

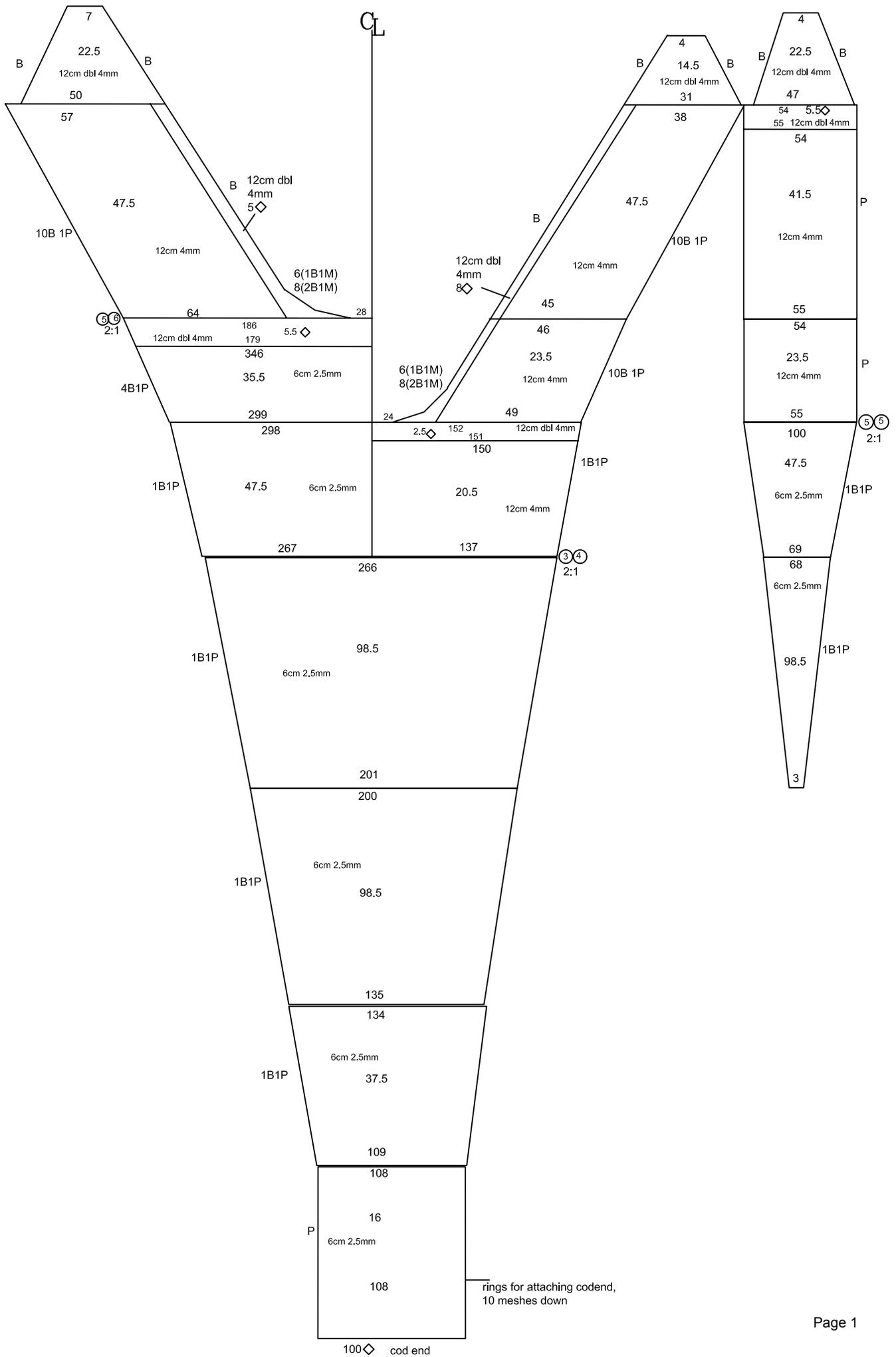
## **4-Seam, 3-Bridle Survey Bottom Trawl Specifications**

**Northeast Fisheries Science Center**

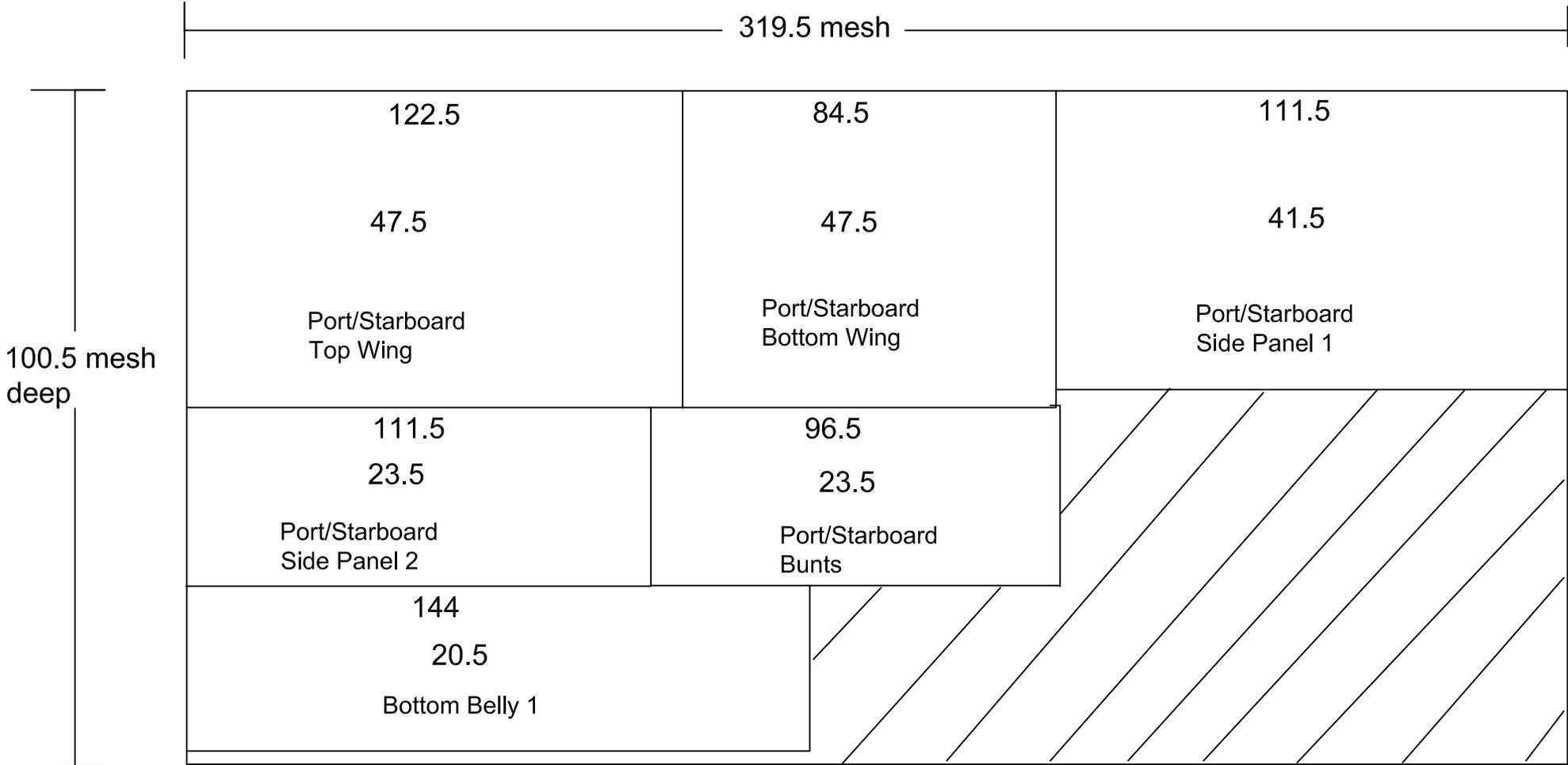
**Standardized Reference Manual  
August 2012**

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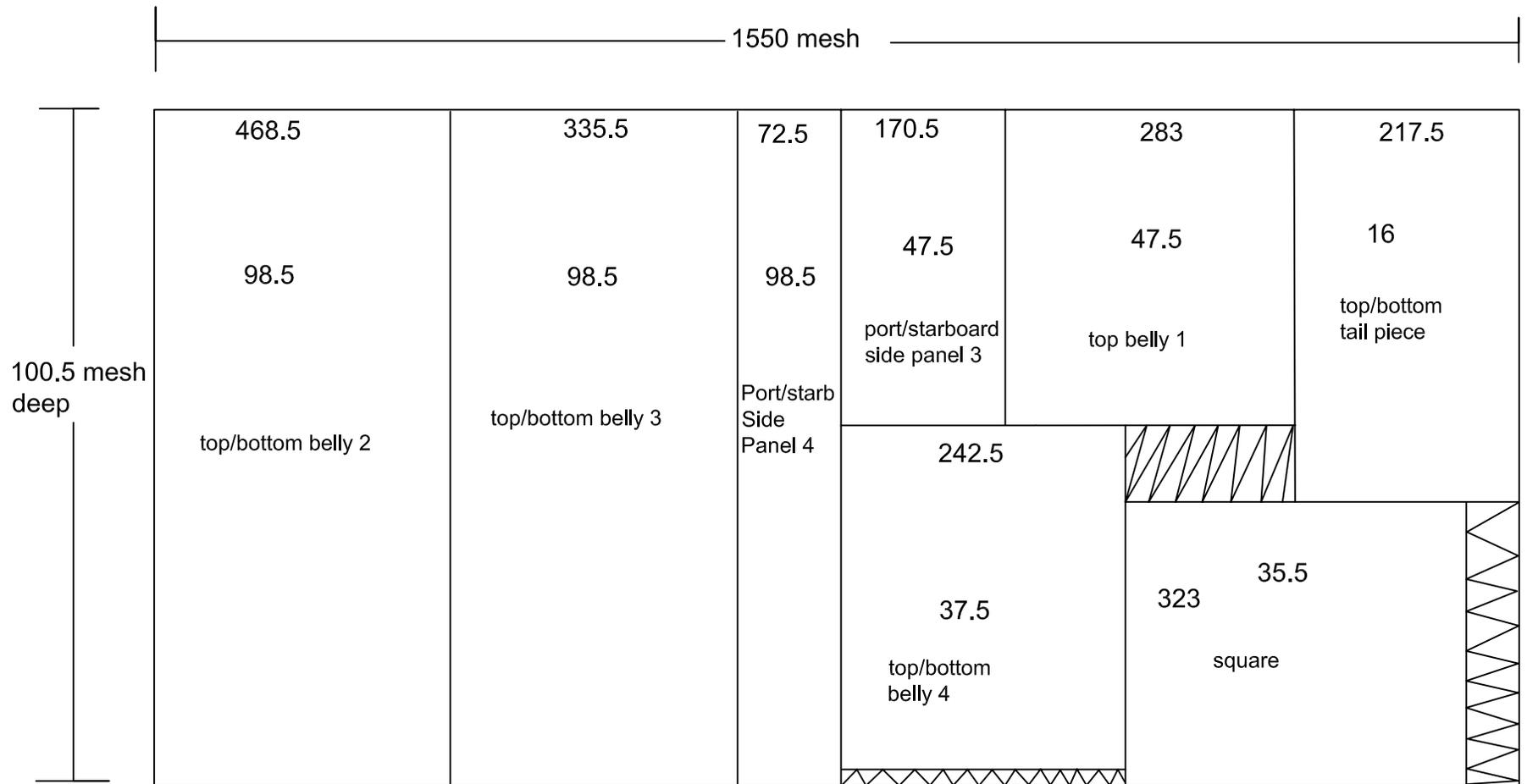
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# 12 cm Webbing



