

Chapter 23

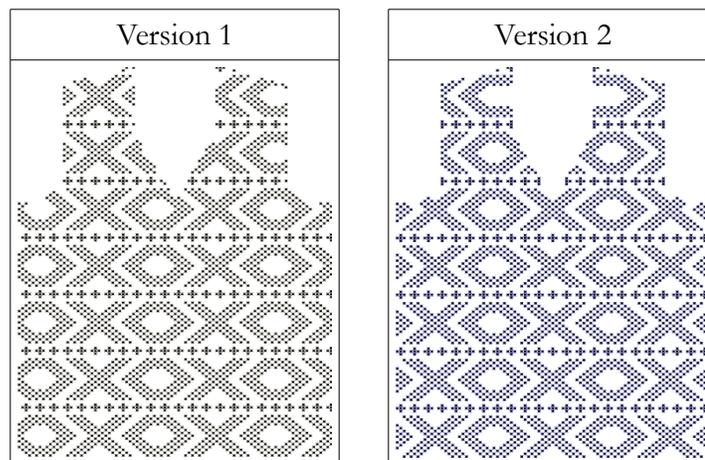
MOTIF STARTING POINTS

Throughout this chapter, I'll use terms that make it sound like the concepts and techniques apply only to garments and their several pieces. But if we want to properly position a stitch pattern on a blanket, place mat, hot pad, or any other non-garment project, we still use all the information here.

If you prefer to chart on paper, you'll get some practice reading computer charts. The charts are so large and numerous that it would have been too time-consuming for me to include equivalent charts on grid paper.



Let's compare two vests made with a very common stitch pattern, the OXO, whose tall bands are separated by short peerie bands with a small cross. They look very similar.



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 stitch pattern.

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.

A Very Asymmetrical Chart

We learned to chart a garment designed with “Bottom-Up Shaping,” and we saw how to work multi-size garments that have “One Chart, Six Sizes.” In both of those chapters, we learned the techniques for a garment in plain old one-color stockinette. Now let’s turn our attention to a garment with a stitch pattern. We’ll add the traditional motif shown in the example vests to “The Basic Vest” in all six sizes.

The Chart

The OXO chart is thirty-four stitches wide and fifteen rows tall. We can interpret the design in at least two ways.

34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1				
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- ☉ Each No Stitch symbol could represent a public-side purl, since we know from part one’s purl diamond project that diagonal lines of purls stand out very nicely against a background of stockinette.¹ The design effectively has a lot of seed stitch, and we might not get the same stitch gauge in seed stitch as we do in stockinette, so for a real project, we might want to swatch to double-check our gauge in pattern.
- ☉ Each No Stitch symbol could indicate a foreground color knit against the background color’s stockinette.² We would probably want to swatch to see if we get the same gauge in stranded colorwork as we do in single-color knitting.

¹ If we prefer purl symbols, we can change all of them simultaneously with Find and Replace, as explained in part four’s “More Charting Tips.”

² If we want to change the No Stitch symbols’ color, we can change all of them simultaneously as shown in “More Charting Tips.”

For simplicity, we'll assume we do get the vest's design gauge of five stitches per inch, which allows us to keep using the same stitch counts.

The Issue

We saw in the two versions of the vest how we can position the motifs so that the overall effect is symmetrical or asymmetrical. The motif chart is asymmetrical, and there are no plus stitches to make the left and right edges match. That means the motif's designer—*cough*—is assuming that we'll be figuring out for ourselves the correct starting point based on the number of stitches across the width of our project.

So what do you think the chances are that all six sizes of the vest made with this very wide motif can all start with motif stitch one in project stitch one and have even one size wind up with the OXO in perfect mirror-image?

Exactly. Slim to none.

Labeling the Stitches

Before we go any further, let's make sure we've labeled the stitches correctly.

- ☉ All knitters, both traditional and mirror-image, must have the stitch labels for both the project and the motif running in the same direction. We can't have one set running right to the left and the other running left to right.
- ☉ All knitters, both traditional and mirror-image, must number the project stitches consecutively, with stitch one at one edge and going to the highest-numbered stitch at the other edge, instead of starting with stitch one in the center and increasing toward both the left and right edges as we saw in "One Chart, Six Sizes."

We've already seen the motif chart runs its stitch labels from right to left, starting with stitch one. That means all the project charts will have to run their stitch labels from right to left as well. We'll see both of these conditions in all the traditional knitter charts.

Lesson Learned

When we label stitches in both the garment and motif charts, they must both start with stitch one at one edge and increase all the way to the highest stitch number at the other edge. Traditional knitters need stitch one at the right edge of both charts, and mirror-image knitters need stitch one at the left edge of both charts.

Since the knitting font has boxed numbers only up to one hundred, then we must realize that the second boxed “thirty-one” in a project chart is actually stitch number a hundred and thirty-one. Always use the true stitch number.

Lesson Learned

We use the true stitch number, not merely the number in the boxed stitch label, when there are more than a hundred project (or motif) stitches.

For Mirror-Image Knitters

MIKs use the techniques in this chapter exactly as described after reversing the direction that **both** sets of stitch labels run. The specific stitch numbers used in the various steps will be different, but the motif positions in the final MIK charts will be identical to those in the traditional knitter charts we’ll see in this chapter.

Finding the First Worked Motif Stitch: The Hard Way

The way to get multiple sizes from a single motif chart and always have project 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 vest’s 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 project symmetry (see issue one in the appendix “Garment Design Details”). 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 total stitches.

All six sizes of “The Basic Vest” have an odd number of chest stitches to allow for the single project symmetry stitch.

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

For the Size Small

Since the size small has ninety-one stitches on the front/back, we need to figure out the stitch number of the dead-center stitch. We have to—brace yourself—do some simple arithmetic (calculators are optional) to figure out how many stitches are on either side of the central stitch.

$$\begin{aligned} \text{some number} + 1 + \text{some number} &= 91 \\ \text{some number} + \text{some number} &= 90 \\ \text{some number} &= 45 \end{aligned}$$

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

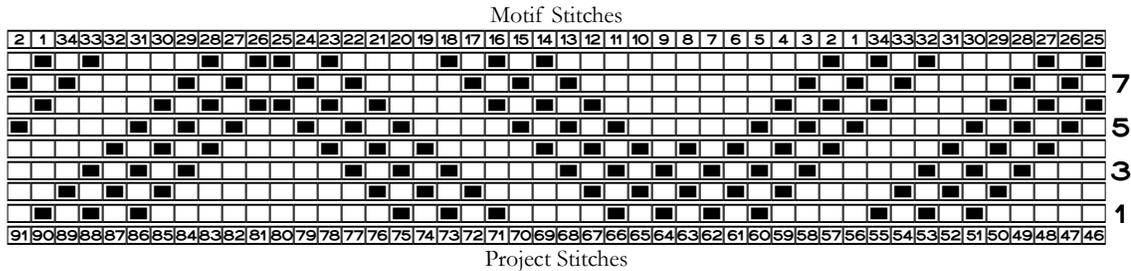
We need the dead-center stitch number for the other five sizes also, but we’ll use an easier method a little later.

