Pearson New International Edition

Sewing for the Apparel Industry
Claire Shaeffer
Second Edition

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Overview to Apparel Production

Apparel manufacturing firms are just as diverse as the designs they produce. They can be large or small, have one employee or thousands, and produce high-end high-fashion or budget everyday garments. They can have one machine or hundreds, produce **one-offs** or thousands, and manufacture all goods **in house** or use outside contractors. They can have one plant or dozens, manufacture in America or offshore, and produce garments for men, women, or children. They can be diversified or specialists and may produce only for a particular store or large chain, for many wholesalers, or for one exclusive boutique. Clearly no two firms are exactly alike, but all focus on providing the **target customer** with apparel that meets his or her expectations for performance, quality, and value.

Apparel manufacturing is composed of three processes: design, production, and merchandising. The **design department** develops ideas into styles, the **production department** produces or manufactures the garments, and the **merchandising department** promotes and sells them.

Chapter Objectives

After completing this chapter, you will be able to:

- Describe the organizational structure of an apparel manufacturer.
- Identify and define job opportunities in apparel manufacturing.
- Identify and describe the three processes in manufacturing.
- Describe the interaction among the design, production, and merchandising departments.
- Evaluate fit on the sample garment.
- Identify the machines most commonly used in the needle trades.
- Identify the six stitch classifications.

THE DESIGN PROCESS

The design process begins in the design department, whose primary purpose is to develop a successful product. This complex process requires a thorough knowledge of what will sell and what can be manufactured at a profit, as well as the ability to create new and interesting styles.

Product Development

Product development takes place in the design studio. Generally the **design studio** is a room or group of rooms with tables for patternmaking and cutting and machines for making sample garments.

The **designer** is responsible for all aspects of the design process. In a small firm, he or she may actually do all the work. In larger firms, a staff of designers, **assistant designers**, **samplemakers**, **patternmakers**, and **graders**, each with specific skills and responsibilities, share the work under the supervision of a head designer. Many firms have no design department or operate with skeleton staffs that rely on **freelance designers** or **stylists** for designs and design-related services.

Product development, or the creation of new styles, involves a variety of specific operations: developing design ideas, selecting fabrics that are available and appropriately priced, making the **first pattern**, making a **sample garment** or **prototype**, evaluating and refining the fit and design, computing the cost, making a **production pattern**, making **duplicates**, and grading the production pattern.

FIGURE 1 A croquis by Ila Erickson.
Courtesy of Ila Erickson

From Idea to First Pattern

The designer begins with a thorough knowledge of the firm's target market, its target customer, his or her buying habits, and hundreds of ideas and sketches from many sources. Design ideas fall into three categories: (1) modifications or new **fabrications** of successful styles from the current or previous **season** and adaptations of current trends; (2) **knockoffs** or copies of more expensive, high-fashion designs; and (3) original, **trend-setting** designs.

Most designers make a **croquis** or **sketch**, as shown in Figure 1, to describe the design and clarify the concept. If the designer is making the first pattern or working closely with the patternmaker, the croquis may have little detail. If the croquis will be turned over to an assistant, first patternmaker, or freelance patternmaker, it will be more detailed and very accurate. It will clearly represent the designer's ideas for the **silhouette**, seams, and darts; such style features as sleeves, cuffs, collar type and shape, yokes, and pockets; and such design details as belts and epaulets, fastenings, and trims. It may also include notes on construction methods.

The first patterns for most designs are made using the firm's **slopers** or **body shapes**. The slopers are basic patterns for blouses, shirts, pants, skirts, dresses, and jackets that reflect current fashion styles. They have a specific fit and silhouette and have been used successfully in the past. If the design is entirely different, a new sloper is developed from the basic **block** or **foundation pattern** or from another sloper. The basic block follows the natural line of the target customer's body shape.

The Sample Garment

Once the new pattern is made, it is used to cut a sample or **trial garment**. In some workrooms the sample garment is cut by the assistant designer or

patternmaker; in others, by the samplemaker. If the design is completely new, it is cut from muslin. If it is a new version of a previously successful style, the sample garment is often cut from a **sample cut** of a material being considered for production.

Generally the pattern pieces are placed on the fabric and secured with weights. Then chalk or a well-sharpened pencil is used to trace the pattern onto the fabric. Although the sample can be cut without chalking the outline, careless cutting at this stage can damage the original pattern as well as the sample itself.

Next, a skilled seamstress or samplemaker, who requires no instructions or assistance, assembles the garment. The samplemaker is responsible for sewing the entire garment precisely and for advising the design team if the pattern pieces do not fit together properly.

The samplemaker must have extensive knowledge of industry methods for mass production, even though he or she often modifies them in the sample room. Here are some reasons for such modifications:

1. The sample room is rarely equipped with special attachments or automated machines.
2. The goals are different. Because the sample will be used as a guide for making the production pattern, it must be as close to perfect as possible. To achieve this goal, the samplemaker frequently uses basting aids and more **underpressing** than would be cost-effective in final production.
3. The skills are different. The samplemaker can perform many operations successfully but is rarely as fast or as proficient as factory operators who perform only one or two operations.

After the sample garment is completed, it is first tested on a dress form and then fitted on a live or **fit model**, whose measurements correspond to those for the firm's **sample size**. The sample is evaluated for fit, silhouette, and design; then it is corrected or modified until the design is perfected.

When a new silhouette is being developed, this process may be repeated several times before the design is approved because of the need to determine the exact dimensions of the production pattern for the selected material.

BOX 1 Evaluating the Fit

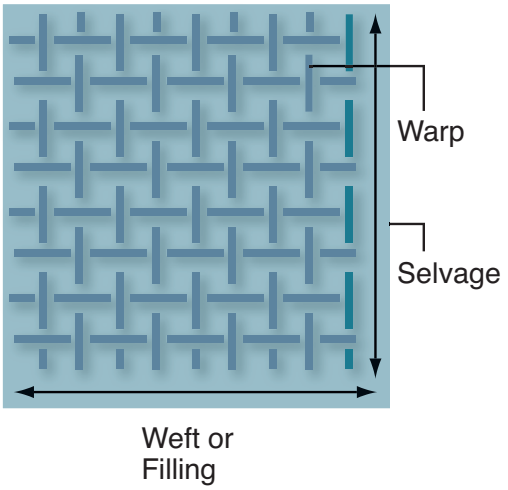
Fit is as important to the success of the product as the design. The purpose of a fitting is to check the size, balance, ease, style lines, and silhouette.

According to Ruth Glock and Grace Kunz (*Apparel Manufacturing: Sewn Product Analysis*, 4th ed., p. 175), **balance** and **ease** are the fundamental components of establishing the fit of a basic block or sloper.

Grain

The **grain** determines the balance. Grain describes the fabric threads. All woven fabrics have at least two sets: the **warp** threads, which run lengthwise, and the **weft** or **filling** threads, which run crosswise. The warp threads are put on the **loom** at the outset, and the filling threads interlace with them. When the fabric is *on-grain*, all warp threads are parallel to each other, and the filling threads are parallel to each other and at right angles to the warp threads. If they are not, the fabric is *off-grain* and should be avoided.

NOTE: Fabrics that are off-grain cannot be straightened permanently if they have any kind of permanent finish, and most do.

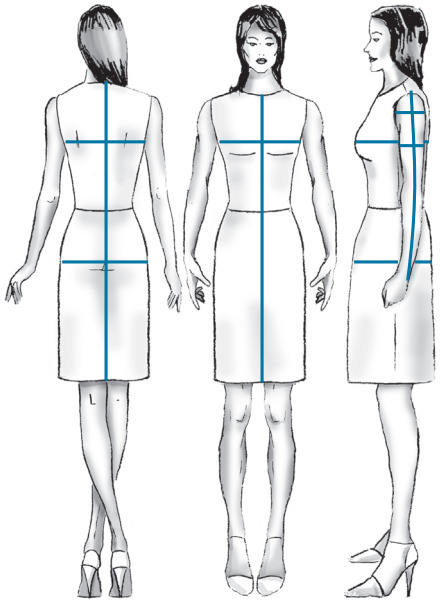


Fabric grain.

The warp threads are stronger and have less stretch than the filling threads. Most fabrics drape better when the warp is perpendicular to the floor.

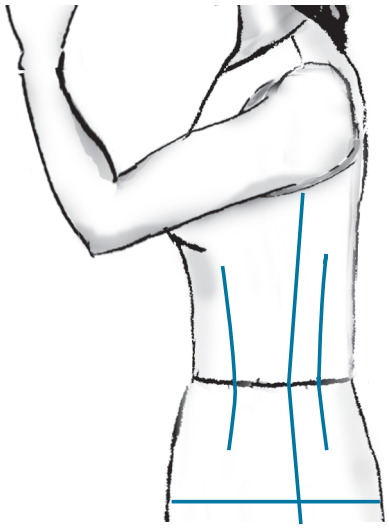
The **lengthwise grain** should be perpendicular to the floor at the center front and back; on the sleeve, it should be

BOX 1 *(continued)*



Balance lines on basic front, back, and sleeves.

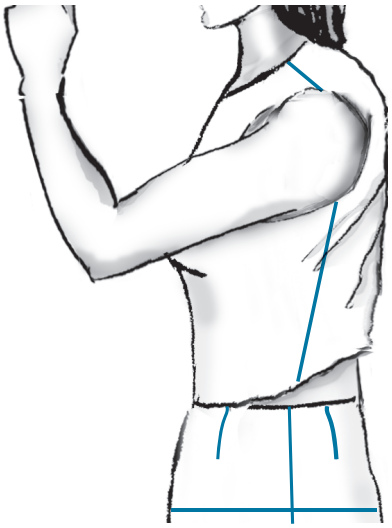
perpendicular from the shoulder point to the elbow. The **crossgrain** or **crosswise grain** on the bodice should be parallel to the floor between the bust points and across the chest about 3″ below the neck in front and 5″ below the neck in back. On the sleeve, it should be parallel to the floor at the **biceps** or **underarm line**; on the skirt, the crossgrain should be parallel at the hip.



Structural lines divide the body into pleasing proportions.

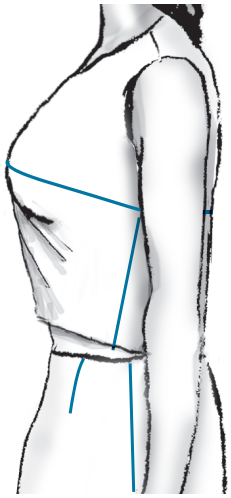
Structural Lines

Equally important are the **structural lines** or seams, which divide the body into pleasing proportions. Side seams should hang perpendicular to the floor and appear centered between the front and back.



Effect of crosswise grain on a figure with a rounded back.

HINT: A good comparison is a figure with a large bust and a narrow back and a figure with a large back and flat chest. On the former the side seam will be toward the bodice front with diagonal wrinkles on the back pointing to the bust. On the latter, the seam will pull toward the back.



Effect of crosswise grain on a figure with large bust.

The balance at the shoulder is determined by the slope of the shoulder seam and its location. A good starting point for the shoulder seam is just behind the ear to the midpoint of the **armscye**. The seam should set on the top of the shoulder and be inconspicuous from both the front and back. It should not slide to either the back or front.

HINT: When fitting any design with shoulder pads, insert the pads at the first and every fitting.

Balance is also the right proportion between the depth of the front armscye and the back armscye (see the preceding figure). A noticeable example is a figure with a rounded back. A diagonal wrinkle will point to the shoulder blade, indicating that the length of the back bodice is too short above the bustline (as shown in the figure). The reverse—a too-short front, which occurs on a figure with very erect posture or a very large bust—requires extra length in the front bodice above the bustline or the addition of darts.

Ease

Ease is the difference between the body measurements and the garment measurements. There are two types of ease—**fitting ease** and **design ease**. Sometimes called **comfort**, **wearing**, or **movement ease**, fitting ease is the minimum amount needed for comfort and movement. Designs made of stretch knits can have **negative ease** with measurements that are less than the body measurements. Design ease is an additional amount added to create the style. The basic block includes fitting ease only; once design ease is added, it becomes a basic pattern or sloper.

Guidelines for Fitting Garments

1. Check the general effect.
2. Identify all potential fitting problems before ripping any seams.
3. Check first for size; the garment must have enough ease to fit over the body smoothly. Is it large enough at the bust, waist, and hips? Is the shoulder length too long or too short? Is the neck too large or too small?
4. Check the vertical grainlines at garment centers. Are they perpendicular to the floor?
5. Check the horizontal grainlines across front, across back, and hips. Are they parallel to the floor?
6. Check the drape of the sleeve. Is the center perpendicular to the floor and is the sleeve cap parallel?
7. Check to ensure that the garment appears symmetrical unless designed otherwise.
8. Check the side seams. Are they centered under the arm?
9. Do blouses, dresses, and jackets set smoothly on the shoulders? Do they fit the shoulder slope?
10. Locate any diagonal wrinkles and examine the cause. Is the garment too tight below the wrinkles? Is the section too long?
11. Locate any diagonal wrinkles and trace them to the area that doesn't fit.
12. Check the armscye for size and shape.
13. Adjust the fit as needed.
14. Evaluate the style lines.
15. Evaluate the silhouette.

The Production Pattern

Once the sample garment is approved, the costs of production and fabrication are evaluated. If the garment appears profitable, the design is given a **model** or **style number**. The **production patternmaker** then perfects the first pattern so it is easy to assemble, makes optimum use of the material, and meets the firm's fit, quality, and production standards. Then, to proof or test the pattern, the fabric is cut and the garment is made using factory methods.

Proofing may require several samples because the pattern must be adjusted precisely for the particular material to be sewn. Production sewing requires careful planning to be sure every edge and notch will fit together precisely. By contrast, in home sewing, you can adapt the pattern as you sew for differences in fabric weight, thickness, and texture.

Additional samples are sometimes made to determine the desired finished width of bindings; the size of the cord in pipings; or exactly how wide the material should be cut for **bindings**, **pipings**, and **spaghetti tubing**. This ensures that the binding strips will fit in the folders properly, piping strips will have the desired seam width after they are folded and the cord inserted, and spaghetti tubing will be the desired size when turned.

Costing

Who costs the garment and where, when, and how **costing** is done varies with the firm. It can be done

by the designer or **production engineer** in house or by the **contractor** who will actually sew the garments (Fig. 2).

If the cost for a style is too high, the design department may be asked for cost-cutting suggestions. Production costs can be reduced in a variety of ways, including some minor changes at the design level.

BOX 2 Common Methods for Reducing Costs

1. Use different production methods, change the types of seams or stitches, or reduce the number of stitches per inch.
2. Reduce the number or size of trims, such as pockets, pleats, tucks, buttons, and belts.
3. Change the trim type. Replace buttons with a zipper, bindings with bias facings, set-in pockets with patch pockets, tailored plackets with bound plackets, and shank buttons with sew-through buttons.
4. Eliminate such elements as linings, belts, and facings.
5. Use less-expensive trims, such as buttons, zippers, ribbons, belts, buckles, and shoulder pads.
6. Use less-expensive material, interlinings, and linings.
7. Reduce the widths of seams, hems, and facings.
8. Reduce the number of pattern pieces.
9. Reduce the garment width or fullness.
10. Change the grain on some pattern pieces.

Preparing for Production

After the production pattern is approved, it is used to make duplicates of the style. Sales representatives or **reps** use these duplicates to show the firm's line to the retail buyers, as a guide for advertising **copywriters** and ad photos, and as a sample for contractors and factory supervisors.

Once the decision is made to send the style to production, the production pattern is graded (Fig. 3). **Grading** is a method for increasing and decreasing the sizes of the individual pattern pieces so that garments in larger and smaller sizes will have the same appearance, fit, and proportion as the sample garment. Generally the difference between sizes smaller than a 10 is 1″; for sizes 10 to 16, it is 1½″; and for sizes larger than 16, it is 2″, but this can vary with the manufacturer.