# 6cm Webbing



## Components of the Trawl

### Trawl

- 4 seam & 3 bridle
- 400 x 12cm 4800cm
- Footrope = 2700cm
- Headrope = 2424cm (including wing end extensions and shackles)

### Twine Size and Thickness

- 12cm (kc), 4mm regular, dark green, braided polyethylene  
in top & bottom wings in 1<sup>st</sup> bottom belly  
in bunts in 1<sup>st</sup> & 2<sup>nd</sup> side panels
- 6cm (kc), 2.5mm regular, dark green, braided polyethylene  
in square in 2<sup>nd</sup> belly aft to codend  
in 3<sup>rd</sup> & 4<sup>th</sup> side panels

### Section Joining Twine

- 12cm mesh sections joined by double 2.5mm Orange P.E.
- 6cm mesh sections joined by single 2.5mm Orange P.E.
- 12cm mesh to 6cm mesh joined by single 2.5mm Orange P.E.
- Selvedge joined to wing sections by single 4mm dark green, braided, P.E.

### Selvedge

- Selvedge cut from 12.0cm (kc), double 4mm dark green, braided polyethylene, Euroline with yellow tracer
- 8 meshes deep on the bottom wing bars
- 5 meshes deep on the top wing bars
- 5.5 meshes deep across forward square
- 5.5 meshes deep across forward 1<sup>st</sup> side panel
- 2.5 meshes deep across forward 1<sup>st</sup> bottom belly
- All jibs (top, bottom and side)

### Gores

- 4 full meshes will be put into each gore
- Port Top= Orange 2.5mm P.E. & White #48 nylon
- Port Bottom= Double Orange 2.5mm P.E.
- Starboard Top= Green 2.5mm P.E. & White #48 nylon
- Starboard Bottom= Double Green 2.5mm P.E.

## Hanging Lines

Hung using #96/108 white, braided, nylon twine

### Headrope

- ¾” combination rope, IWRC, polypropylene clad with stainless steel core
- ¾” stainless steel heavy wire rope thimbles
- Top Wing End Extensions: ½” stainless steel wire & ½” stainless steel heavy wire rope thimbles
- Headrope is 2058cm eye to eye
- The headrope eye, the top jib end meshes and the upper wing end eye are all put in a ¾” Blue Line bow shackle with the 174cm headrope extension of ½” s.s. wire coming from it
- The headrope extension of ½” s.s. wire is 174cm
- The total headrope length from eye to eye is 2424cm, including port & starboard ¾” bow shackles (9”) and 174cm, ½” s.s. wire, extensions
- A ½” hammerlock goes on the end of the 174cm extension
- 3 Nokalon #508, 8” center hole, orange trawl floats go on each 174cm extension separated by 4”x ½” rubber cookies

### Wing End (Up & Down Lines)

- 5/8” combination wire rope, IWRC, polypropylene clad with stainless steel core
- 5/8” stainless steel HWR thimbles
- The upper wing end is 552cm eye to eye
- The lower wing end is 460.5cm eye to eye
- The top jib eye goes into the ¾” Blue Line bow shackle on the top
- The two side panel eyes and the middle jib end meshes are put into a ¾” Blue Line bow shackle with the middle extension coming from it
- The middle extension is made of 5/8” s.s. wire with 5/8” s.s. HWR thimbles. It is 133 cm - 9cm (¾” bow shackle) = 124cm eye to eye
- The lower wing end eye and lower jib end meshes are put into a ¾” Blue Line bow shackle
- A 5/8” hammerlock goes on the end of both the middle and lower 124cm extensions

### Floats

- 60 Nokalon #508, 8” center hole, orange trawl floats
- The floats are mounted vertically in two 30-float strings, with the first float of each string starting 50cm from the center of the headrope
- Float line is made of ¾” polysteel blue, with orange tracer, float rope
- The first 24 floats are mounted at 25cm on center and the remaining 6 floats are mounted at 50cm on center
- 3 floats are put onto each port & starboard top wing end extensions

### Bolschline (Rubberline): 3 Piece

- 2436cm total length outside eye to outside eye (including hammerlocks, 6cm each)
- 5/8" stainless steel wire.
- Center Section: 842cm outside eye to outside eye
- Wing Sections: 791cm outside eye to outside eye
- 2-3/8" spacer cookies cover wire. 4" cookies cover sockets
- 198 2-hole orange hangers total; center 76; wings 61
- 1 link of 5/8" trawlex chain used as hangers to pass traveler through, spaced 60cm
- 40 chain-link hangers total; center 14; wings 13
- 2, 5/8" Crosby hammerlocks connect 3 piece bolschline sections
- 5/8" Esco sockets swaged on each end of bolschline sections
- 10, 5/8" wire clamps total; center 6; wings 2

### Tailpiece

- Tailpiece diameter is 216 meshes x 16 meshes deep, of 6.0cm, 2.5mm
- Placed 10 meshes down from top of tailpiece; for attachment to codend.
- 31 rings 3.5" plastic, 1 ring at top center 3/8" x 3" stainless steel, sewn on with #96 braided nylon twine.

### Codend Liner

- #504 knotless nylon, 1" stretched diamond mesh.
- 432 meshes across by 384 meshes deep.
- The 432x384 section of knotless webbing is machine sewn, the full length of webbing, selvedge to selvedge, to form a tube open at both ends.
- The knotless nylon tube is joined to 6cm, 2.5mm green p.e. webbing 216 meshes around by 5.5 meshes deep (215.5 mesh wide sewn into cylinder 216 mesh circumference).
- A 700cm in length joining rope is spliced into a 648cm circle and marked at 3cm intervals (216 marks).
- 6cm, 2.5mm green p.e. webbing cylinder and #504 knotless nylon tube is gathered and sewn simultaneously to the joining rope at each mark using #182 braided nylon twine.
  - 6cm 1:1 ratio (216 meshes to 216 marks).
  - #504 2:1 ratio (423 meshes to 216 marks).
  - #504 sewn through 3<sup>rd</sup> mesh from top
  - Webbing sections sewn to rope with 1 locking hitch and 3 half hitches.
- 6cm p.e. webbing on forward portion of liner is sewn 1:1 to aft meshes of tailpiece.

## Codend

- Same webbing as selvedge, 12.0cm (kc), double 4mm P.E. Euroline
- 100 meshes in diameter & 75 meshes deep, from 2 panels of 54 mesh x 75 mesh
- 4 meshes in each gore, 2 from each webbing panel port and starboard.
- The codend utilizes 1" diameter gore ropes.
  - Gore ropes are to have eyes spliced on forward and aft ends
  - Forward End- 14cm inside eye length. Aft End- 10cm inside eye length
  - At the aft end, the gore rope eye should be flush with the rings; at the forward trawl end, the gore rope should extend 70cm (includes 14cm eye)
- 32 total zipper rings at forward trawl end to attach codend to tailpiece. 31 3.5" plastic rings, 1 stainless steel ring at top center 3/8"x 3".
- 50 puckering rings total at terminus, attached 2:1. 5/16" x 2.5" stainless steel.
- Codend zipper line made from 1/2" polydacron rope, 650cm length.

## Codend Ring Attachments

- Codend rings are attached on the forward and aft sections by #8 virgin polyester twine
- The forward trawl end ring attachment:
  - First row is 1:1 all the way around (108 meshes), 10cm bar length.
  - Second row is sewn with the following pattern, 10cm bar length:  
Beginning at the TOP CENTER:  
Five times » 2:1, 2:1, 1:1/ One time » 2:1, 2:1/ Ten times » 2:1, 2:1, 1:1/  
One time » 2:1, 2:1/ Five times » 2:1, 2:1, 1:1
  - Third row is 1:1 all the way around (64 meshes), 15cm bar length to accommodate the rings. Rings attached 2 meshes per ring. 32 total rings.
- The aft ring end attachment:
  - Puckering Rings: 50, 5/16" x 2.5" stainless steel rings. Rings sewn on 2:1 with 8cm bar length

## Codend Strengthening Straps, Splitting Strap & Bull Rope

- 5 straps around codend: 1 Lifting strap, 3 strengthening straps, 1 splitting strap.
- All straps attached by twine beackets.
  - Twine for beackets is 12mm virgin polyester.
  - Full circumference (other than top lifting strap stop 10 meshes from gore for reinforcement)
  - Spacing is 3 meshes x 1-1/2 meshes.
- Lifting strap is 3/4" 12 strand, plasma rope, 650cm eye to eye. 20cm eyes connected by twine seizing.
  - Placed at 65 meshes from aft.
- Strengthening straps are 5/8" Samson Tenex-Tec, braided, 600cm eye to eye. 8cm eyes connected by twine seizing.
  - Placed at 25, 35, 45 meshes from aft.
- Splitting strap made from 1" Samson Tenex-Tec, braided, 600cm eye to eye. 8cm eyes connected by 3/4" stainless steel, pear shaped, opening link.
  - Placed at 15 meshes from aft.

