Feeding systems

Material feed means the controlled movement of the material being sewn from one stitch position to the next. Moving the material through the sewing point is what converts a series of stitches into a seam. In principle, the material can be moved in any horizontal direction; in most cases, it is only forwards or backwards. Usually the fabric is moved just after the needle point is raised clear of the surface and stops just as it is about to re-enter.

The simplest sewing machine feed system, and still the commonest, is known as the drop feed; the subject is best introduced by describing the constituent parts of this system and their functions. The limitations of this system will then become clear and the alternatives that aim to overcome these limitations can be considered.

The three sewing machine parts, which together constitute the drop feed mechanism are:
1. the presser foot
2. the throat plate or needle plate, and
3. the feed dog
Material feed is achieved by the feed dog which contains several rows of serrated teeth. The feed dog is moved upwards and forwards through slits in the throat plate to engage with the under side of the material being sewn and to advance it by a distance of one stitch length. Contact between feed dog and material is controlled by the spring-loaded presser foot. The feed dog is then lowered and moved back to its starting position.

• inter-ply shift problem?
Types of feed systems

Feed systems usually work on the underside of the material but can also operate from above or from both sides at the same time, depending on requirements and the need to avoid particular technical problems in sewing.

**Drop feed**

This is the basic material feeding system and is suitable for general sewing operations on any material which has no particular sewing problems.

**Differential drop feed**

Differential drop feed utilises two independently driven feed dogs. The stroke of each feed dog can be adjusted separately.

If the stroke of the front feed dog is greater, then the fabric may be gathered as it is sewn.

If the rear feed dog has the greater stroke, then the fabric may be stretched to provide a more extensible seam.

Combined feed systems

**Compound feed**

A combination of synchronised drop feed and needle feed. Feeding occurs whilst the needle is still in the material by combined motion of needle bar and feed dog.

The needle holds the fabric plies in registration during feeding to avoid slippage and seam pucker. Used mainly for edge stitching, checks and stripes.

**Variable top and bottom feed** (before the needle)

A feeding foot, similar to the presser foot, is provided with e.g. two rows of teeth and acts alongside the presser foot.

The strokes of the feeding foot and the feed dog can be adjusted independently.

It is used, for example, in gathering the top ply.
### Variable top and bottom feed
(behind the needle)

In this case, the feeding foot operates behind the needle to deliver especially smooth seams. This construction makes it easier to install machine attachments.

![Variable top and bottom feed](image)

### Alternating compound feed

This system involves a combination of three types of feeding: feed dog, needle feed, and feeding foot. The fabric can not be gathered.

**Applications:**
- Sewing of multiple plies (plies are kept in registration)
- Sewing bulky seams in heavy fabrics

![Alternating compound feed](image)

### Puller feed, Roller feed

An auxiliary feed, usually a wheel or roller, supplements the normal feeding system. The roller is located behind the needle and operates either continuously or intermittently. Suitable for long straight seams, such as in bed linen, which can be produced without puckering.

![Puller feed, Roller feed](image)

### Special feeding devices

#### Clamp feed, jig

Automatic sewing stations, such as button-holers, belt loop makers, and small part fabricators are provided with a special jig, which has openings for the stitching line, into which the fabric plies are fixed.

The jig is driven automatically and guides the material under the needle according to the required sewing pattern.

![Clamp feed, jig](image)
The throat plate is the most passive of the three parts and its function is to provide a smooth, flat surface over which the fabric passes as successive stitches are formed. It has one or more slots in it which match the sections of the feed dog and it has a hole through which the needle passes as it goes up and down. The needle hole should be only about 30 per cent larger than the size of the needle since, if this hole is too large, fabric can be pushed into the hole with each penetration of the needle. This is a problem known as ‘flagging’, which can cause missed stitching and yarn breakage. Most throat plates are made of steel with a polished surface to enable the material to pass freely over it.

The motion of the needle in an up and down direction must be synchronized accurately with the elliptical motion of the feed dog so that movement of the fabric takes place only when the needle is out of the fabric. Even in the simple drop feed, the feed dog can vary in the number and position of the sections comprising it and in the nature of its toothed surface. A single row feed dog has only a small area gripping the fabric and there is a tendency for the fabric to slip to the right or left instead of passing straight through the machine. It is normal in a lockstitch machine to have feed dogs situated both to the right and to the left of the needle hole to ensure that the fabric is fed in a straight line.
Various designs of feed dog, presser foot and throat plate are utilised according to the type of material being sewn and the particular sewing operation. Feed dogs can have different shapes and types of teeth.

