Chapter 460

MOTIF STARTING POINTS

Let's compare two vests made in stranded knitting with the common OXO motif separated by short peerie bands with a small cross pattern. They look very similar.

Version 1 Version 2

What differences do you see? Are they equally pleasing? The essential idea of both is the same: a basic V-neck vest with the traditional X and O motif.

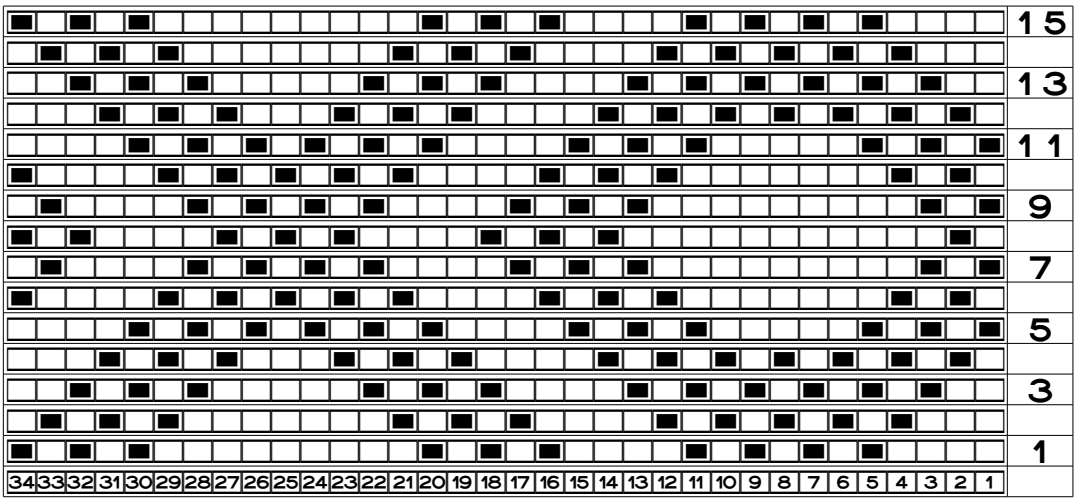
One major difference—the only one I can see (well, the only one I intend!)—is that the motifs are not symmetrically positioned in version one, but they are in version two.

Why is this positioning important? In and of itself, it isn't, except for the aesthetic qualities of the final result. But this positioning does help explain something that can be very confusing in some project charts.

Multiple Starting Points, One Chart

Suppose we want to make chapter 410's V-neck vest with the traditional motif shown in the vests above. The OXO chart is thirty-four stitches wide and fifteen rows tall.[1] Of course, we would have to swatch to see if we get the same gauge in stranded colorwork compared to single-color knitting, but for simplicity, we'll assume we do get chapter 410's design stitch gauge so we can keep using the same stitch counts.

[1] Usually we would add stitches of the motif color to break up the long runs of the background color inside the O and between the arms of the X. They've been changed to the background color here to make it easier to focus on the O and X themselves.



We've seen in the two versions of the vest how we can position the motifs so that the overall effect is symmetrical or asymmetrical. Since the motif itself is asymmetrical—there are no plus stitches to make the left and right edges match—the motif's designer (yours truly) is assuming that we'll be figuring out the correct starting point for ourselves based on the width of our project and our stitch gauge.

So what do you think the chances are that all six sizes of the vest made with this very wide motif will all start with motif stitch one in project stitch one and still all wind up with the OXO in perfect mirror-image? Exactly. Slim to none.

Find the First Worked Motif Stitch: The Hard Way

The way to get multiple sizes from a single motif chart and always have symmetry is to **start each size at its own place in the chart**.

So how do we figure out where in the motif each size needs to start? We have to use the motif's width in stitches and the project's width in stitches.

Step 1: Determine the Dead-Center Stitch of the Motif

If we look closely at the OXO chart, we see that stitch twenty-five is in the exact center of the X and that stitch eight is in the exact center of the O. If we put either of those stitches in the dead-center stitch of each size of the vest, then the OXOs will be mirror-image.

Since we actually have two choices—the center of the X and the center of the O—we'll make a command decision to put the center of the X in the exact center of each size of the vest.

Step 2: Determine the Dead-Center Stitch of the Project

Because our V-neck has a single stitch at the very bottom, we need to have the same number of stitches on both sides of that single stitch if we want symmetry (see issue one in appendix 528). There may be an even or odd number of stitches on either side of the center stitch, but that single dead-center stitch means that we will have an odd number of stitches total.

Here are the number of stitches in each size from chapter 410's written-out instructions for the vest. We already have an odd number of stitches to allow that extra stitch to be used for seaming (see issue two in appendix 528).

	Small	Medium	Large	XL	XXL	XXXL
Front/Back Stitches	91	101	111	121	131	141

Size Small

Since the size small has ninety-one stitches on both the front and the back, we need to figure out the stitch number of the dead-center stitch. We have to—brace yourself—solve a very simple equation:

<some number> + 1 + <some number> = 91
<some number> + <some number> = 90
<some number> = 45

Since we have forty-**five** stitches before and after the central stitch of both the front and the back of the size-small vest, then the dead-center project stitch is stitch forty-**six**.

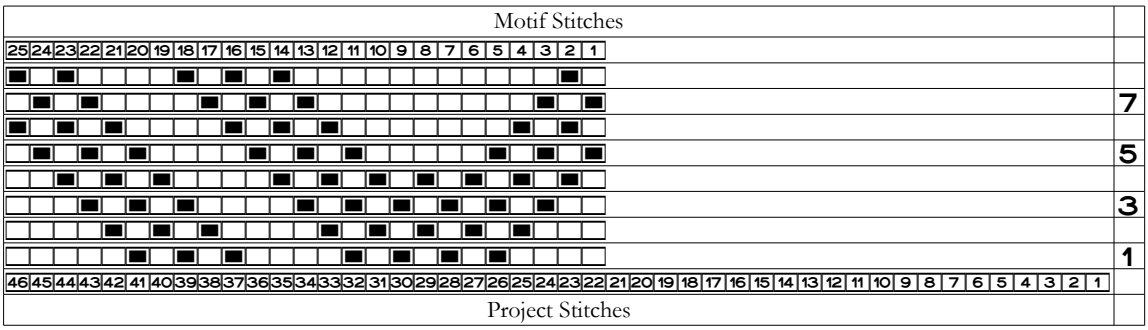
We can figure out the dead-center stitch of the other five sizes the same way.

Step 3: Position the Motif

Now we're ready to determine the placement of the motif for each size. If we start each size at stitch one of the motif, it's pretty low odds that motif stitch twenty-five, the center of the X, will be in the dead-center stitch of any size of the vest.

Our solution, therefore, is to first place motif stitch twenty-five in the dead-center stitch of the vest, then work from there backwards to the beginning of the row. We'll use—what else?—a chart to figure out the answer.