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, we’re pretty sure that motif stitch twenty-five, the center of the X, won’t be in the dead-center stitch of any size of the vest.

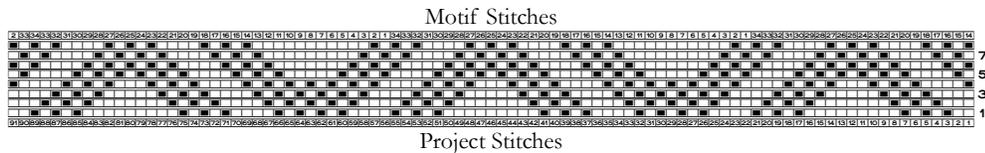
Our solution, therefore, is to first place motif stitch twenty-five in the dead-center stitch of the vest, then work from there backwards to the beginning of the row. We’ll use—what else?—a chart to figure out the answer.

This partial chart shows the project stitch labels across the bottom and the motif stitch labels across 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.



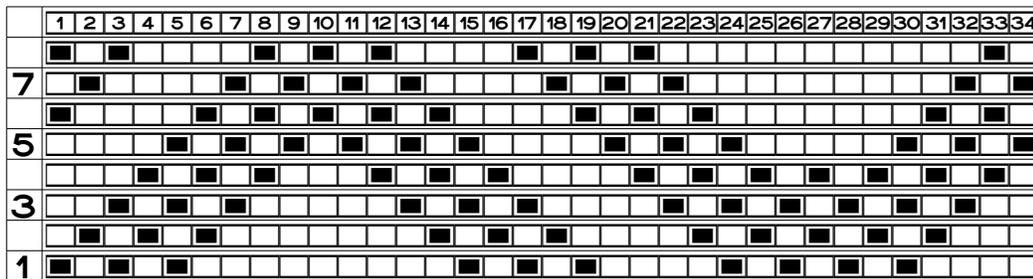
So we added one full repeat of the motif, then we needed just two more stitches to complete the size small chart.

Let's look at the full width of the first eight rows for the size small. With really good light, I can just make out some of the boxed stitch labels on paper, and if you're reading the electronic PDF, they'll be legible if you zoom in a bit. But just looking at the motif stitches, we can see that the both halves of the chart and especially the left and right edges are mirror-image.



For Mirror-Image Knitters

Let's work through the same steps for MIKs. The motif chart's stitch labels run left to right, and we'll show just the first eight rows to save space.



We want the center of the X in the center of the size small vest, so that means we put motif stitch ten in project stitch forty-six. As with the motif chart, the project's stitches are labeled from left to right.

For All of Us

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

Why, yes, I believe it would!

Finding the First Worked Motif Stitch: The Easy Way

We use 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:³

☉ m: motif width in stitches

☉ d: dead-center project stitch

☉ p: picked motif stitch that should be in project stitch d

We know m immediately, and we can figure out d from the full number of chest stitches. 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.

The Super-Simple Equation

Using the three numbers above, we determine **f**, the first 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 Basic Vest."

We've 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. These two numbers will stay the same for all six sizes of the vest.

Now we need to figure out d, using the width of the vest front/back. Here again are those widths in stitches (stitch count w in the appendix "Garment Design Details") for each size from "The Basic Vest."

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

³ I picked slightly odd names because I wanted to avoid reusing any of the stitch count letters from the "Garment Design Details" appendix.

Since all six are an odd number of stitches, the easiest way to determine d is by adding one, then dividing by two.

	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

Note that if the stitch count includes selvedge stitches, we must subtract them before we determine d . We must find d based solely on the stitches that will be worked in the stitch pattern.

Lesson Learned

Before we use the equation for the first worked motif stitch, we must subtract the total number of selvedge stitches from the stitch count.

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

$$\begin{aligned} f &= m - d + p + 1 \\ f &= 34 - 46 + 25 + 1 \\ f &= 14 \end{aligned}$$

We'll start each public-side row with stitch fourteen of the motif. Yay! That matches the answer we got doing it the hard way with a hand-constructed chart.

Size Medium

d is fifty-one, so we have the equation

$$\begin{aligned} f &= m - d + p + 1 \\ f &= 34 - 51 + 25 + 1 \\ f &= 9 \end{aligned}$$

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

Size Large

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

$$\begin{aligned} f &= m - d + p + 1 \\ f &= 34 - 56 + 25 + 1 \\ f &= 4 \end{aligned}$$

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

$$\begin{aligned} f &= m - d + p + 1 \\ f &= 34 - 61 + 25 + 1 \\ f &= -1 \end{aligned}$$

Uh, OK. Negative one? How do we start with stitch “negative one”?

If f turns out to be less than zero, we add the motif width m to our initial value of f , so our new f becomes

$$\begin{aligned} f &= -1 + m \\ f &= -1 + 34 \\ f &= 33 \end{aligned}$$

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

Lesson Learned

If the number we get from the equation for the first worked motif stitch is less than zero, we add the motif’s width to it.

Size XXL

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

$$\begin{aligned} f &= m - d + p + 1 \\ f &= 34 - 66 + 25 + 1 \\ f &= -6 \end{aligned}$$

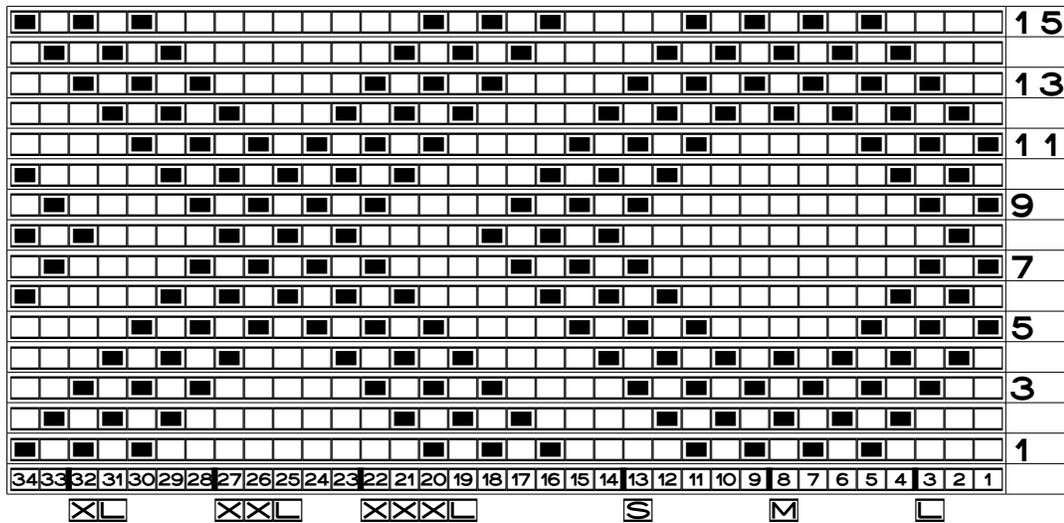
We add m to f when f winds up negative, so

Below the boxed stitch labels, 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 and wanted the OXO on the sleeves, we would have to do all the same calculations, except that d would be 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, perhaps along the top of the chart to minimize confusion.