In an overedge machine, the feed dog is usually mainly to the left of the needle drop point, because it trims and sews the fabric to the right of the needle and because there is a chaining-off finger on the throat plate over which the stitch is formed. Here again the fabric tends to be guided to the left. The problem can be overcome if a machine has a three-row feed dog with one row in front of the needle.
Types of feed dog teeth and their applications

- **Saw-tooth**: single-direction feeding
- **Upright**: uniform two-direction feeding
- **Diamond**: feeding of fine fabrics

The teeth on the surface of the feed dog can be of different types and sizes but they are generally slanted slightly towards the direction of feeding. For sewing of light to medium weight fabrics, a tooth pitch (distance from peak to peak) of 1.3–1.6 mm is normal, with the peaks slightly rounded off if damage occurs on fine fabrics. On very lightweight fabrics, sagging can occur between the teeth and pucker can appear after sewing as a result. Fine-toothed feed dogs with a pitch of only 1.0–1.25 mm can be used to prevent this. By contrast, on heavyweight fabrics, a certain amount of sagging is required for satisfactory feeding in order to keep both plies together. In this case, coarser feed dogs of 2.5 mm tooth pitch may be needed.

On very delicate fabrics, damage or marking of the fabric may arise against the feed dog, despite rounding off the tops of the teeth. In this case, a rubber-coated feed dog with no sharp teeth at all may be used, although it tends to wear out quickly.

Of more importance in preventing damage during feeding is a deliberate mismatch between stitch size and feed dog size. If, for example, a seam is sewn at six stitches per centimeter using a feed dog with six teeth per centimeter, then a tooth will repeatedly hit the same section of fabric as it moves past and marking or even damage of the fabric could occur.
The presser foot is required to hold the fabric down firmly against the throat plate, thus preventing the fabric rising and falling with the needle. At the same time, it holds the fabric against the teeth of the feed dog as it rises up to transport the fabric. It is normally held down by spring pressure in order to ‘give’ slightly whilst the fabric plies are being fed. Minimum pressure should be used consistent with correct feeding of the particular fabric in use. Unfortunately, in high speed sewing there is a tendency for the presser foot to bounce as the feed dog makes contact with it, and this reduces the effective contact between the presser foot and the fabric and thus the control of the fabric.

In the drop feed system, the presser foot remains stationary with the fabric sliding under its sole and this surface must have low friction characteristics. The use of PTFE-coated feet helps reduce friction, though care must be taken not to run the machine without fabric between the PTFE surface and the feed dog or the surface will be damaged.
Work aids

Edge guides. (i) Straight. (ii) Curved.

Feed system for use with a folder
Lap fell seam folder

Hem folders.
(i) Narrow hem folder.
(ii) Wider hem folder.

Compensating feet.
Special presser feet. (i) Piping foot. (ii) Half zip foot. (iii) Narrow toed zip foot.

3: Pivoting presser foot

4: Double presser foot with edge guide (5 to 7 mm inset)
5: Double presser foot with 2 mm edge guide

6: Left hand zipper closing

7: Presser wheel and swivelling edge guide

8: Presser foot with built-in piping guide
(i) Gauging foot. (ii) Split ruffling foot.

Invisible zips.
(i) Presser foot for invisible zips.
(ii) Seam diagram as sewn.
(iii) Seam diagram as worn.
B- Mechanized (short and long cycle) machines (simple automatics)

These are machines that still require the operator to place and control parts within the sewing area but which sew a predetermined stitch line or pattern. Such machines include:
- buttonhole machines;
- button sewing machines;
- bar tack machines;
- pocket welt machines;
- spot tack machines.

In general, they are powered by continually running motors that, when engaged, power the sewing head for the duration of the stitching cycle. The motion of the feed system is generated from stitch cams, which can be engineered to give different seam profiles.
• **Buttonhole machines**

These come in a variety of types according to the type of buttonhole needed on the garment. The variables in buttonhole machines are the form and size of the buttonhole, the stitch type (lockstitch or single- or two-thread chainstitch), the stitch bight, the stitch density, whether the buttonhole is cut before or after sewing, and the presence or absence of a gimp.