This partial chart shows the project stitch numbers across the bottom and the motif stitch numbers along the top. We've put the first twenty-five stitches of the pattern repeat into the chart so that motif stitch twenty-five is in the size small's dead-center stitch, stitch forty-six.



Step 4: Fill In the Beginning of the Chart

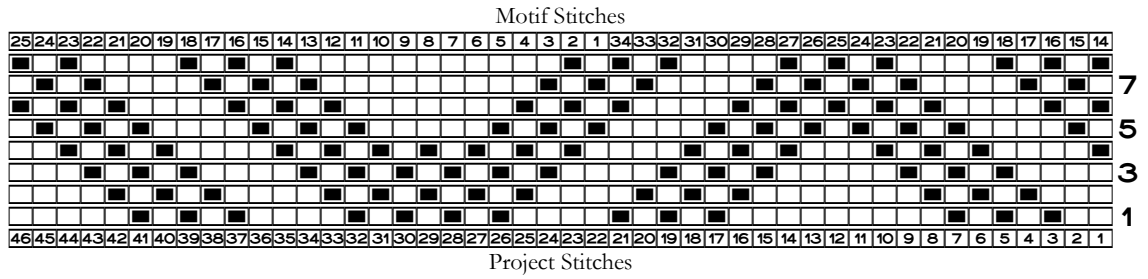
What we need to do now is fill the gap in the first twenty-one project stitches, using the proper stitches of the OXO motif.

Which motif stitch will precede motif stitch one on each project row? Stitch thirty-four, the last stitch of the motif chart. Let's refer to the motif's width in stitches as **m**.

Since the chart gap is twenty-one stitches wide, we need to figure out the **inclusive** number of motif stitches to fill in the beginning of the chart. "Inclusive number" means that we subtract from m the number of project stitches in the gap, then add one to the result. The first worked motif stitch, which we'll call **f**, that will be in project stitch one can be determined with

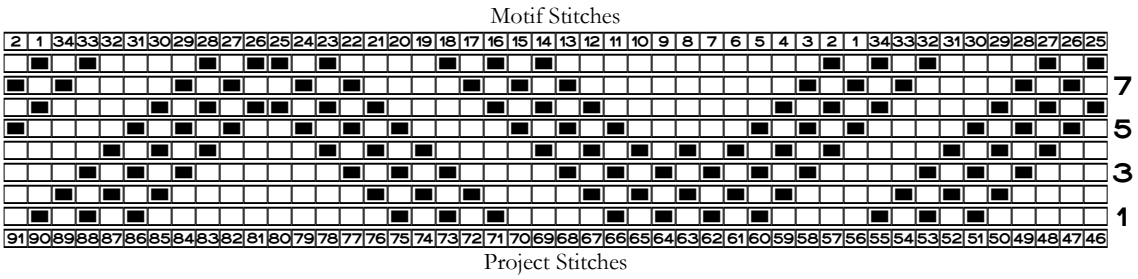
f = m – number of stitches needed + 1
f = 34 – 21 + 1
f = 14

So by that simple calculation, we fill the gap at the beginning of the project chart with motif stitches fourteen through thirty-four for the size small vest. Let's confirm our numbers by putting those twenty-one motif stitches in the blank spot of the chart.

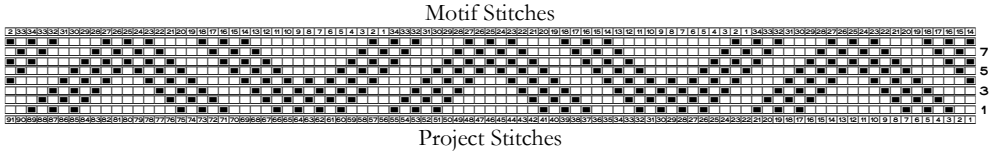


We would of course continue on with motif stitches twenty-six through thirty-four after

the dead-center project stitch, then start over again with motif stitch one. Here's the second half of the chart for the small size, starting with project stitch forty-six.



Let's look at the first eight rows for the size small. With really good light, I can just make out some of the boxed stitch numbers on paper, so if you're reading the electronic PDF, they will be legible if you zoom in. But even looking at the motifs on paper, we can see that the left and right edges are mirror-image.



Wouldn't it be a lot more convenient to figure out which stitch of the motif we need to start with without going to the trouble of making a chart as wide as our project, with all the attendant slicing and dicing of the motif stitches?

Why, yes, I believe it would!

Finding the First Worked Motif Stitch: The Easy Way

There's a very simple equation to figure out which motif stitch we need to start with in project stitch one. All we need are three numbers that we already know:[2]

- m: **m**otif width in stitches
- d: **d**ead-center project stitch
- p: **p**icked motif stitch that should fall at project stitch d

We know m immediately, and it's a snap to figure out d. Stitch p, of course, we get to choose at our pleasure, as either stitch twenty-five for the X or stitch eight for the O.

[2] I picked some odd names because I wanted to avoid reusing any of the stitch-count letters from appendix 528.

The Super-Simple Equation

Using the three numbers above, we determine **f**, the **f**irst worked motif stitch, as

$$f = m - d + p + 1$$

We'll use this equation to figure out the first worked motif stitch for all six sizes of the vest from chapter 410. Here are the **w**idths in stitches, which we'll call **w**, of the vest front/back in each size.

	Small	Medium	Large	XL	XXL	XXXL
Front/Back Stitches w	91	101	111	121	131	141

We have picked stitch twenty-five of the motif to be in the exact center of our front/back, so that takes care of p. The motif width in stitches means that m is thirty-four.

We determine d by finding the dead-center stitch of the front/back in each size. Since we have an odd number of stitches, one way to determine d is by adding one to the total number of stitches, then dividing by two. Here are the values of d.

	Small	Medium	Large	XL	XXL	XXXL
Front/Back Stitches w	91	101	111	121	131	141
Dead-Center Stitch d	46	51	56	61	66	71

Now we're ready to just plug in the numbers to find the first worked motif stitch for each size.

Size Small

Since d is forty-six for this first size, our equation becomes

$$f = m - d + p + 1$$
$$f = 34 - 46 + 25 + 1$$
$$f = 14$$

We will start each public-side row with stitch fourteen of the motif. Yay! That matches the answer we got doing it the hard way.

Size Medium

d is fifty-one, so we have the equation

$$f = m - d + p + 1$$

f = 34 – 51 + 25 + 1
f = 9

Each public-side row will start with stitch nine of the motif.

Size Large

For the large, d is fifty-six, which gives us

f = m – d + p + 1
f = 34 – 56 + 25 + 1
f = 4

We start with stitch four as the first motif stitch we work on the public side.

Size XL

For the extra-large, d is sixty-one, which gives us

f = m – d + p + 1
f = 34 – 61 + 25 + 1
f = –1

Uh, OK. Negative one? How do we start at stitch "negative one"?