Note that, just as we suspected, none of the sizes started with motif stitch one in project stitch one.

Some charts may put a thick 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 centering for the peerie pattern, but many knitters wouldn't bother to do so because it's quite narrow, just four stitches wide, compared to the very wide OXO motif.

Since we're designing our own project, 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.⁴ That's the good news. The bad news is...we have to do some fourth-grade arithmetic as the first step.

The Mod Squad

A long time 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.”

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

If we do

$$91 \div 34$$

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

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

so the remainder is twenty-three.

To find the ending motif stitch, we need these remainders. The geeks out there realize that we're doing modulo arithmetic. 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.

Our examples would be written as

⁴ 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.

$$5 \bmod 2 = 1$$

and

$$91 \bmod 34 = 23$$

Finding Remainders with a Calculator

For harder 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

$$91 \bmod 34$$

we divide ninety-one by thirty-four on a calculator and 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 were **smaller** than the second number? Suppose we wanted to find

$$21 \bmod 34$$

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. Subtracting the whole number, zero, doesn't change anything, so when we multiply 0.6176470588 by the number we divided with initially, thirty-four, we get back twenty-one.

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. The mod function, however, is key to finding **ahead of time** the motif stitch we'll end with 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 ending 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**: width of the project in stitches

☉ **m**: motif width in stitches

☉ **f**: first 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 add our just-calculated first worked motif stitches to the table with the stitch counts. (As with finding the first worked motif stitch, we can't include in the values of **w** any stitches that are used for selvages.)

	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

$$91 \bmod 34 = 23$$

that means that

$$\begin{aligned} e &= 23 + 14 - 1 \\ e &= 36 \end{aligned}$$

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.

$$\begin{aligned} e &= 36 - m \\ e &= 36 - 34 \\ e &= 2 \end{aligned}$$

When we work public-side rows of the size small vest on ninety-one stitches starting with OXO 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.

Lesson Learned

If the number we get from the equation for the ending motif stitch is larger than the motif's width, we subtract the motif's width from it.

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

$$\begin{aligned} e &= (w \bmod m) + f - 1 \\ e &= (101 \bmod 34) + 9 - 1 \\ e &= 33 + 9 - 1 \\ e &= 41 \end{aligned}$$

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

$$\begin{aligned} e &= 41 - m \\ e &= 41 - 34 \\ e &= 7 \end{aligned}$$

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

$$\begin{aligned} e &= (w \bmod m) + f - 1 \\ e &= (111 \bmod 34) + 4 - 1 \\ e &= 9 + 4 - 1 \\ e &= 12 \end{aligned}$$

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

$$\begin{aligned} e &= (w \bmod m) + f - 1 \\ e &= (121 \bmod 34) + 33 - 1 \\ e &= 19 + 33 - 1 \\ e &= 51 \end{aligned}$$

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

$$\begin{aligned} e &= 51 - m \\ e &= 51 - 34 \\ e &= 17 \end{aligned}$$

Size XXL

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

$$\begin{aligned} e &= (w \bmod m) + f - 1 \\ e &= (131 \bmod 34) + 28 - 1 \\ e &= 29 + 28 - 1 \\ e &= 56 \end{aligned}$$

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

$$e = (w \text{ mod } m) + f - 1$$

$$e = (141 \text{ mod } 34) + 23 - 1$$

$$e = 5 + 23 - 1$$

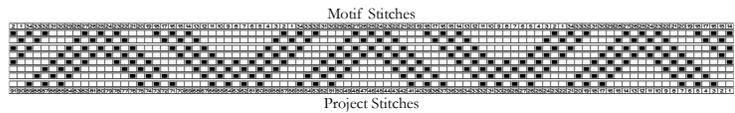
$$e = 27$$

The 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 show all six sizes proportionally.

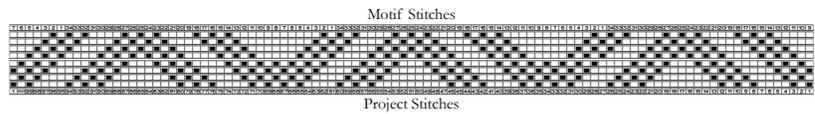
Size Small

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



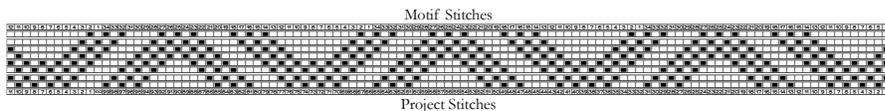
Size Medium

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.



To find the first worked motif stitch, MIKs still use the equation

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

The center of the X, since we're counting from the left, is in stitch ten instead of stitch twenty-five. MIKs still use thirty-four for m and forty-six for d .

$$\begin{aligned} f &= m - d + p + 1 \\ f &= 34 - 46 + 10 + 1 \\ f &= -1 \end{aligned}$$

Since the equation results in a negative number, we add m , the motif's width, to that initial value, so the final f is

$$\begin{aligned} f &= -1 + m \\ f &= -1 + 34 \\ f &= 33 \end{aligned}$$

For the ending motif stitch in the size small, MIKs still use the same equation as traditional knitters, plugging in thirty-three for the just-calculated f .

$$\begin{aligned} e &= (w \bmod m) + f - 1 \\ e &= (91 \bmod 34) + 33 - 1 \\ e &= 23 + 33 - 1 \\ e &= 55 \end{aligned}$$

Since the motif is only thirty-four stitches wide, MIKs need to do the same thing as traditional knitters when e is greater than m , subtracting m from the initial value of e .

$$\begin{aligned} e &= e - m \\ e &= 55 - 34 \\ e &= 21 \end{aligned}$$

If we look back at the size small MIK chart made by filling in the project chart by hand, we confirm that MIKs start size small public-side rows with MIK motif stitch thirty-three and finish them with MIK stitch twenty-one.

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.

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 (yes, we're still ignoring the small purl diamond's plus stitch), d is the dead-center stitch of the project, and p is the picked motif stitch we want 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

$$\begin{aligned} f &= m - d + p + 1 \\ f &= 8 - 46 + 5 + 1 \\ f &= -32 \end{aligned}$$

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

$$\begin{aligned} f &= m \\ f &= 8 \end{aligned}$$

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

$$\begin{aligned} e &= (w \bmod m) + f - 1 \\ e &= (91 \bmod 8) + 8 - 1 \\ e &= 3 + 8 - 1 \\ e &= 10 \end{aligned}$$

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

$$e = 10 - m$$

$$e = 10 - 8$$

$$e = 2$$

So for the size small, the first motif stitch we work is stitch eight, and we end each public-side row with motif stitch two. If we look back at the chart for the size small, we see that the chart starts and ends with those motif stitches. It's also 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 wind up with

$$f = 3$$

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.