The choice between cut-before and cut-after machines applies principally to buttonholes in tailored outerwear. The advantage of cut before buttonholes is a neat appearance with the thread covering the raw edges of the hole effectively. The disadvantages are that once the sewing cycle has begun, the position of the hole cannot be altered and that with the fabric flagging slightly at the edge of the hole the regularity of stitch formation may vary (which tends to restrict cut before buttonholes to relatively densely woven, well-milled fabrics).

The advantages of cut-after buttonholes are that the edge of the fabric gives some protection to the thread, the fabric is more stable during sewing, and repositioning is possible after the machine cycle begins if an error is detected. The main disadvantage relates to the finished appearance of the buttonhole, with the cut ends of fibres protruding between the stitches; the worst appearance is on the fronts of jackets with a dark coloured outer fabric and a light coloured interlining. This style of buttonhole is also used on denim jackets and jeans that are laundered before sale to give a worn look. In this case the cut-before buttonhole is preferable as the severity of the laundering process causes a very untidy appearance on cut-after buttonholes.
Gimp is a stiff thread positioned at the edge of the buttonhole under the stitching when the finished buttonhole requires reinforcement to preserve its shape and bulk to raise the purl effect of the stitch proud of the surrounding fabric.

The choice between lockstitch and chainstitch is affected by the security requirements of the hole, the finished appearance required and the relative costs involved (both capital and operating costs). In general, buttonholes on tailored outerwear make use of a two-thread chainstitch of the 400 class, the chain effect giving an attractive purl appearance to the buttonhole. The simpler shape of a buttonhole on shirts and other lightweight garments is often sewn with single thread chainstitch, and in some cases the sewing is done inside out on the garment so that the purl side of the back of the stitch is on the right side. Increasing use is being made of lockstitch buttonhole sewing to give greater security on these types of garment. For shirts, where the garment shape remains the same and the fronts can be buttonholed before assembly, sequential machines are available which sew all the buttonholes on the front, moving the garment part along by the correct amount between each and stacking it at the end. These will be referred to again when describing automatic machines.

• **Buttonsew machines**

  The variables in buttonsew machines are the size and shape of the button that determines the design of the button clamp, the number and disposition of the holes, the form of stitching where there are four holes (this may be crossover or parallel – known as 'swiss kiss'), whether the button has a sewn shank or neck, the stitch type (lockstitch or single thread chainstitch), and the number of stitches. Buttons may be flat with two or four holes or they may have a shank on the back.

  The advantage of lockstitch buttonsewing is security but its disadvantage is an untidy look to the stitching on the other side of the fabric from the button. A chainstitch buttonsewer gives a cleaner appearance at the back but less security.
• Bar tack machines

These machines sew a number of stitches across the point to be reinforced and then sew covering stitches over and at right angles to the first stitches. The variables are the number of tacking stitches and the number of covering stitches. Typical uses are closing the ends of buttonholes, reinforcing the ends of pocket openings and the bottoms of flies, and sewing on belt loops.

• Label sewers

A variety of label sewers are available, from those sewing simple zig-zag stitches to a predetermined length on one or two edges of a label, to programmable profile stitchers that can sew round a wide range of shapes and sizes of label. A specially shaped cylinder bed machine is available over which the inside pocket of a jacket can be passed, enabling jackets to be labelled with a retailer’s label after manufacture.

C- Semi-automated machines

(Automated workstations)

These offer many features similar to mechanized machines but are electronically controlled and are hence more flexible. Parts are still entered by a human operator but are subsequently clamped and moved by an x–y stepper motor arrangement, which can be reprogrammed to give different seam profiles. Some of the examples already given (buttonhole and button sewing machines) now use this technology. A principal application has been programmable bar tack machines, which can produce basic patterns (i.e. on seat belt mountings). Other applications include:

• semi-automated serges;
• semi-automated leg seaming machines.
In all the machinery that has been discussed so far, the operator must still undertake a significant amount of the handling. Despite the application of a wide range of work aids, the operator’s pattern of activity is still handle – sew – handle – sew – handle, etc. The principle behind automated workstations is that the operator is able to undertake further useful handling while the machine is sewing and at least some of the handling time is incorporated into the sewing time. Such workstations always contain a sewing machine, but in many cases it is surrounded by other parts of the total system and is barely visible. Combinations of pneumatic and mechanical handling achieve the wide variety of fabric movements that are needed.

Their modes of working can be roughly classified as follows:

(a) The machine sews continuously while the operator keeps it supplied with garments. An example would be a machine that turns up the cuffs on short sleeved casual shirts. The operator can pick up and position a garment part during the time the machine takes to sew the previous part.