- Reinforcement is 12mm virgin polyester, 18cm mesh size.
  - 6-1/2 mesh deep, 20 meshes wide, All Bars taper.
  - Bottom edge knotted to codend webbing 12 meshes from top of codend, 10 mesh on each side of Port gore.
  - Spectacle consisting of two 2.5" and one 3" s.s. ring.
  - Top meshes of reinforcement sewn into 3" ring.
- Extension to 3<sup>rd</sup> belly is 925cm, 12 strand, plasma rope.
  - 8cm eye on aft end only.
  - Attached to lifting strap by 5/8" hammerlock.
- Bull rope is 1-1/8" 8 strand, braided, Samson "Ultra Blue", 4267cm. 8cm eye on aft end only. Attach to splitting strap into 3/4" s.s. pear shaped link.

#### Chafing Mat

- 25L x 30W
- 6.0" kc, nylon
- Sewn at 33 mesh from aft, on underside of codend
- Seized on sides, each 7 meshes, using #8 polyester

## Hanging Information

Twine Size- 12.0cm (knot center-knot center) 4mm Euroline, dark green, braided polyethylene.

Selvedge/Jibs are 12.0cm (kc-kc) double 4mm Euroline.

Bars hung at 105%

### **BOTTOM**

24 ROUND MESHES @ 6cm = 138cm

in 23 spaces

6, 1B1M @ 10cm = 60cm

9, 2B1M @ 16cm = 144cm

12 BUNT BARS @ 105% = 151cm

48 WING BARS @ 105% = 605cm

14.5 JIB BARS + ½ @ 105% = 189cm

TOTAL WEBBING = 2436cm

EXTENSION = 133cm [124cm E.T.E (5/8" s.s. wire) + 9cm (3/4" Bow shackle)]

TOTAL FOOTROPE = 2702cm (see bolschline drawing for details)

### **TOP**

28 ROUND MESHES @ 6cm = 162cm

in 27 spaces

6, 1B1M @ 10cm = 60cm

9, 2B1M @ 16cm = 144cm

36 WING BARS @ 105% = 454cm

22.5 JIB BARS + ½ @ 105% = 290cm

TOTAL WEBBING = 2058cm

EXTENSION = 183cm [174cm E.T.E (1/2" s.s. wire) + 9cm (3/4" Bow shackle)]

TOTAL HEADROPE = 2424cm

### **WIND ENDS**

#### **LOWER**

BOTTOM - 14.5 JIB BARS + ½ @ 1.025 = 184.5cm

SIDE- 22.5 JIB BARS + ½ @ 1.0 = 276cm

TOTAL = 460.5cm

#### **UPPER**

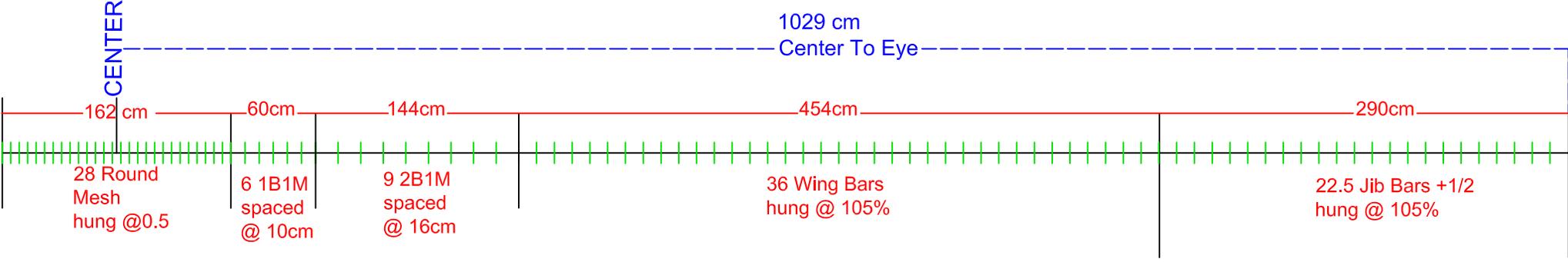
TOP - 22.5 JIBBARS + ½ @ 1.0 = 276

SIDE - 22.5 JIBBARS + ½ @ 1.0 = 276

TOTAL = 552cm

# HEADROPE HANGING RATIOS

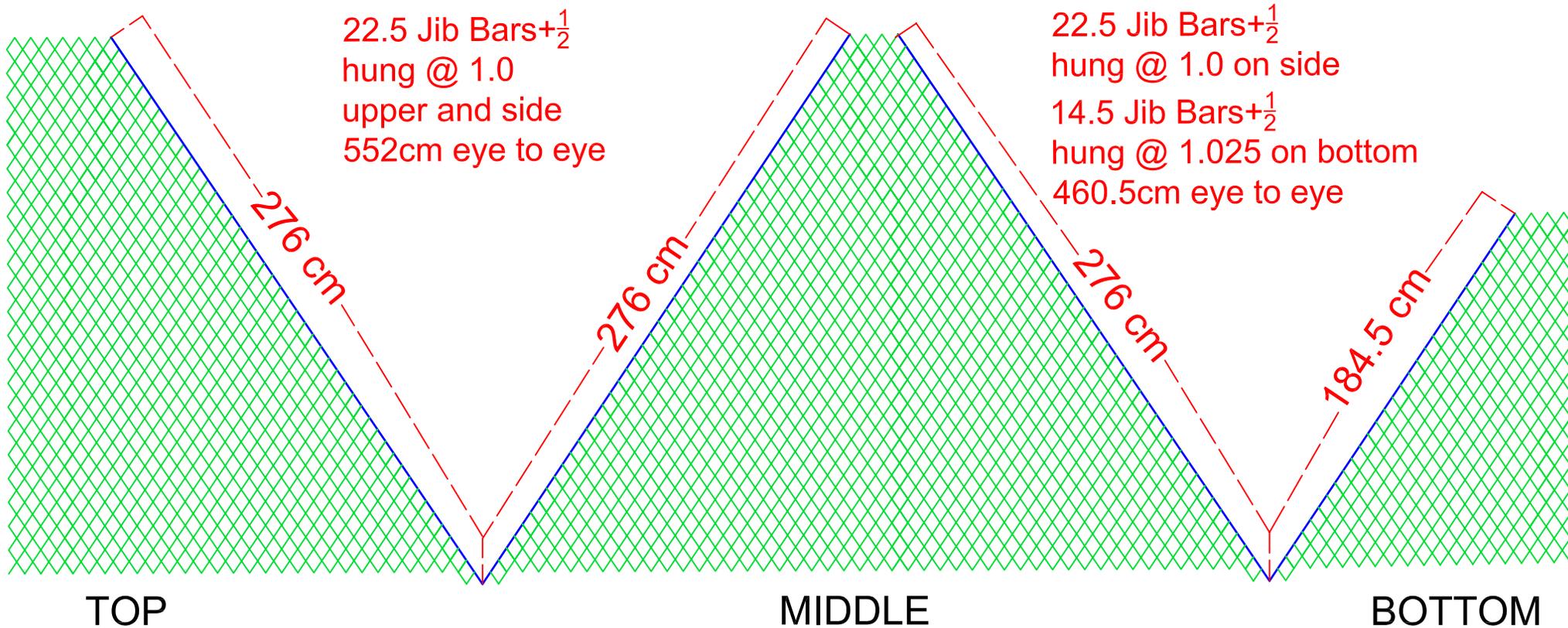
2058cm eye to eye  
12.0 cm (kc-kc) meshes along headrope  
Bars hung at 105%



# Wing End Up & Down Lines Hanging Ratios

12.0cm (kc-kc) double 4mm, Euroline

Upper = 552cm eye to eye  
Lower = 460.5cm eye to eye



400x12cm. 3-Bridle  
Selvedge plan

Top

12cm. Dbl.4mm.  
8(2B1M)  
6(1B1M)

11.5°  
28

Bottom

12cm. Dbl.4mm.  
8(2B1M)  
6(1B1M)

11.5°  
24

⑤⑥ 21

4B1P

6cm. 2.5mm

35.5°

# 400x12cm. selvedge plan

BOTTOM

12cm. double 4mm.

