Weft vs Warp Knitting: Loop Formation, Needles, Machines and Fabrics Compared

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In one paragraph

Weft and warp knitting both make fabric from loops of yarn drawn through other loops; what differs is the way the yarn travels. In weft knitting a yarn is fed across the needles and each needle in turn pulls a loop from it, so a row of loops (a course) is made by one yarn running across the fabric, as in hand knitting, T-shirt jersey, rib cuffs and socks. In warp knitting a sheet of yarns comes off beams, each needle is fed its own yarn, and guide bars wrap the yarns round all the needles at once, so every yarn zigzags along the length of the fabric from one column of loops (a wale) to the next, as in tricot lingerie fabric, swimwear, lace and power-net. Everything else follows from that. Weft knits stretch more across their width, a plain weft knit can ladder and unravel, and weft machines can shape panels and whole garments. Warp knits are flatter and more stable, cannot be unravelled course by course, and come off the machine in continuous widths, knitted from beams of thousands of yarns on tricot machines rated at up to 4,400 rpm.

At a glance

Weft and warp knitting at a glance

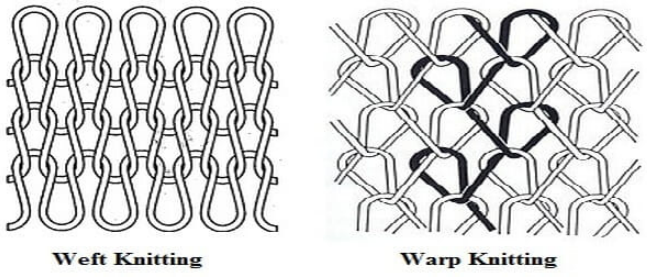
	Weft knitting	Warp knitting
How the yarn is fed	One yarn (or a few, when plating) per feeder, laid across the needles; a single package can make a fabric	A sheet of parallel yarns from warp beams; guide bars give every needle its own yarn
Which way each yarn runs	Across the fabric, along the course	Along the fabric, zigzagging between neighbouring wales
How the needles move	One after another, each lifted by cams acting on its butt	All together, fixed in a needle bar; a whole course is knitted at once
Needles	Mainly latch; compound on some machines	Compound on tricot and many raschels; latch on other raschels; bearded on older machines
Machines	Circular (single and double jersey), flat V-bed, fully fashioned, whole-garment	Tricot (two to four guide bars), raschel (lace, power-net, nets), double-needle-bar raschel (spacer fabrics)
Basic structures	Single jersey (plain), rib, interlock, purl	Tricot, locknit, sharkskin, queenscord; raschel lace and power-net
Stretch	Most across the course; rib most of all	Set by the lapping: long underlaps give width-way stretch, pillar stitches lock the length
Ladders and unravelling	Plain jersey ladders and unravels from either end	Cannot be unravelled course by course; ladder-resistant
Shaping	Panels and whole garments can be shaped on the machine	Continuous widths only
Speed (makers' figures)	3,744 courses a minute: 96 feeders × 39 rpm on a 30-inch single jersey machine	3,200 to 4,400 rpm on two-bar tricot machines
Width and gauge (examples)	Cylinders of 15 to 38 inches, E16 to E44	130 to 210 inches, E28 to E50 (E50 at 130 inches only); 330 inches on the widest

	Weft knitting	Warp knitting
Yarn supply	Cones on a creel, one or a few per feeder; spun or filament	Beams carrying thousands of ends, wound first; filament is the usual feed, staple yarns are harder to run
Typical end uses	T-shirts, knitwear, socks and hosiery, underwear, fleece	Lingerie, swimwear, sportswear, lace, nets, car interiors, mattress covers, technical fabrics