Motif Stitches																																																																																																			
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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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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.

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

$$e = (111 \bmod 8) + 6 - 1$$

$$e = 7 + 6 - 1$$

$$e = 12$$

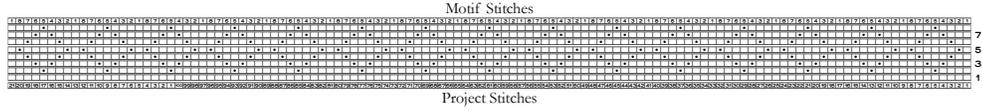
Since e is bigger than m , we subtract m from e .

$$e = 12 - m$$

$$e = 12 - 8$$

$$e = 4$$

Motif Stitches	
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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 at least to zero, we finally get

$$f = 4$$

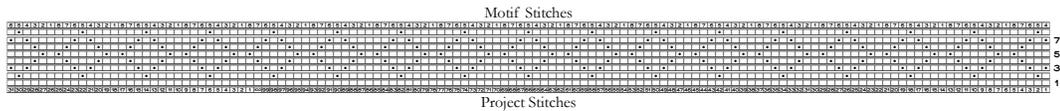
For the ending stitch of the motif, w is a hundred and thirty-one.

$$e = (w \text{ mod } m) + f - 1$$

$$e = (131 \text{ mod } 8) + 4 - 1$$

$$e = 3 + 4 - 1$$

$$e = 6$$



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.

$$\begin{aligned}
 e &= (w \bmod m) + f - 1 \\
 e &= (141 \bmod 8) + 7 - 1 \\
 e &= 5 + 7 - 1 \\
 e &= 11
 \end{aligned}$$

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

$$\begin{aligned}
 e &= 11 - m \\
 e &= 11 - 8 \\
 e &= 3
 \end{aligned}$$

Motif Stitches	
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counting backward from motif stitch 34, we say	on motif stitch
-1	33
-2	32
-3	31
-4	30
-5	29
-6	28

When we add m to our initial f of -6 , then our “proper” f is ...twenty-eight.

Finishing After the End of the Motif

A similar thing happens when we’re supposed to finish a public-side row with a motif stitch number that’s bigger than the motif is wide.

We can think of an e larger than m as telling us to count from the beginning of the motif but **continuing on** from the value of m instead of starting over with “one.”

So when we determined that e was thirty-six for the size small OXO vest, then when we’re

counting forward from motif stitch 34, we say	on motif stitch
35	1
36	2

When we subtracted m from the initial e of thirty-six, e was really...two.

For the size medium OXO vest, we initially calculated an e of forty-one, so

counting forward from motif stitch 34, we say	on motif stitch
35	1
36	2
37	3
38	4
39	5
40	6
41	7

When we subtract m , thirty-four, from the initial value of f , forty-one, we see that we finish with motif stitch...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 that's only twenty-one stitches wide. The dead-center stitch of the project, d , is therefore eleven (add one and divide by two). Since this project is only one size, let's see the two results using both values of p : 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.

$$\begin{aligned} f &= m - d + p + 1 \\ f &= 34 - 11 + 25 + 1 \\ f &= 15 \end{aligned}$$

The corresponding ending motif stitch will be

$$\begin{aligned} e &= (w \bmod m) + f - 1 \\ e &= (21 \bmod 34) + 15 - 1 \\ e &= 21 + 15 - 1 \\ e &= 35 \end{aligned}$$

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

	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

$$e = (w \text{ mod } m) + f - 1$$

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** stitches in the center of both the motif and the project?

Be Consistent in Picking Right or Left

Since we have two symmetry stitches in both the motif and the project, we need to use **either** the left-hand **or** the right-hand stitch of **both** pairs 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 in 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 is an even number of front/back stitches in each size, we have to re-define *d* from being the single dead-center stitch needed for one-stitch symmetry to being one of the pair of project symmetry stitches. Because we picked the right-hand motif symmetry stitch, we need to use the right-hand stitch of the central pair of front/back stitches. We simply divide *w* by two to get that stitch’s number.

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

$$\begin{aligned}f &= 42 - m \\f &= 42 - 38 \\f &= 4\end{aligned}$$

Note that we got the same answer even when we used the second of the two symmetry stitches. Since the equation for finding the ending motif stitch does not use d or p , e doesn't change either.

Why Using Either Symmetry Stitch Works

So why can we use either the left- or right-hand stitch of each pair of symmetry stitches? Let's rearrange the equation for f by writing all the pieces in the opposite order.

$$\begin{aligned}f &= m - d + p + 1 \\f &= 1 + p - d + m\end{aligned}$$

In the middle of the equation for f , we see that part of what we wind up doing is

$$p - d$$

When we used the right-hand symmetry stitches, p was twenty-eight and d was twenty-five, so

$$p - d = 28 - 25 = 3$$

When we switched to the left-hand stitch of both pairs, p was twenty-nine and d was twenty-six, so

$$p - d = 29 - 26 = 3$$

Since the other two numbers in the equation don't depend on p or d , we get the same answer no matter which of the symmetry stitches we use.

And If We Use One of Each?

The previous results also show us why we can't mix one right-hand symmetry stitch with one left-hand symmetry stitch.

Suppose we use the motif's right-hand stitch twenty-eight with the project's left-hand stitch twenty-six. In the middle of the equation for f , we would have

$$p - d = 28 - 26 = 2$$

If we reverse the situation, using the motif’s left-hand stitch twenty-nine with the project’s right-hand stitch twenty-five, we get

$$p - d = 29 - 25 = 4$$

In either case, we can see that if we aren’t consistent in picking matching symmetry stitches, we won’t get the correct result.

Lesson Learned

When the garment piece and the motif have two-stitch symmetry, then in the equation for the first worked motif stitch, we must use either the right-hand symmetry stitch from both the piece and motif, or the left-hand stitch from both. We cannot mix in the equation the right-hand symmetry stitch of one with the left-hand symmetry stitch of the other.

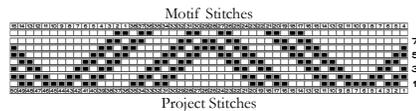
The Rest of the Vest Sizes

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 vest and the corresponding two-stitch-symmetry OXO motif.

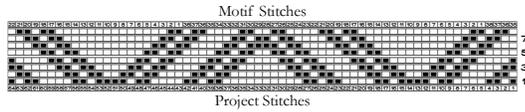
	Small	Medium	Large	XL	XXL	XXXL
Front/Back Stitches w	50	64	74	96	104	120
First Worked Motif Stitch f	4	35	30	19	15	7
Ending Motif Stitch e	15	22	27	38	4	12

Let’s look at the charts for all six sizes to check the results.