11.5  $\diamond$

8(2B1M)  
6(1B1M)

24 MESHES

CL



400x12cm. Selvedge plan

TOP

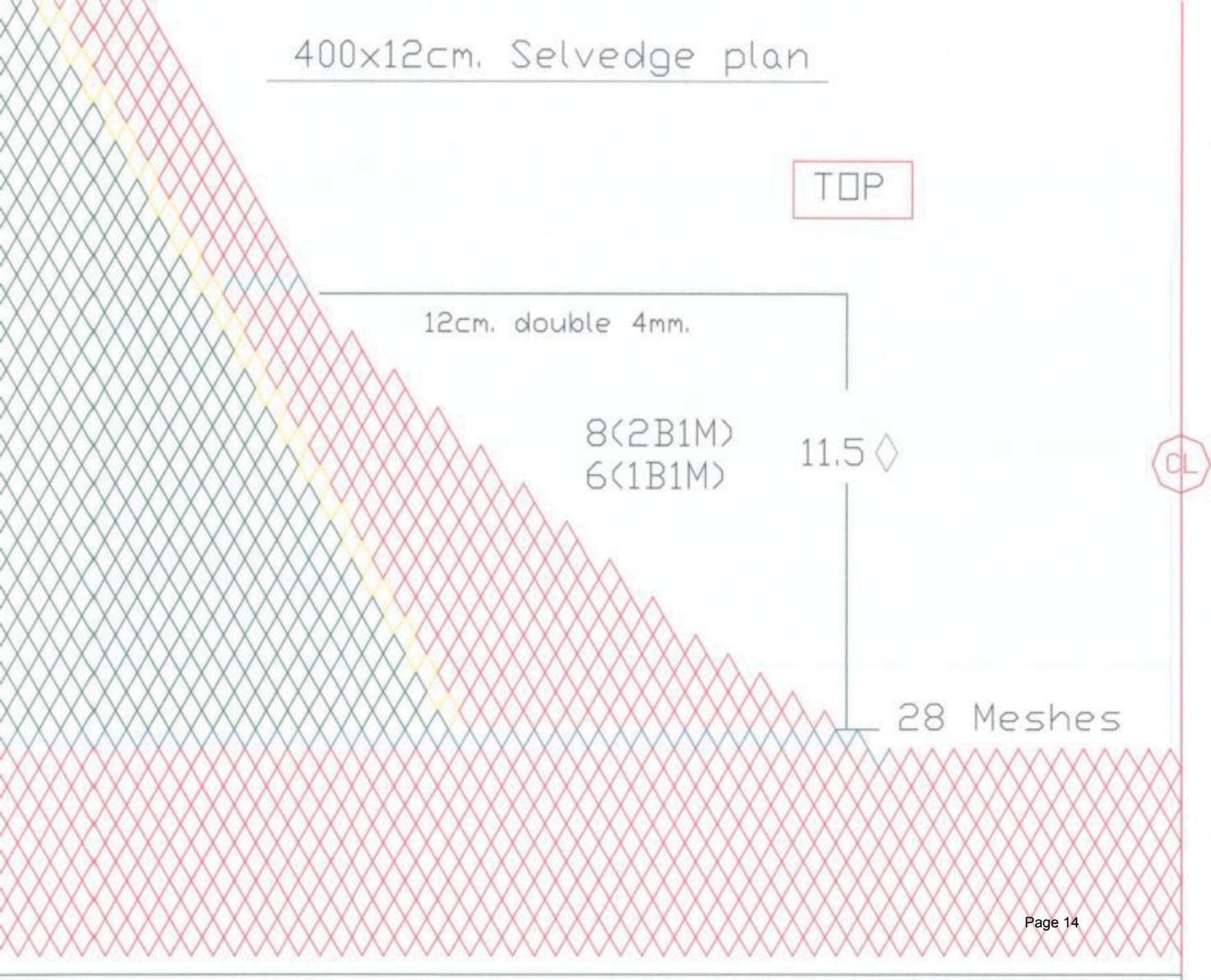
12cm. double 4mm.

8(2B1M)  
6(1B1M)

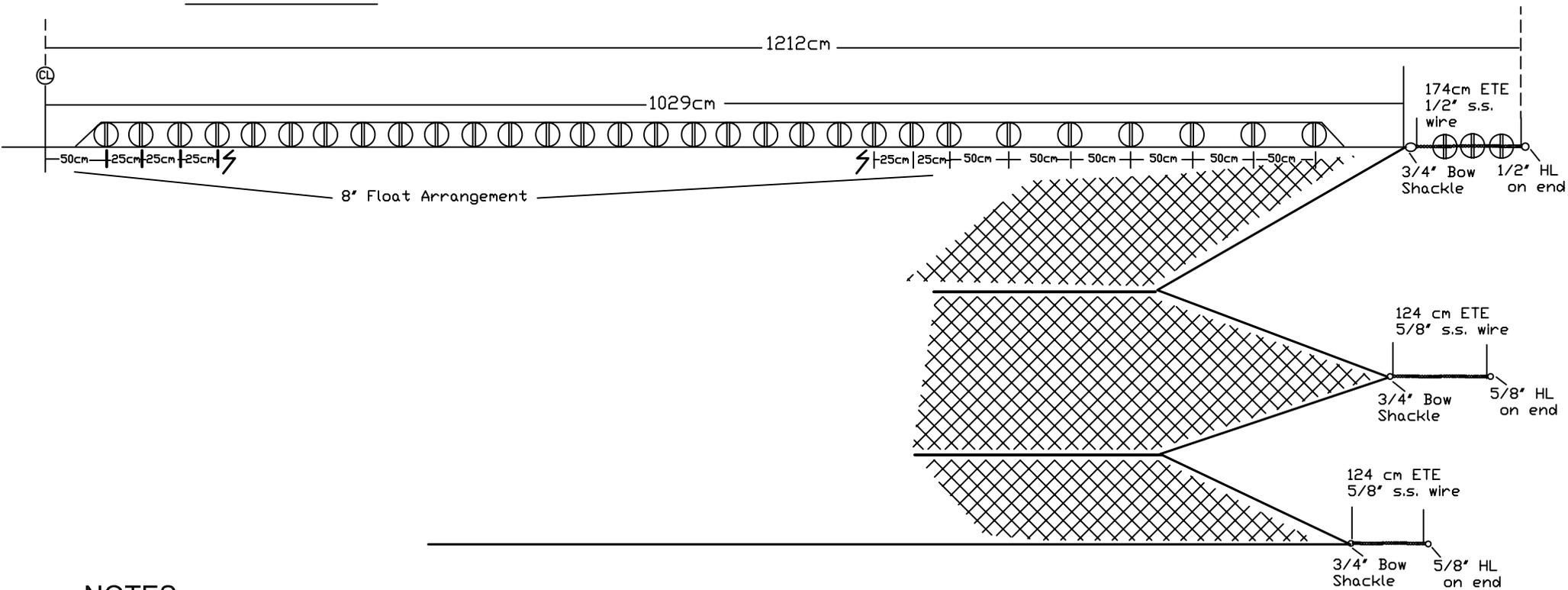
11.5 ◊

CL

28 Meshes



# Side View



## NOTES:

Total Headrope Length = 2424cm ETE including port and starboard 3/4" bow shackles and 174cm, 1/2" s.s. wire, extensions.

Upper wing end length is 685cm ETE including the middle 3/4" bow shackle and 124cm, 5/8" s.s. wire, extension.

Lower wing end length is 592cm ETE including the lower 3/4" bow shackle and 124cm, 5/8" s.s. wire, extension.

3 Nokalon #508, 8" center hole, orange trawl floats are put onto each top, 174cm extension.  
The floats are separated by 4" x 1/2" rubber cookies.