If f winds up as a negative number, we add the motif's width, m, to f, so our new f becomes

f = –1 + m
f = –1 + 34
f = 33

Our first worked motif stitch on the XL's public-side rows will be motif stitch thirty-three.

Size XXL

For the extra-extra-large, d is sixty-six, which gives us

f = m – d + p + 1
f = 34 – 66 + 25 + 1
f = –6

We add m to f when f winds up negative, so

f = –6 + m

f = –6 + 34
f = 28

For the XXL, we start the public-side rows with stitch twenty-eight of the motif.

Size XXXL

For the XXXL, d is seventy-one, which gives us

f = m – d + p + 1
f = 34 – 71 + 25 + 1
f = –11

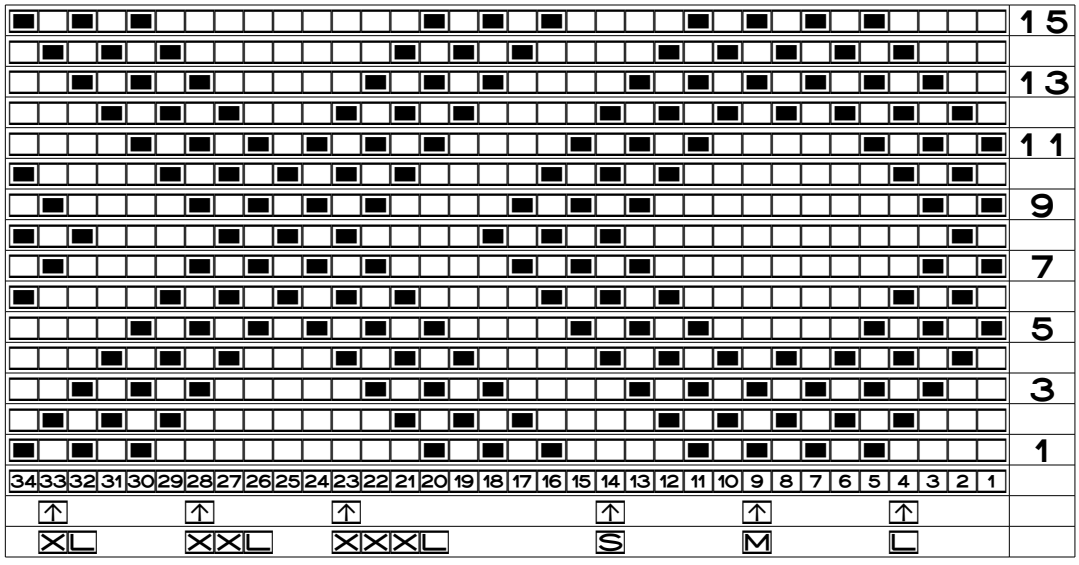
Since we once again determined a negative number for f, we add the width of the motif, m, to f.

f = –11 + m
f = –11 + 34
f = 23

For the biggest size, we start the chart at motif stitch twenty-three.

First Worked Motif Stitches Shown in the Chart

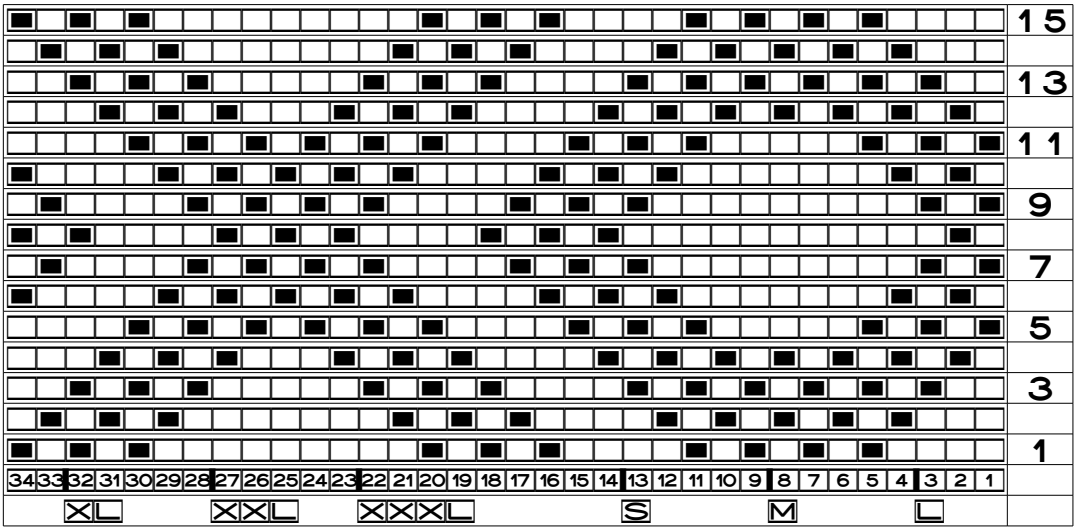
Now that we know the first worked motif stitches for each size, we can modify the OXO motif chart to show those points.



Below the boxed stitch numbers, the arrows point to the motif stitch we need to start with so that we get the center of the X in the center of each size of the vest.

If we were making a sweater, we would have to do all the same calculations using for d the maximum number of stitches in each size's sleeve (usually at the upper arm before the armhole shaping starts). Then we'd have similar markings showing the first worked motif stitch for each size's sleeve as well.

Some charts may put a heavy line to the right of each size's first worked stitch.



What About the Small Peerie Motif?

In this project, we could do the exact same thing with the peerie pattern, but many knitters wouldn't bother to do so because it's quite narrow, just four stitches wide, in relation to the very wide OXO motif.

Since we're designing our own motifs, we can center the peerie in the exact same way if we so choose.

Ending Motif Stitches

Can we determine ahead of time the ending motif stitch so that we can check our accuracy when we get to the end of the public-side project row? You bet.[3] That's the good news. The bad news is…we have to do some fourth-grade arithmetic as the first step.

[3] And of course the first worked and ending motif stitches on public-side rows are the ending and first worked motif stitches on private-side rows.

The Mod Squad

Long, long ago in a schoolroom far, far away, we learned to do long division. On paper. Without a calculator. Remember that? Instead of a long string of digits after the decimal point like we get with a calculator, on paper we got a *remainder*. The remainder was the part left over after we divided one number into another.

For example, if we do

$$5 \div 2$$

on a calculator, we get 2.5. But what if we give the answer from fourth-grade arithmetic? We would say five divided by two is two with a remainder of one.

$$\begin{array}{r} 2\text{ R }1 \\ 2\overline{)\,5} \\ -\,4 \\ \hline 1 \end{array}$$

If we do

$$91 \div 34$$

on a calculator, the calculator would say 2.676470588235. If we work on paper like in fourth grade, we have

$$\begin{array}{r} 2\text{ R }23 \\ 34\overline{)\,91} \\ -\,68 \\ \hline 23 \end{array}$$

so the remainder is twenty-three.