If H and S are taken to represent operator handling and machine sewing respectively, and – to indicate continuous operation, the operation of this type of machine can be represented diagrammatically:

Operator  H – H – H – H – H  deal with bundle
(b) The machine sews an automatic cycle, which includes the handling during sewing that would normally be done by the operator. During the cycle the operator performs the considerable amount of handling that is needed to prepare for the next cycle of automatic sewing. An example is the automated version of the stitching jigs described earlier. In this situation the machine, once loaded with a jig and started, controls the speed and direction of sewing around that jig. It stops automatically at the end, whereupon the operator removes the jig and replaces it with a new one, which was loaded with garment parts during the previous sewing cycle.

Operator  H : H : H : H : H deal with bundle
Machine  S : S : S : S : S pause

(·) indicates a brief pause on the part of the operator and the machine as each reaches the end of its cycle of loading or sewing.

(c) The machine sews an automatic cycle in which a difficult sewing job is achieved very quickly and accurately, but the operator is not able to do much during the cycle time. Examples are the construction of a jetted pocket in a tailored jacket or the attaching of a patch pocket to a shirt front or a pair of jeans. Several parts have to be loaded into the machine but the sewing cycle is then short and of perfect quality. The utilisation with these machines is about 80 per cent.

A representation of the operation of this type of machine would be as follows, w indicating that the operator is waiting for the machine.

Operator  H w H w H w H w H w H deal with bundle
Machine  S : S : S : S : S : S pause
(d) The machine sews a fairly long automatic cycle during which the operator is idle between loading and unloading. To avoid this, more than one machine is operated, perhaps even three or four. An example is the buttonhole and buttonsew machines referred to as sequential, which can move the garment part, normally a shirt front not yet attached to the rest of the shirt, by the correct amount between each buttonhole or button until the complete set has been sewn. Automatic button feeding would, of course, be included. The sewing of six buttonholes on a shirt front can take around 0.35 minutes and in this time the operator can easily load another machine and then another.

Operator : H(1) : H(2) : H(3) : . . . . .
Machine 1 : S(1) : . . . . .
Machine 2 : S(2) : . . . . .
Machine 3 : S(3) : . . . . . . . . . .

Automated workstations have achieved productivity improvements by:

• increasing speeds of machines
• numerically-controlled (NC) features, often combined with sensors
• attachments and work aids, generally requiring the operator to load and unload only
• enhancing reliability and thereby reducing downtime
• quick changeovers, thereby reducing downtime
D- Automated transfer lines
(Reprogrammable automated systems)

The later part of the 1980s and the early 1990s saw investment by both the USA and Japan in fully automated sewing systems. In the USA, the Textile and Clothing Technology Centre ([TC]²) developed a transfer line system for producing men’s trousers, while, in Japan, the Ministry for Trade and Industry (MITI) sponsored research into a robotics system for the manufacture of ladies’ jackets.

The reality is that it is extremely difficult to use robots to handle limp materials such as apparel fabrics. However, some offshoots of the research into fault detection and control systems have transferred over to industrial applications quite well, i.e. thread break detection and fabric fault detection.
Garment Accessories and Enhancements

- labels
- decoration (embroidery, motifs and badges, sequins)
- fabrics for support and insulation (linings, interlinings, wadding, shoulder pads)
- narrow fabric trims (lace, braid, elastic, seam binding and tape)
- fastenings (hook and loop fastenings, eyelets and laces, zips, buttons, tack buttons, snap fasteners and rivets)

LABELS

Textile product labels have six main uses:

- informing consumers at the time of purchase, so that better decisions are made
- providing a service to customers regarding the care of the products
- a design feature, giving the product a brand identity (as part of a marketing strategy)
- stating that the product conforms to certain environmental standards
- identifying the flammability risk to help minimise injury
- incorporating a security tag to deter theft
Methods of sewing labels to garments. (a) Sewn flat; (b) rectangular sewing with automated machine; (c) sewn using zig-zag stitching.

DECORATION

Embroidery

Embroidery is a decorative pattern superimposed on an existing fabric by machine stitching using polyester, cotton or rayon threads, or hand needlework using linen, cotton, wool, silk, gold, or silver thread. Open-width fabrics are embroidered using Schiffli machines, whereas cut parts and garments are embroidered using multi-head machines.