Season		Description				Date	Style #
1ST PATTERN #		COLORS				SIZE	PRICE
Fabric	**Description**	**1st Ydge**	**Actual Ydge**	**Price**	**AMT**	**SKETCH**	
SELF							
CONT #1							
CONT #2							
CONT #3							
MISC.							
Lining							
Fusing							
Tearaway							
TOTAL FABRIC COST							
TOTAL TRIMMING COSTS							
SALES-DESIGN-FRT-TAX							
LABOR GARMENT						SELF	CONT #1
LABOR SEND OUT							
LABOR HAND TRIMMING							
CUTTING							
MISC.						CONT #2	CONT #3
TOTAL LABOR COST							
TOTAL COST							
REMARKS							

FIGURE 2 A sample cost sheet, used to estimate the cost of a garment.

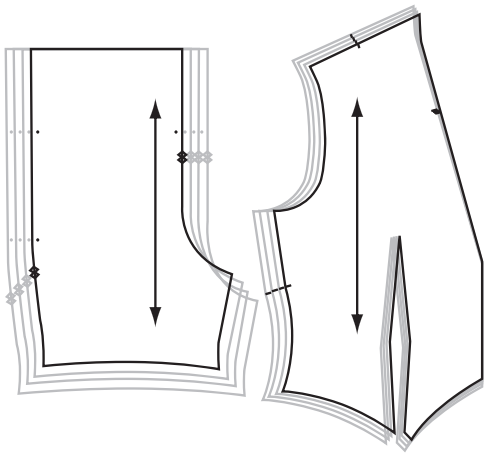


FIGURE 3 A graded pattern.

THE PRODUCTION PROCESS

Production, or manufacturing, includes the cutting, sewing, pressing, and packaging of finished garments. It can be done by the apparel manufacturer, contractors, or a combination of the two.

Some manufacturers rely on **cut-make-and-trim (CMT)** contractors to do everything from cutting the fabric to furnishing trims such as **zippers**, **seam bindings**, and threads, to packaging the finished garments for selling. Other manufacturers use contractors just for sewing and pressing; cutting and packaging is done in their own factories.

The Cutting Process

Once a style is **adopted** and included in the collection and the cut order is written, actual production begins. The first stage is cutting, which requires five specific operations:

1. **Marking**, which consists of planning the layouts and making markers.
2. **Spreading** the fabrics to create a *spread* or *lay*.
3. Cutting of the lay into **cut parts**: the individual **garment components** or **garment parts**.
4. Marking cut parts by **notching** and **drilling** individual garment components.
5. **Bundling** the cut parts so they are ready for sewing or other procedures such as **fusing** interlinings, **pleating**, **shirring**, or **silk-screening**.

The cutting production takes place in the cutting room, where the primary purposes are to cut piece **goods** into the component parts of a garment and to keep the sewing room supplied with work.

The cutting room is a spacious area with one or more long tables that can accommodate the **bolts** of fabrics and **trimmings** to be prepared for sewing. Here the bolts are unrolled and spread with multiple **plies** or layers of fabric one on top of another.

A marker or guide for cutting the pattern is placed on top of the fabric plies, and the stack is cut into the component parts, which are notched and marked for accurate assembly. Finally, the pieces are separated and bundled appropriately for the individual operators who will assemble them.

In a large cutting room, the various operations are performed concurrently in different areas; in a small room or area, they are done one or two at a time. Because the cost of materials represents approximately 50% of the total production cost, cutting operations greatly influence the total cost of the garment. Even small savings of an inch here and there add up, and a reduction in waste or **fallout** among the garment components will decrease the average cost of materials per individual garment by its improved **material utilization**.

Marking

Marking, or **marker making**, is the process of transferring the pattern to the fabric or paper. It should not be confused with the marking of cut parts.

BOX 3 Comparison of Marker and Pattern Layout

A **marker** is similar to the layout included with home sewing patterns, but there are several important differences.

1. A marker is a full-scale diagram of the individual pattern pieces. The commercial **pattern layout** is a small-scale diagram showing how the pattern pieces are to be positioned.
2. A marker is used instead of individual pattern pieces.
3. A marker is generally drawn on paper or pattern cloth, but it can be drawn directly on the top ply of the lay.
4. Markers for woven fabrics are generally made with a full pattern piece for each garment component so the individual pieces can be laid out more efficiently on an **open lay**. Generally, home sewing pattern layouts include pieces for the right half of the garment, and the garment sections are cut **on the double** or **in the fold**.
5. A marker is used only once. It is laid on top of the fabric spread and cut when the garment parts are cut; then it is sometimes used as a guide for bundling, and eventually it is discarded. A pattern layout can be used an unlimited number of times.
6. A marker can be made for a single garment, a portion of one or more garments, or multiple garments. A pattern layout is for a single garment or a portion of that garment.
7. A marker is made for a specific fabric with a specific width, specific size(s), and a specific number of garments. A pattern layout is planned for a range of sizes, materials that may vary several inches in width, and generally for a directional or "**with nap**" fabric.
8. A marker includes special marks on pattern pieces for matching plaids, stripes, and other fabric patterns.

In apparel production, marking is generally done by making a paper marker, which is a full-scale **layout** of all pattern pieces to be cut from a particular **spread** or **lay**. Made for a specific style and fabric, it can have one or more sizes on it. It can be made by arranging the pattern sections manually or on a computer with a **CAD (computer-aided design)** program (Fig. 4).

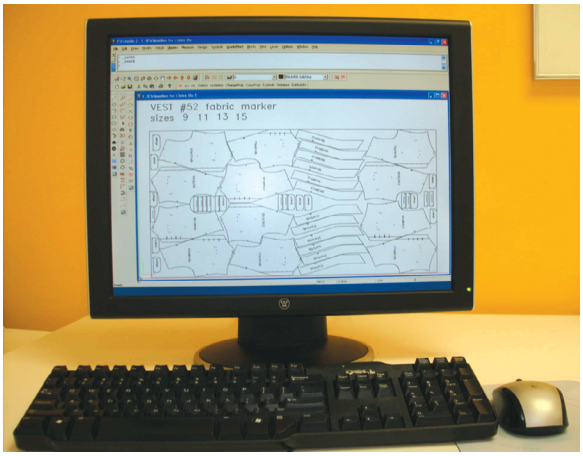


FIGURE 4 Computerized marker.
Courtesy of Pattern Works International, LLC

In the design room and in **haute couture**, the marker is frequently made by placing the pattern pieces directly on the fabric itself. A similar procedure is used in home sewing, in which the marker is made directly on the fabric, using the appropriate layout guide on the pattern guide sheet for the style, pattern size, and fabric width.

Marker making, or planning the marker, is the process of arranging all pattern pieces that will be cut in a single lay. This is one of the most important operations in apparel production because the marker determines how much fabric will be used. Any reduction in waste or fallout among the garment components will increase the material utilization and decrease the average cost of materials per individual garment.

A separate marker is made for every material used in the style—the **main fabric**, which is sometimes called the **self**, **outer**, or **shell material**; the **interlining**; the **lining**; and any **trim fabrics**. Whether the markers are made manually or by computer, the goal is to create a tight marker with little space between the components (see Fig. 4). The pattern pieces are interlocked as tightly as possible so that the arrangement is efficient but does not sacrifice garment quality.

The cut order, cutting ticket, or **cutter's must** determines how many markers are needed (Fig. 5). The choice varies among manufacturers and depends on the size of the manufacturer, whether the cutting is to be done in house or by a contractor, and how many items are to be cut. No matter which form is used, it should include as much information as possible, such as the style number, the quantity, and a list of all fabrics, trims, and pattern pieces. It may also include the size range, quantity in each size, fabric swatches, delivery date, a sketch or technical drawing, and specific layout, sewing and finishing instructions.

The cutter's must is used by many smaller manufacturers and for sample making. It is a list of the components for the style. The cutter's must shown in Figure 5 is for a single garment. It lists the sections to be cut from the self—the organza—the sections to be cut for the slip, a buttonhole marker, and paper shapers as well as the trimmings: button loops, buttons, and zipper.

Spreading

Sometimes called **stacking up** or **laying up the cut**, spreading is the process of stacking the material one layer on top of another to create a lay. Whether done manually or with a **spreader**, it is a slow, time-consuming process because it must be done precisely to avoid fabric waste and to ensure that the plies are aligned so the parts can be cut accurately.

Known by a variety of terms, such as *spread*, *lay-up*, or *stack*, the lay is generally spread **on the open** with the material unfolded and open to its full width. The plies can be spread **face up**, **face down**, or **face to face**. Although the spread can also be *in the fold*, this involves more fabric waste. Thus, it is generally used only on tubular knits.

The lay can be a single ply of fabric or several hundred plies. The number of plies is determined by many factors, such as the equipment available, the skill of the cutter, the thickness and slipperiness of the material, the total number of garments to be cut, the number of garments to be cut in the lay, company policy, and standards for quality.

The height of the lay is generally no more than a few inches because tall lays are more likely to shift or tilt and be cut inaccurately.

Spreading is usually done by two people even though one person can perform this operation with a machine. The cutting table is first covered with a layer of kraft paper; then the spreaders lay the first ply so one **selvage** is about an inch from the long edge of the paper, and the paper extends at each end. The remaining plies are then spread one layer at a time, so that the selvages along one edge are perfectly matched. When several bolts are used, it is not

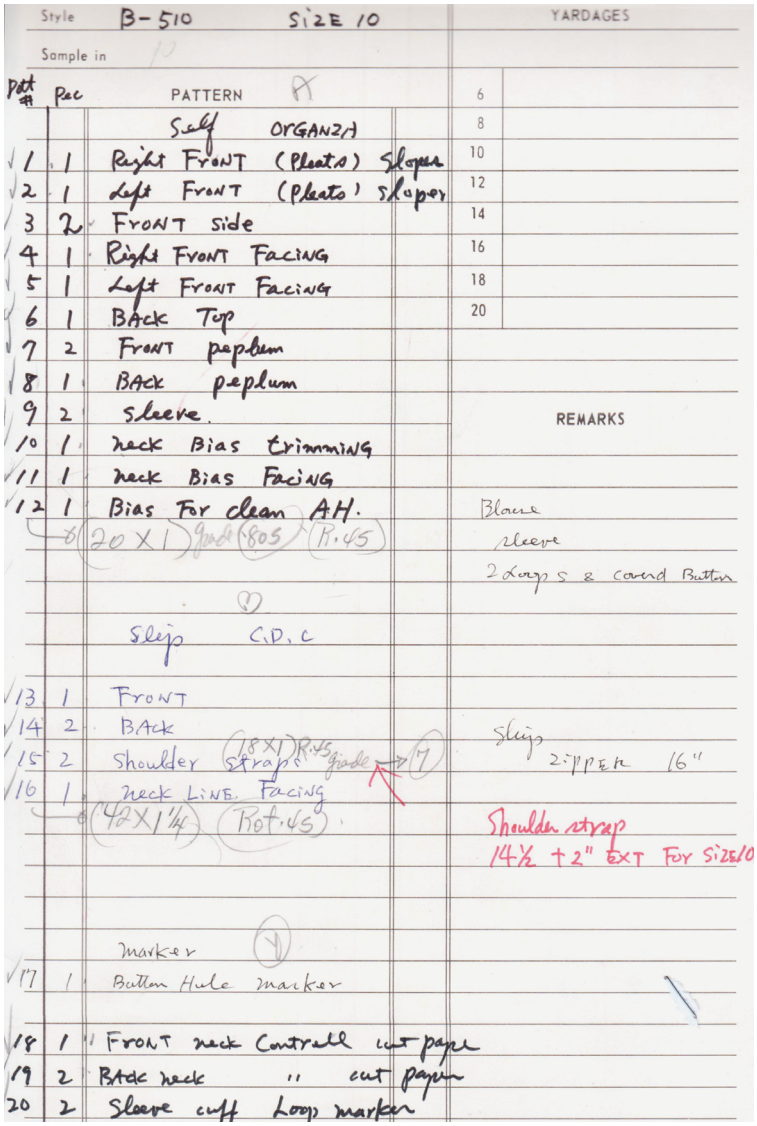


FIGURE 5 A cutter's must.
Courtesy of Wes Gordon, Inc.

uncommon to find when the lay is finished that the selvages on the opposite side are uneven because the plies are not equal in width.

The spreading continues until the lay reaches the number of plies specified by the cutting order. In some spreads, layers of tissue paper are spread at the end of each bolt, to indicate a change in the shading on a bolt, or after a particular number of plies. Once the spread is finished, the marker is placed and secured on the top layer with staples or weights.

Vertical **spikes** or **pins** are used to secure plaids and other fabrics that require precision cutting and matching. The spikes are set at regular intervals on each side of the table. As each layer is spread, it is carefully matched to the one below it and set on the spikes to secure it when cutting.

Cutting

Cutting methods vary widely, depending on the equipment available, the skill of the cutter, the total number of garments to be cut, the number of garments to be cut in a spread, the number of plies or depth of the spread, the material to be cut, the thickness of individual plies, and the type of spread.

FIGURE 6 Automated cutting machine.
Courtesy of Jeffery Diduch and Empire Clothing, Inc., Montreal. Photo by the author.

Cutting equipment ranges from manual hand shears to computer-controlled machines that use laser beams (Fig. 6). One of the most common cutting machines is the portable electric straight-blade knife (Fig. 7), but round blade knives, stationary band knives, **dies**, and clickers are also used.

FIGURE 7 Bluestreak electric straight-blade knife.
Courtesy of Eastman Machine Company

The most common cutting devices in small factories and design rooms are shears, small electric round-blade knives as shown in Figure 8, and straight-blade knives. The cutter guides each of these around the pattern outlines drawn on the marker. If the cutting is inaccurate, the operators must compensate by stretching, easing, and trimming to make the parts fit together.

FIGURE 8 Chickadee round-blade knife.
Courtesy of Eastman Machine Company

Marking and Work Indicators

After cutting, the component parts are marked with **work indicators** as a guide for assembling the sections correctly. The type, location, and number of indicators varies from one design to another, but there are only two basic groups: edge or perimeter marks and internal marks.

Edge marks, or **notches**, are the least expensive and the most widely used work indicators (Fig. 9). Notches are placed on the edges of the component parts so that operators can align and sew the parts together quickly and accurately. This is done with a tool such as the HotNotcher that notches all layers in a stack at the same time.

Internal marks, as the name implies, are placed on the body of the component. They are used for aligning and positioning pockets, overlays, trims, buttons, and buttonholes, and are more time-consuming to place than edge marks. The most common internal marks are drill holes (Fig. 10), chalk marks, marking dyes or wax, fluorescent ink, and thread tacks. Used on less expensive garments, a drill makes holes in all layers at the same time.

Bundling

After the cut parts are marked, they are separated into **bundles** according to the first operations to be

FIGURE 9 HotNotcher.
Courtesy of Eastman Machine Company

FIGURE 10 Drill.
Courtesy of Eastman Machine Company

performed on them. Some are sent to subcontractors for fusing, quilting, tucking, or pleating. Others are sent to the sewing room or to independent contractors for completion.

Sewing Production

Once a style is cut, marked, and bundled, it is distributed to outside contractors or to the operators in the sewing room so that the individual parts can be joined by one step or operation at a time until the garment is completed. Unlike the cutting room, which is large, spacious, and quiet, the sewing room is filled with machines and the sounds they make.

In apparel manufacturing, several production systems with many variations are used to assemble garments. Two of the most common are **whole-garment** or **single-hand production** and the section system.

Whole-Garment Process

In whole-garment production, **making up** or **making through**, one person makes the entire garment. This system is inefficient and costly because it requires a highly skilled individual to perform operations that could be done at a lower cost by lesser-skilled workers. It is rarely strictly applied, except by custom clothiers, home sewers, and samplemakers, but variations are used in haute couture ateliers, **Savile Row** workrooms, and high-end **ready-to-wear**.

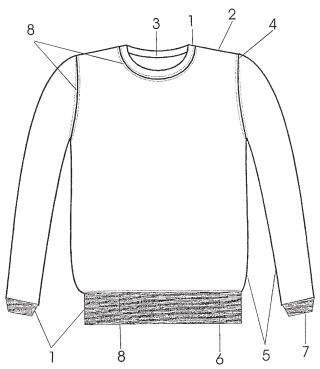
In high-end ready-to-wear, a typical workroom has **operators**, who use single-needle lockstitch machines to do all of the machine work on a garment, and **finishers**, who do the handwork, embroidery, and beading. Most workrooms have a presser, even though the operators may do some of the underpressing during the construction of the garment. Some also have overedge or pinking machines, but few have other special equipment, such as a buttonholer, button-sew machine, or coverstitch machine.

