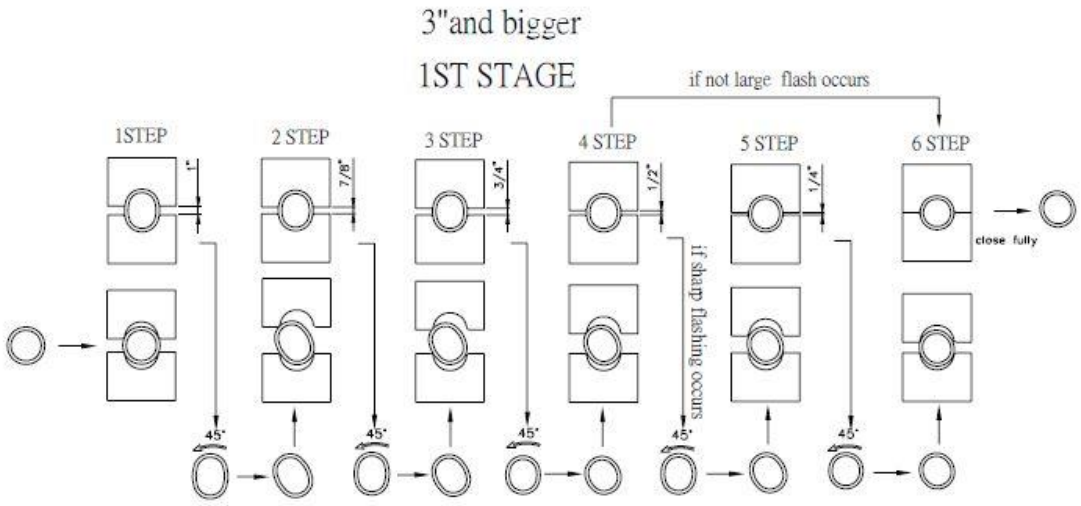


When using the 2nd stage, each sleeve must be swaged at least seven times. Allow the dies to remain open 3/4” on the first swage, 5/8” on the second swage,1/2” on the third swage, 3/8” on the fourth swage, 1/4” on the fifth swage, 1/8” on the sixth swage and close on the seventh swage if no longer flash develops. Another swage may be required a smoother finish. Rotate the sleeve 45°between each swage. Dies must be fully closed.

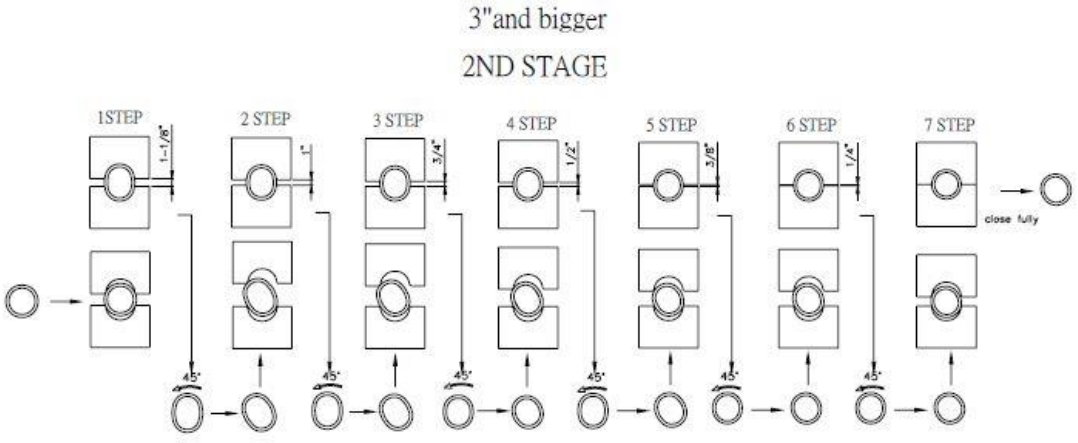


3” and bigger sleeves

Open channel dies are used for both the 1st stage and 2nd stage. Each fitting has to be swaged at least five times in the 1st stage die. Allow the die to remain open approx. 1” on the first swage, 7/8” on the second swage, 3/4” on the third swage, 1/2” on the fourth swage and close on the fifth swage. However, if sharp flashing occurs, allow the dies to remain open 1/4” on the fifth swage. Then close the dies when there is no longer a sharp flash. Rotate the sleeve 45°between each swaging operation.



When using the 2nd stage, each sleeve must be swaged at least seven times. Allow the dies to remain open 1-1/8” on the first swage, 1” on the second swage, 3/4” on the third swage, 1/2” on the fourth swage, 3/8” on the fifth swage, 1/4” on the sixth swage and close on the seventh swage if no longer flash develops. Another swage may be required a smoother finish. Rotate the sleeve 45°between each swage. Dies must be fully closed.