As a working rule-of-thumb, about 6 m of embroidery thread is consumed for every 1000 embroidery stitches, and about 2 m of bobbin thread. The bobbin thread tension is set much tighter than the embroidery thread tension, so that only the latter appears on the surface of the fabric.
Many common embroidery problems are caused by an incorrect thread tension or a slightly bent or burred needle. However, garment technologists should give most attention to the way the embroidery design is translated into a sewing programme. There is usually some kind of trade off between cost and visual appearance, and in many cases, the embroidery looks poor because of inadequacies in the conversion of the design to the sewing program.

Regarding machinery, single-head, three-head, six-head and multthead machines are produced to serve the needs of both small-lot manufacturing and mass production. Modern machinery operates at speeds of over 1000 stitches per minute. Variants include the size of the sewing area, the number of needles, features to assist changeover and reduce downtime, electronic control and the provision of programmability.

Embroidery may require the use of a backing fabric to ensure a uniform appearance of stitching. Backings are normally non-woven and may be ‘tearaways’ (removed afterwards by tearing loose material) or ‘cutaways’ (removed by trimming with scissors). Tearaway backings are preferred for economy of both materials and labour. Cutaway backings are used with higher quality embroidery designs.
Miller (1995) has identified examples of poor embroidery that occur in three different areas:

- the quality of stitching
- the quality of punching
- the quality of design

The poor quality stitching can be traced to the embroidery machining operation, for example ends not trimmed properly, joining threads not trimmed properly, and uneven fabric stretching when loading.

The poor quality punching relates to the digitising process, taking an image and representing it in electronic form. Punching needs to take account of the thread being used, the size of the design, and the fabric being embroidered. Failure to address these issues can lead to embroidery that does not adequately cover the background fabric, where details are too prominent visually and detract from the design, and where the fabric deforms because it is poorly matched with the design.

Printed images are two dimensional, whereas embroidery is a three-dimensional structure. Factors such as stitch direction, stitch colour, stitch length and stitch type must all be considered when preparing electronic instructions for a programmable embroidery machine.

Poor designs tend to occur when embroidery is perceived as an ‘add-on’ feature, with the primary purpose of enhancing the value of a garment. The embroidery then tends to be abstracted from the whole garment, rather than integrated within an overall design. The resultant problems may relate to the size, the placement, the thread colours, the design theme and the ability of the wearer to relate the embroidery to the end use of the garment.
Motifs and badges

The term motif is often used to describe a decorative addition to a garment, but the use of motifs carrying a company’s name, trade mark or logo is now widespread.

Consequently, the subject of labels and the subject of motifs cannot be separated easily. The majority are either an all-over embroidery, a section of fabric with some embroidery on it, or a section of fabric neatened or sealed in some way at the edges and carrying a printed design.

Printed motifs are often designed to be attached by a heat transfer process for which a special small heated press is used. Motifs may be attached by sewing but to do it freehand is likely to be slow and potentially inaccurate. For companies sewing large quantities of such items, lockstitch machines are available which can be programmed to sew the particular profile required.

Sequins

Sequins come in a wide range of shapes and are usually made of plastic. They generally have a shiny, metallic finish, but some are nearly transparent and some are iridescent. Typical diameter ranges are 6–16 mm.

Traditionally, the method of assembly makes use of a special device called a tambour hook, often with an embroidery thread. They may be sewn in rows using large backstitches, applying one sequin with every stitch. Clothing manufacturers can use a purpose-built chainstitch machine to sew sequins one at a time, using a special foot to hold the sequins. Alternatively, pre-strung sequins or sequins attached to a backing fabric can be sewn using a lockstitch, chainstitch or zig-zag machine. The machine is fitted with a fine needle so that it penetrates the sequins without causing damage.
Child’s tee shirt. The flower is made of sequins and beads. The stalk and the brand identity are embroidered.

FABRICS FOR SUPPORT AND INSULATION

Linings

Linings are generally a functional part of a garment, being used variously to maintain the shape of a garment, to improve the hang and comfort by allowing it to slide over other garments, to add insulation, and to cover the inside of a garment of complicated construction to make it neat.

Linings are available as warp knits, but predominantly they are woven and are made from polyester, polyamide, acetate and viscose for use where a slippery material is required, and from cotton, polyester/cotton and wool or wool mixtures in plain or brushed versions where decoration or warm handle is required. Where non-slippery lining fabrics are used in garments, they are generally used only for the body, the sleeve being lined with a more slippery material to make putting on and taking off easier.
For jackets, coats and raincoats the outer garment must not be constrained in any way by tightness in the lining and in these garments there is normally extra lining fabric in the body and the sleeve. In skirt and trouser linings, the stability of the outer garment in wear may be assisted by the lining being slightly smaller than the garment.

