INTERNATIONAL STANDARD

**ISO 23606**

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# Textiles — Knitted fabrics — Representation and pattern design

*Textiles — Étoffes tricotées — Représentation et mise en carte*

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# Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 23606 was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 20, *Fabric descriptions*.

# Textiles — Knitted fabrics — Representation and pattern design

## 1 Scope

This International Standard specifies various systems of symbolic notation and pattern design for knitted fabrics.

The symbolic notations contained in this International Standard do not necessarily constitute the only method of representation.

## 2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

**2.1**
**knitted fabrics**
generic name applied to textile fabrics in which at least one system of threads is formed into knitted loops and the knitted loops are intermeshed into stitches

[ISO 8388:1998, definition 3.0.1]

NOTE Knitting machines classified according to ISO 7839 are used.

**2.2**
**weft-knitted fabrics**
generic name applied to knitted fabrics in which the stitches made by each thread are formed substantially across the width of the fabric

NOTE 1 Weft-knitted fabrics are characterised by the fact that each weft thread is fed more or less at right angles to the direction in which the fabric is produced.

[ISO 8388:1998, definition 3.0.2]

NOTE 2 Weft-knitted fabrics are manufactured on flat or circular weft-knitting machines as classified in ISO 7839.

**2.3**
**warp-knitted fabrics**
generic name applied to knitted fabrics in which the stitches made from each warp thread are formed substantially along the length of the fabric

NOTE 1 Warp-knitted fabrics are characterised by the fact that each warp thread is fed more or less in line with the direction in which the fabric is produced.

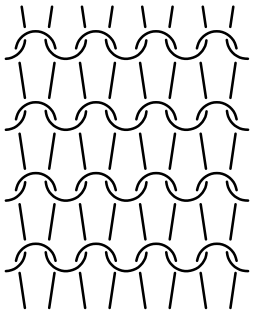
[ISO 8388:1998, definition 3.0.3]

NOTE 2 Warp-knitted fabrics are manufactured on flat or circular warp knitting machines as classified in ISO 7839.

NOTE 3 Stitch-bonded fabrics are a special variation of warp-knitted fabrics manufactured on flat warp knitting machines in accordance with ISO 8640-4, which are equipped with stitch-through compound needles, etc.

# 3 Weft-knitted fabrics

## 3.1 Representation

| Term No. | Term | Definition, example |
|---|---|---|
| **3.1.1** | **loop structure** | magnified, two-dimensional line representation of the yarn path in a knitted construction<br>EXAMPLE Single jersey-based fabric (technical reverse side).<br>  |
| **3.1.2** | **pattern draft** | diagrammatic representation of a knitted fabric carried out on a pattern drafting screen by taking stated divisions into account<br>NOTE A distinction is made between a graphic pattern draft (3.1.2.1) and a technical pattern draft (3.1.2.2). |
| **3.1.2.1** | **graphic pattern draft** | pictorial representation of a knitted fabric |
| **3.1.2.2** | **technical pattern draft** | symbolic representation of the stitches of a knitted fabric read according to the manufacture of a knitted fabric from bottom to top<br>NOTE 1 A technical pattern draft can be a two-dimensional representation on a grid or a linear representation on matrix dots (yarn path).<br>NOTE 2 A technical pattern draft is represented either as a construction pattern draft (3.1.2.2.1) or as a working pattern draft (3.1.2.2.2). |
| **3.1.2.2.1** | **construction pattern draft** | symbolic representation of the structure of a knitted fabric |
| **3.1.2.2.2** | **working pattern draft** | symbolic representation of the working process according to the manufacture of the knitted fabric |

## 3.2 Basic rules of representation

**3.2.1** The two-dimensional representation and yarn path representation can be used simultaneously or separately for the technical pattern drafting of a knitted fabric. The construction can either be represented according to the knitted structure (construction pattern draft) or according to the manufacture (working pattern draft).

**3.2.2** The pattern draft is built up according to the yarn path from bottom to top. To achieve the representation of the yarn path, start with the left needle of the front needle carrier and finish with the right needle of the rear needle carrier. Knitting machines with short and long needles in their needle carriers have a long, first needle in their front needle carrier.