Section System

Most manufacturers use a variation of the **section system**. In this system, each operation—such as pocket making, placket making, binding, sleeve closing, and zipper setting—is completed by a different person on a number of identical pieces with the most appropriate machinery. The sewing room has numerous **lockstitch machines**, as well as **overedgers**, **blindstitch hemmers**, **safety-stitch** and **mock safety-stitch machines**, buttonholers, and button-sew machines. Operators are trained to sew one or more specific operations on a particular type of machine.

Machines are often fitted with special attachments or feet so the operator can perform a specific task accurately with a high degree of efficiency. To maximize production in small- and medium-sized factories, operators ar to perform more than one operation, and some are trained to sew on more than one type of machine.

SWEAT-SHIRT 02



Union Special

Product: Sweat-Shirt 02
Project:
Factory:
Pieces : 1000 Pieces per 8 hours
Machines: 17 22 Days/Month
264000 per Year
22000 per Month
Auslastung: 100%
Description:

Power total 12,75 Kilowatt
Air Total 1240 Liter p minute

MACHINE STYLE Sorted	Min.	Max.	Actual
CS122 K02 2D64/ UT4	5	5	4,17
SP161 S800 M032	2	2	1,46
SP172 S900 HAC+CP+CC+VC	4	5	3,54
SP172 S900 HAC+WS72800 AP-1A	2	3	1,77
SP172 S900 HAC+WS72800 AQ-1A	2	2	1,04
	15	17	11,98

OP.		MACHINE STYLE	te per	Pieces Daily per M/C	Total M/C	No of M/C	Pieces per h per M/C
1	Close collar cuffs+bottom rib	SP161 S800 M032	70	686	2	1,46	86
2	Close shoulder seams	SP172 S900 HAC+CP+CC+VC	40	1200	1	0,83	150
3	Att. rib collar	SP172 S900 HAC+WS72800 AP-1A	35	1371	1	0,73	171
4	Att. sleeves	SP172 S900 HAC+CP+CC+VC	60	800	2	1,25	100
5	Close sleeves+side seams	SP172 S900 HAC+CP+CC+VC	70	686	2	1,46	86
6	Att. bottom rib	SP172 S900 HAC+WS72800 AQ-1A	50	960	2	1,04	120
7	Att. rib cuffs	SP172 S900 HAC+WS72800 AP-1A	50	960	2	1,04	120
8	Topstitch coll.,sleeves+bottom	CS122 K02 2D64/ UT4	200	240	5	4,17	30
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

FIGURE 11 Production sequence for a sweatshirt.
Union Special Technical Training Center

Because each garment is assembled one operation at a time, production begins with a list of the individual components and a list of all operations required to complete the garment (Fig. 11). For simple garments, such as T-shirts, briefs, and pull-on pants, which are assembled with only a few operations, the list is obviously much shorter than for more complex garments, such as trousers, jeans, and simple jackets that require numerous operations.

INDUSTRIAL MACHINES

Thousands of different sewing machines are used in the needle trades. They range from the single-needle lockstitch machine, which is a multipurpose machine that can be used for many different operations, to hundreds of single-purpose machines, such as the button-sew machine, buttonhole machine,

bartacker, and welt pocket machine, which can be used only for a single, specific operation.

In addition to the many trade names used for the individual industrial machines, most sewing machines are classified according to their intended use and the method used for forming the stitch in ASTM D6193, which has recently replaced the U.S. Federal Standard No. 751A. This standard "establishes, defines, and illustrates the requirements for the types of stitches, seams, and stitching formations specified in Government specifications for the fabrication of sewn items." (It can be ordered from the American Society for Testing and Materials, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, or www.astm.org.) This classification system is used by sewing machine and apparel manufacturers and governments throughout the world.

But what exactly is a sewing machine? According to Textile/Clothing Technology Corp. ([TC]^2) expert Jack Nienke, it is a mechanical unit with a coordinated motion that moves the material and handles thread. It can fasten two or more plies together or decorate fabric with a pattern of stitching.

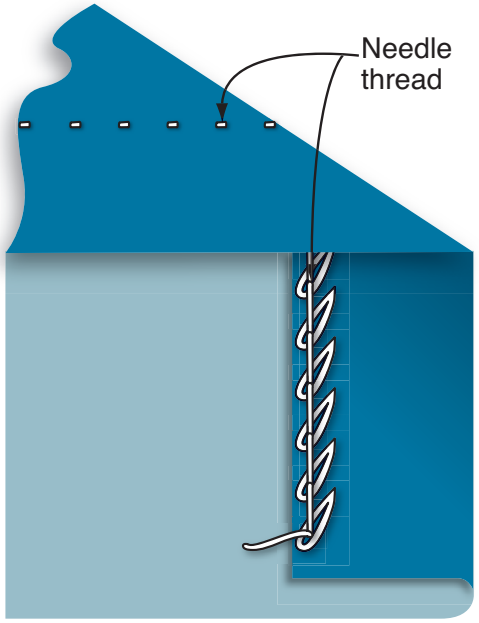
The stitches are divided into six major stitch classes based on the mechanism used to control the lower thread:

Class 100—Chainstitch
Class 200—Hand stitch
Class 300—Lockstitch
Class 400—Multi-thread chainstitch
Class 500—Overedge stitch
Class 600—Coverstitch

BOX 4 Stitch Classifications

Class 100—Chainstitch

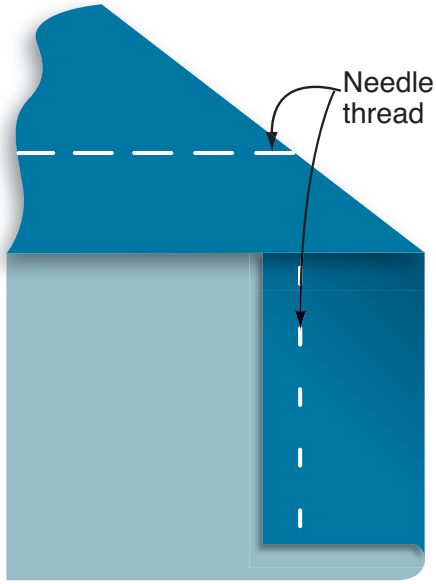
One of the simplest stitch types, the **chainstitch** has one or more needle threads and is formed by intralooping. This stitch is very insecure and unravels easily if a stitch is broken or skipped or if the last loop is not fastened securely. This stitch is used for sewing buttons and buttonholes, **hemming**, **basting**, and **padstitching**.



Chainstitch (Class 100).

Class 200—Hand Stitch

Generally formed by hand, the **hand stitch** is made with a needle that is passed from one side of the material to the other as a single line of thread. The most important machine to duplicate this stitch is a **pickstitching** machine (209); pickstitching is used as a decorative detail on the outer edges of jackets.

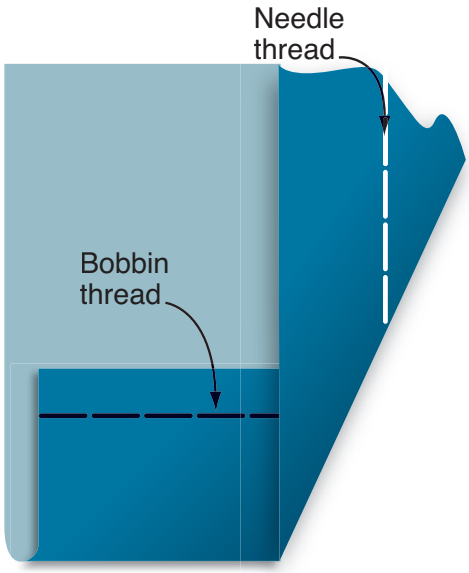


Hand stitch (Class 200).

BOX 4 *(continued)*

Class 300—Lockstitch

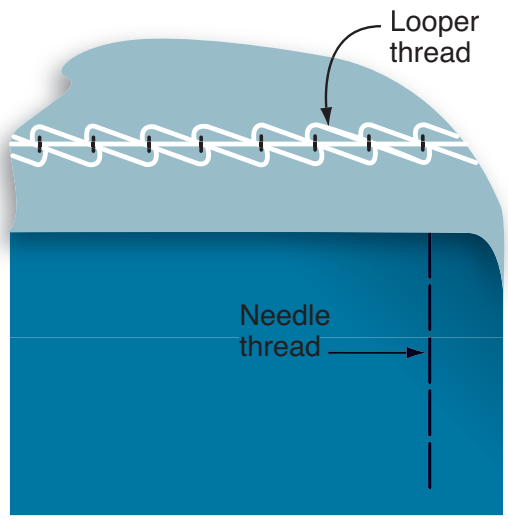
The most common stitch type, the **lockstitch** has two or more groups of threads that interlace to form the stitch. One group is called the *needle threads* and the other the *bobbin threads*. These stitches do not unravel easily and always require a bobbin. Very versatile, they are used for seaming, hemming, and setting zippers and pockets.



Lockstitch (Class 300).

Class 400—Multi-Thread Chainstitch

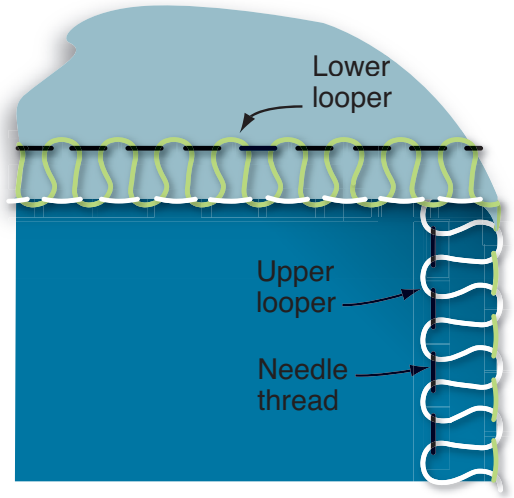
Sometimes called a **double-locked stitch**, the **multi-thread chainstitch** has two or more groups of threads that interlace and interloop with each other. One group is called the *needle threads* and the other the *looper threads*. This stitch is actually stronger than the lockstitch; however, if the threads are not properly secured on the finishing end, it will unravel. It is used for seaming and in combination with the overedge stitch on overlock machines. When used for seaming, the needle thread determines the seam strength and the looper threads can be finer.



Multi-thread chainstitch (Class 400).

Class 500—Overedge Stitch

The **overedge stitch** is formed with one or more groups of threads that interloop to form a thread sheath around the fabric edge. The most common stitches have one or two needle threads and one or two looper threads.



Overedge stitch (Class 500).

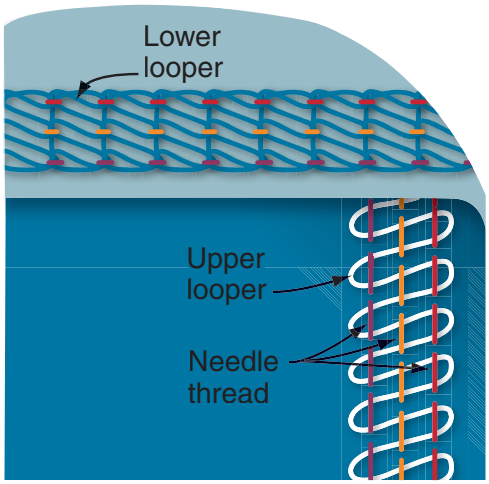
Overedge stitches are very elastic and do not unravel easily. They are used for neatening edges, seaming woven and low-stretch knitted fabrics, and forming decorative edgings. All of the stitches can be used for neatening; however, one- and two-thread overedge stitches cannot be used for seaming because the stitch opens up when stressed transversely. And because the stitches produce a closed seam that cannot be pressed open, it is not always acceptable on better garments. When used for seaming, the needle thread determines the seam strength.

This stitch is frequently combined with a multi-thread chainstitch (401) to seam and finish the edges.

In this text, the terms *overedge machine*, *overlock machine*, and *serger* are used interchangeably because you may encounter any of them in the workplace.

Class 600—Coverstitch

The most complex stitch class, the **coverstitch** is generally formed with three or more groups of threads that cover the raw edges of both surfaces. Very elastic, it is used to create low-bulk and decorative seams on underwear and knitted casual garments. Threads should be strong with a soft hand.



Coverstitch (Class 600).

The most widely used stitches are the lockstitch (Class 300), which requires a bobbin and hook or shuttle to form the stitches; the chainstitch (Classes 100 and 400); and the overedge stitch (Class 500), which relies on loopers and spreaders to form stitches.

Depending on the machine's mechanisms, a machine can produce one or more different stitch types. Machines that can make only one stitch type (Fig. 12) include the single-needle lockstitch (Class 301) and zigzag lockstitch (Class 304), which make lockstitches, and the single-thread blind hemmer (Class 103) (Fig. 13), which makes a single-thread chainstitch.

FIGURE 12 Lockstitch machine.
Photo by the author.

FIGURE 13 Blindstitch machine.
Photo by the author.

The most widely used machine that makes more than one stitch type is the safety-stitch machine (Fig. 14). On these machines, four to six threads make an overedge stitch to finish the edge while a

FIGURE 14 Overedge machine.
Photo by the author.

seam is stitched with a needle and bobbin or a needle and looper.

The focus of this text is on machines that are most often used in a small factory or workroom: the lockstitch machine, the single-thread **blindstitch machine**, and the overedge machine. With these machines, you can sew most garments and home furnishings.

Pressing

An integral part of production, **pressing** is the process of shaping the material, garment components, and completed garments with heat, moisture, pressure, and time. The two types of pressing operations are underpressing and off-pressing.

Underpressing, or *in-process pressing*, includes all pressing operations performed during the construction of the garment. It prepares each component for the next sewing operation and includes **busting seams**, pressing darts and pockets, molding and shaping garment parts, fusing, creasing, and shrinking. Although underpressing adds to the quality of the garment, it is generally kept to a minimum because it increases the cost of production. On better garments, underpressing occurs at various stages of the assembly.

Sometimes called **top pressing** or **finish pressing**, **off-pressing** is the final pressing. It describes the pressing operations performed after the garment has been assembled. It includes pressing edges, reviving the nap, removing any glazing, and smoothing the fabric. It does not mean pressing from the face or top side. On budget and some moderately priced garments, it is often the only pressing and can be done on the premises or by a contractor.

Finishing, Inspecting, Packing, and Shipping

After sewing is completed, the garments are finished, pressed, and inspected, but the order in which this is done varies with the manufacturer.

Finishing includes a variety of operations, such as trimming all loose threads, top-pressing, sewing or pinning in hang tags, and closing buttons, snaps, and hooks and eyes. It also includes a variety of hand-finishing details such as sewing buttons, labels, zippers, shoulder pads, and linings, which are used only on better and high-end ready-to-wear because of the increased labor costs.

To ensure a uniform product, the finished apparel is examined and inspected for flaws in workmanship, fabric defects, and spots or stains before packing and shipment. Garments may also be measured to check the fit. Some firms inspect all garments before shipping; others inspect only a sampling.

At the final inspection, thread ends are trimmed and hang tags attached. Garments that meet the established quality specifications are folded or hung for shipping. Items with defects are routed to the appropriate workers for correction or for sales as **seconds**. Unsalable garments are discarded or used as samples when training new operators. The percentage of unsalable items varies widely among production plants.

THE MERCHANDISING PROCESS

The merchandising process includes identifying, producing, and promoting products that relate to the firm's objectives; it is used to establish goals for long- and short-term plans. The merchandising process also identifies consumer needs and wants and determines how to satisfy them. Thus, although the primary function of the merchandising department is to sell products, the merchandising process begins long before the product is created.

Successful merchandising requires a thorough knowledge of the firm—its image, goals, and capabilities; a description of its target customer by gender, age, income, interests, and lifestyle; and a definition of its market, according to garment type and use, price range, **size range** and figure type, quality, value, and fashion.