Linings made from polyester, polyamide or viscose can, in some constructions, be prone to the problem of seam slippage described earlier. Since these fabrics also tend to fray easily, a loss of seam allowance by fraying can contribute to seam slippage and it may be necessary to neaten seam edges during lining construction even though the garment and its lining will be totally bagged out and the lining edges will not be seen. Where a coat and its lining are open at the hem it is common to neaten the lining edges. In practice, if safety stitch machines are available, linings can be joined and neated simultaneously at no extra cost except for the thread.

**Interlinings**

Interlinings are used to support, reinforce and control areas of garments such as collars, cuffs, waistbands, hems, facings and the fronts of jackets and coats. They may be sewn into the garment or attached by means of fusing.

Interlinings are available in a wide variety of weights and constructions to match the properties of the garment fabrics they will support. They can be woven or non-woven, both of which can be constructed to give a different softness or resilience in different directions. Woven interlinings are, most commonly, plain weave construction.

Non-woven interlinings are made directly from textile fibres and are held together by mechanical, chemical, thermal or solvent means or by a combination of these. The fibres used can be viscose rayon to provide the harder handles, polyester to provide supplier handles, nylon to provide resilience and bulk, or some combination of these fibres to give specific physical and mechanical properties.
Non-woven interlinings have different properties according to the way in which the fibres are laid in making the material. The fibres may be laid at random for all-round stability, parallel to give stability in one direction with extensibility in the direction at right angles, cross to give extensibility in both directions (making them suitable for soft outer fabrics), and composite to give combinations of properties for general purpose interlinings. A variety of methods is available to bond the fibres together within the material and this also affects the interlining properties.

Wadding

Wadding or batting are the names given to the fibre fillings used in garments where warmth is required without great weight. They aim to simulate the warmth and lightness of down, but with the advantage of washability and speed of drying as well as lower cost. The fibre used most commonly is polyester, although polypropylene is also used where a garment will not be subjected to the heat of dry-cleaning.

For maximum insulation, as much air as possible must be trapped among or within the fibres, which must be as light and resilient as possible. The fibres themselves are of various diameters and may be solid or hollow with the possibility of one or more hollow channels within them.
In the construction of a garment, the batting must be quilted, i.e. sewn to an outer fabric. Present fashion demands that this quilting, where it shows on the outside of the garment, should be spaced as widely as possible. The more closely spaced traditional quilting does not require that the fibres in the batt are attached to each other in any way because they are held sufficiently in place by the quilting itself.

The further apart the stitching is, the greater is the need for some kind of binding agent in the wadding, enabling the fibres to adhere together and not drop towards the garment hemline or the lower part of a stitched cube, box (the traditional diamond shape), or channel.

The necessary bonding can be achieved in a variety of ways, mainly by the addition of a resin or the use of heat bonding. Heat-bonded battings are softer and are the result of the inclusion of a proportion of fibres of lower melting point or the making of each fibre in a bicomponent form.

The main factors governing the choice of wadding are the amount of bulk appropriate to the style, the amount of insulation that must be provided, and the cost.

For showerproof garments, the problem of water penetration exists where an outer fabric is quilted. This may be overcome with thin wadding by the use of stitchless quilting by ultrasonic welding in the kind of box designs normally achieved by sewing.
Shoulder pads

Shoulder pads have long been a standard item in tailored garments both for women and for men, but from time to time they become a fashion item and are seen in a much wider range of garments including knitwear and lightweight blouses.

The pads themselves are available in a variety of shapes and thicknesses to suit garment styles and to give the requisite amount of bulk, and in a variety of materials and constructions, depending largely on whether they are required to be washable or only dry-cleanable, and whether they are to be used in a lined or unlined garment.

The simplest are made from foam with a lightweight knitted polyamide covering; these are used in unlined garments such as blouses, dresses and knitwear. They are tacked to appropriate seam turnings using a buttonsew machine and are both washable and dry-cleanable.
If a particularly neat appearance inside the garment is required, the pads might be covered with the actual garment fabric but it is essential to preserve the three-dimensional shape of the pad. Washable and dry-cleanable pads for lined garments often consist of an outer layer of non-woven material sandwiched over a foam or fibre inner. Large stitches through all the layers hold the pad together. They are attached by methods similar to those for the unlined garments.