To find the ending motif stitch, we need the remainders. You geeks out there realize that we're doing *modulo arithmetic*, but the geeks didn't need me to remind them of that, did they? For the non-geeks, we're going to refer to keeping the remainder after doing division as taking the *mod* of the first number with respect to the second number.

So our examples would be written as

$$5 \bmod 2 = 1$$

and

$$91 \bmod 34 = 23$$

Finding Remainders with a Calculator

For non-trivial cases like the second one, we can actually use a regular calculator to find remainders. After we do the initial division, we subtract the whole number from the answer, then multiply the decimal part by the same number we divided with originally. So for

91 mod 34

when we get 2.676470588235, we subtract two (the whole-number part to the left of the decimal point), then we multiply what's left, the 0.676470588235, by the number we divided with initially, which was thirty-four. The calculator then shows us a nice, clean

23

which is the remainder we get with fourth-grade long division on paper.

One Special Case

What would happen if the first number was **smaller** than the second number? Suppose we wanted to find

21 mod 34

What would the answer be? If the first number is smaller than the second, then the remainder, and therefore the mod, is actually just the first number.

Why? Suppose we did this division on a calculator. The answer would be 0.6176470588. What is the whole number, the part to the left of the decimal point? Zero, since thirty-four can't go into twenty-one even once. When we multiply 0.6176470588 by the number we divided with initially, thirty-four, we get back twenty-one.

So when the first number is smaller than the second number, the mod is simply the first number.

How Is This Relevant?

Enough with the blast from the past, with some horrible descent into the kind of math only nerds dream about. But really, the mod function is key to finding ahead of time the ending stitch of our motif when we've worked all the way across our project on public-side rows.

The simple (well, aside from the mod thing) equation for the ending stitch is

$$e = (w \bmod m) + f - 1$$

Breathe! One more deep breath, please.

The **e**nding motif stitch **e** is the last stitch of the motif that we'll work on public-side rows (and the one we start with on private-side rows). And we already know the three other numbers:

- w: **w**idth of the project in stitches
- m: **m**otif width in stitches
- f: **f**irst worked stitch of the motif, which we just figured out

Let's determine the last OXO motif stitch we'll work at the end of the public-side rows in all six sizes of our V-neck vest.

Time to Calculate

Let's create a table that shows the width in stitches for the front/back in each size and add to it our just-calculated first worked motif stitch, f.

	Small	Medium	Large	XL	XXL	XXXL
Front/Back Stitches w	91	101	111	121	131	141
First Worked Motif Stitch f	14	9	4	33	28	23

Did you notice in the equation that we don't need to know which stitch is the center stitch of our project? Instead, we need to know how long the entire row is, which is the front/back stitches w.

For all sizes, m is thirty-four as before. But w and f will be specific to each size.

Size Small

The size small has ninety-one chest stitches, and we first work OXO stitch fourteen. That means our ending stitch is

$$e = (w \bmod m) + f - 1$$
$$e = (91 \bmod 34) + 14 - 1$$

Since 91 mod 34 is 23, that means that

$$e = 23 + 14 - 1$$
$$e = 36$$

Whoa! How can we end with motif stitch thirty-six when the motif is only thirty-four stitches wide? Clearly, we can't, so we do a fiddle similar to the one we did in some cases when we were finding the first worked motif stitch, but this time we **subtract** the width of the motif instead of adding it.

e = 36 – m
e = 36 – 34
e = 2

When we work public-side rows of the size small vest on ninety-one stitches starting with motif stitch fourteen, we will finish those rows with motif stitch two. (If we flip back to the full chart we so painfully made by hand the hard way, we'll see there that we did indeed end with motif stitch two.)

On private-side rows, we'll first work motif stitch two and end with stitch fourteen.

Size Medium

Each row is a hundred and one stitches long, and the first worked motif stitch was nine. We'll end with motif stitch

e = (w mod m) + f – 1
e = (101 mod 34) + 9 – 1
e = 33 + 9 – 1
e = 41

Since e is greater than m, we subtract m from e:

e = 41 – m
e = 41 – 34
e = 7

We'll end each public-side row with motif stitch seven for the medium.

Size Large

Starting with motif stitch four, when we work across the hundred and eleven stitches of public-side rows, we'll end with motif stitch

e = (w mod m) + f – 1
e = (111 mod 34) + 4 – 1
e = 9 + 4 – 1
e = 12

Size XL

The extra-large is a hundred and twenty-one stitches wide, and we first work motif stitch thirty-three. Our ending motif stitch will be

e = (w mod m) + f – 1

e = (121 mod 34) + 33 – 1
e = 19 + 33 – 1
e = 51

Since e is greater than m, we subtract m from e:

e = 51 – m
e = 51 – 34
e = 17

Size XXL

The 2XL first works motif stitch twenty-eight, and the hundred and thirty-first stitch will be

e = (w mod m) + f – 1
e = (131 mod 34) + 28 – 1
e = 29 + 28 – 1
e = 56

Subtracting the width of the motif, our ending motif stitch is

e = 56 – m
e = 56 – 34
e = 22

Size XXXL

The 3XL is a hundred and forty-one stitches wide, and we first work motif stitch twenty-three. We'll end with motif stitch

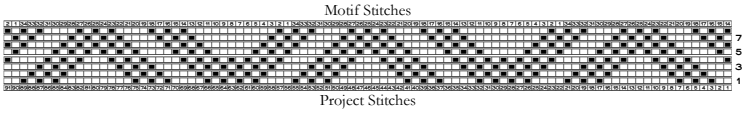
e = (w mod m) + f – 1
e = (141 mod 34) + 23 – 1
e = 5 + 23 – 1
e = 27

The As-Worked Charts

Just so we can double-check our equations and the answers we got from them, let's construct charts showing the first eight rows of each size. The font is quite small to make the XXXL chart fit on the page and to show all six sizes proportionately to one another.

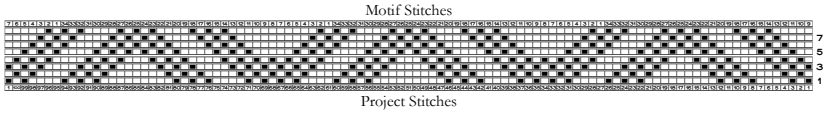
Size Small

The small starts with motif stitch fourteen and ends with stitch two.



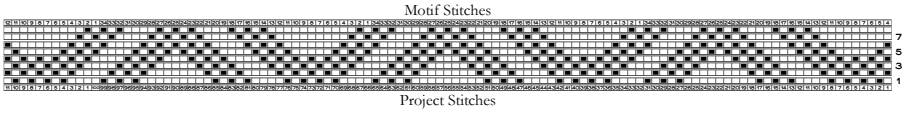
Size Medium

The medium starts with motif stitch nine and runs through stitch seven.