The merchandising process thus provides a foundation for design and business strategies. It greatly influences the designs produced by the firm, beginning with the initial direction to the design department, continuing to the editing of styles that do not fit the firm's image and target customer, and ending with promotion and sales.

The director of merchandising is responsible for all aspects of merchandising the product. In a small firm, the designer or owner may do all the merchandising. In larger firms, staff members with specific skills and responsibilities share the work under the supervision of a merchandising manager. Many firms, however, have no merchandising department. They operate with only skeleton staffs and rely on freelance sales representatives for merchandising and marketing services.

KEY WORDS

adopt
armscye
assistant designer balance
basting
biceps line (underarm line)
binding
blindstitch hemmer
blindstitch machine
block
body shapes
bolt
bundles
bundling
busting seams
CAD (computer-aided design)
chainstitch
CMT (cut-make-and-trim)
comfort, wearing, movement ease
contractor
copywriters
costing
coverstitch
croquis
crossgrain (crosswise grain)
cross-trained
cut parts
cutter's must
design department
design ease
designer
design studio
dies
double-locked stitch
drilling
duplicates
ease
fabrication
face down
face to face
face up
fallout
filling
finishers
finish pressing
first pattern
fit model
fitting ease
foundation pattern
freelance designer
fusing
garment components
garment parts
goods
grader
grading
grain
hand stitch
haute couture
hemming
in house
interlining
in the fold
knockoff
lay
laying up the cut
layout
lengthwise grain
lining
lockstitch machine
loom
main fabric
making through
making up
marker
marking (marker making)
material utilization
merchandising department
mock safety-stitch machine
model number
multi-thread chainstitch
negative ease
notches
notching
off-pressing
one-off
on the double
on-the-open
open lay
operators
overedger
overedge stitch
padstitching
pattern layout
patternmaker
pickstitching
piping
pleating
ply (plies)
pressing
production department
production engineer
production pattern
production patternmaker
proofing
prototype
ready-to-wear
rep
safety-stitch machine
sample cut
sample garment
samplemaker
sample size
Savile Row
seam binding
season
seconds
section system
self (outer or shell material)
selvage
shirring
silhouette
silk-screening
single-hand production
size range
sketch
sloper
spaghetti tubing
spikes (pins)
spread
spreader
spreading
stacking up
structural line
style number

stylist
target customer
top pressing
trend setting
trial garment
trim fabrics
trimmings
underpressing
warp
weft
whole-garment production
with nap
work indicators
zipper

SUMMARY

Apparel manufacturing firms are just as diverse as the designs they produce. Clearly no two firms are exactly alike, but all of them focus on providing the target customer with apparel that meets his or her expectations for performance, quality, and value.

Apparel manufacturing is composed of three processes: design, production, and merchandising. The design department develops ideas into styles; the production department produces or manufactures the garments; and the merchandising department promotes and sells them.

REVIEW QUESTIONS

1. Describe the three processes in apparel production.
2. What are the responsibilities of the designer or design department?
3. Describe the three categories for design ideas.
4. What is a croquis?
5. Why is fit important at the design stage?
6. What are the differences between samples and production garments?
7. Why is costing important?
8. Discuss several methods for reducing costs.
9. Describe the five stages of the cutting process.
10. Describe material utilization and why it is important.
11. What is a marker?
12. Compare a marker and pattern layout.
13. Why is a separate marker needed for each material used in the style?
14. What is a cutter's must?
15. Describe several work indicators and how they are used.
16. How do whole-garment production and the section system differ?
17. Why are special feet or attachments used?
18. Why is the ASTM D6193 important?
19. Describe the six stitch classifications.
20. What are the differences between underpressing and off-pressing?
21. Why are finished garments measured before shipping?
22. What are the final steps of garment manufacturing before the garments are shipped to stores?
23. Why is merchandising important?

Quick-Start Tutorial

This quick-start tutorial provides the essential information you will need to select tools and supplies, learn apparel industry applications, and assemble samples using those applications. If you are a novice, this chapter will introduce you to the fundamentals of sewing. If you are more experienced, it will help you transition from home sewing methods and provide a helpful review as well as explain how this text differs from those you've used in the past.

Unlike most texts, this text is application or sample focused. Each application includes a specific pattern and step-by-step instructions for completing a sample using a few easy-to-sew fabrics such as muslin, jersey, interlock, double knit, and fleece. This reduces the variables of fabric characteristics, fit, and challenges that you encounter when making sample garments and allows you to focus on mastering specific construction techniques. It also allows you to learn a variety of applications and comparative methods and to develop the skills to select the most appropriate ones when making sample garments in this and other courses and when you become a designer.

Chapter Objectives

After completing this chapter, you will be able to:

- Identify and select tools and supplies.
- Select appropriate fabrics for sampling.
- Prepare fabrics for sampling.
- Prepare fabrics for garment designs.
- Identify the basic elements of fabrics.
- Describe how yarns are made.
- Describe the differences between natural and manufactured fibers.
- Explain how fabrics are made.
- Identify lengthwise and crosswise grains.
- Describe the importance of grain.
- Identify off-grain fabric.
- Explain bias cut.
- Discuss the differences among knit, woven, and nonwoven fabrics.
- Label a pattern.
- Compare industry and commercial patterns.
- Lay out and cut fabric parts with a pattern.
- Cut fabric parts without a pattern.
- Identify commonly used pressing tools.
- Use a tape measure for dividing measurements.
- Discuss techniques for coping with troublesome fabrics.

EQUIPMENT AND SUPPLIES

This section includes helpful information about the various tools and supplies recommended in Appendix 9, Basic Tools and Supplies. Depending on the equipment provided in the sewing laboratory at your school, your instructor may recommend additional items or indicate that some will not be needed.

HINT: When purchasing tools, select and buy the best quality you can afford.

Fabric for Sampling

The applications in this text were developed for a few basic fabrics. A woven cotton fabric such as **muslin** or quilting cotton is recommended for the samples. Many of the optional samples recommend other fabrics that are sometimes more difficult to sew. This is an opportunity to experiment with these materials, improve your skills when sewing them, and learn more about the individual properties of different fabrics that influence the design's construction and success.

You will need 5 yards of 100% cotton muslin or a similar quilting cotton to begin.

At the store, unroll the fabric and examine it. The fabric should be **on-grain** with the crosswise yarns at right angles to the selvages (Fig. 1). The crosswise yarns, or **crossgrain (crosswise grain)**, that extend from one selvage to the other at the end should be at right angles to the lengthwise yarns, or **lengthwise grain**. If they are not, the grain may affect the success of your samples.

It is not uncommon for fabrics, especially inexpensive ones, to become distorted during the weaving or finishing processes. When this occurs, the grain is skewed and the fabric is **off-grain**. If the fabric has been treated with a special finish, it cannot be straightened and is permanently off-grain.

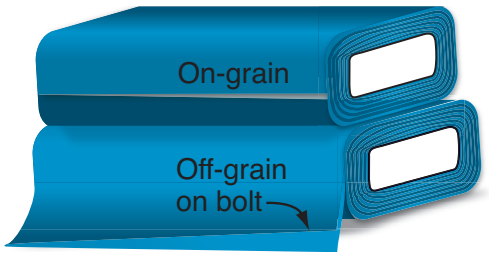


FIGURE 1 Bolts of fabric: on-grain and off-grain.

Garments made from off-grain fabrics will not drape properly.

When the fabric is torn at the end, it is easy to identify on-grain fabrics. Fold the fabric lengthwise, matching the selvages. Smooth the top layer to remove any wrinkles. The fabric is on-grain if the torn edges match (Fig. 1). If they do not, the fabric is off-grain. If the difference is only a small amount—no more than 1″ at the selvages—the fabric can be used for most samples without compromising the quality of the sample. It should not be used for sample garments; even this small amount will affect the drape.

HINT: If the available muslin is off-grain, look at cotton quilting fabrics. They are the same weight and generally a better quality than muslin.

HINT: Because many fabrics have special finishes that set the grain permanently, off-grain fabrics can sometimes be straightened temporarily, but not permanently. For a temporary fix, pull two opposite corners until the grain is aligned (Fig. 2).

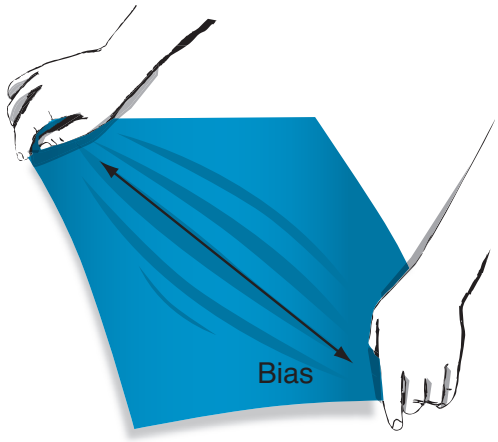


FIGURE 2 Temporary fix for off-grain fabrics.

Knit fabrics that are finished off-grain cannot be straightened.

Fabric Preparation for Sampling

Press the muslin or cotton with a steam iron to use for the samples. Do not preshrink in the washer and dryer.

When the fabric looks the same on both sides, it doesn't matter which side is the **face** or right side and which is the **back** or wrong side, but you should be consistent.

HINT: I use chalk to mark the wrong side of each section with an X—even when working with muslin, which looks the same on both sides.

Fabric Preparation for Garments

Generally, when preshrinking fabric, you will use the method you plan to use for the finished garment. The exception is when making sample garments. To maintain the pristine finish of these fabrics, do not wash and dry them.

Examine the fabric care recommendations when purchasing fabrics. These directions are generally found on the end of the fabric bolt. The label should indicate whether it requires dry-cleaning or can be washed and dried. Some labels indicate that the manufacturer has preshrunk the fabric, or they indicate the amount of shrinkage.

If the fabric has not been preshrunk, preshrink it before cutting. Other fabrics such as interlining, backing, and lining materials must also be preshrunk to remove any temporary finishes and shrink the fabric. Preshrinking will relax knits that were stretched when rolled onto the bolt.

To preshrink washable fabrics, wash and dry the fabric using the method you plan to use on the finished garment. Some fibers have progressive shrinkage and should be preshrunk three times. To preshrink dry-cleanable fabrics, steam the fabric or have a dry cleaner preshrink it for you. Most fabrics will not require dry cleaning.

HINT: When making garments for sample garments, consider dry-cleaning washable fabrics to maintain the pristine quality of the fabric.

Machine Tools, Accessories, and Supplies

Bobbins, bobbin cases, special machine feet, tweezers, screwdrivers, Allen or needle wrenches, lint brushes, needle threaders, and threading wires are essential tools needed when threading, adjusting, and cleaning the machine. Purchase several bobbins to use in the workroom; these may be different from the bobbins used in your home machine. Generally bobbin cases are provided because each bobbin case must be adjusted for a specific machine.

In addition to a regular screwdriver for changing machine feet, attaching folders, and cleaning the machine, you'll need a small screwdriver for adjusting the tension on the bobbin case and replacing some machine needles. Some machines require an Allen or needle wrench for removing and setting needles.

Needle threaders and threading wires are useful tools for threading needles and intricate machines. Your instructor will tell you which special feet need to be purchased and which are available in the workroom.

When the applications in this text are completed on home sewing machines, most samples can be stitched with universal point machine needles. For industrial machines, use the needles recommended for that particular machine. On most machines, this information can be found on the machine bed. These needles will be available in the workroom or bookstore.

HINT: I use small needles when possible; they are less likely to leave holes if the stitching has to be removed. In the sewing laboratory, I prefer small needles because they generally break before becoming dull.

For the samples in this text, use all-purpose, medium-weight threads. Always choose a quality thread. Nothing is more frustrating than thread that breaks frequently. Cotton and cotton-wrapped polycore threads are the best choices for muslin and some knits because they cause fewer stitching problems (see Fig. 3). Look for terms such as *long-staple*, *mercerized*, *Egyptian cotton*, or *Peruvian cotton*, which indicate quality. For knit samples, use polyester thread, which is more elastic and durable than cotton.

For overedging fabrics, choose lightweight, two-ply threads to reduce bulk, weight, and cost. When sewing garments, choose threads in a fiber, weight, and color that are appropriate for the fabric.

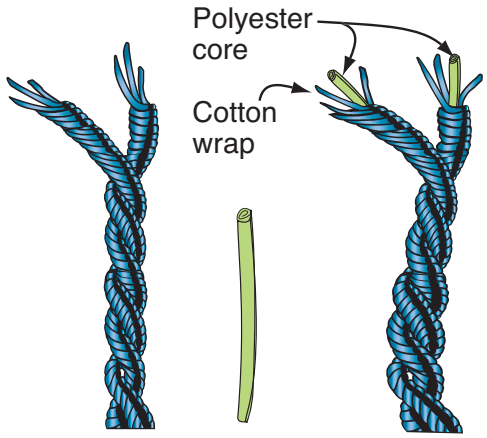


FIGURE 3 Thread types: spun, filament, core-spun.

Other Sewing Equipment

Cutting Equipment

Scissors are used for cutting threads, trimming, and clips. They have two matching blades and handles and are rarely more than 6″ long. *Nippers* have a single ring and are held in the palm of the hand. They are used at the machine for cutting threads and small clips.

Shears are designed for cutting fabrics in a wide range of weights. They have a small handle for the thumb and a larger handle for several fingers. They can have straight or bent-handles and are generally 7″ or longer; 8″ is a good length for your first pair. Quality shears can be stainless steel or chrome over nickel. Ideally, you should have several pairs: a chrome-plated pair for cutting most fabrics, serrated blades for cutting lightweight and squirmy fabrics, and a stainless steel pair for cutting paper, polyester, nylon, and microfiber fabrics.

HINT: Scissors and shears are easily damaged by polyester, nylon, and microfiber fabrics as well as paper. If you can afford only one pair of quality shears, choose stainless steel; they do not dull as quickly as chrome-plated ones.

Quality is particularly important when choosing scissors and shears. The blades should cut over the entire cutting edge, including the points.

HINT: If you are left-handed, use left-handed shears or learn to cut with your right hand.

A *rotary cutter*, which requires a special mat to avoid damaging the table, is particularly useful for cutting straight edges and multiple layers. This handheld tool made with a rolling razor blade is available in two sizes—45 mm and 60 mm—and can be used in the right or left hand. Generally, the smaller size is better for cutting intricate curves. The blades dull quickly when cutting synthetic fabrics; replacement blades are readily available. Most have a blade safety cover.

Seam rippers are used to remove unwanted stitches and to cut buttonholes. They are available in several sizes. A seam ripper should be extra sharp and cut smoothly. If it does not, it is dull and should be replaced.

Measuring Tools

A 6″ ruler is a handy tool to use at the sewing machine.

Tape measures are available in fiberglass or durable vinyl that will not stretch, tear, or shrink. They can be marked in inches or centimeters on one or both sides. Most are 60″ (150 cm) long, but they can be 120″ or 10 feet.

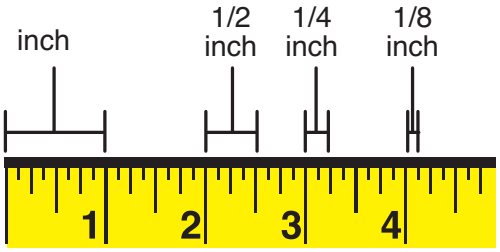
HINT: I prefer a tape measure that begins with the number 1 at each end and has centimeters on one or both sides.

If you are using an old tape measure, compare the measurements with a steel ruler to be sure the tape is printed accurately. Tape measures are also handy tools for conquering math problems such as dividing measurements.

See-through rulers (such as C-Thru brand) are particularly useful for sewing as well as patternmaking. These rulers have 1″ grid markings with 1/2″, 1/4″, and 1/8″ increments. The edges are marked with 1/16″ increments. They are available in several widths and lengths. A 2″ × 18″ ruler is the most versatile size. Occasionally, the printing on a ruler is skewed and the printing is not parallel to the edges. Examine it carefully and compare the measurements to a steel ruler.