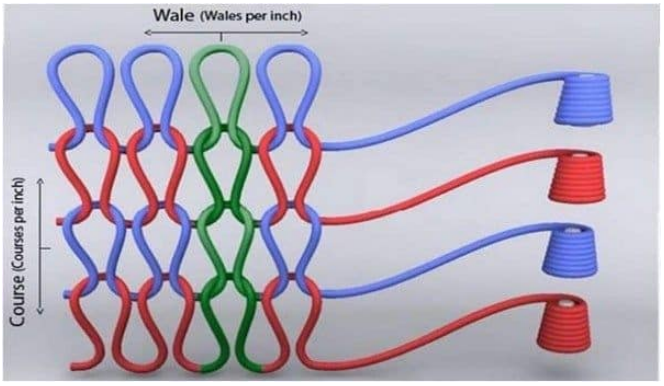
Key figures and their sources

- Mayer & Cie's S4 3.2 II comes in cylinders of 15 to 38 inches and gauges E16 to E44, with 96 feeders and up to 39 rpm on a 30-inch cylinder (Mayer & Cie S4 3.2 II).
  Source: Mayer & Cie S4 3.2 II (mayercie.com)
- Mayer & Cie's D4 2.2 II has 66 feeders and up to 38 rpm on a 30-inch machine, in E14 to E32, and also knits spacer fabric (Mayer & Cie D4 2.2 II).
  Source: Mayer & Cie D4 2.2 II (mayercie.com)
- The company rates the HKS 2-S at up to 3,200 rpm (Karl Mayer, 20 November 2024) and the elastic-fabric HKS 2-SE at 4,400 rpm, calling it "the fastest warp knitting machine in the world" (Karl Mayer, 28 October 2025).
  Source: Karl Mayer, 20 November 2024 (karlmayer.com)
- The widest run slower: 3,800 rpm for the HKS 2-SE at 312 inches (29 June 2026) and up to 2,800 for the three-bar HKS 3-M EL at 330 inches (9 September 2026).
  Source: 29 June 2026 (karlmayer.com)
- Two needle beds knit two faces joined by yarns running between them, which is how spacer fabrics are made (NPTEL, module 8); Karl Mayer's DM 6/2-6 EN runs at 850 rpm making spacer fabrics for luggage and furniture (Karl Mayer, 11 November 2024).
  Source: NPTEL, module 8 (archive.nptel.ac.in)

Diagrams



Weft knitting (left): follow any row and it is one yarn. Warp knitting (right): the dark yarn travels up the fabric, forming a loop in one wale, then in the next, and back.



Courses and wales in a weft knit. Each course comes from its own package, as on a multi-feeder circular machine; one wale is picked out in green. The number of each per inch is the fabric's count.

Revision questions

The questions readers ask most, with the article's own answer.

What is the difference between weft and warp knitting?

The direction the yarn travels. In weft knitting one yarn runs across the fabric and the needles form the loops of a course one after another from it; in warp knitting every needle has its own yarn from a beam, a whole course is formed at once, and each yarn zigzags along the fabric between wales.

What is weft knitting?

Knitting in which the loops are formed across the width of the fabric, each course from one yarn (or a few), fed to the needles in turn. It is done by hand and on circular and flat machines, and its four base structures are single jersey, rib, interlock and purl.

What is warp knitting?

Knitting in which a sheet of parallel yarns from warp beams is lapped round a row of needles by guide bars, so the loops form along the length of the fabric and every needle knits at once. It is done on tricot and raschel machines and makes lingerie and swimwear fabrics, lace, power-net, nets and spacer fabrics.

Is hand knitting weft or warp? Can warp knitting be done by hand?

Hand knitting is weft knitting: the structures weft machines make are the ones “commonly associated with hand pin knitting” (Power, 2008). Warp knits are “produced only by machine” (Britannica), since every needle needs its own yarn, lapped round it at the same moment as all the others.

Which is more stable, a warp knit or a weft knit?

A warp knit. Its yarns zigzag between wales, and it is flatter, closer and more stable and ladders less easily, while a weft knit lets yarn flow from loop to loop and stretches more (KSRCT; Power, 2008).

Is tricot a warp knit or a weft knit?

Tricot is a warp knit, made on a tricot warp knitting machine with compound needles and two to four guide bars. Britannica describes it as having fine vertical wales on the face and crosswise ribs on the back, and as used for lingerie and as a backing for laminated fabric.

Test yourself

Ten questions on this topic. Answer them without looking, then check on the last page.

1. In knitting, what is a wale and what is a course?
2. In weft knitting, how are the needles moved so that the loops of a course form in sequence?
3. In warp knitting, what is the difference between the overlap and the underlap?
4. How many courses make a rack, the standard unit in warp knitting?
5. Who first patented the compound needle, and when?
6. Why is a latch needle slower than a compound needle?
7. What does gauge E mean on a knitting machine?
8. Why is 1×1 rib used for cuffs and the tops of socks?
9. How are the courses a minute of a circular weft knitting machine calculated?
10. About how many warp threads does a two-bar tricot machine of 28 gauge and 5 m width carry?

Answers

Each answer is stated in the article; the section to read again is named after it.

1. **A wale is a column of loops running lengthwise; a course is a crosswise row of loops.**
   See: Weft and warp knitting at a glance
2. **Each needle's butt rides in a cam track; the cams lift and lower the needles one after another.**
   See: How weft knitting makes a loop
3. **The overlap wraps the yarn round the needle hook and forms the loop head; the underlap, on the other side of the needles, joins one wale to the next.**
   See: How warp knitting makes a loop
4. **480 courses.**
   See: How warp knitting makes a loop
5. **Jeacock of Leicester, in 1856.**
   See: Needles: latch, bearded and compound
6. **A latch needle has to travel more than twice as far as a compound needle in each cycle.**
   See: Needles: latch, bearded and compound
7. **The number of needles per inch of bed.**
   See: Weft knitting machines and warp knitting machines
8. **It has, in theory, twice the width-wise recoverable stretch of plain fabric and will not unrove from the end knitted first.**
   See: Stretch, ladders and unravelling
9. **Rpm × feeders.**
   See: Which is faster? A worked example on two machines
10. **About 11,000 warp threads (NPTEL).**
    See: What yarn each method needs

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