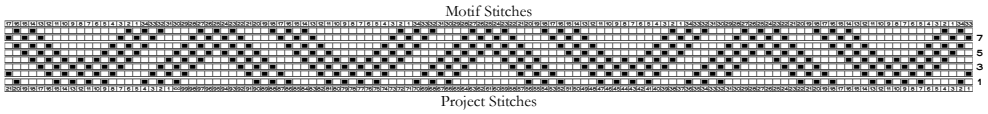
Size Large

The large starts with motif stitch four and ends with stitch twelve.



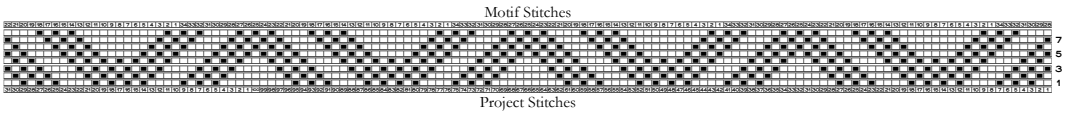
Size XL

The XL runs from motif stitch thirty-three to stitch seventeen.



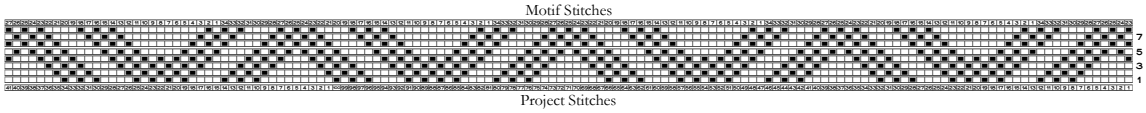
Size XXL

The XXL starts with motif stitch twenty-eight and goes through stitch twenty-two.



Size XXXL

The XXXL starts with motif stitch twenty-three and ends with stitch twenty-seven.

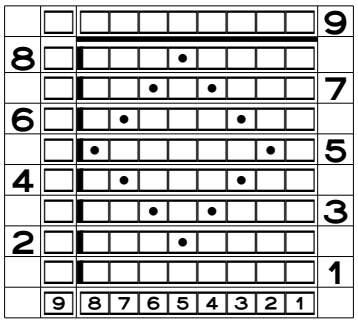


Even though the font is quite small, some of the boxed numbers are just barely legible on paper, enough of them that we can see that each chart begins and ends where we calculated it would. In the electronic PDF, we can zoom in to see the boxed stitch numbers, but even on paper, we can see that in each size, the left and right edges are all mirror-image.

If f = 0

Depending on the number of stitches in our project and the width of our motif, we might come upon a situation where the numbers work out to give us a first worked motif stitch of zero.

As I was initially writing this chapter, I decided to test the equation by finding the first worked motif stitch for the size small vest using the small purl-diamond motif from chapter 210. Here's that chart again:



For the size small, we still have d, the dead-center project stitch, as forty-six. Let's make the center of the diamond fall at the center of the vest, which means p is five. m is the width of the pattern repeat, which is eight.[4] Our equation for f is therefore

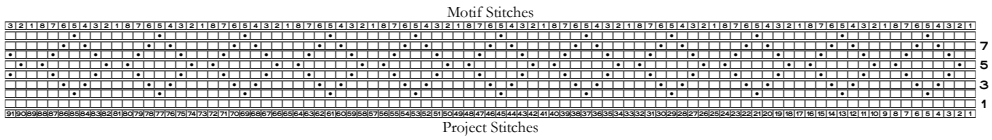
$$f = m - d + p + 1$$
$$f = 8 - 46 + 5 + 1$$
$$f = -32$$

Since this motif is so narrow, we have to keep adding m repeatedly until f is no longer negative. After adding m four times, we wind up with

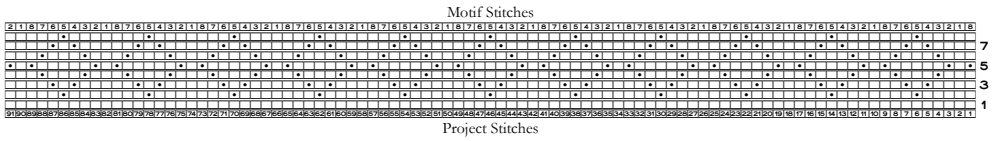
$$f = 0$$

[4] Yes, we are completely ignoring the plus stitch at this point.

Off the top of my head, I guessed that that result meant we could start anywhere in the motif and still get a symmetrical result. So I put motif stitch one in project stitch one in a chart to see if that was true.



Clearly, my assumption was quite wrong. However, it's pretty obvious from the chart that all we have to do is slide the motifs to the left by just one stitch.



Only after working through the numbers repeat by repeat from the middle of the vest back to its first stitch did I realize my error: **f must be between one and m**. Well, duh! Our motif chart is m stitches wide and starts at…stitch one. If our equation gives us an f of zero, isn't that essentially the same as the stitch **before** motif stitch one? As we work our motif across the width of the project, what motif stitch do we work before we work stitch one? The last stitch of the repeat, of course.

That's why we can say that if our equation gives

$$f = 0$$

then in reality

$$f = m$$

And based on the chart above, we can see that that's exactly what we need to do.

While We're at It…

Let's look at the rest of the vest sizes using the purl-diamond motif. We can calculate the first worked and ending motif stitches quickly with our equations, and we'll even chart them all to make sure the motifs do wind up symmetrical.

The first worked motif stitch is determined by

$$f = m - d + p + 1$$

where m is the number of stitches in the motif (ignoring any plus stitches), d is the dead-center stitch of the project, and p is the picked motif stitch we want to be in the center of the project.

The motif stitch we end with is

$$e = (w \bmod m) + f - 1$$

where w is the width of the project in stitches, m is the motif's width in stitches, and f is the first worked motif stitch we just determined.

For the purl diamond, m is eight, and we've picked p to be stitch five, which is where the top and bottom points of the diamond are. d and w both vary with the vest size.

Size Small

d is forty-six, so the first worked motif stitch is

$$f = m - d + p + 1$$
$$f = 8 - 46 + 5 + 1$$
$$f = -32$$

We have to add eight to that number repeatedly until f is zero or more. Since adding eight four times will give a value of zero, we know that

$$f = m$$
$$f = 8$$

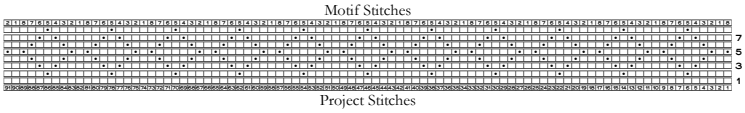
For the ending stitch, w is ninety-one, so

$$e = (w \bmod m) + f - 1$$
$$e = (91 \bmod 8) + 8 - 1$$
$$e = 3 + 8 - 1$$
$$e = 10$$

Since e is larger than m, we subtract the motif width m from e until e is less than m.

$$e = 10 - m$$
$$e = 10 - 8$$
$$e = 2$$

So for the size small, the first worked motif stitch is eight, and we end each public-side row with motif stitch two. If we make a chart for the size small, we see that the chart is symmetrical, which verifies the results from the equations.