BOX 1 Easy Math

Dividing measurements can be challenging. Use a tape measure to do this easily.



To divide a number in half, fold the tape measure with the beginning end at the number you are dividing. For example, when dividing 10-1/2″ in half, align the end of the tape measure with 10-1/2″. The measurement at the fold is 5-1/4″. You can continue folding the beginning end of the tape measure to get a quarter (2-1/8″) and an eighth (1-1/16″).

To convert inches to centimeters, use a tape measure or see-through ruler with inches on one side and centimeters on the other.

Marking Tools

For the applications in this text, a sharp *#2 pencil*, *chalk pencils*, *chalk wheels*, *nongreasy soap slivers*, and *erasable pens* (air-erasable and water-erasable) can be used. When marking garments, avoid colored chalks, pencils, and erasable pens, which may leave a permanent stain. Use wax chalk only when sewing wool and hair fibers.

Pins, Weights, and Sprays

To cut accurately, use *pins*, *weights*, or a *temporary adhesive spray* such as OESD's 202 to hold the pattern

sections in place for cutting. You can use large washers from the hardware store as weights; they are inexpensive and flat. Superfine pins have a diameter of 0.5 mm; they are less likely than larger pins to leave pin scars on fabrics. Surprisingly, they also work well on many densely woven fabrics. Flower pins are extra long and have large, flat heads. They are a good choice when placing a ruler on top of pins.

HINT: I keep my used pins in a separate box from the new ones so I can use only new pins when sewing delicate fabrics. I also discard all pins that fall on the floor.

To avoid accidents, learn to stitch without pins. Pins shatter easily when hit by the needle.

Safety pins are a good tool for marking fabrics on the right side and marking matchpoints on open-knit or open-weave fabrics such as lace, mesh, net, and novelty fabrics.

Hand Sewing Needles

Needles with a large eye are easier to thread. You'll need three needle types (Fig. 4): *crewel* or *embroidery needles*, which are short, to use for finishing stitches such as hems; *darners*, which are long, for basting; and *tapestry needles* (size 22) for turning bias tubings. Sizes 8 and 9 are a good choice for sewing the samples in this text and similar-weight fabrics. When making garments, use larger needles (size 5 or 6) for heavier fabrics and finer needles (size 9 or 10) for sheers and lightweight materials. Use betweens for tailoring.

HINT: Use *beeswax* or a white candle to wax the thread for strength and to reduce knotting and twisting. Press the thread to melt the wax into the fibers and to prevent it from rubbing off during the first few stitches.

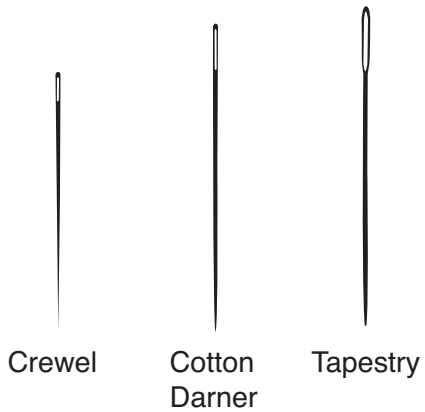


FIGURE 4 Needle types: crewel, darner, tapestry.

Sewing Thread

Sewing thread is a yarn used to sew the garment parts together. It should make a smooth, flat stitch when sewn at high speed and last for the useful life of the garment.

Sewing threads are multi-ply threads composed of cotton, nylon, or polyester, which are made into three thread types: spun, filament, or core-spun. **Spun thread** is composed of cotton or polyester **staple fibers**. Continuous **filament thread** is composed of 100% synthetic filaments. **Core-spun thread** is manufactured with a polyester filament yarn at the center, protected by cotton fibers on the outside (see Fig. 3).

Spun thread is the most versatile and least costly thread. Compared to filament thread, it is weaker and less likely to pucker. Filament thread produces the neatest seams, but it is most likely to cause seam pucker. Compared to spun thread, filament thread is finer without sacrificing strength. Core-spun thread combines the strength and fineness of filament thread with the sewing performance of spun fiber thread. It is well suited for seaming durable-press garments and is the most expensive. Dual Duty is a common core-spun thread.

Thread can have a variety of finishes. The most common finishes are mercerized, glacé, and textured. **Mercerized** and **glacé** finishes are applied to natural cotton or soft threads. **Textured** finishes are applied to synthetic filament threads.

Mercerized threads are smoother, stronger, more expensive, more lustrous, and more stable than natural cotton threads; they are used in the production of better garments. Glacé thread is the strongest cotton thread with the most resistance to abrasion. In apparel production, it is used primarily for gathering rows in high-end production. Textured threads are elastic and have a soft hand. They are used primarily on overlock underthreads when a soft seam is required.

Threads are available in many sizes. In production, the thread choice depends on many factors such as seam strength, fabric weight and type, end use, stitch type, seam type, and needle size. Generally, finer threads are preferred because the breaking strength of the seam should be less than that of the fabric being sewn so that, when stressed, the seam will break before the fabric tears. Fine threads require smaller needles that are less likely to distort and damage the fabric; they sink into the fabric instead of lying on the surface, reducing the amount of abrasion received by the thread.

Patterns

Each sample in this text was developed for a specific construction application. The directions for each specify one or more pattern pieces.

The patterns have been drafted with appropriate seam allowances ranging from 1/4″ to 1″ wide. To keep the samples simple and easy to complete, support materials such as interlinings are rarely included.

A few samples have no pattern pieces because they are simple rectangles. For these, the sizes are indicated with the width first. A 5″ × 9″ rectangle is 5″ on the crosswise grain and 9″ on the lengthwise grain; a 9″ × 5″ rectangle is 9″ on the crosswise grain and 5″ on the lengthwise grain.

Grainline

The **grainline** (Fig. 5) is the most important label on the pattern. It marks the lengthwise grain and determines the drape of the fabric. The grainline indicates that the pattern is to be placed on the fabric with the marked grainline parallel to the selvage.

HINT: If the garment or section is cut on a different grain or off-grain, it will not drape properly.

Work Indicators

Notches are used on the outer edges of patterns to indicate matchpoints, the width of seam or hem allowances, the beginning of darts or tucks, the ends of zipper plackets, facing foldlines, and garment centers. The notches on the patterns in this text are indicated with a short (1/8″) line. Use a short clip to mark the notch on your fabric.

Internal marks on the body of a garment section are indicated with a small circle (Fig. 6). Use an awl to pierce the pattern. Use chalk or a sharp pencil to transfer the mark to the right side of the fabric.

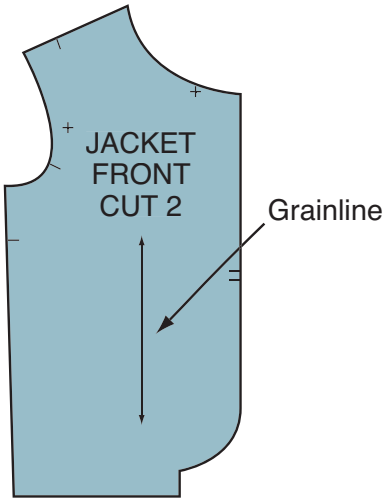


FIGURE 5 Grainline marked on a pattern piece.

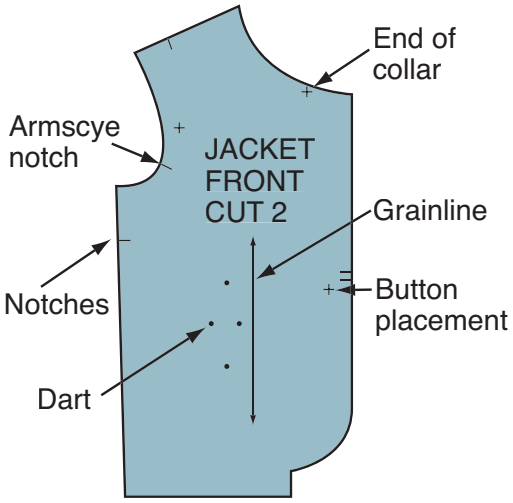


FIGURE 6 Work indicators on a pattern piece.

Seam Allowances

The **seam allowance** (Fig. 7) is the distance between the seamline and the cut edge. On commercial patterns, the seam allowance is generally 5/8″. In this text, the seam allowances vary from 1/4″ to 1″, depending on the application and the location and intricacy of the seam. Read the directions carefully to determine the correct seam allowance.

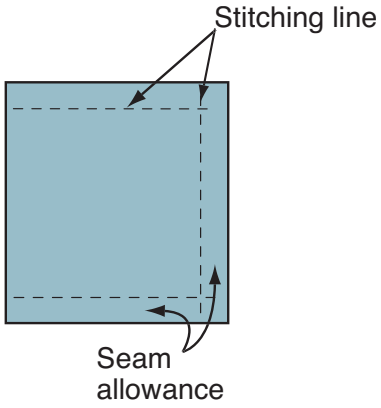
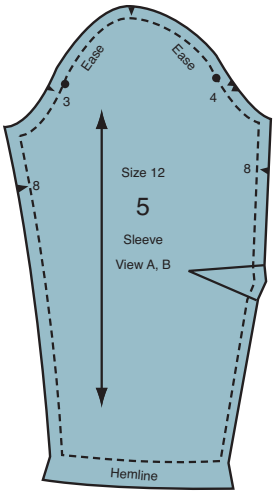
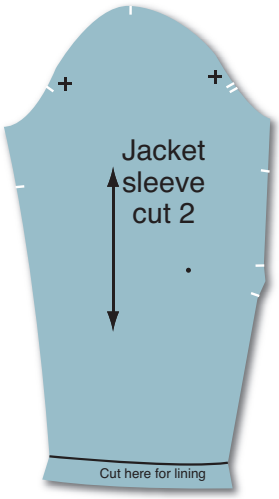


FIGURE 7 Seam allowances.

BOX 2 Comparison of Patterns



Sleeve pattern from a commercial pattern.



Sleeve pattern from this text.

The patterns included in this text are similar to those used in the industry. Industry patterns and commercial patterns have similarities and differences in both their labeling and their uses.

- Industry and commercial patterns are labeled with the following:

  the name of the pattern piece (Front, Back, Sleeve)
  the pattern size
  the number of pieces to be cut

- On industry patterns, each piece is marked with a grainline; on commercial patterns, each piece is marked with a grainline or foldline.
- Industry patterns are made for a single size; commercial patterns are often printed with several sizes.
- The commercial pattern is printed for the right half of the garment except when the garment is asymmetrical; the industry pattern has a pattern piece for each section.
- Generally commercial patterns are laid out and cut in a double layer; industry patterns are cut from a single layer.
- Commercial patterns are usually cut with a fold at garment centers; industry patterns are cut in a single layer without a fold.
- Notches on commercial patterns are marked with small black diamonds; on industry patterns, they are marked with a short line perpendicular to the cutting line.
- Commercial patterns have adjustment lines so the pattern can be lengthened or shortened easily. On industry patterns, the length is determined by the target customer.
- Patterns for a center front opening are marked at center front on commercial and industry patterns.
- On industry patterns, pocket locations are marked with drill holes and with an outline on commercial patterns.

Fibers, Yarns, and Fabrics

Fibers, the basic elements of fabrics, are made into yarns, which are then made into fabrics. Because these elements—the fibers, yarns, and fabric structure—affect the construction of the garment as well as the finished design, a basic knowledge of fibers, yarns, and fabrics is essential in apparel production.

There are hundreds of fabrics in a variety of fibers, weaves, knits, and qualities. The scope of this text does not permit an in-depth discussion of fibers, yarns, and fabrics, so you will want to consult a textile text such as *Textiles*, 10th ed., by Sara J. Kadolph and Anna L. Langford, which provides important information about the physical properties that affect a fabric's aesthetics and performance, and Claire Shaeffer's *Fabric Sewing Guide*, 2nd ed., which focuses on the fabric characteristics, how they affect the design and construction, and how to select appropriate construction methods.

Fabric Characteristics and Performance

In apparel design, the **fabrication** or choice of fabric is one of the first decisions to be made. The fabrication is based on (1) the garment, its type and design, planned use, and quality, (2) the fabric characteristics, (3) its performance, and (4) cost.

The fabric characteristics describe the texture, transparency, hand, weight, type of fabric construction, and fiber content. The fabric performance describes the fabric durability, strength, shape retention and resiliency, colorfastness, absorbency and wicking abilities, breathability, care requirements, and resistance to abrasion, wrinkling, spotting, and static electricity.

Fibers

Fibers are divided into two categories: natural and manufactured. Found in nature, natural fibers include

(1) cellulosic fibers made from plants and (2) protein fibers that come from animals. Cotton and linen are the most common cellulosic fibers. Silk and wool are the most common protein fibers.

Manufactured fibers, as the name implies, are synthetic. They include **rayon**, **lyocell**, and **acetate**, which are made from natural materials such as wood pulp and cotton linters, and synthetic fibers, which are made from chemicals and petroleum by-products. The most commonly used synthetic fibers include **nylon**, **polyester**, **acrylic**, **modacrylic**, **olefin**, and **spandex**.

Yarns

Fabrics, with the exception of felts and nonwovens, are made from yarns. These yarns can be dull or lustrous, thick or thin, smooth or bulky, all one fiber or a combination of different fibers, weak or strong, or tightly twisted or not at all, but there are only two basic groups: spun and filament.

Spun yarns are made by twisting or spinning short fibers called staple fibers to hold them together. The staple can be from the natural fibers of cotton, linen, or wool; silk or manufactured filament fibers that have been cut into short lengths; or a combination of natural and manufactured fibers.

Filament yarns are made from the long filaments of silk or manufactured fibers. They can be **monofilament**, composed of a single filament, or **multifilament**, composed of more than one filament. When filament yarns with the same diameter are compared, softness and flexibility increase with the number of plies. When filament yarns are compared to spun yarns, filament yarns are more lustrous, do not require as much twisting or spinning to hold them together, and have a greater tendency for slippage.

The simplest yarns are monofilament or a single **ply**, but most yarns are made by twisting two or more plies together. Cord or **cable yarns** are made by twisting two or more plies together (Fig. 8).

Fabrics

In apparel manufacturing, fabrics are made in a variety of ways. The two most common structures are woven and knit, but nonwoven materials such as felts are also used.

Woven fabrics are made on looms by interlacing crosswise yarns through the yarns that were previously stretched on the length of the loom. **Knit fabrics** are made on knitting machines with needles that interlock the yarns to form a series of connected loops.

Woven Fabrics

All woven fabrics have warp yarns and filling or weft yarns. The **warp** runs the length of the fabric, and the **filling** or **weft** interlaces through it at right angles to create various weave structures. The three basic weaves—**plain**, **twill**, and **satin**—are used to make many variations such as satin, jacquard, rib, and pile fabrics (Fig. 9).

The finished edges of the fabric have a **selvage**, which is frequently used to identify the lengthwise

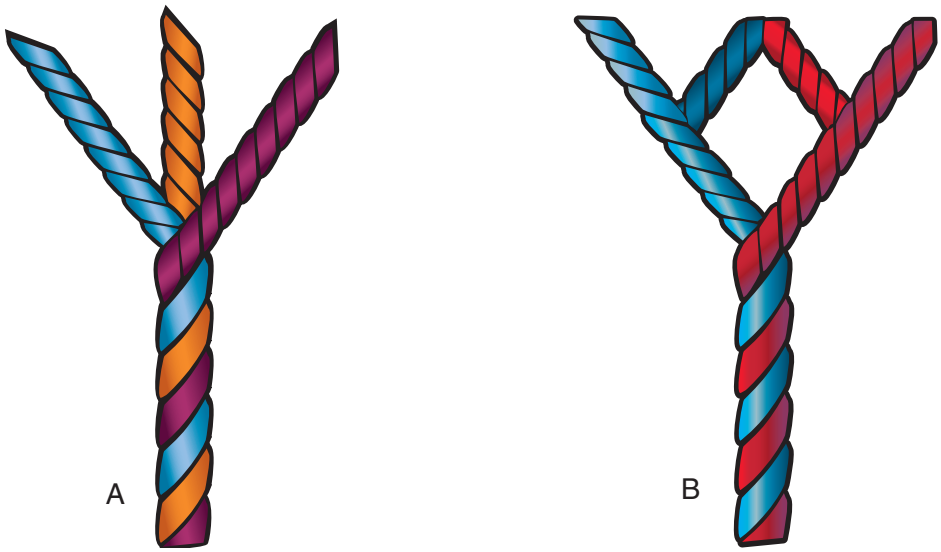


FIGURE 8 (A) Three single yarns twisted to form 3-ply yarn; (B) two plied yarns twisted to form cord.