For lined garments that will be dry-cleaned only, such as men’s tailored jackets, the pads are normally built up of several layers of foam or various non-woven materials, and these layers may be needle-punched together. The pad is attached to the edge of the jacket at the armhole seam and also to the interlining, forming the chest piece, and accurate positioning is vital.

Many companies now make use of pads on which there are small areas of adhesive resin of the type used in fusible interlinings. These pads can be attached to the jacket using an iron or, to be really sure that the jacket is in the correct shape that it will be when worn, using the type of shaped shoulder press that is common in menswear production.

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NARROW FABRIC TRIMS

Lace, braid and elastic

Lace

The term lace correctly refers to the type of open structure originally made by hand and now available in a variety of machine-made forms. Some are formed from twisted yarns, some are embroideries on net or more solid fabric, and others are knitted. For present purposes, the construction is important for the following reasons. Some types may be so open structured that stitch types such as 101 may not sew them satisfactorily.

Some fray on one edge rather than being neat on both sides and these must be neated during garment construction. This is common with the embroidered fabric known as broderie anglaise. Others have a scalloped edge and for maximum decorative effect must be sewn to the garment along the shape of the scallop.
**Braid**

Braids were originally braided fabrics, produced by interlacing yarns diagonally in a form of plaiting. They were either narrow flat fabrics or the type of narrow tube familiar as shoelaces.

![Braid Image](image)

**Elastic**

Where elasticated effects are required locally on garments but without added decoration, corded elastic of various widths and even flat rubber strips are used.

Corded elastics contain rubber or elastane threads, which provide high stretch and recovery. Elastane is more common nowadays than natural rubber because of its greater durability. A typical use is on the waist of a loose-fitting dress or at the wrist of a sleeve that ends in a frill. A 3 or 4 mm elastic would be used and it would most commonly be sewn using a 304 lockstitch zig-zag.

Flat strips of rubber are used to provide control on the edges of garments such as swimwear and men's briefs. On swimwear they are normally attached to the fabric edge by overedging; the hem is then turned up and secured by sewing with stitch types 304 or 406, depending on the appearance required.
FASTENINGS

Hook and loop fastenings

Hook and loop fastenings, e.g. Velcro, consist of two woven polyamide tapes, one covered with very fine hooks and the other with very fine loops. When pressed together they adhere securely to each other. Hook and loop fastening is used in a limited number of garment applications. Since any part of one side will fasten to any part of the other it is used for adjustable fastenings.

Eyelets and laces

Garments frequently require small holes in them in the form of eyelets for a variety of purposes such as for the prongs of buckles on belts, for ventilation on waterproof garments, for the emergence of drawstrings at waist or around hoods, and for use with lacing as a fastening.

Machines are available of the chainstitch buttonhole type which will stitch a small round hole and these are often used on belts, especially on more expensive raincoats. Since the prong of the buckle is normally of polished metal, the sewn eyelet does not suffer great wear. A more common and more hard-wearing alternative to a sewn eyelet is a metal eyelet and reinforcing washer in brass or steel with a plated or coloured, lacquered surface.
Eyelets that are likely to become wet must be rustproof. A special machine is required to attach the two sections that make up the eyelet. The centre of the visible circle of the eyelet has a short tubular projection on the back. The attaching machine presses the two eyelet sections together through the fabric, with the projection through the centre of the reinforcing washer, and spreads out the end of the tubular section over the edge of the washer so that they become held together permanently.

Any application that is to have a drawstring or lacing of any kind through it must be reinforced with another layer of fabric or interlining.
Zip fasteners

These are the principal items used in clothing that are partly textile in nature and partly non-textile, hard material. They provide a neat, strong fastening in garments, and can be functional or decorative or both. They provide two edges that will mesh together and resist pulling apart when stressed, on a tape support that can be sewn into the garment. They can vary in the materials of the tape, the form and materials of the meshing sections, and in the overall construction and function of the zip. The latter affects predominantly their methods of attachment to garments.

The major types of zip are:

- individual metal teeth
- spiral coil
- plastic moulded teeth
- invisible zips

The tapes are most commonly woven and can be of cotton, polyester, polyamide or mixtures. The meshing sections can be individual teeth of metal, typically brass although aluminium can be used to reduce the cost. For aesthetic reasons, a variety of finishes have been developed: antique brass, black oxidized, nickel, antique nickel, and copper.