Size Medium

d is fifty-one.

$$f = m - d + p + 1$$
$$f = 8 - 51 + 5 + 1$$
$$f = -37$$

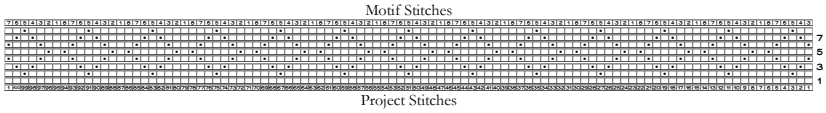
When we add eight as many times as needed to get at least to zero, we have

$$f = 3$$

For the ending stitch of the motif, w is a hundred and one.

$$e = (w \bmod m) + f - 1$$
$$e = (101 \bmod 8) + 3 - 1$$
$$e = 5 + 3 - 1$$
$$e = 7$$

A full chart will confirm these first worked and ending motif stitches give a symmetrical result.



Size Large

d is fifty-six.

$$f = m - d + p + 1$$
$$f = 8 - 56 + 5 + 1$$
$$f = -42$$

When we add the motif's width as many times as needed to get at least to zero, we have

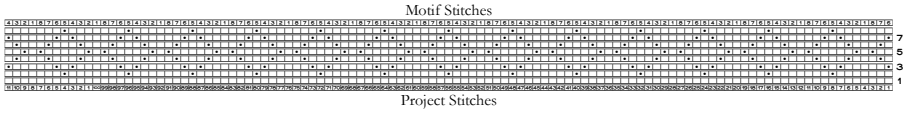
$$f = 6$$

For the ending stitch of the motif, w is a hundred and eleven.

e = (w mod m) + f – 1
e = (111 mod 8) + 6 – 1
e = 7 + 6 – 1
e = 12

Since e is bigger than m, we subtract m from e.

e = 12 – m
e = 12 – 8
e = 4



Size XL

d is sixty-one.

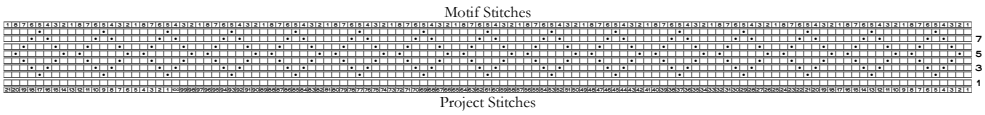
f = m – d + p + 1
f = 8 – 61 + 5 + 1
f = –47

When we add eight, the motif's width, as many times as needed to get at least zero, we have

f = 1

For the ending stitch of the motif, w is a hundred and twenty-one.

e = (w mod m) + f – 1
e = (121 mod 8) + 1 – 1
e = 1 + 1 – 1
e = 1



Size XXL

d is sixty-six.

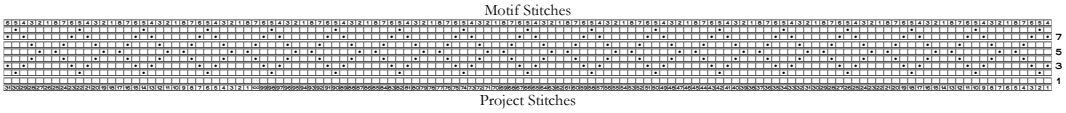
f = m – d + p + 1
f = 8 – 66 + 5 + 1
f = –52

When we add the motif width as many times as needed to get a number bigger than zero, we have

f = 4

For the ending stitch of the motif, w is a hundred and thirty-one.

e = (w mod m) + f – 1
e = (131 mod 8) + 4 – 1
e = 3 + 4 – 1
e = 6



Size XXXL

d is seventy-one.

f = m – d + p + 1
f = 8 – 71 + 5 + 1
f = –57

When we add m as many times as needed to get at least zero, we have

f = 7

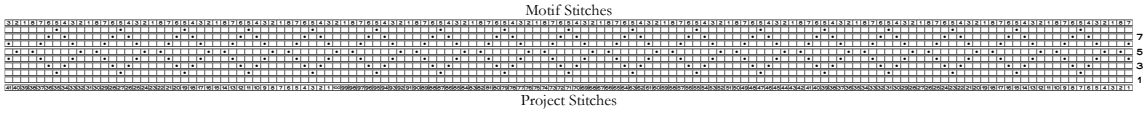
For the ending stitch of the motif, w is a hundred and forty-one.

e = (w mod m) + f – 1
e = (141 mod 8) + 7 – 1
e = 5 + 7 – 1
e = 11

Since e is bigger than m, we subtract m from e.

e = 11 – m

e = 11 – 8
e = 3



Adding and Subtracting the Motif Width m

Why do we sometimes have to add m to f or subtract m from e?

For the size XL OXO vest, the first worked motif stitch equation told us that f was –1. We therefore added m to get a "proper" f of thirty-three.

What the negative value is actually telling us is that we need to start counting **backward** from the **last** motif stitch, not forward from the first motif stitch. Since m is thirty-four, when we start at stitch thirty-four and count backwards one stitch, we wind up on motif stitch thirty-three, the exact same result as adding m to –1.

For the XXL OXO vest, f came out to be –6. Starting from motif stitch thirty-four, we count backwards, saying "–1" on stitch thirty-three, "–2" on stitch thirty-two, "–3" on stitch thirty-one, "–4" on stitch thirty, "–5" on stitch twenty-nine, and finishing with "–6" on stitch twenty-eight. If we add m to an f of –6, then f is…twenty-eight.

A similar thing happens when e is larger than m, as in the size small OXO vest. When we determined that e was thirty-six, we could think of a number larger than m as telling us to start counting over again at motif stitch one but saying "thirty-five" on stitch one and "thirty-six" on stitch two. When we subtracted m from an e of thirty-six, e was…two.

The size medium had an e of forty-one, so continuing from the size small's counting, we would say "thirty-seven" on stitch three, "thirty-eight" on stitch four, "thirty-nine" on stitch five, "forty" on stitch six, and "forty-one" on stitch seven. When we subtract m from an f of forty-one, we get…seven.

Wide Motifs in Narrow Projects

What if our project is narrower than our motif? Let's work through the numbers with the OXO motif and a narrow project, like a headband or a cell-phone pouch, that is twenty-one stitches wide. The dead-center stitch of the project, d, is therefore eleven. Since there's only one size for this project, let's see what happens when we pick p as both eight and twenty-five.

Centered on the X

With p as twenty-five, we find the first worked motif stitch with the same equation as before.

$$f = m - d + p + 1$$
$$f = 34 - 11 + 25 + 1$$
$$f = 15$$

The corresponding ending motif stitch will be

$$e = (w \bmod m) + f - 1$$
$$e = (21 \bmod 34) + 15 - 1$$
$$e = 21 + 15 - 1$$
$$e = 35$$

Remember that since m is larger than w, then w mod m is w itself, because thirty-four won't go into twenty-one even once. Since e is greater than m, we have to subtract m.