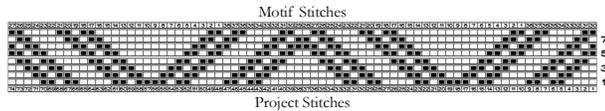
Size Small



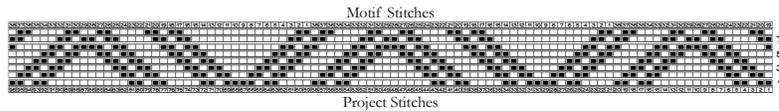
Size Medium



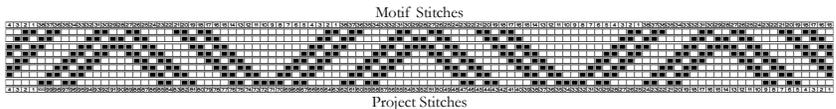
Size Large



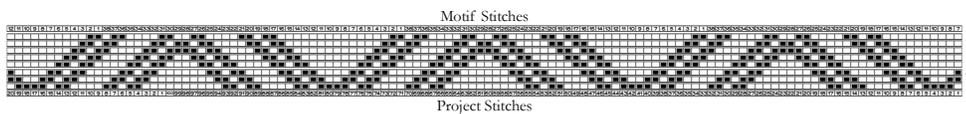
Size XL



Size XXL



Size XXXL



What If a Stitch Pattern Has Plus Stitches?

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(es) in our vest (in six sizes, and with both one- and two-stitch symmetry, 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 stitch pattern **itself** to tell us how to mirror-image the right and left edges. Instead, we're essentially calculating our own plus stitches when we figure out the first worked and ending motif stitches based on where we want the motif placed in our project.

Lesson Learned

We completely ignore a stitch pattern's plus stitch(es) when we use the equations for the first worked and ending motif stitches. Instead, we use as m only the width of the repeating portion of the stitch pattern.

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.⁷

Handling Width Changes

There are two ways we might change the width of a garment's front, back, or sleeves after we cast on.

- ☉ We work the bottom ribbing on fewer stitches, then increase after we complete it. In some projects, we do all the increases in one row or round. In others, we do some increases immediately after the ribbing, and we do the rest at intervals as we work toward the underarm.
- ☉ A-line body shaping and bell sleeves, among other styles, have more stitches at the cast-on than are needed for the chest or upper arm, so we decrease, gradually or all at once, as we work upward.

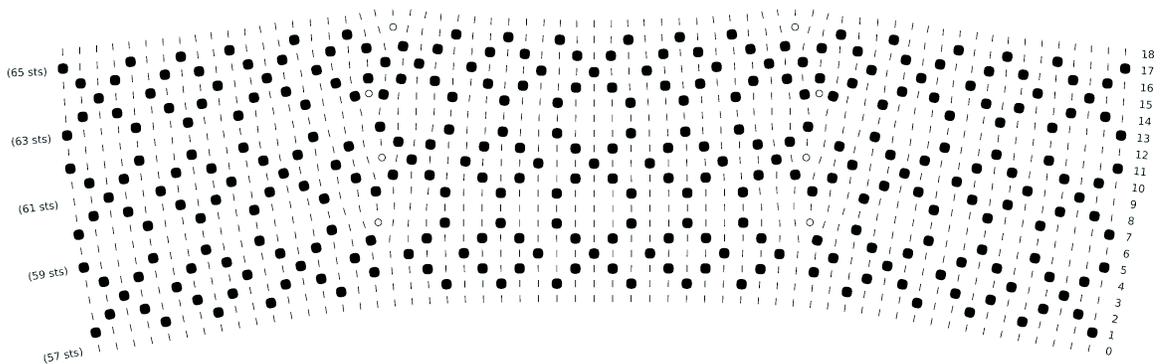
For the chest, we have two options. We work all the shaping, then determine the symmetry stitch(es). Or we determine the symmetry stitch(es) at the cast-on, then plan the exact placement of the shaping so that we don't accidentally move the symmetry stitch(es) out of the piece's center.

For sleeves, we really have only one option, because we usually do paired shaping all along the underarm seam (whether an actual seam in the flat or a hypothetical seam in the round). Once we complete the ribbing, we may do some of the sleeve shaping right away. If so, we work it, then use for d the total number of stitches on the needles at that point. We

⁷ 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?

	333231302928272625242322212019181716151413121110987654321123456789101112131415161718192021222324252627282930313233	
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and in a [stitch map](#). Both are similar to the earlier attempts.



Shape in Plain Fabric

Instead of trying to optimize the appearance of partial motifs, we can omit the stitch pattern in however many places we need to do the shaping, which we then do in columns of plain fabric, whether areas of stockinette or reverse stockinette in a texture pattern or the background color in colorwork.

We'll eliminate the second column of Os, counting from the right and left edges

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then do the shaping in what's now all background. We don't have to be careful to use both wedges' inner or outer edges or do any other special placements since the shaping areas are just plain fabric.⁸

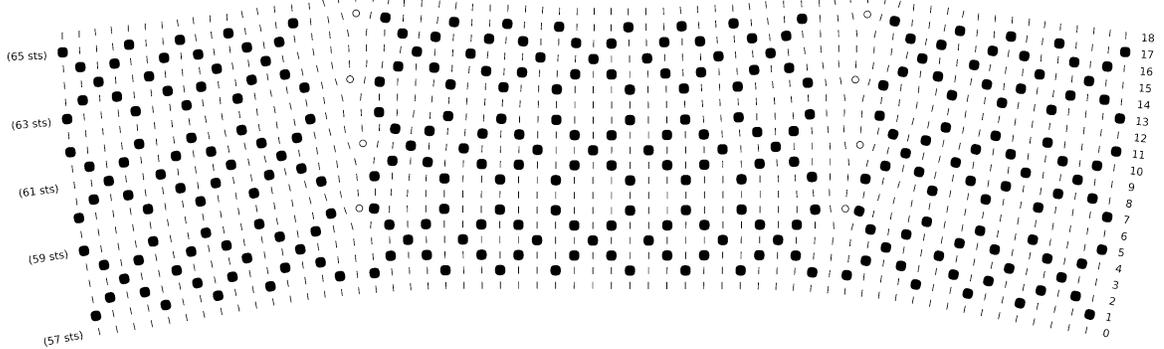
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Will the squished-grid version

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⁸ Well, most of us—*ough*—wouldn't.

and the **stitch map** more closely resemble each other than the other pairs of grid charts and stitch maps did? No, they will not.