Alternatively, they can consist of plastic teeth. These are either attached to tape by injection moulding or they are made from a continuous spiral of plastic (polyamide or polyester).

The slider should be considered the most important part of the zip. When selecting the appropriate slider, consideration should be given to convenience of use, functional performance, laundering, and aesthetic appearance. For example, ball and chain sliders or sliders with large pull tabs or rings are usual on skiwear and other outdoor garments because they can be grasped by gloved hands.
Zips are available in a variety of forms, principally:

- made to length with stop and slider
- invisible, made to length with stop and slider
- continuous with added stop and slider
- made to length, open ended with slider
- made to length, open ended with two sliders
Zip insertion. (i) Concealed skirt zip insertion. (ii) Men's trouser zip fly construction.

Continuous zips are of the polyamide spiral type and can be purchased either as a reel of closed zip or with the two sides separate. In the closed form, they can be inserted into a variety of seams, for example in the back of a child's or lady's dress; a twin-needle machine can be used. The end stop and the slider are added later by means of special machines. No top stops are needed, provided there is a seam across the top as part of the garment's construction.

One of the most important advantages of continuous zip tape, however, is found when it is used unjoined as it often is in the construction of men's trousers. It is a common construction sequence with men's trousers that each leg is assembled completely, with a partly or even completely finished waistband, and the garment then completed by joining the crutch seam and the zip.
Zips that can be opened at the lower end are required in garments such as cardigans and jackets which have to be undone completely rather than stepped into. They are also used when a garment section might be removed for some situations of wear, e.g. anoraks and ski jackets with zip-out sleeves or with an inner body-warmer that attaches by means of a zip. The two sections of the garment can only be joined or separated when the slider is fully to the bottom of the zip. This type of zip may have chunky, plastic teeth and slider and be decorative as well as functional.

Zips with two sliders are used on longer length jackets and waistcoats where there would be a strain on the bottom of the zip when the wearer is seated. Both sliders must be fully to the bottom for the zip to be joined or separated, but in wear the lower slider can be pulled up and the lower end of the zip opened when required.

Buttons

Buttons are hardware items used in conjunction with buttonholes for the fastening of garments. They can add decoration as well as providing a closure; buttons can be used alone as decoration. The variety of materials from which buttons can be made is considerable, including natural wood, bone, horn and mother-of-pearl, and man-made metal, polyester, polyamide, acrylic, urea formaldehyde and casein.
Tack buttons

Tack buttons consist of two sections. The outer button fastens with the buttonhole and has a similar appearance to the previously described shank button, except that it is not attached by sewing. The inner tack penetrates the fabric from the inside of the garment and is secured into the shank of the button by means of a special machine.

The two parts can be brass or steel and the button can be made with a decorative design or logo, but it must be rust proofed. Once attached to the garment, they cannot be moved and it is thus more important that positioning is accurate than it is with sewn buttons. The garment fabric must be sufficiently strong, with the addition of an interlining if necessary, to take the stress to which such a button will be subject.
Snap fasteners

Snap, press or stud fasteners come in a variety of types. They all consist of four elements: a cap and socket that fit together and form the outer, female part of the fastening, and a stud and post that form the inner, male part of the fastening, not normally seen when the garment is fastened.

Fasteners should never be attached through a single thickness of material, but a backing fabric should be used, especially with knitted fabrics. The size used must be appropriate to the number of thicknesses and weight of fabric. The rim of the ring must not cross varying thicknesses of fabric and fastening through binding is preferably avoided. A common-sense test is to insert the fingernail between fabric and rim; if this can be done, failure is probable.
Snap fasteners can be made from plastic, steel or brass with a design on the cap if required. The metal can be enamelled and thus colour-matched to the garment if required. They can also have plastic caps on an otherwise metal assembly, which gives further design and colour possibilities. They have wide uses, both decorative and functional, and in appropriate sizes and materials are used from heavy denim jackets to infants’ stretch suits. They are quick to attach using appropriate machinery which automatically feeds the separate sections into position.

Rivets

Rivets are used for decoration and reinforcement on garments, mainly jeans, and may consist of one or two sections but in both cases a special machine is required to attach them. When the rivet is used alone, the tubular section on the back of the rivet that is passed through the material is spread out by the machine on the inside of the garment. In the two-part system the rivet is attached to a cap or a washer on the other side, and depending on the appearance required, either side may be used on the outside of the garment.