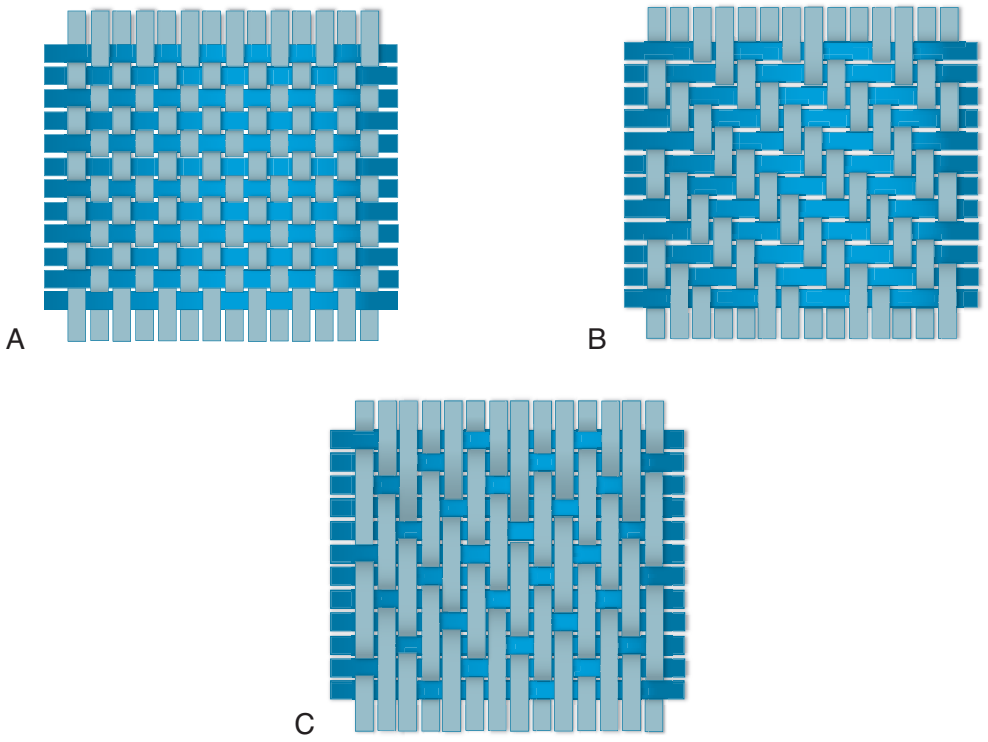


FIGURE 9 Weaves: (A) plain; (B) twill; (C) satin.

BOX 3 Coping with Troublesome Materials

Generally all fabrics are easier to sew on industrial equipment because the foot and throat plate are designed to hold the fabric more firmly, the needle bar has less deflection because it does not make a zigzag stitch, and the feed dog is compatible with the fabric weight. For this reason only a few troublesome fabrics are described.

Densely Woven Fabrics and Materials with Special Finishes

Puckered seams are frequently a problem on fabrics that are densely woven, such as denims and microfibers and fabrics with wash-and-wear or permanent-press finishes, particularly on seams located on the straight grain. The handling of these fabrics must be careful and controlled for satisfactory results.

When possible, avoid seams on the straight grain. Even a small shift to the garment bias will make a big difference.

Use a slender needle, a throat plate with a very small hole, polyester core thread, and light pressure on the thread tension and presser foot. Avoid feeding the work too quickly. Wind the bobbin uniformly with as little tension as possible.

Synthetic Nonwoven Fabrics

Many of these materials are easy to sew; others are quite difficult. Lengthen the stitch to 10 SPI (2 mm) or less. Review the suggestions for wash-and-wear fabrics to prevent puckering.

When the underply feeds too rapidly, change to a low-friction foot with a Teflon sole, a roller bearing foot, or a feeding foot, and lighten the pressure on the foot.

Knits

For best results, stitch knits on an overlock, safety-stitch, or mock safety-stitch machine. Reduce the differential feed to prevent wavy seams; lighten the thread tensions and presser foot pressure as much as possible. When using a lockstitch machine, wind the bobbin uniformly with a very light tension.

grain or **straight grain**. The straight grain is strong with little or no stretch. By contrast, the **true bias**—a diagonal that intersects the straight grain at a 45-degree angle—has the greatest elasticity. And **bias** or **garment bias**, any diagonal between the true bias and straight grain, has more elasticity than the crossgrain (Fig. 10).

HINT: The term *bias-cut* is generally used to describe designs cut on the true bias or with the bias located at garment centers.

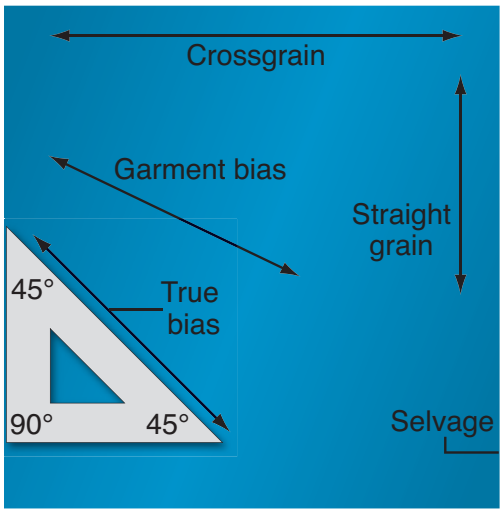


FIGURE 10 Grainlines and bias.

When the warp and weft do not interlace at right angles, the fabric is off-grain (see Fig. 2). Because many materials today have special finishes, it is difficult, and frequently impossible, to straighten or correct off-grain fabrics.

HINT: To determine the lengthwise grain when the selvage has been cut away, hold the fabric securely along one grainline with your hands only an inch apart. Pull. Repeat in the other direction. The grain that stretches least is the lengthwise grain.

Knit Fabrics

Knit fabrics are divided into two general groups—weft or warp—depending on the type of machine used to make them. **Weft knits** are similar to hand knitting and are formed with a single yarn by knitting horizontal rows. Jerseys, rib knits, and double knits are common weft knits.

Warp knits are made on machines with multiple needles and an equal number of yarns to form loops in the warp or lengthwise direction. Tricot and raschel are common warp knits (Fig. 11).

Instead of a warp and filling, knit fabrics have wales and courses. The **wales** or **ribs** are vertical columns that run the length of the fabric, and the **courses** are horizontal rows across the width. Generally the wales are called the straight grain and the courses the crossgrain, even though this is not technically correct.

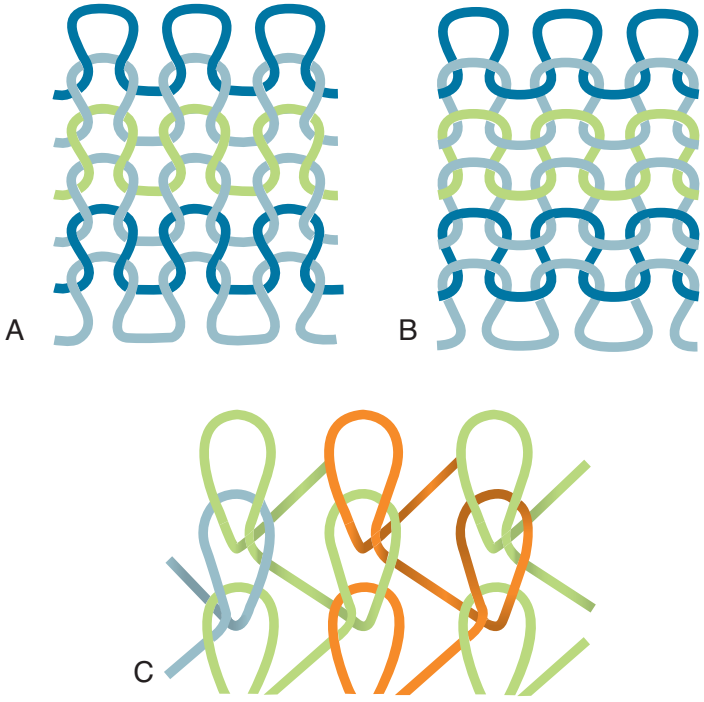


FIGURE 11 Knits: (A) weft, face; (B) weft, back; (C) warp.

Nonwoven Fabrics

Nonwoven fabrics are made by bonding the fibers together with heat, moisture, and sometimes an adhesive substance. The fibers are arranged in a variety of patterns so the material will be stable, or have stretch in all directions, or stretch only in the width. The most common nonwoven materials are felt and interlinings.

Designs and Patterns

Many fabrics such as stripes, plaids, large prints, **pile fabrics**, and **one-way patterns** have designs or characteristics that impose special considerations and increase the costs of materials and labor.

Stripes and plaids require special layouts so the design is aesthetically pleasing and the fabric pattern can be matched at seamlines. Large prints, pile and napped fabrics, and fabrics with a one-way design require a "with nap" or "nap" layout with the tops of all sections in one direction to avoid upside-down flowers, shading differences or mismatched stripes (Fig. 12).

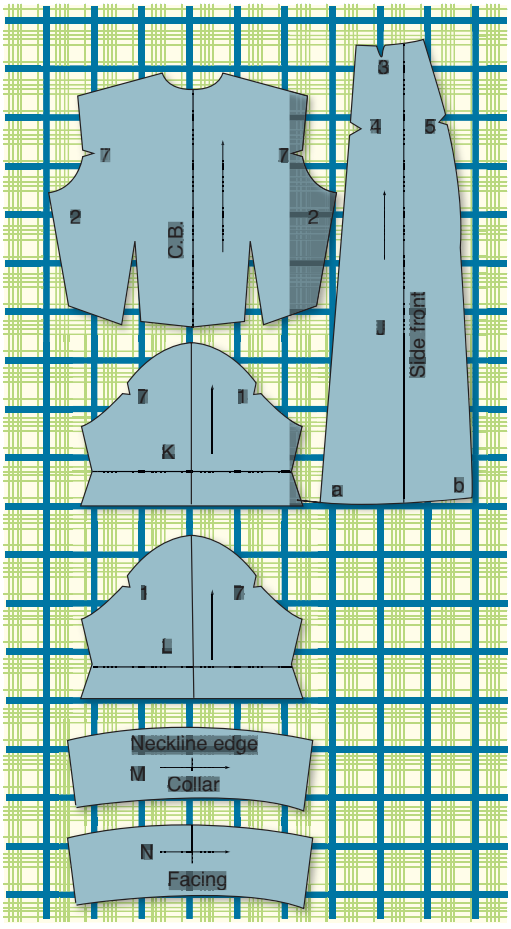


FIGURE 12 For a "with nap" layout, place the tops of all sections in the same direction.

LAYOUT AND CUTTING SAMPLES

The success of the finished sample or garment begins with laying out the pattern.

Use these directions to lay out and cut the muslin for the samples in this text.

Application: Cutting with a Pattern

1. Cut out the indicated pattern. When cutting, cut carefully along the outside edge of the cutting lines.
2. Press the muslin.
3. Spread the muslin in a single layer face side up on the cutting table. When cutting with a rotary cutter, cover the table with a rotary cutter mat.

HINT: When working with a large piece of fabric, cut a smaller block so the fabric can be rotated during cutting. If the block does not include a selvage, draw the lengthwise grain on the fabric before cutting the block.

4. Smooth the fabric so the crosswise grains are at right angles to the selvages.

HINT: Align the selvage edge with one side of the table and the crosswise grain with the end.

5. Use a C-Thru ruler to chalk-mark a line 12″ long parallel to the selvage and about 1″ away from that edge. If there is no selvage, chalk-mark a line parallel to the lengthwise threads.
6. When cutting multiple parts, cut the muslin into 1-yard lengths and stack the muslin plies. Smooth the layers and align the grainlines.
7. Place the pattern pieces face up on the fabric. Lay out the large pieces first, then the smaller ones. Do not cut any parts on a fold.
8. Align the grainlines on the pattern sections and muslin. Use a ruler or tape measure to measure the distance from the selvage to the top of the pattern grainline. Pin. Measure the same distance from the selvage to the bottom of the grainline. Pin (see Fig 13).

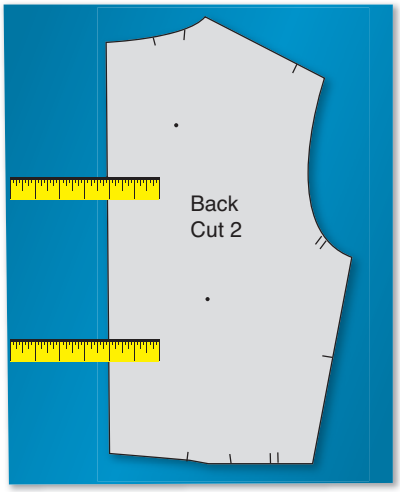


FIGURE 13 Lay out the pattern with the grainline parallel to the selvage.

HINT: Do not shift pattern pieces off-grain to save fabric. When the grainlines are not aligned, the section will be off-grain and the garment will not drape properly.

9. Anchor the pattern with weights or pins.

HINT: When using pins, insert them within the seam allowances on the lengthwise grain.

10. Draw around the pattern with chalk or a well-sharpened pencil. To avoid damaging the patterns, do not cut around the pattern.
11. Remove the pattern. When cutting multiple layers, use pins or weights to keep the layers from shifting.
12. Cut on the marked lines with shears or a rotary cutter. When using shears, position the shears so the marked line is between your eyes and the shears and so the blades do not obscure the marked line. Hold the shears in your hand so they are parallel to the table with the lower blade resting on the table and your thumbnail pointing to the marked cutting line. To cut, close the blades. Open them, and slide the blade along the table to make the next cut. When cutting inward corners, cut into the corner.

When using a rotary cutter, cut into a curve or angle. Try to avoid overcutting.

NOTE: If you are left-handed, use left-handed shears or learn to cut with your right hand.

13. Mark the notches at fabric edges with small (1/8″) clips.
14. Mark any matchpoints on the fabric surface with chalk or a sharp pencil.

HINT: You can also use temporary marking pens; however, because they may stain permanently, I do not use them when marking garments.

Cutting Pattern 1

Choose the appropriate grainline when using Pattern 1.

- To cut parts on the lengthwise or straight grain, use the grainline parallel to the long straight edge shown in Figure 14A.
- To cut parts on the crossgrain, use the grainline parallel to the short edge shown in Figure 14B.
- To cut parts on the bias, use the diagonal grainline shown in Figure 14C so that the long edge of the rectangle is on the true bias—midway between the straight grain and crossgrain.

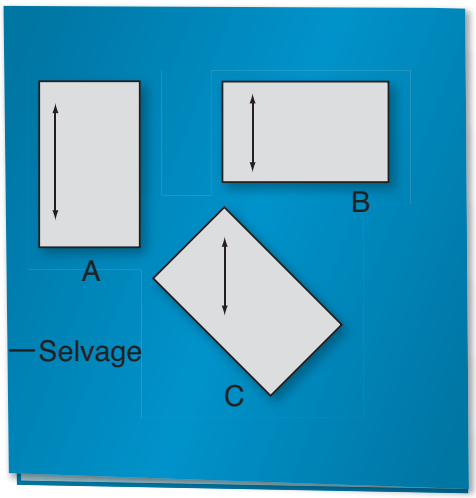


FIGURE 14 Pattern layout: (A) lengthwise, (B) crossgrain, (C) bias.

Application: Cutting without a Pattern

Many of the applications in this text use muslin rectangles instead of a pattern. When the rectangle can be described easily, a pattern is not provided. The rectangle is described first by the width, then the length; for example, 5″ × 9″ describes a rectangle 5″ wide and 9″ long. The width of the rectangle is located on the crossgrain, and the length is on the straight or lengthwise grain.