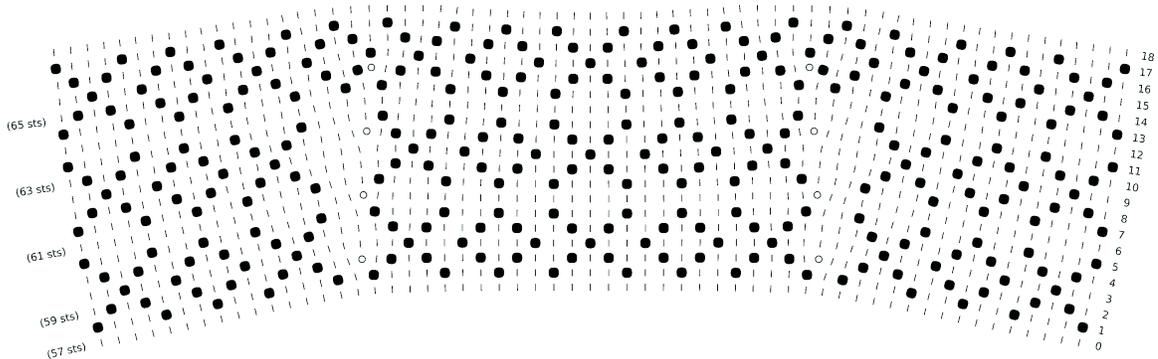
Of course, I ought to have changed the two outer portions from X-O-X to O-X-O, which would have prevented two Xs from being next to each other along the shaping lines. This is what happens when one rushes in instead of thinking for 0.02 seconds first.

Rearrange the Stitch Pattern to Better Match the Shaping

As a reminder to myself to spend 0.02 seconds thinking, here's that option

	333231302928272625242322212019181716151413121110981716151413121123141516171819101112131415161718192021222324252627282930313233	
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	333231302928272625242322212019181716151413121110981716151413121123141516171819101112131415161718192021222324252627282930313233	

along with its **stitch map**.



For the—*cough*—fussiest among us, this option may well be the best.

Choices, Choices, Choices

Depending on how many stitches we add or lose, we can use several techniques to help us achieve the proper shaping while minimizing the effects on the stitch pattern.

Change the Number and/or Size of the Wedges

We might be able to use a different number of wedges, which would need corresponding changes in the number of stitches we increase or decrease as well as the number of plain rows between shaping rows.

In lots of cases, we can change “one stitch in eight locations every four rows” to “one stitch in four locations every other row” or even “one stitch in two locations every row.” We could also mix and match these options several times along the way—now using eight locations every four rows, now doing two locations every row—so the number of places we do the shaping plays nicely with our stitch pattern. Knitting is stretchy and squishy, so we don’t have to be rigid either.

Adapt the Stitch Pattern’s Foreground

What if we fiddle the stitch pattern to work with the number of stitches on our needles? In the OXO, for example, we could eliminate the interior lines of both the X and the O, then do increases to add them, which brings them and the project up to their full width.

In the following OXO charts, I’ve done two things to make it easier to play with the shaping:

- ④ split the individual letters into their own table columns
- ④ removed the partial Os at the left and right edges of the chart

Separating the letters means that once I add the increases in that letter, I can just copy and paste it as needed in the rest of the chart (except for the X at the left edge). Note that to omit the partial O at the right edge of the chart, I added a column just three stitches wide to complete the right-most X. Splitting out those three stitches separately means three of the four Xs in the project chart are identical.

If we want an O at each edge, we would remove the bits of the X in the left-most O chart and add them to the left edge of the rest of the O columns. The three-stitch column at the right edge of the chart completes that O and allows three of the four O columns to be identical.

These charts' cells have bigger left and right internal margins than normal to make the column boundaries clearer.

Let's make a garment with four Xs and three Os on the front and back. When we're doing increases, the motifs will start out with only two lines, as in the charts above. If we're decreasing, they'll start out with the three lines we've seen throughout the chapter.

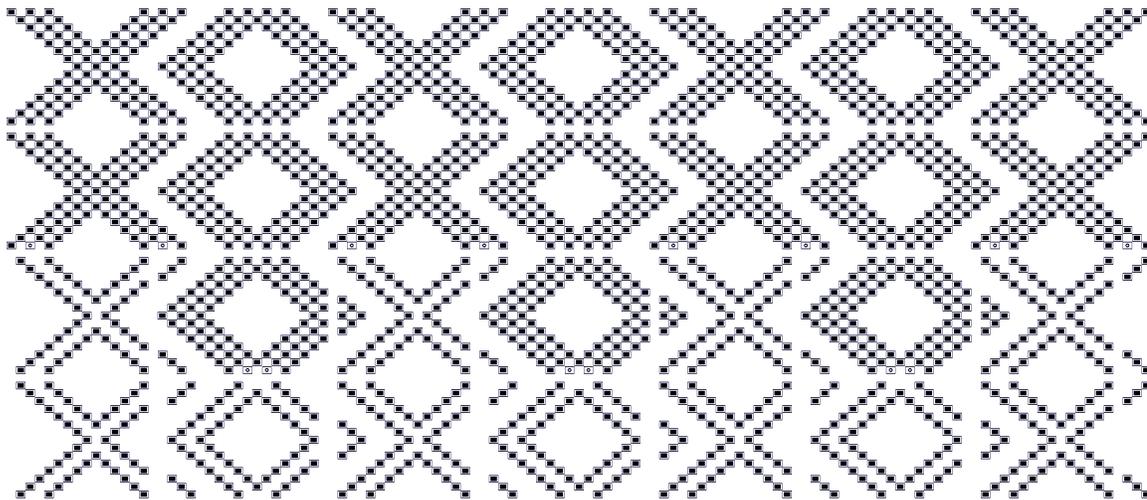
Unfortunately, these charts have one and half, two and a quarter, and three and a half times the number of stitches that stitch-maps.com allows, so we can only see them as grid charts. One thing we can do to help grid charts out a bit, especially if we're trying to get an overview of the project, is to change all the knit symbols to spaces with our software's Find and Replace. All five sample charts show this change, which minimizes clutter and helps us focus on design and layout. Once we're happy with the chart, we just change all the blank spaces back to knit symbols.