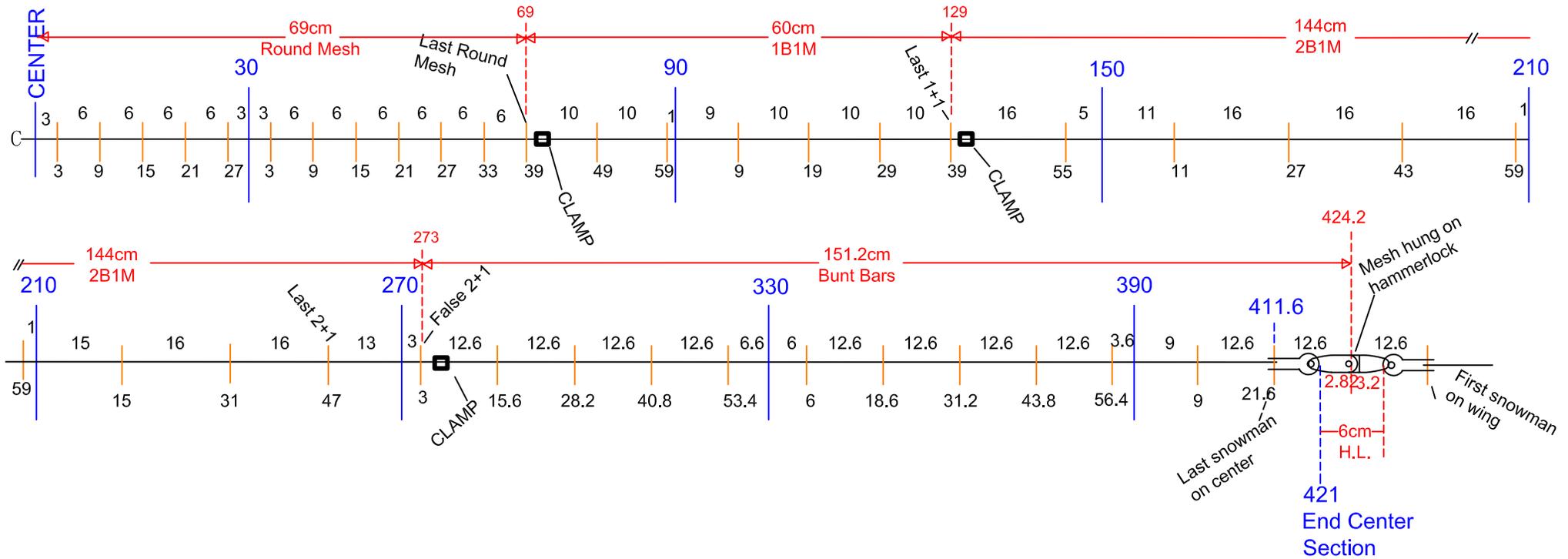


# Bolschline Center Section Spacing

842cm Length, outside eye/outside eye

76 Snowmen  
14 Hangers,  
6 Clamps total

Cut wire 827.5 cm  
String cookies from center  
Then swage sockets

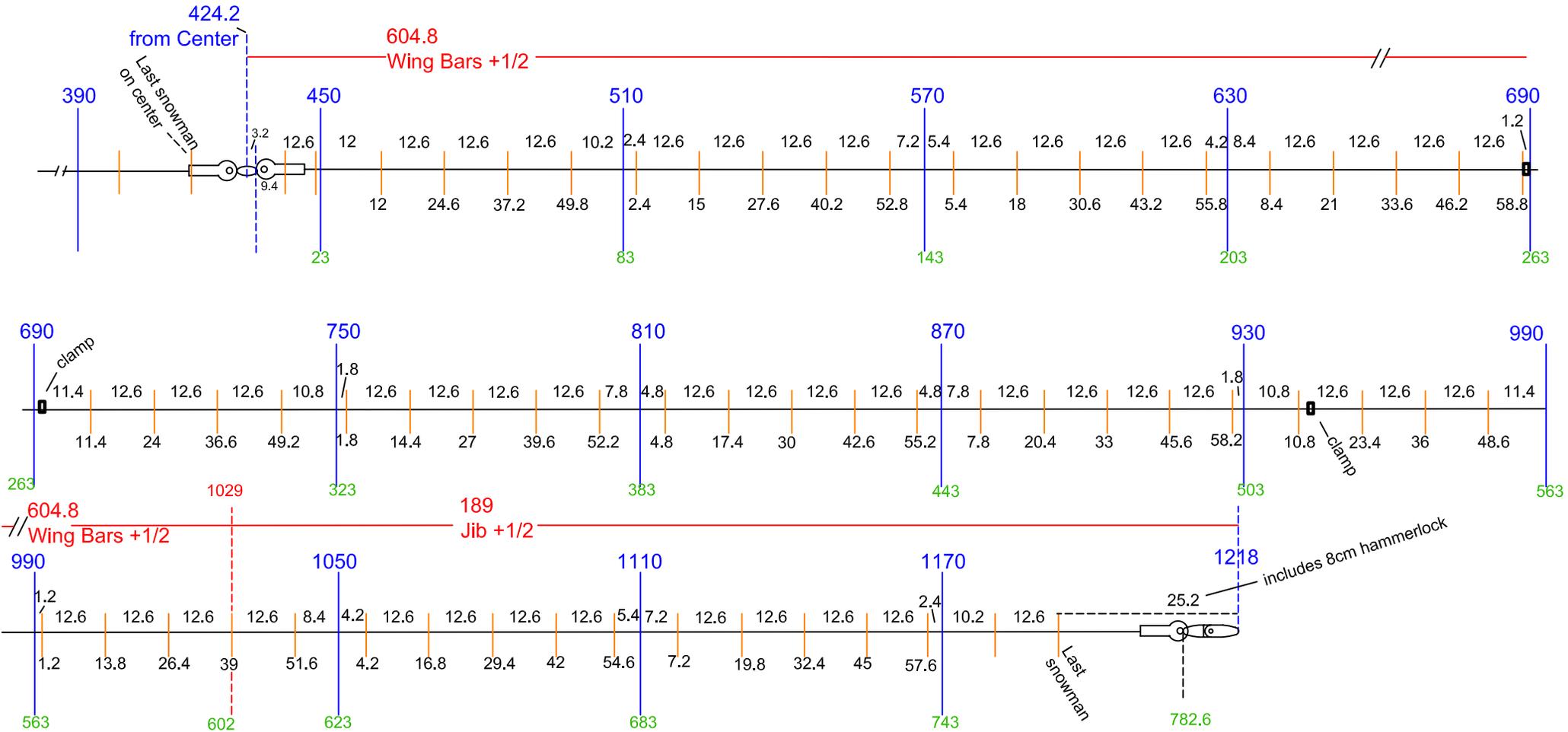


# Bolschline Wing Spacing

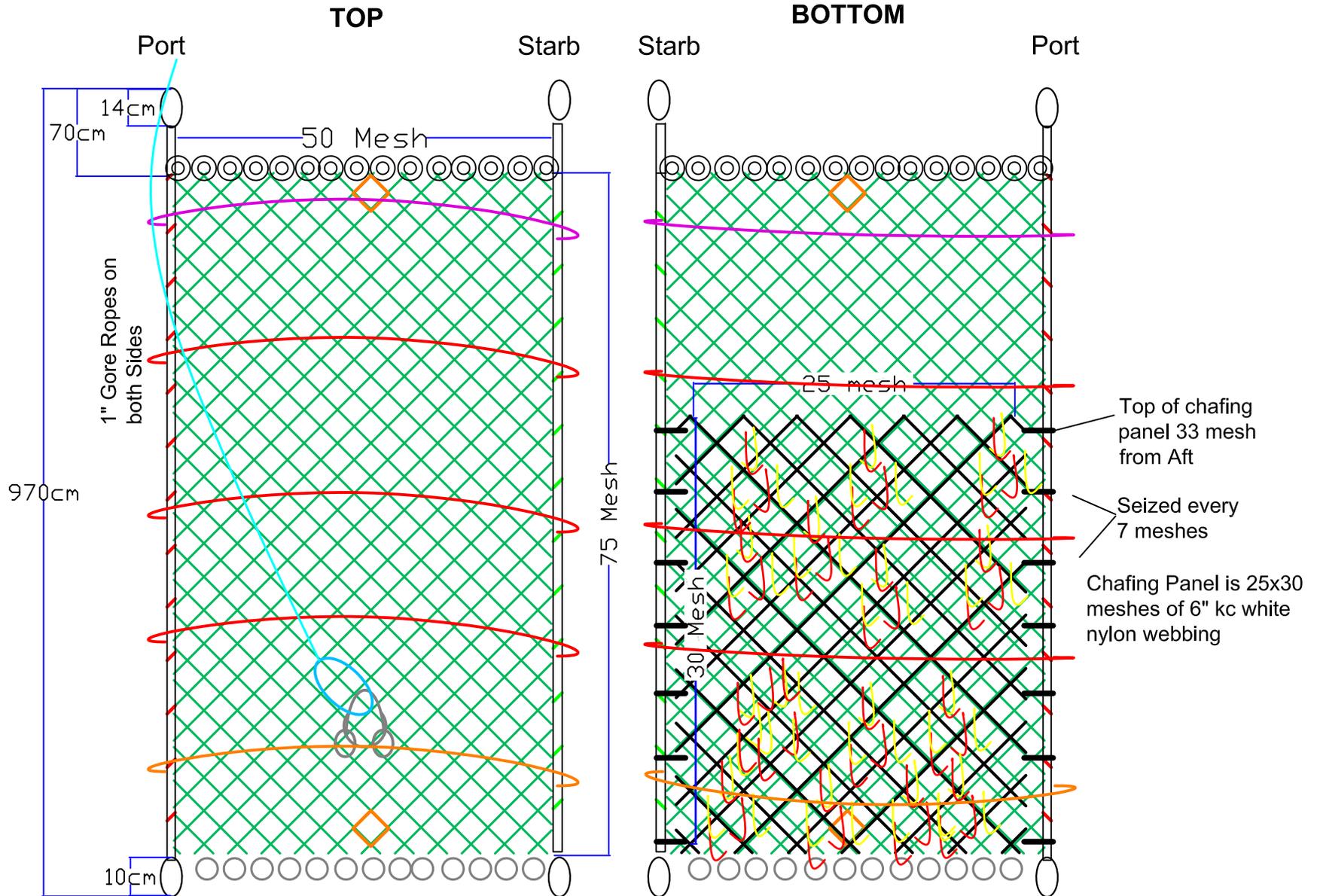
782.6 cm Length, outside eye/outside eye

Cut wire 766.2 cm

61 Snowmen 13 Hangers 2 Clamps



# 100x75 Mesh Codend



2 panels of 12cm (knot center), 4mm double Euroline Webbing. 54 x 75 meshes each, gored together with 1" gore ropes. 4 meshes in each gore (2 mesh from each panel).

Center Mesh forward, aft, top and bottom marked with orange poly twine.

## Tailpiece Rings Detail

32 rings total (31 plastic 3.5", 1 steel @ top center 3/8" x 3")

Attached using #96 braided nylon twine. 10 meshes down from top of tailpiece.

Tied on every other mesh with 10cm bar length

Start on first mesh next to gore (either side). 3 10cm mesh to 1 ring. 16 rings top and bottom.



## **Forward Trawl End Zipper Rings Detail**

32 rings total (31 plastic 3.5", 1 steel @ top center 3/8" x 3")  
Attached using #8 polyester twine

FIRST ROW: 1:1 all the way around (108 meshes), 10cm bar length

SECOND ROW: 10cm bar length, following pattern:

Begin @ Top Center

2:1, 2:1, 1:1 Five Times

2:1, 2:1 One Time

2:1, 2:1, 1:1 Ten Times

2:1, 2:1 One Time

2:1, 2:1, 1:1 Five Times

THIRD ROW: 15 cm bar length (to accommodate ring)

1:1 all the way around (64 meshes)