1. Spread the muslin on the cutting table.
2. Using a C-Thru ruler and chalk, mark a line on the lengthwise threads about 1″ from the

selvage and parallel to it. Mark the length of the rectangle (9″) on the chalked line.

3. To mark the top of the rectangles, draw a line perpendicular to the chalked line at the first chalk mark. This line is on the crossgrain. Extend the line across the fabric width.

HINT: To draw one line perpendicular to another, align a short vertical line on the ruler with the chalked line. Draw the perpendicular line at the top of the ruler. This is called squaring a line (Fig. 15).

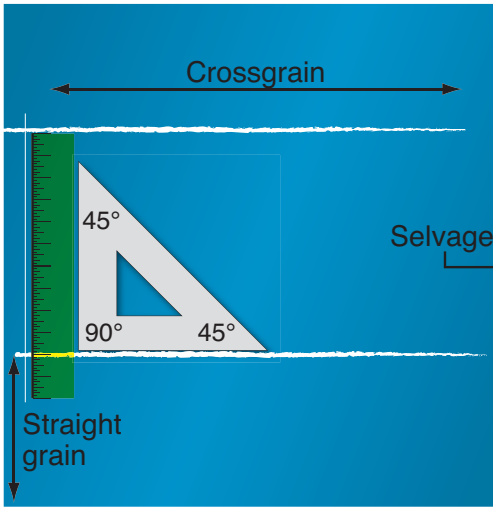


FIGURE 15 Squaring a line.

4. To mark the bottom of the rectangles, draw a line perpendicular to the chalked line at the remaining chalk mark. Extend the line to the fabric width.

5. Cut the strip on the two marked lines.

HINT: To save time later, stack several pieces of muslin to cut multiple strips.

6. Measure and mark the rectangles 5″ wide, cutting as many as possible from the strip. Set aside any unused rectangles for later use.

Assembling the Samples

The samples in this text were developed so you can learn specific applications, using industry methods. As a samplemaker, you will have neither the speed nor the proficiency as that of an operator who sews only one or two different operations, and you may not have the same specialized equipment as a factory.

HINT: When learning a new technique, focus first on accuracy, not speed.

The manner in which you handle the work as well as the techniques themselves is different from home sewing. You will not use pins as a basting aid when stitching. This is sometimes difficult and requires practice, but it is important to avoid accidents. There will also be some situations when you will apply home sewing techniques such as hand sewing to improve the quality of the finished sample.

Very little hand sewing is used in apparel manufacturing because it is too costly for most manufacturers. However, it is often used in samplemaking and on expensive ready-to-wear. The hand sewing basics described in this text are typical of those used in samplemaking and on better garments.

PRESSING

Pressing is an essential element in samplemaking and expensive ready-to-wear. Good pressing can enhance a poorly stitched garment, whereas improper pressing can destroy a well-made design.

HINT: On some garments, especially sample designs, you may spend more time pressing than stitching.

For the applications in this text, the first sample will often be sewn in cotton muslin. Optional samples are also recommended; they will provide challenges in pressing as well as sewing. Use them to learn or improve your skills when creating designs in other fibers and fabrics.

Pressing Tools and Supplies

Many types of pressing equipment are used in apparel construction. This section focuses on pressing tools and supplies.

The essentials include an *ironing board* or **pressing stand**, **pressing cushions** such as a **tailor's ham**, **seam roll**, or **seam stick**, a variety of **press cloths**, vinegar, and Ivory soap.

Ironing board or pressing stand. I prefer a pressing stand that sits on a table because the table will support the weight of the garment and prevent it from wrinkling and stretching out of shape.

Sleeve board. A **sleeve board** is a small pressing stand used for pressing small sections and sleeves.

Pressing cushions. The tailor's ham is a firmly shaped pressing cushion that allows you to press curved sections of the garment easily. A *ham holder*

is a nice addition and allows you to set the ham on its end or side. The seam roll is a firm cylinder used for pressing straight and slightly curved seams open.

HINT: If your budget is limited, substitute a rolled-up towel for a seam roll and a small firm pillow, pot holders, or an oven mitt for a ham.

Point presser. The **point presser**, a narrow wooden tool, allows you to press the seam allowance open on collars, cuffs, and garment edges. Some are straight with a point at the end; others have a variety of curved edges. Some are short; others are long. Some can also be used as a clapper.

Clapper. A **clapper**, sometimes called a *beater*, is a wooden tool used to flatten seams and faced edges by holding the steam in the fabric after the iron is removed. For difficult-to-press fabrics, use the clapper to spank the fabric and flatten the steamed section. Clappers can be a separate tool or the base of the point presser.

Seam stick. This half-round wooden stick is used for pressing seam allowances open.

HINT: I prefer the seam stick to a seam roll. I have a second stick to use on top as a clapper when pressing difficult fabrics.

Needleboard (optional). Made with fine steel wires set vertically on a base, the **needleboard** is used primarily to press velvet and other pile fabrics.

HINT: I use a needleboard when pressing wool and hair fibers and occasionally to remove pressing imprints. A piece of mohair upholstery fabric or a wide piece of Velcro can be used as a substitute.

Sponge. A clean cellulose sponge is indispensable for applying water directly to fabrics that will not waterspot or to a press cloth. Wet the sponge and shake it out first so it will not drip.

Press cloths. Dry or damp, press cloths are essential. They protect the fabric from the heat of the iron and unwanted waterspots. Use white or light-colored cloths on light-colored fabrics and dark cloths on dark fabrics. Launder them frequently to avoid transferring soil to your garments. You can purchase press cloths or make your own. Lightweight cotton muslin that has been machine-washed several times makes a good all-purpose press cloth.

Satin-faced silk organza or two layers of plain organza make nice see-through press cloths. Wool press cloths are essential when pressing wool and hair fibers. Cover the ironing board with a large piece of wool and use a smaller piece to cover the fabric.

Vinegar and Ivory soap. Use a 50/50 solution of white vinegar and water to set pleats, creases, and seams on microfibers, polyesters, and other difficult-to-press fabrics. Always test first to be sure that the solution does not spot the fabric or change the colors. Use a bar of Ivory soap for sharper creases and seams on wool fabrics. For folded edges, rub the soap on the wrong side and press. For seams, rub the stitching line on each side, then press the seam open.

KEY WORDS

acetate
acrylic
back
bias
cable yarn
clapper
core-spun thread
courses
crossgrain (crosswise grain)
fabrication
face
filament thread
filament yarn
filling
glacé
knit fabric
lengthwise grain
lyocell
mercerized
modacrylic
monofilament
multifilament
muslin
needleboard
notches
nylon
off-grain
olefin
one-way pattern
on-grain
pile fabric
plain weave
ply
point presser
polyester
press cloths
pressing cushions
pressing stand
rayon
ribs
satin weave
seam allowances
seam roll
seam stick
selvage
sleeve board
spandex
spun thread
spun yarn
staple fibers
straight grain
tailor's ham
textured
true bias
twill weave
wales
warp
warp knit
weft
weft knit
woven fabric

SUMMARY

This quick-start tutorial provides the essential information needed to learn the applications and assemble the samples in this text. It includes basic guidelines for assembling tools and supplies, selecting appropriate fabrics for sampling, preparing fabric, using the patterns, laying out patterns, and cutting fabric, and step-by-step instructions for sewing the samples.

This chapter introduces the fundamentals of fibers, yarns, and fabrics; the fiber categories—natural and manufactured; yarn types; the differences among woven, knit, and nonwoven fabrics; how to identify off-grain fabrics and label patterns; and the differences between industry and commercial patterns.

REVIEW QUESTIONS

1. Why are muslin and easy-to-sew knits used for sampling in this text?
2. Describe the differences between shears and scissors.
3. Identify the basic elements of fabrics.
4. How are yarns made?
5. Explain how fabrics are made.
6. Discuss the differences between natural and manufactured fibers.
7. What is the most important label on a pattern?
8. Why is grain important?
9. What is the straight grain?
10. What is the difference between the straight grain and the crosswise grain?
11. What is the proper way to cut with and without a pattern?
12. How do you cut a 5″ × 9″ rectangle?
13. How do you mark work indicators?
14. Why are notches important?
15. Why do seam allowances vary in width?
16. What is ¼ of 27½″?

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Orientation: The Lockstitch Machine

Orientation: The Lockstitch Machine

This chapter focuses on the lockstitch machine: both the industrial lockstitch and the home sewing machine, sometimes called a domestic or household machine. If you already know how to sew, you are familiar with this machine even though you may not recognize the name *lockstitch*. If you are learning to sew, your first machine will probably be a lockstitch machine.

Chapter Objectives

After completing this chapter, you will be able to:

- Compare the lockstitch power machine and the home sewing machine.
- Understand how the lockstitch is formed.
- Identify the five basic elements of stitch formation.
- Identify and explain the functions of the parts of the lockstitch machine—industrial and/or home sewing.
- Operate a lockstitch machine—industrial or home sewing—with coordination, skill, and confidence.

THE LOCKSTITCH MACHINE

The single-needle lockstitch machine is the number one workhorse in the fashion industry and for home sewers. It is used more extensively than any other type of machine, even though overedge or serger machines (Class 500) and chainstitch machines (Class 400) are generally used for knits; large factories use automated equipment, particularly for the production of garments such as men's shirts and trousers.

A basic understanding of the way the machine operates and the formation of the lockstitch will allow you to use both an industrial machine and a home sewing machine efficiently, and it will enable you to prevent stitching faults.

Lockstitch machines (301) are used in the production of all kinds of stitched merchandise at all price points. They are especially important in the production and alteration of fashion goods and are used in small factories, drapery workrooms, sample rooms, alteration workrooms, better and high-end ready-to-wear, and foreign factories with less expensive labor costs. The machine can make a straight or a zigzag stitch. It can have a **flat bed**, **cylinder bed**, **post bed**, or **feed-off-arm**, and one or more needles; but it always has a needle and a **bobbin**.

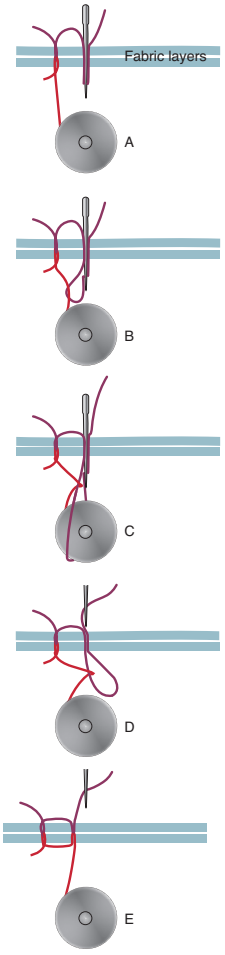
The **lockstitch**, which is the most familiar stitch, looks the same on both sides. It is the flattest, most supple, most secure, least conspicuous, and most versatile stitch. If the stitches break during use, they do not unravel badly because the two threads are locked together. Because it looks the same on both sides, the lockstitch can be used to sew most operations in a garment, to sew many garments completely, and to sew on most materials.

Compared to other stitch types, the lockstitch uses the least amount of thread and the seam stretches the least. It is slower to operate than an overedge or chainstitch machine because the machine's speed is often slower, and there is more downtime because the bobbin must be refilled frequently.

The lockstitch is formed with a needle thread that feeds from a spool at the top and a bobbin thread that feeds from a bobbin at the bottom. To form the stitch, a **rotary hook** or **shuttle** catches the needle thread loop so that it passes around the bobbin housing to interlock the two threads. When the stitch is formed correctly, equal amounts of thread are used from the spool and bobbin, and the threads lock in the center of the fabric plies.

BOX 1 The Formation of a Stitch

There are five steps for creating any stitch type. They are illustrated in the cross-section view of the lockstitch shown in the figure.



A. **Penetration:** The needle penetrates and carries the thread through the cloth.

B. **Needle thread loop:** The needle thread forms a loop at the side of the needle as the needle point begins to withdraw from the cloth.

C. **Conformation:** The needle thread encloses the bobbin thread.

D. **Castoff:** The lower thread carrier releases the needle thread.

E. **Set stitch:** The needle thread is drawn up and tightened to set the stitch in the material.

THE POWER MACHINE

This section focuses on the basic elements of the industrial lockstitch machine. Other machine types—overedgers and blindhemmers—may look different, but the basic elements are quite similar. Many of the same elements on the industrial lockstitch machine can be identified on the home sewing machine.

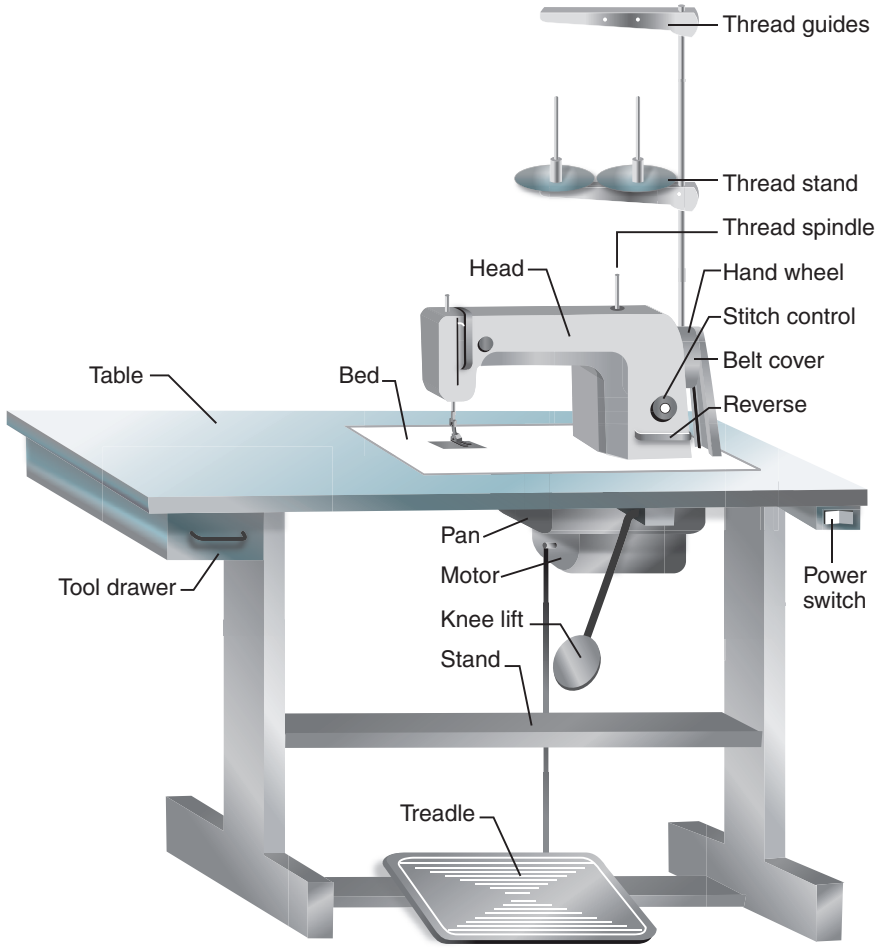


FIGURE 1 Parts of the lockstitch machine.

Safety is particularly important when sewing on any machine, especially power machines.

The simplest, most basic lockstitch machine (301) outsells other machine types by about nine to one. Sometimes called a *flat-bed machine* (because most industrial models have a flat bed), many models only make a straight stitch, and older machines only sew forward.

Directions: Identify the Parts of the Industrial Machine

The individual parts of the industrial machine and the home sewing machine are the same or quite similar. If you are sewing on a home sewing machine, read this section first; then review Box 5, Parts of the Home Sewing Machine.

1. Begin with the power switch off. If the machine is threaded, remove the thread.
2. Locate and identify the thread stand and thread spindles, thread guides, head, bed, belt or belt cover, table, pan, stand, motor, treadle, power switch, tool drawer, and knee lift (Fig. 1).
3. Examine the machine head. Locate and identify the arm, handwheel, thread spindle, thread guides, needle-thread tension assembly, take-up lever, take-up lever guard, stitch length regulator, reverse stitch control, pressure regulator, presser foot, belt, and manual presser bar lifter (Fig. 2). (Two parts, the belt and the manual presser bar, are not visible in this diagram. The belt connects the handwheel and motor; and the manual presser bar lifter is located on the back of the machine just above the presser bar itself.)