Increasing

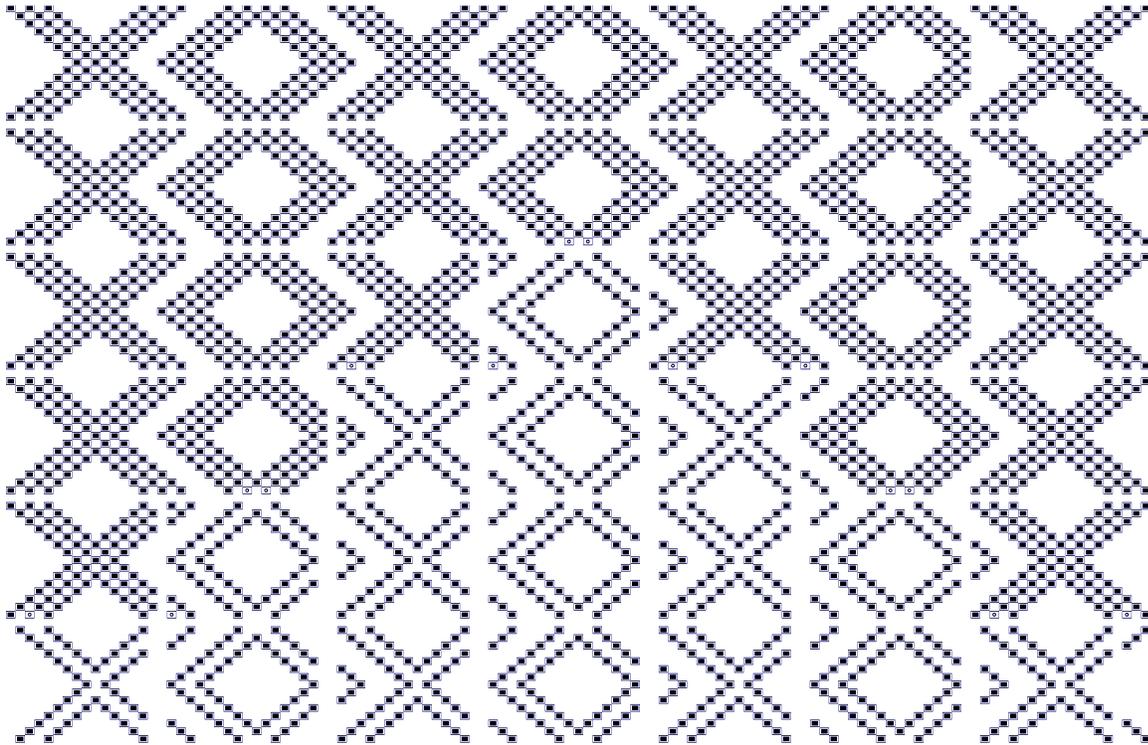
With four Xs and three Os on the front and back, each piece starts with a hundred and seven stitches. Adding the extra pair lines inside each letter will increase the stitch count to a

hundred and twenty-one. At five stitches per inch, the fabric width will grow from about twenty-one and a half inches to a little over twenty-four inches.

This version of the project chart widens the Os in the second row of motifs and the Xs in the third motif row.



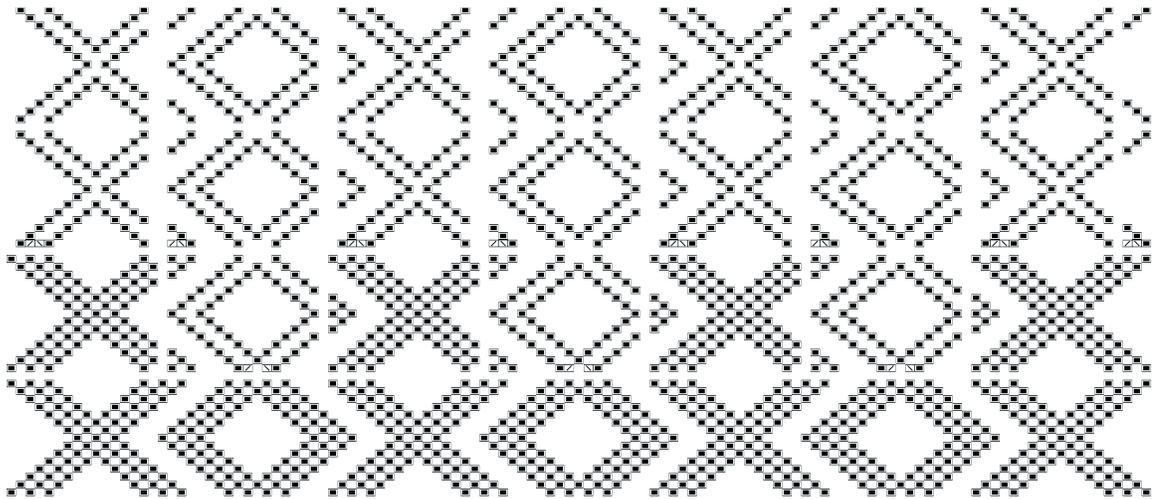
If we need to increase more gradually, we could increase in just two motifs each time. In this version, we widen the outer two motifs in each motif row, finishing with the O in the center.



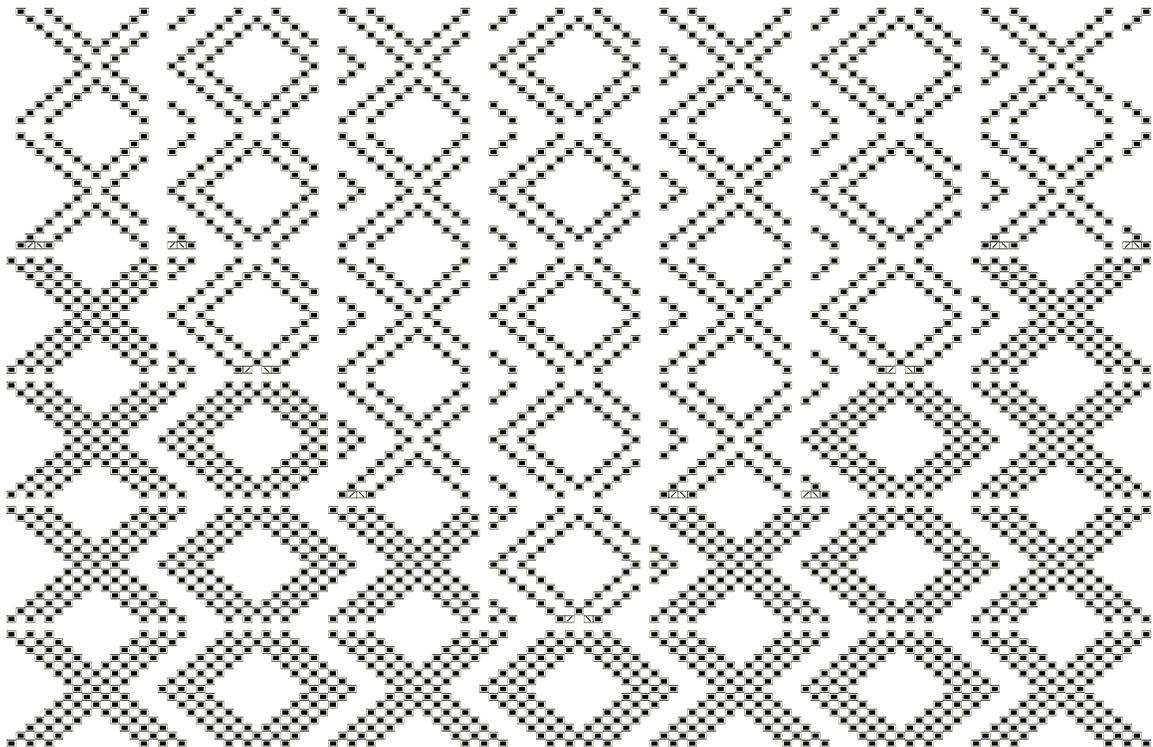
We could also start the shaping in the center O, then move it outward on each half of the fabric.

Decreasing

If we need to make the fabric narrower, we can reverse any of the ideas shown or suggested for the increase shaping. In the first chart, we decrease all the stitches in just two rows of motifs, decreasing first in the Os, then in the Xs.