2 meshes per 1 ring



## Aft Codend Puckering Rings

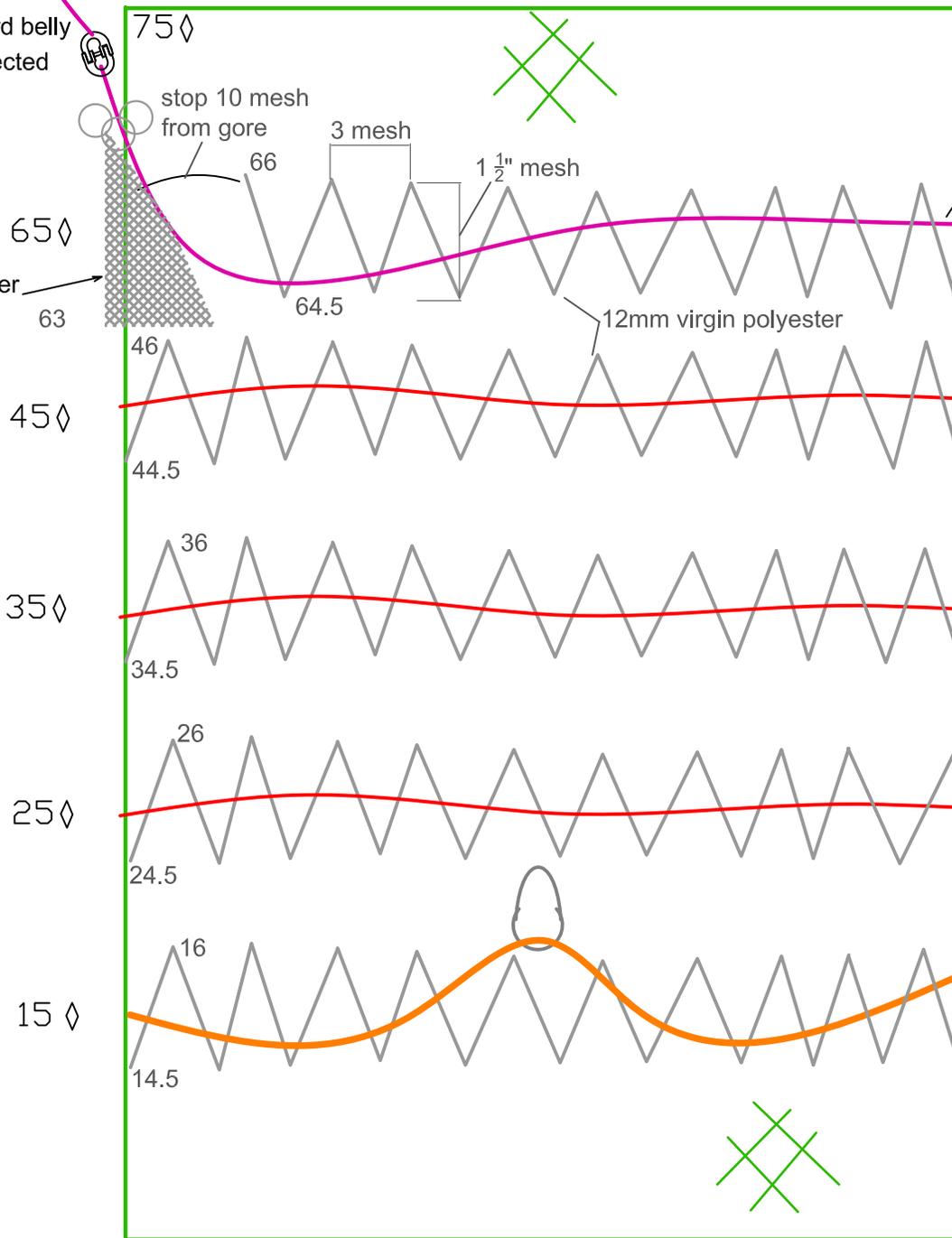
50 stainless steel rings. 5/16" x 2.5"  
Rings sewn on 2:1, (25 rings per panel)  
8cm bar length



# Codend Strengthening Strap Detail

925cm Extension to 3rd belly  
 $\frac{3}{4}$ " Plasma Rope connected  
 by  $\frac{5}{8}$ " hammerlock

Reinforcement  
 with 3 ring spectacle  
 12mm Virgin Polyester  
 12 mesh from top



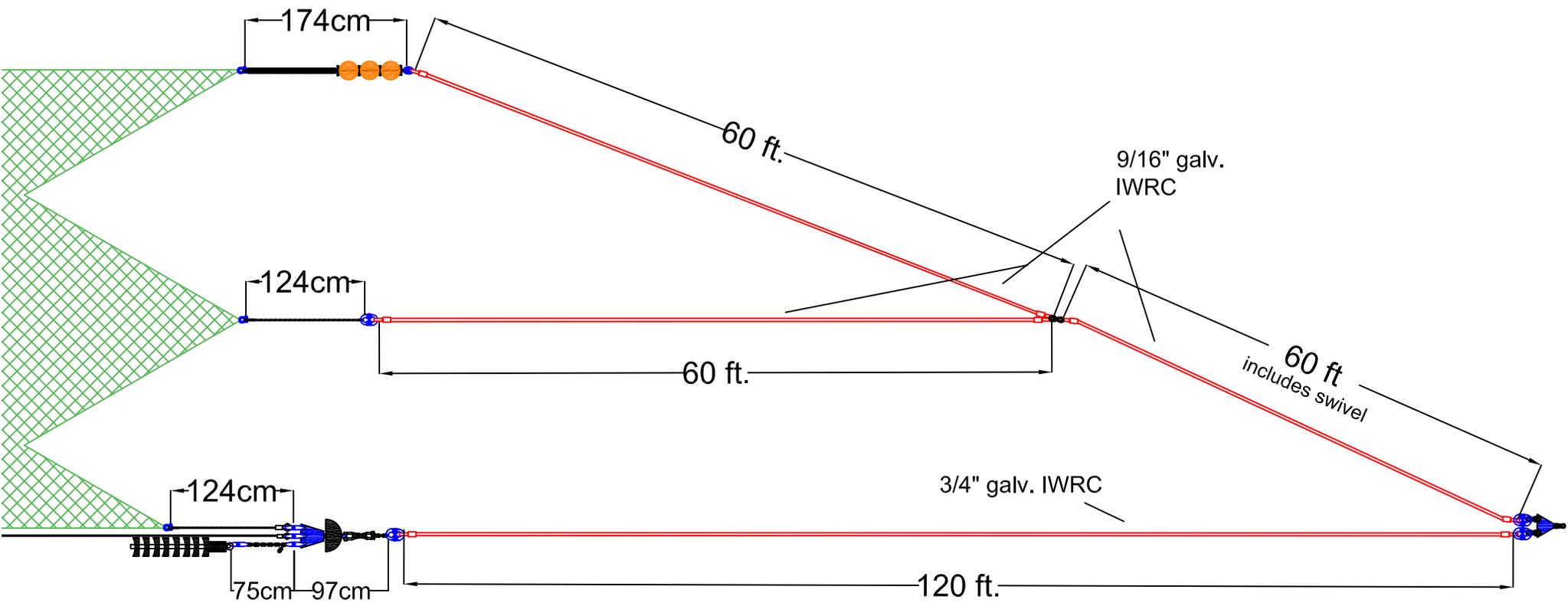
Lifting Strap  
 $\frac{3}{4}$ " 12 strand Plasma Rope  
 650cm ETE (20cm eyes)  
 eyes connected into  $\frac{5}{8}$ " hammerlock

Strengthening Straps  
 $\frac{5}{8}$ " Samson Tenex-Tec  
 600cm ETE (8cm eyes)  
 eyes connected by seizing

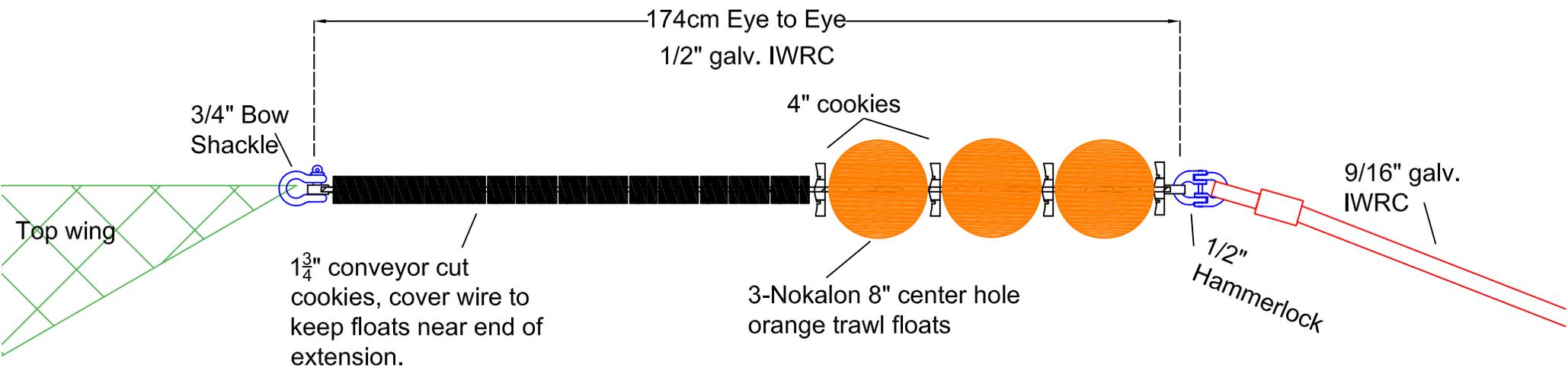
Splitting Strap  
 1" Samson Tenex-Tec  
 600cm ETE (8cm eyes)  
 eyes into  $\frac{3}{4}$ " pear shaped s.s. link



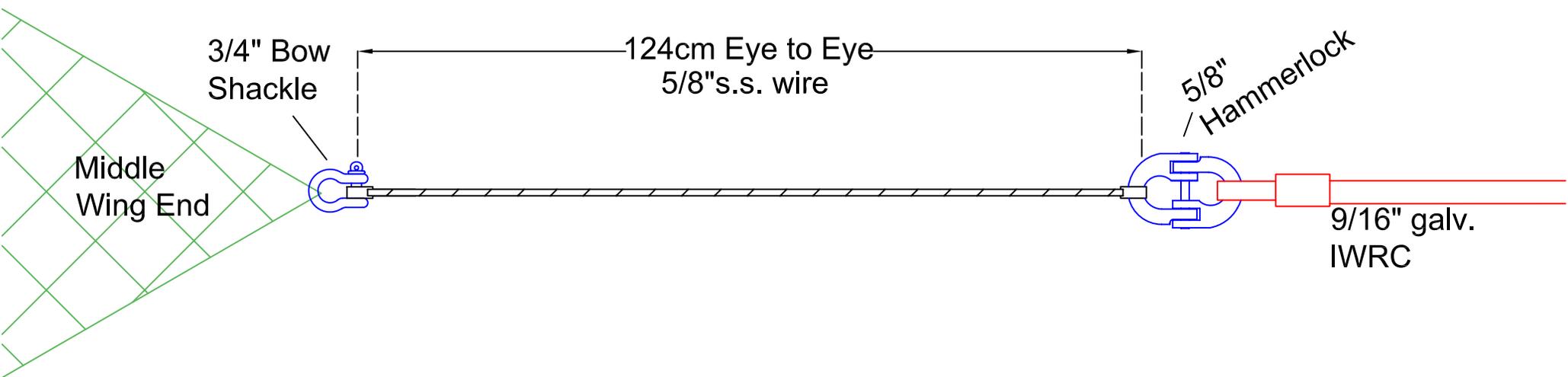
# NEFSC 4 Seam, 3 Bridle Survey Trawl Rigging Profile