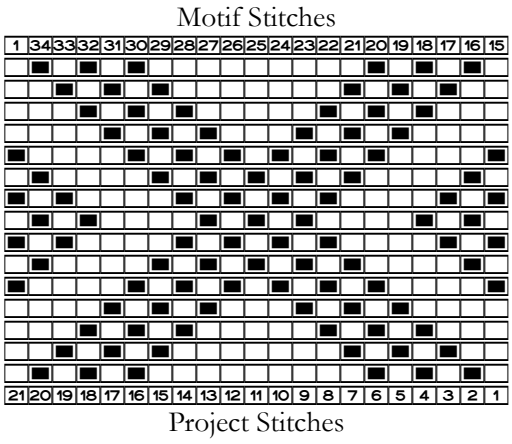
$$e = 35 - m$$
$$e = 35 - 34$$
$$e = 1$$

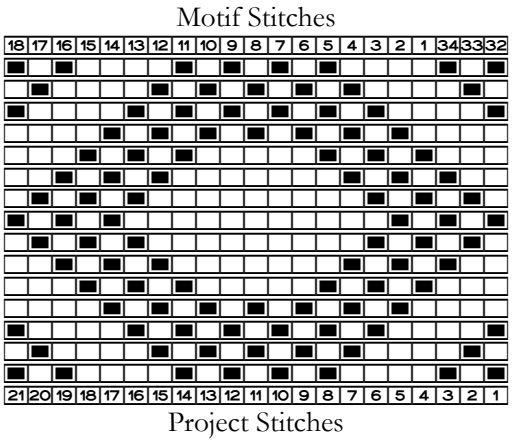
Centered on the O

If we use the center of the O, stitch eight, for p, we find that f is thirty-two and e is eighteen.

Double-Checking with a Chart

Are both versions symmetrical if we chart them?



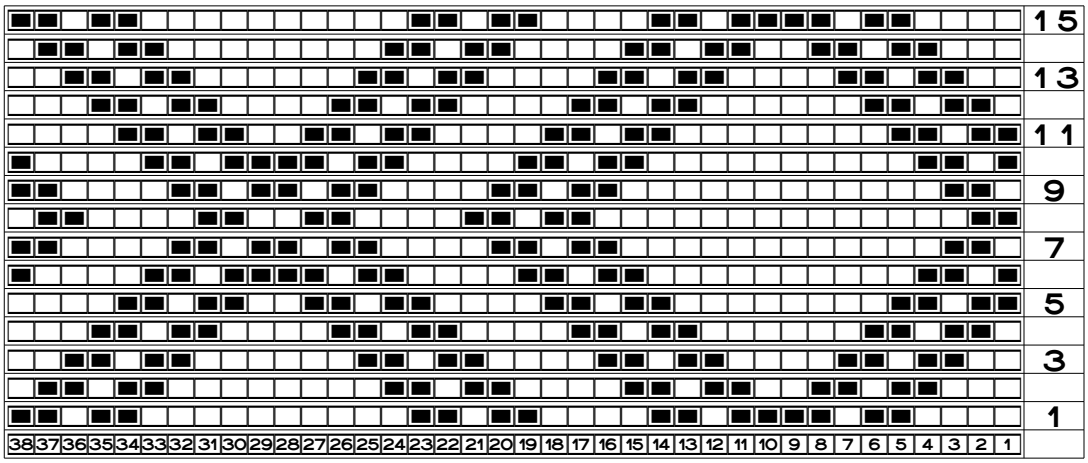


Once again, the motifs are centered, even when the project is narrower than the motif.

Symmetry Around a Pair of Stitches

If our motif has symmetry around a pair of stitches, then we'll want to match that pair of stitches to the center two stitches of our project.[5]

We like the OXO, so can we fiddle it a little bit to get two symmetry stitches in the middle of both the X and the O? That's a piece of cake with a chart.



So which stitches in this new motif can we use to get project symmetry? There are two such pairs, one pair in the X at stitches twenty-eight and twenty-nine, and the second pair in the O at stitches nine and ten.

Will the formulas we used for single-stitch symmetry work for two-stitch symmetry?

A Slightly Different Vest

Let's just pick out of thin air the number of front/back stitches in six sizes of a different vest for this new OXO motif with two stitches of symmetry. Instead of having the total stitches increase at smooth and regular steps from one size to the next, the width of each size jumps by some random number of stitches, just to push the equations and the method to the limit. After all, since the chapter 410 vest increased from size to size by ten stitches each time, maybe there was some peculiarity or coincidence that allowed the equations to work right only because of those equal intervals.

The following table increases the front/back widths by a unique number of stitches from one size to the next. Note also that we have an even number of stitches in each size so we have two stitches in the exact center of the front/back.

[5] See issue one in appendix 528 for a complete discussion of one- and two-stitch symmetry.

	Small	Medium	Large	XL	XXL	XXXL
Front/Back Stitches w	50	64	74	96	104	120

Let's just dive right in with our single-stitch-symmetry equations to see if they'll work when we have two-stitch symmetry. Our first worked motif stitch, f, is found with

$$f = m - d + p + 1$$

and the ending motif stitch, e, is found with

$$e = (w \bmod m) + f - 1$$

m is the width of the motif, so for our two-stitch-symmetry version, m is thirty-eight. d and p were the project dead-center stitch and the picked motif stitch to be in the project dead-center stitch when we had single-stitch symmetry in both our project and our motif. What do we do now that we have **two** center stitches in both the project and the motif?

Be Consistent in Picking Right or Left

Since we have two symmetry stitches in both the motif and the project, we need to be consistent in picking either the left-hand or right-hand stitch of both pairs to use in our equations.

Let's make a command decision to use the right-hand stitch of the symmetry pair of stitches for both our project and our motif.

Since the X is symmetrical at stitches twenty-eight and twenty-nine, that means p, the picked motif stitch that goes in the right-hand symmetry stitch of the project, will be motif stitch twenty-eight.

The total number of stitches across the project is still w. Since there are an even number of front/back stitches in each size, we have to redefine d from being the single dead-center stitch needed for one-stitch symmetry to being the right-hand stitch of the central pair of front/back stitches. We simply divide w by two to get the number of the project's right-hand symmetry stitch.

Let's add the values of d to our funkified vest's table, then figure out the first worked and ending motif stitches in each size.