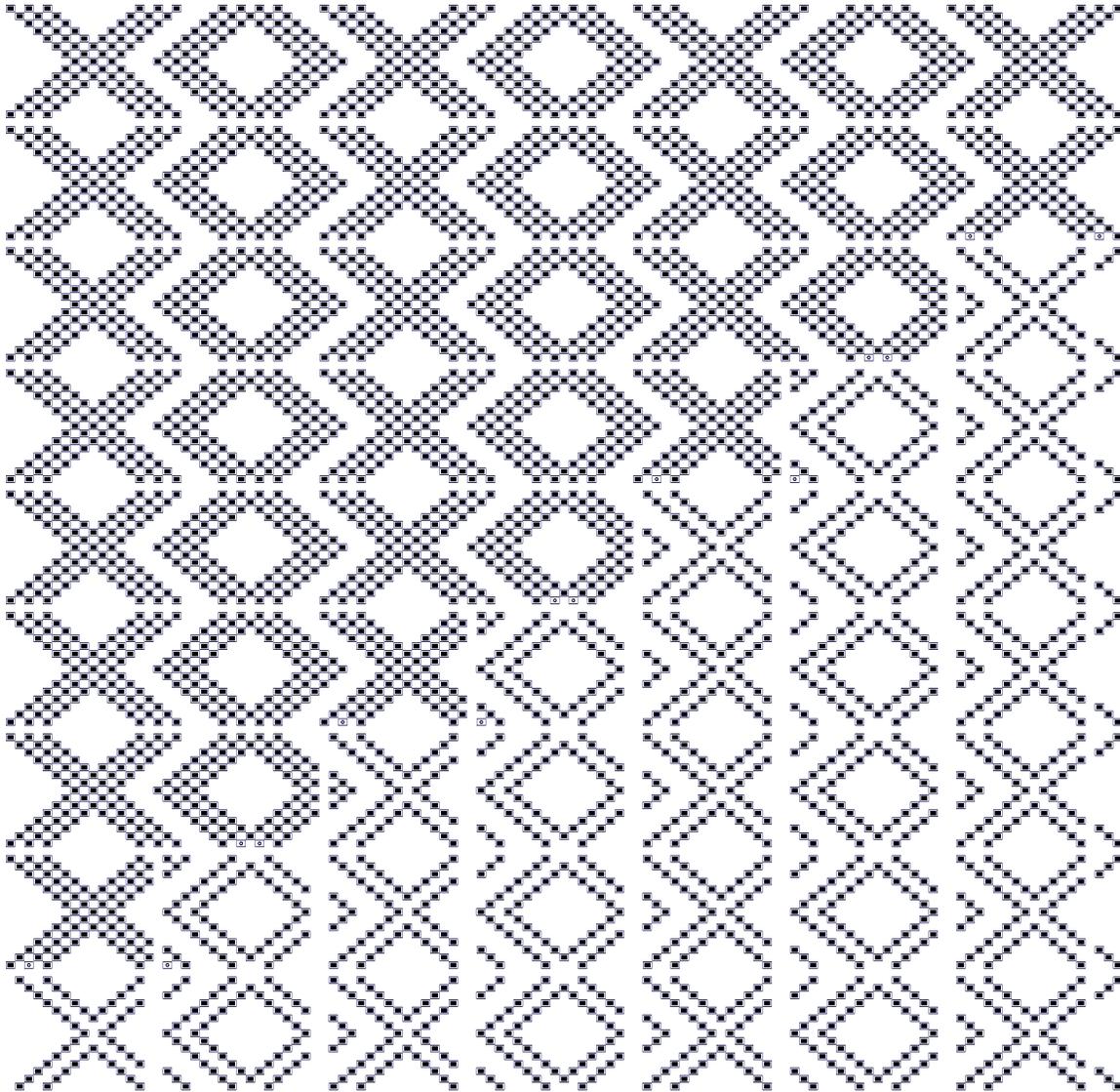
We can also slow down the rate of decreases. We'll decrease first in the center O, then decrease in the next outward pair as we work our way upward.



Asymmetrical Shaping

There's no rule that says garments have to be mirror-image. If we need lots of rows and ei-

ther would not mind or would actually prefer asymmetry, we could start the shaping at one edge, then increase across the fabric one letter at a time to the other edge.



Adapt the Stitch Pattern's Background

If there are clear areas of separation between parts of the motif, we might be able to hide the shaping in those background areas.

Suppose we have an Aran sweater with several cables separated by reverse stockinette. If we need eight stitches of reverse stockinette between each cable at the fabric's full width,

then we might start with only five purls between the cables. Every shaping row we add one more purl stitch in the reverse stockinette.

In the other direction, we start with, say, eleven purl stitches between the cables, then decrease away one stitch in each area every so many project rows or rounds.

In either case, we have to do some planning to see how many stitches we need to add or remove, how many project rows we have, and how many shaping rows we need to work in that number of project rows.

Other motifs may have similar areas, or **could be tweaked to have such areas**, where we can hide shaping while keeping the motifs more or less intact.

Adapt the Motif's Size

If the motif in its original form doesn't play well with the number of stitches and/or rows in our project, we can try changing its height and/or width, exactly as we learned to do in part one's purl diamond project. We may have to make several versions, trying out various proportions until we like the overall effect.

In a child's sweater, a fifteen-row OXO may be much too tall. We can re-chart it as short as necessary, going down even to the five-by-five Xs and Os we've used here. We can make the legs of the Xs and the segments of the Os wider or narrower, and we could increase or decrease the number of background stitches between the Xs and Os.

Work the Shaping in a Plain Area

Sometimes trying to work the stitch pattern in the areas where we do shaping will lead only to a big fat mess. We can simply dodge the issue entirely by using stockinette, reverse stockinette, or the background color in the shaping areas instead.

Depending on the width of the motifs and the number of stitches we increase, we might be able to squeeze in an extra segment of the stitch pattern as we go along.

Experiment in Charts or in Yarn?

Whatever technique, or combination of techniques, we want to use to make the shaping work with the stitch pattern, we might need to try several combinations. Charts help us see what the fabric will look like when we complete the shaping.

We may need to juggle the number of shaping stitches, the number of project stitches, the number of shaping rows, and/or the number of project rows as we're trying to put a stitch pattern of any kind in a project. In some cases, we might have to change any or all of

these numbers to help our projects look their best. We might also, in some cases, need to alter the stitch pattern itself.

Multiple rounds of charting may be necessary, and even if we decide against a particular setup in a particular project, we may want to use the same idea in a later project. Keeping all these variations by putting each one in its own file, or at least its own table, builds our own project libraries.

Stitch maps do a much better job showing shaping effects than grid charts, because their rows and columns bend and tilt in response to what's going on around them. If we're really zealous or, er, nervous about the effects of our shaping choices in a project with a stitch pattern, stitch maps will give us a very good idea of the outcome before we even cast on.

Yes, making multiple charts will be annoying, but it will probably be much less annoying than getting halfway to the underarm in yarn and only **then** realizing that we don't like the results—again!