Swaging Table for Flemish Eye Steel Sleeves

Wire Rope Dia.		Max.Dia.after swage (mm)	Max.Dia.afte Swage (mm)
Inch	mm	1 st Stage	2 nd Stage
1/4"	6~7		0.57"(14.5)
5/16"	8		0.75"(19.1)
3/8"	9~10		0.75"(19.1)
7/16"	11		1.01"(25.6)
1/2"	13		1.01"(25.6)
9/16"	14		1.24"(31.5)
5/8"	16		1.24"(31.5)
3/4"	18~19		1.46"(37.1)
7/8"	22		1.68"(42.6)
1"	25~26	2"(50.8)	1.93"(49.1)
1-1/8"	28~29	2.25"(57.2)	2.13"(54.1)
1-1/4"	31~32	2.5"(63.5)	2.32"(59.0)
1-3/8"	34~35	2.74"(69.8)	2.52"(64.0)
1-1/2"	37~38	2.87"(72.8)	2.71"(68.8)
1-3/4"	44~45	3.34"(84.8)	3.1"(78.7)
2"	50~52	3.8"(96.7)	3.56"(90.4)
2-1/4"	56~57	4.44"(112.7)	4.12"(104.5)
2-1/2"	62~64	4.81"(122.3)	4.5"(114.3)
2-3/4"	68~70	5.02"(127.5)	4.7"(119.4)
3"	75~76	5.25"(133.4)	4.96"(126.0)
3-1/4"	81~83	5.69"(144.5)	5.37"(136.4)
3-1/2"	87~89	6.12"(155.5)	5.77"(146.6)
3-3/4"	93~95	6.62"(168.1)	6.23"(158.2)
4"	100~105	7.1"(180.3)	6.69"(170.0)
4-1/2"	112~114	7.9"(200.7)	7.45"(189.2)

Recommended to be used with 6x19, 6x25, 6x29, 6x37 IPS or XIP(EIP),XXIP(EEIP),RRL, FC or IWRC wire rope. If using with any other type of construction or grade of wire rope, it is recommended to make the breaking load test of the swaged termination to prove the adequacy of the assembly to be manufactured. **Wirop does not recommend a "Texas Tuck" style termination with Wirop Flemish eye steel sleeves**

4. QUALITY ASSURANCE

4.1 Components of the wire rope sling

The records shall be used to confirm that the verification clauses of ***EN 12385-1, EN 1677 parts 1 to 6, EN 13411-2*** and ***prEN 13411-3*** have been satisfied for the wire rope, hooks and links, and spliced and or ferrule secured terminations from which the sling is formed.

4.2 Rope construction

The supplier's records shall be used to verify the rope construction, diameter and grade of rope used.

4.3 Length of the sling

The length of the sling shall be measured with a steel tape graduated in increments of **1 mm**.

4.4 WLL of terminal fittings

The supplier`s records shall be used to verify the WLL of terminal fittings used in the construction of the sling.

4.5 Marking

Each sling shall be legibly and durably marked with the information listed in **4.5.1** or **4.5.2**.

4.5.1 Single-leg sling

a) The sling manufacturer`s name or identifying mark.
b) Numbers and/or letters to identify the sling with the certificate.
c) The working load limit**(WLL)**
d) Any legal marking.

4.5.2 Multi-leg sling

a) The sling manufacturer`s name or identifying mark.
b) Numbers and/or letters to identify the sling with the certificate.
c) The working load limits and the angels applicable, i.e. the WLL 0˚ to 45˚to vertical and, additionally, the WLL 45˚ to 60˚ to the vertical if applicable.
d) Any legal marking.
e) Rated load for the types of hitches (single-leg vertical, choker, and basket) and the angle upon which they are based ***(According to ASME 30.9)***

4.6 Certification

A certificate shall be supplied with each sling or batch of slings. This shall identify the sling with the certificate and include statement that the sling conforms to the European standard. The certificate shall contain at least the following information.

a) The name of the manufacturer and the address.
b) The number and part of the European standard.
c) The description of the sling including all component parts.
d) The WLL and the appropriate angle(s) to the vertical for multi leg slings.

4.7 Inspection

A proper inspection should follow a systemic procedure.

First, it is necessary that all parts of the sling are readily visible. The sling should be laid out so every part is accessible.

Next, the sling should be sufficiently cleaned of dirt and grease so wires and fittings are easily seen. This can usually be accompanied with a wire brush or rags.

The sling should then be given a thorough, systematic examination throughout its entire length, paying particular attention to sections showing the most wear.

Special attention should also be paid to fittings and end attachments, and areas of the sling adjacent of these fittings.

When the worst section of a sling or the weakest link has been located, this area should then be carefully checked against the criteria.

Label or identify slings that are inspected.

Check the sling`s diameter, length, eye dimensions and ferrule`s dimension- if any- .

Keep records of inspections that include dates and corresponding conditions of slings.

Dispose immediately of slings that are rejected.