	Small	Medium	Large	XL	XXL	XXXL
Front/Back Stitches w	50	64	74	96	104	120
Right Stitch of Symmetry d	25	32	37	48	52	60

Size Small

To find f, we have

$$f = m - d + p + 1$$
$$f = 38 - 25 + 28 + 1$$
$$f = 42$$

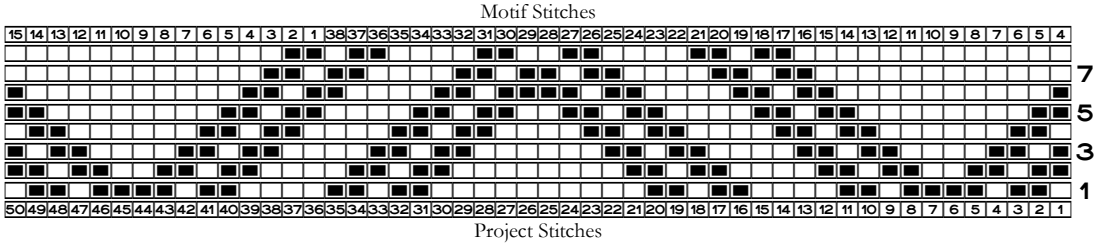
Since f is greater than m,

$$f = 42 - m$$
$$f = 42 - 38$$
$$f = 4$$

Then e is found with

$$e = (w \bmod m) + f - 1$$
$$e = (50 \bmod 38) + 4 - 1$$
$$e = 12 + 4 - 1$$
$$e = 15$$

Let's chart the two-stitch-symmetry OXO for the funkified size small vest where the first worked motif stitch is stitch four. Will we end the public-side rows with motif stitch fifteen?



Using the Left-Hand Stitch of Both Pairs

What happens if we select the left-hand symmetry stitch in both the motif and the project? That means that we would add one to both d and p. For the size small vest, we have

$$f = m - d + p + 1$$
$$f = 38 - 26 + 29 + 1$$
$$f = 42$$

We again subtract the two-stitch-symmetry m of thirty-eight from f, so f is still four, as we found when we used the right-hand stitch of each pair.

Why can we use either the left- or right-hand stitch of each pair? In the middle of the equation for f, we see that part of what we wind up doing is subtracting d from p. When p was twenty-eight and d was twenty-five, p minus d was three. If both d and p go up by one, making them twenty-nine and twenty-six, then when we subtract, we still get the same result of three.

This result shows us why we can't mix one right-hand symmetry stitch with one left-hand symmetry stitch. Only one of d and p would go up by one if we aren't consistent, so when we subtract, we won't get the same result as we do when both d and p go up by one.

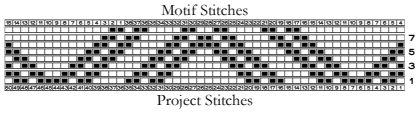
The Rest of the Vest Sizes

Instead of showing all the calculations step by step, here's a table showing the first worked and ending motif stitches for all six sizes of the funkified two-stitch symmetry vests and the corresponding two-stitch-symmetry OXO motif.

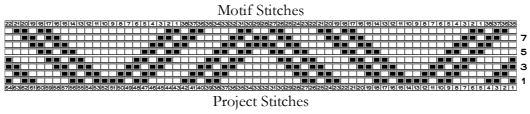
	Small	Medium	Large	XL	XXL	XXXL
Front/Back Stitches w	50	64	74	96	104	120
First Worked Motif Stitch f	4	35	30	19	15	7
Ending Motif Stitch e	15	22	27	38	4	12

Here are charts for all six sizes to check the results.

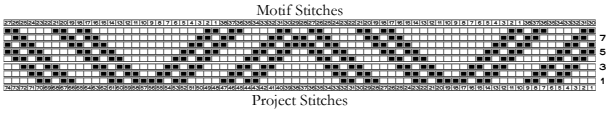
Size Small



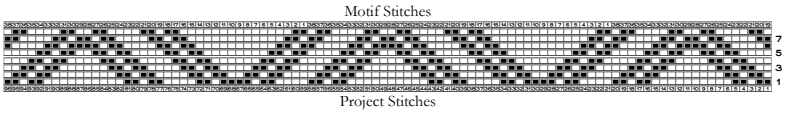
Size Medium



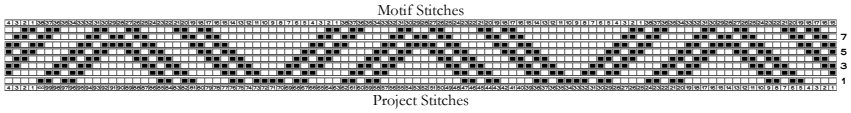
Size Large



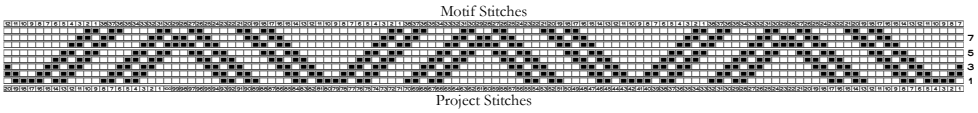
Size XL



Size XXL



Size XXXL



Handling Plus Stitches in a Pattern Chart

Neither OXO chart given in this chapter had plus stitches. Ordinarily, we would expect an asymmetrical motif to have plus stitches so that we can make the left and right edges of a project be mirror-image.

But since we figured out where we wanted to position the motif's symmetry stitch on our vest (in six sizes, thank you very much!), then we automagically started and ended the motif in such a way that we got symmetry.

The purl diamond came out symmetrical too, even though we completely ignored that chart's plus stitch. We can ignore plus stitches because we're no longer relying on the motif **itself** to tell us how to mirror-image the right and left edges. Instead, we're calculating the first worked and ending motif stitches based on where we want the motif placed on our project.

Whether a motif has plus stitches or not, and whether it has one or two stitches of symmetry, the simple equations shown in this chapter allow us to position any motif symmetrically on projects of any size.[6]

[6] Should I use some weasel words here to allow for the possibility that these equations won't work for a particular project using a particular motif?

Working Motifs in the Round

What if we want to make our vest in the round instead of in two flat pieces that we sew together?

We can certainly do so. We simply mentally split our in-the-round project into front and back halves, then proceed as described.

If we're working sleeves in the round, then we have to remember a sleeve is only a single piece even though we wind up seaming it. So for sleeves, whether worked flat or in the round, we always use for w the number of stitches at the widest part of the sleeve (usually at the upper arm just before the underarm shaping starts).

Increasing After Ribbing

We often work a garment's bottom-edge ribbing on fewer stitches, then increase after the ribbing to bring the stitch count up to the number of stitches needed for the full width of the chest.

We likewise often do the same thing for sleeves, working the ribbing on fewer stitches, then increasing gradually up the length of the sleeve until we get to the full width needed for the upper arm.

We have two options if we start with fewer stitches than we'll have at the piece's full width.

- We determine the symmetry stitch(es) after we complete all the increases.
- We determine the symmetry stitch(es) at the cast-on, then plan the exact placement of the increases so that while we work them, we don't accidentally move the symmetry stitch(es) from the piece's center.