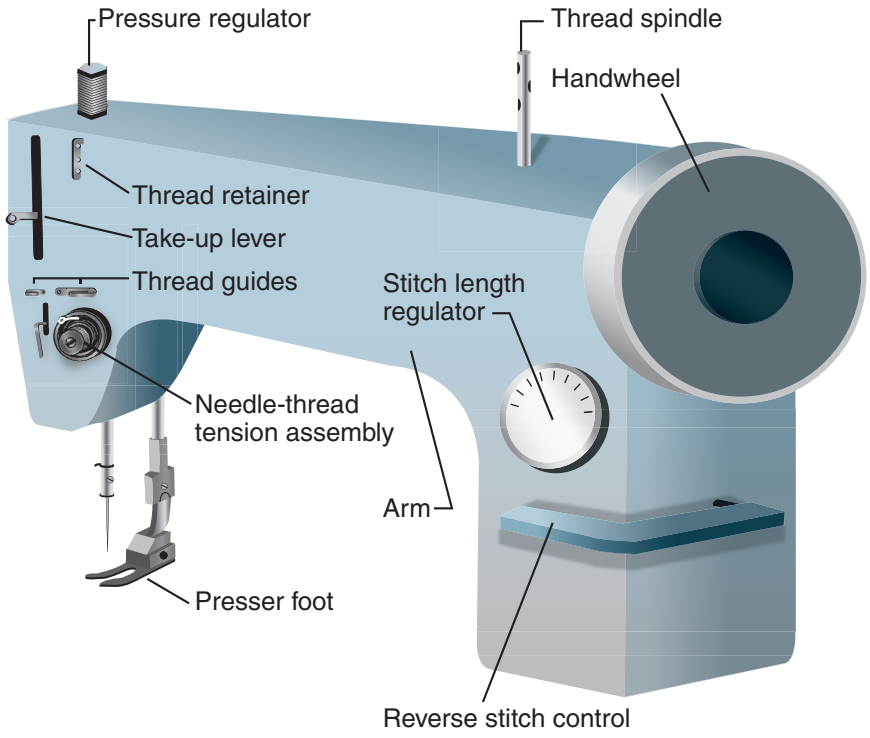


FIGURE 2 Machine head.

4. Locate the needle-thread tension assembly and identify the parts: the tension springs or tension discs, slack thread regulator, and check spring (Fig. 3).

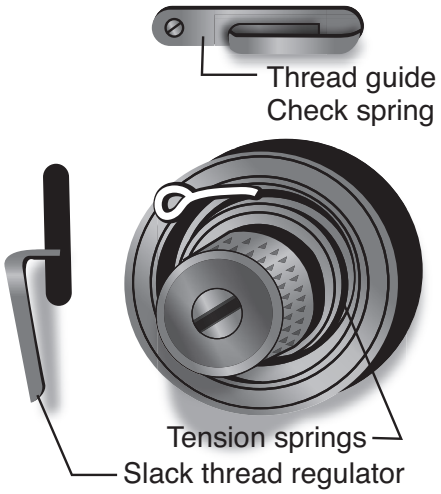


FIGURE 3 Needle-thread tension assembly.

5. Locate the feeding mechanism. Identify the presser foot, needle, feed dogs, throat plate, presser bar, needle bar, needle screw, needle hole, and slide plate (Fig. 4).

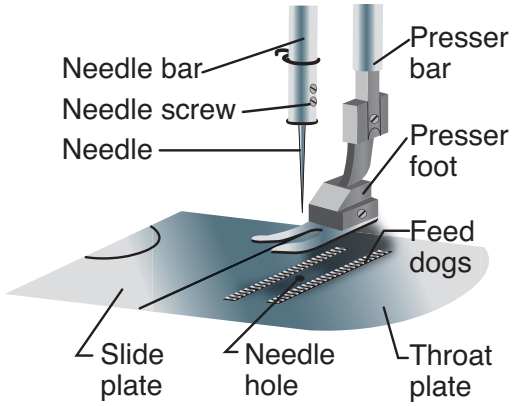


FIGURE 4 Feeding mechanism.

6. Locate the presser foot and identify the parts: the shank, sole, toes, and heel (Fig. 5). Locate the knee lift, which raises the presser foot.

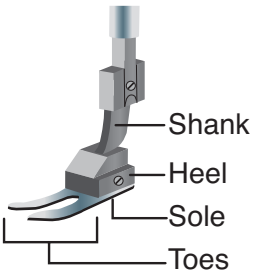


FIGURE 5 Presser foot.

7. Locate the needle and the last thread guide above the needle. Use your thumbnail to locate the long groove on that side of the needle.
8. Locate the bobbin mechanism and identify the hook, bobbin case, bobbin, and center post (Fig. 6).

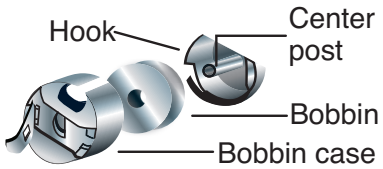


FIGURE 6 Bobbin mechanism.

BOX 2 Comparison of the Lockstitch Power Machine and the Home Sewing Machine

The lockstitch power machine is similar to the standard lockstitch home sewing machine. (The home sewing machine is also called a *household machine* or a *domestic sewing machine*.) However, there are some important differences:

1. The power machine is mounted permanently on a table or stand. Home sewing machines are generally mounted on a table when used in the classroom, but most are portable so they can be moved and put away easily.
2. The power machine is much faster, stitching from 3,000 to 6,000 stitches per minute. The fastest home machines can stitch no more than 1,500 stitches per minute; most stitch 1,000 to 1,200 stitches per minute.
3. The industrial machine can have a *flat bed*, *cylinder bed*, *post bed*, or *feed-off-arm*, and one or more needles. The home sewing machine can have a flat bed or cylinder bed. The cylinder bed is called a **free arm** on a home sewing machine.
4. Many power machines make only a straight stitch; most home machines make straight and zigzag stitches.
5. The presser foot on a power machine is raised and lowered with a knee lift or special foot pedal that raises and lowers the presser foot. On domestic machines, it is generally operated manually by using a lever at the back of the needle bar.
6. The throat plate on many industrial machines may not be marked with frequently used seam widths.
7. The presser foot on a power machine has a narrow opening between two toes and holds the fabric more firmly than the all-purpose, zigzag foot on the home sewing machine.
8. The needle bar on a power machine only moves up and down, not side to side as on zigzag machines, enabling the machine to make a more attractive stitch and preventing deflection when the needle hits a slub in the fabric.
9. The needle hole on the throat plate on an industrial machine is small and round instead of large and oval as on most home sewing machines. This reduces stitching problems.
10. The handwheel rotates away from the operator on some industrial machines and toward the operator on others. On most home sewing machines, it rotates toward the operator.
11. On industrial machines, the bobbin winder is located to the right of the machine head. On home sewing machines, the bobbin winder is on the top of the head or on the front of the machine.

9. Examine the bobbin case and identify the parts: latch, tension spring, tension spring screw, delivery eye, and slot (Fig. 7). (The latch is on the back of the bobbin case and is not visible in the diagram.)
10. Locate and identify the bobbin winder, bobbin winder tension assembly, ferule, and belt (Fig. 8).

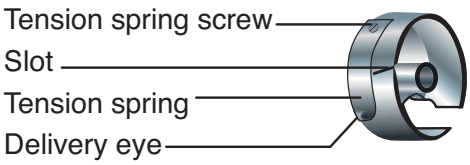


FIGURE 7 Bobbin case.

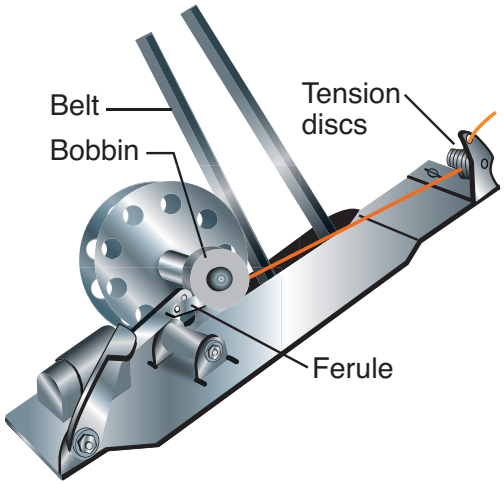


FIGURE 8 Bobbin winder.

BOX 3 Machine Terminology

The parts of the lockstitch machine, which are identified here, are illustrated in Figures 1 through 5.

- *Arm:* The horizontal part of the head that houses the drive shafts.
- *Bed:* The working surface of the machine under which is located the mechanism that handles the lower thread. On a flat-bed machine, the bed rests in the cutout of the table.
- *Belt (motor belt or machine belt):* The circular strap that transmits motion from the pulley to the handwheel, allowing the machine to operate.
- *Bobbin mechanism:* The parts—bobbin, bobbin case, and bobbin tension spring—that control the lower thread and its tension.
- *Bobbin winder:* The part that fills a bobbin while the machine is stitching.
- *Check spring (tension spring or take-up spring):* A small wire spring behind or at the top of the tension discs. It provides a small amount of tension on the needle thread and acts as a shock absorber. On some machines, the check spring is mounted separately.
- *Faceplate:* The cover on the left side of the head that covers the needle bar and the presser bar.
- *Feed dogs (feeder or feed):* The toothed mechanism beneath the presser foot that moves the fabric forward and backward.
- *Fittings:* The parts—presser foot, feed dogs, and throat plate—that control the cloth during stitching.
- *Handwheel (balance or flywheel):* The part that controls the motion of the machine manually and/or electrically.
- *Head:* The part of the machine above the table, containing the stitching mechanism.
- *Heel:* The back of the presser foot.
- *Hook (rotary hook or machine hook):* A rotating device that hooks the needle thread to carry it around the bobbin and form the "lock" on the lockstitch.
- *Knee lift (knee lifter or knee press):* A lever mounted at the right under the sewing table to lift and lower the presser foot with the right knee.
- *Motor:* The electrical unit that drives the machine.
- *Needle:* The part that penetrates the fabric. It carries the thread to the hook or shuttle and up again to make the stitch.

(Continued)

BOX 3 (*continued*)

- *Needle bar:* A vertical bar that holds one or more needles and moves the needles up and down.
- *Needle screw (needle bar clamp):* The screw that holds the needle in the needle bar.
- *Oil gauge:* The part that indicates the amount of oil in self-oiling machines.
- *Pan (machine pan):* The metal pan under the head that catches oil, lint, and metal shards. On self-lubricating machines, it holds the oil.
- *Presser bar:* The bar to which the presser foot is attached.
- *Presser bar lifter:* A lever at the back of the presser bar used to raise and lower the presser foot by hand. It is used to raise the presser foot when winding a bobbin and when not stitching. (Its use is discouraged in industrial sewing because it wastes time and energy.)
- *Presser foot:* A device that holds the fabric in place for stitching.
- *Pressure regulator (pressure dial):* Control that regulates the amount of pressure on the presser foot.
- *Pretensioner:* A simple tension disc used to regulate the thread so that it will feed into the tension assembly evenly.
- *Pulley:* The wheel attached to the motor. It transmits motion from the motor to the handwheel by means of a leather belt.
- *Rotary hook assembly:* The part that holds the bobbin case.
- *Shuttle:* An oscillating device that carries the needle thread around the bobbin and forms the "lock" on the lockstitch. The shuttle and the hook perform the same function—making a stitch—but the hook rotates and the shuttle oscillates.
- *Slack thread regulator:* A metal hook or bar near the tension discs.
- *Slide plate (slide or bed slide):* A removable cover at the left of the machine bed that allows access to the lower mechanism.
- *Sole (shoe or slipper):* The bottom part of the presser foot that contacts the cloth.
- *Stand:* A metal structure on which the table is mounted.
- *Stitch hole (needle hole):* The hole in the throat plate. The needle carries the thread into the hole so that it can interlock with the bobbin thread.
- *Stitch regulator:* A device that regulates stitch length.
- *Switch (power switch):* A key or button that turns the machine on and off.
- *Table:* The cabinet on which the head rests. It generally has a drawer on the left side.
- *Take-up lever:* The part that first loosens the top thread during the stitch formation, then removes any slack to set or lock the stitch.
- *Take-up lever guard:* A piece of metal in front of the thread take-up lever.
- *Tension discs (tension springs):* Two concave discs that control the delivery of the upper thread from the spool to the needle.
- *Thread guides (thread eyelets):* The parts that guide the thread from the thread cone to the needle. They smooth the thread and protect it from abrasion.
- *Thread retainer (pretensioner):* A three-hole guide that applies a small amount of tension on the thread so that it flows into the tension discs uniformly.
- *Thread stand:* A metal device that holds thread cones.
- *Throat plate:* The smooth surface directly under the presser foot that includes the stitch hole and surrounds the feed dog. It protects the lower mechanism from a buildup of excess lint.
- *Toes (prongs):* The front end of the presser foot, or the part that faces the oncoming cloth. It is frequently upturned. Feet such as the zipper foot, cording foot, and shirring foot have only one toe.
- *Treadle (foot treadle):* A metal platform on which the feet rest.

BOX 4 Parts of the Bobbin Mechanism

- *Bobbin:* A small metal spool that holds the lower supply of thread.
- *Bobbin case:* The metal case that holds the bobbin. It has a tension spring that controls the pressure on the bobbin thread. On some machines, the bobbin case is built into the shuttle or rotary hook assembly instead of being in a separate case.
- *Bobbin case holder:* A part of the shuttle or rotary hook. It holds the bobbin case in a stationary position so that the bobbin and shuttle can move independently to form the stitch.
- *Bobbin case tension spring:* A small spring on the bobbin case that controls the delivery of the bobbin thread.
- *Bobbin latch:* A latch on the bobbin case that releases the bobbin from the hook and holds the bobbin in the case.
- *Bobbin tension spring screw:* A small screw on the bobbin case that regulates the amount of pressure on the tension spring.

BOX 5 Parts of the Home Sewing Machine

Many parts of the home sewing machine are similar to those on the industrial machine. One important difference is that the home sewing machine is usually a portable machine that sits on top of a table instead of being set into a table. Even when it is mounted on a table or stand, it probably won't have a thread stand.

Newer home sewing machines have a stitch width regulator to regulate zigzag stitches. They may also have a variety of decorative stitches.

The location of the needle-thread tension assembly can be on the front or on the top. The bobbin winder is quite different. Instead of being located on the table at the side of the machine, it is located on the top or front of the machine head or inside the machine under the throat plate.

MACHINE OPERATION

By completing the applications in this chapter, you will learn many essential machine skills; these can be applied to other machine types. As you practice, you will gain the confidence to use these skills efficiently and comfortably on all machines.

If you have been sewing on a home sewing machine, you will notice immediately that power machines are faster and noisier than home sewing machines. They can be intimidating, but it is not difficult to sew on them. In fact, in some respects, it is actually easier.

Directions: Turning on the Power Machine

If you are new to sewing or have been sewing on a different machine or home sewing machine, read these directions completely; then practice until you can control the machine's speed.

1. Begin with the power switch off and the machine unthreaded. To avoid possible hand injury, keep your hands in your lap until directed otherwise.
2. Sit erect in a relaxed or natural position close to the machine, with your body straight and your back against the chair back. Adjust the chair so your torso is approximately 6″ from the edge of the table and the center of your body is in a straight line with the needle.
3. If the machine has more than one speed setting, check to be sure it is on the slowest setting.
4. Check to be sure the presser foot is in the up position.
5. Place both feet on the treadle, with the right foot slightly forward and the weight on the heels. This position gives maximum leverage with minimum exertion. On a home sewing machine, place one foot on the foot control.
6. Use your right hand to try to turn the handwheel on the industrial machine, which is locked because the motor brake is on. Do not touch the handwheel on the home sewing machine.
7. Push your feet forward, lightly transferring your weight from the heels to the balls of the feet, but do not raise the heels. This action