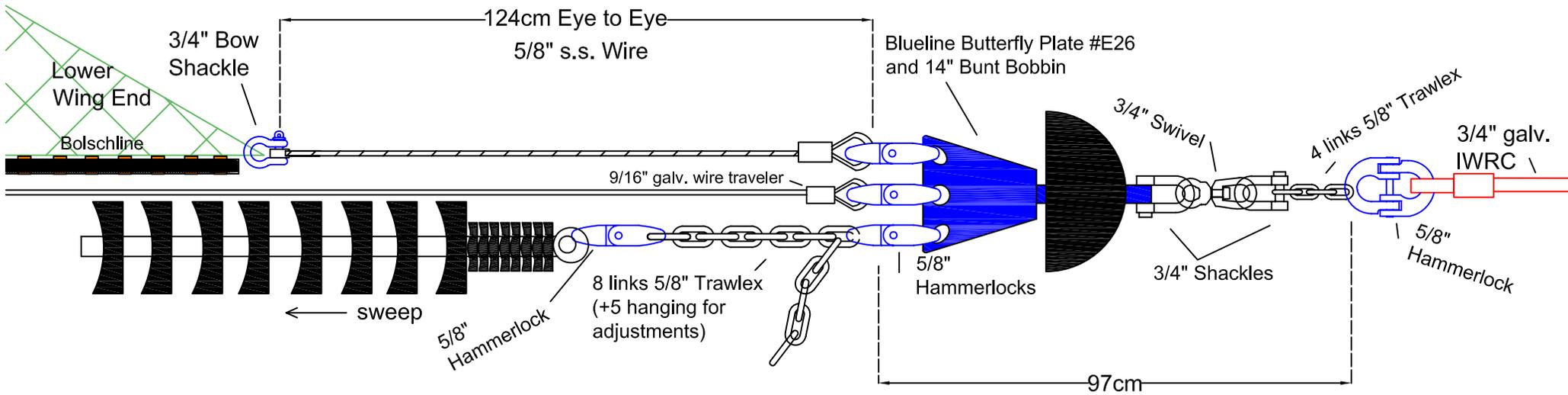
# Top Wing End Extension Detail



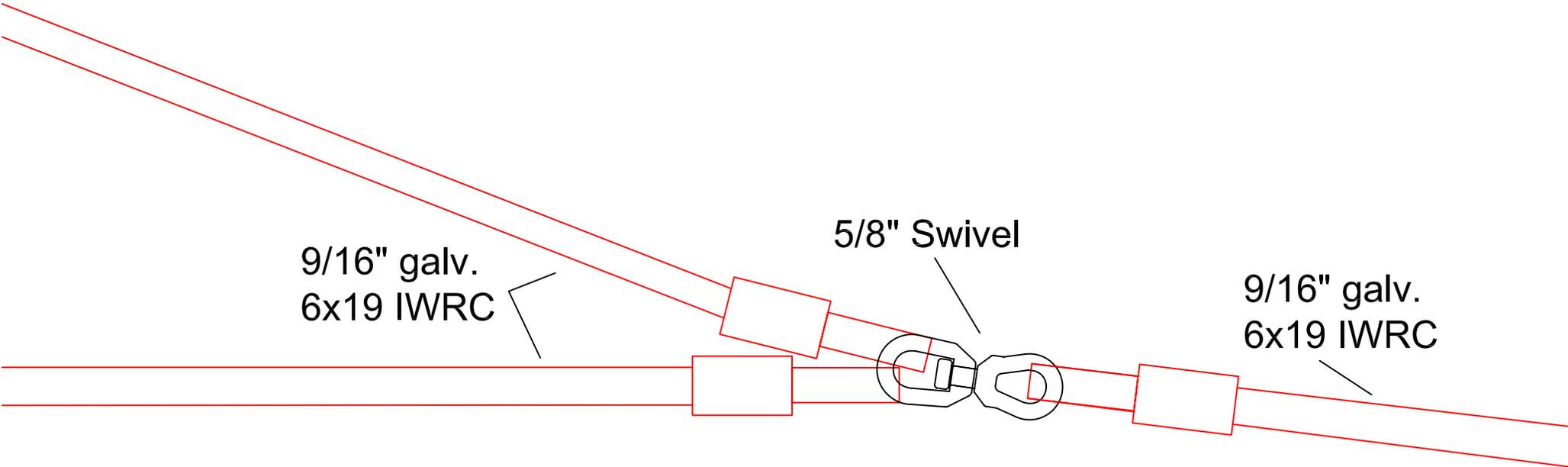
# Middle Wing End Extension Detail



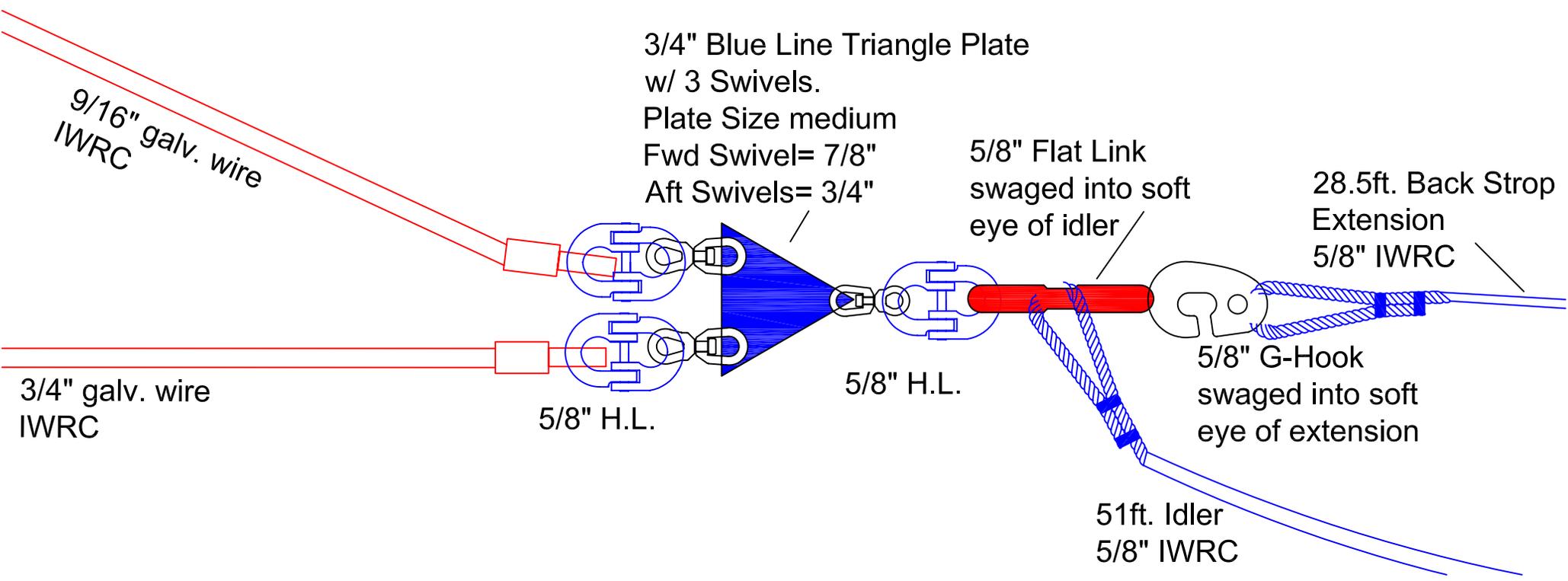
# Lower Wing End Extension Detail



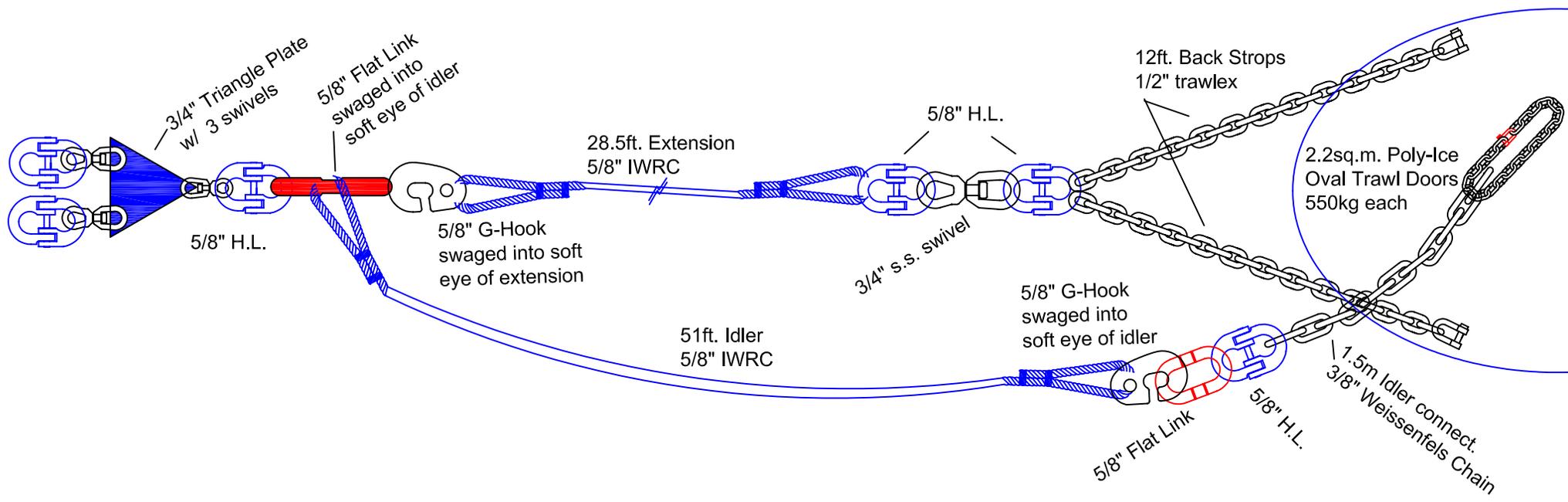
# Upper Legs Connection Detail



# Lower Leg Connection Detail



# Door Rigging Detail



# Rockhopper Sweep Details

## Center Section

- 890cm Eye to Eye.
- 3/4" 6 x 25 IWRC stainless steel wire.
- 3/4" ESCO stainless steel sockets.
  
- Drop Chains:
  - 60cm drop chain spacing.
  - 1<sup>st</sup> and last drop chains are 25cm from inside of socket eye.
  - 15 drop chains total in center section.
  - Drop chains are comprised of 2-links of 5/8" long link trawlex, with 1 5/8" headless shackle.
  
- Total Center section has 14 sections, plus 2 end sections.
  
- 5/8" Wire clamps in every 3<sup>rd</sup> section, 4 clamps total.
  - 1<sup>st</sup> and last clamps spaced 175cm from inside the eyes.
  - Inner 2 clamps spaced 180cm from 1<sup>st</sup> and last and from each other.
  
- Discs
  - Rockhopper Discs
    - 30, 16" x 1", 2.5" thick ( $\pm 0.5$ ") Rockhopper discs, total in center section.
    - 2 rockhoppers per 60cm section.
    - 1 rockhopper on each end section.
    - Concave side of rockhoppers are to face towards the center.
  - Floppy Discs
    - 116, 16" x 1" Floppy discs, total in center section.
    - 8 floppy discs per 60cm section.
    - 2 floppy discs on each end section.
  - Filler Rubber
    - 5" x 1" filler rubber, tread cut. Fill in all gaps between floppy discs and rockhopper discs.
    - 6" x 2-3/8" filler rubber, tread cut. Used on end sections to cover the sockets.
  
- Lead Weight
  - 100 lbs total.
  - 80, 1-1/4 lbs lead weights are to be spaced evenly throughout the center section of the sweep.
  - Leads spaced evenly in between the first and last rockhoppers. No lead on end sections.

## Wing Sections

- 820cm Eye to Eye.
- 3/4" 6 x 25 stainless steel IWRC wire.
- 3/4" ESCO stainless steel sockets.
- 1, 5" x 2-3/8" x 1/2" stainless steel washer, first item on 1<sup>st</sup> end section over the socket.
- 5/8" Hammerlocks connect wing sections to the center section.
  
- Drop Chains
  - 60cm drop chain spacing.
  - 1<sup>st</sup> drop chain is 25cm from inside of socket eye.
  - Last end drop chain is 135cm from inside of socket eye.
  - 12 drop chains total in wing sections.
  - Drop chains are comprised of 2-links of 5/8" long link Trawlex, with 1 5/8" headless shackle.
  
- Each wing section has 11, 60cm sections and 2 end sections.
  - 1<sup>st</sup> end section, towards the center, is 25cm from inside eye to the first drop chain and is comprised of 1 14" rockhopper, 1 14" floppy, and 6" filler rubber covers the socket.
  - Last end section, on the wing end, is 135cm from the last drop chain to inside the eye and is comprised of 4 14" rockhopper, 7 14" floppy discs, 1 5/8" wire clamp between the 20<sup>th</sup> and 27<sup>th</sup> rockhoppers, and 30cm of 6" filler rubber from the 27<sup>th</sup> rockhopper out to the end over the socket.
  
- Each wing section has 4 5/8" wire clamps total.
  - 1<sup>st</sup> clamp goes between the 4<sup>th</sup> and 5<sup>th</sup> drop chains.
  - 2<sup>nd</sup> clamp goes between the 7<sup>th</sup> and 8<sup>th</sup> drop chains.
  - 3<sup>rd</sup> clamp goes between the 10<sup>th</sup> and 11<sup>th</sup> drop chains.
  - 4<sup>th</sup> clamp goes on the last end section, between the 25<sup>th</sup> and 26<sup>th</sup> rockhoppers.

- Discs
  - Rockhopper Discs
    - 27, 14" x 1", 2.5" thick ( $\pm 0.5$ ") Rockhopper discs, total in each wing section.
    - 2 rockhoppers per 60cm section.
    - 1 rockhopper on 1<sup>st</sup> end section towards the center.
    - 4 rockhoppers on the last end section.
    - Concave side of rockhoppers are to face towards the center.
  - Floppy Discs
    - 52, 14" x 1" Floppy discs, total in each wing section.
    - 4 floppy discs per 60cm section.
    - 1 floppy disc on 1<sup>st</sup> end section
    - 7 floppy discs on last end section.
  - Filler Rubber
    - 5" x 1" filler rubber, tread cut. Fill in all gaps between floppy discs and rockhopper discs, between 1<sup>st</sup> and 27<sup>th</sup> rockhoppers.
    - 6" x 2-3/8" filler rubber, tread cut. Used on end sections to cover the sockets. 35cm on last end section from the 27<sup>th</sup> rockhopper out over the socket. On the 1<sup>st</sup> end section, cover the socket area after the 5" steel washer.
- Lead Weight
  - 30 lbs total on each wing section.
  - 24, 1-1/4 lbs lead weights are to be spaced evenly between the 20<sup>th</sup> and 27<sup>th</sup> rockhoppers.

# ROCKHOPPER CENTER SECTION

Section = 890cm, 100lbs Lead

14 Sections (Excluding End Sects.)

60cm Spacing between chains

- Section Makeup -

2 - 16" x 1", 2.5" thick

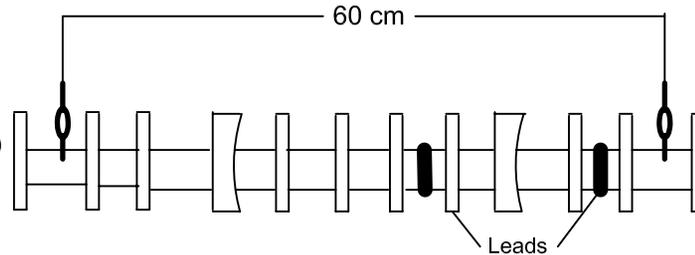
Rockhopper Discs

8 - 16" x 1" Floppy Discs

5" x 1" Filler Rubber (tread cut)

80- Evenly Spaced,

1-1/4 lbs leads , (100lbs total)

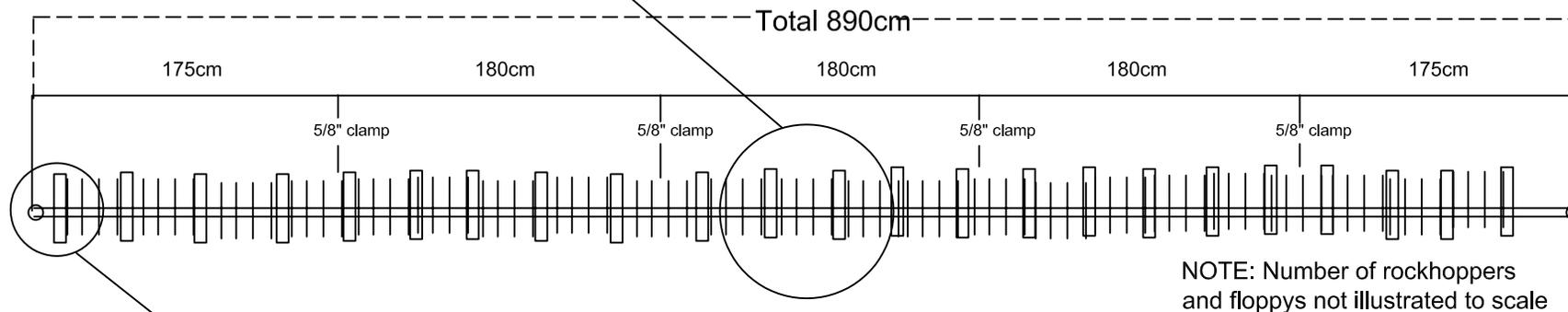


## TOTAL CENTER SECTION

30- 16" x 1", 2.5" thick rockhoppers  
(2 per section with 1 in end sections)

116- 16" x 1" floppy discs  
(8 per section with 2 in the end sections)  
(4 floppys between each rockhopper)

80 pieces of 1-1/4lbs lead (100lbs total),  
evenly spaced in between end rockhoppers.



## Beginning and End Sections

25cm Inside the eye to chain

- End Section Makeup-

1- 16"x1", 2.5" thick

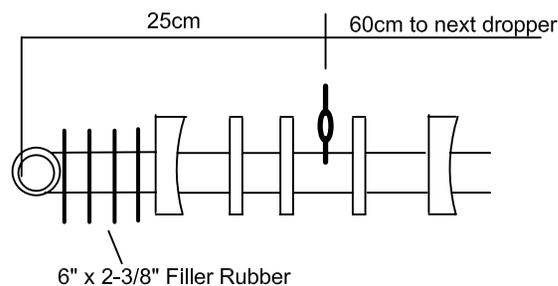
Rockhopper Disc

2- 16"x1"

Floppy Discs

3/4" ESCO s.s. Sockets

6" x 2-3/8" Filler Rubber  
cover the 3/4" socket



Clamp in every 3rd section

4, 5/8" Wire Clamps total in center section  
spaced as shown above

15 drop chains total, drop chains are  
2 links of 5/8" long link trawlex and  
1 5/8" headless shackle

3/4" 6x25 IWRC  
STAINLESS STEEL WIRE

3/4" ESCO STAINLESS STEEL  
SOCKETS

4, 5/8" WIRE CLAMPS

80, 1-1/4 lbs LEADS EVENLY  
SPACED, 100lbs total

5" x 1" FILLER RUBBER  
tread cut

6" x 2-3/8" FILLER RUBBER  
To Cover Sockets on End Sects.

15 HANGING CHAINS

EACH 2-LINKS OF  
5/8" LONG LINK TRAWLEX +  
1, 5/8" HEADLESS SHACKLE