**3.2.3** The technical pattern draft provides options of representation for each stitch element and its variations. The pattern draft can, however, be shortened by drafting the repeats of the ground pattern into the left bottom corner of the pattern draft field and by entering only the variation from the ground pattern in the remaining pattern draft fields (abbreviated representation). If in doubt, the complete representation is mandatory.

**3.2.4** A horizontal row of the technical pattern draft is equivalent to a single manufactured stitch course.

**3.2.5** A working pattern draft of, e.g. a fleecy fabric, requires a multi-row design.

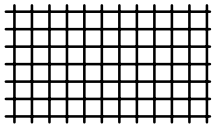
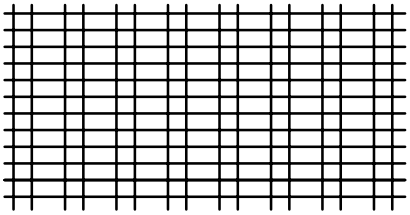
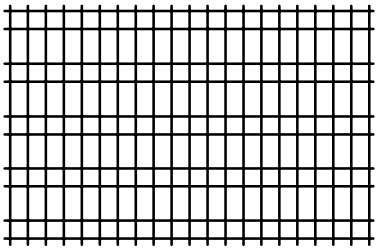
**3.2.6** In two-dimensional representations of transfer stitches, an additional mark of the stitch side is applied for purl-based fabrics by appropriate symbols for the technical face side and the technical reverse side next to the symbol for transfer stitches.

**3.2.7** Auxiliary signs that refer to a crosswise row of the pattern draft (course) shall be arranged on the right side of the pattern draft. Auxiliary signs that refer to a lengthwise row of the pattern draft (wale) shall be arranged below the pattern draft. Auxiliary signs referring to a symbol shall be arranged inside the pattern draft below the appropriate symbol.

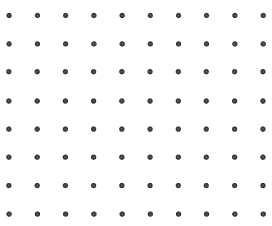
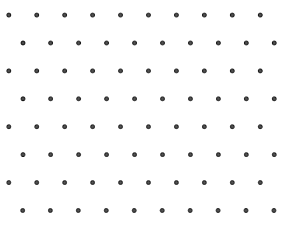
**3.2.8** The pattern draft shall contain at least one pattern repeat for height and width. The pattern repeat shall be marked.

## 3.3 Pattern draft grids

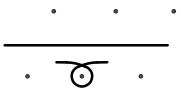
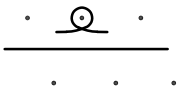
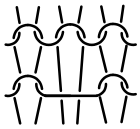
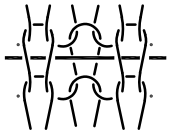
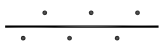
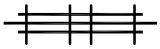
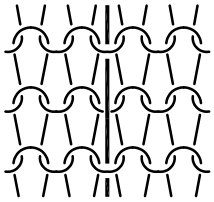
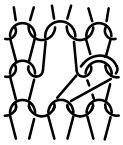
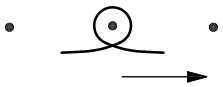
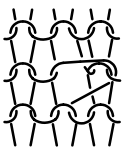
### 3.3.1 Pattern draft grids for two-dimensional representation

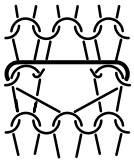
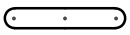
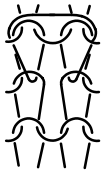
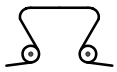
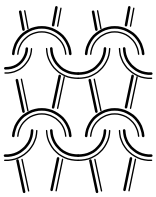
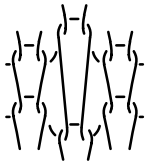
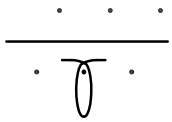
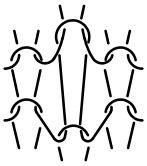
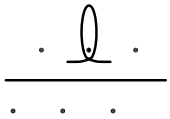
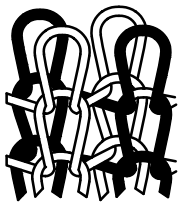
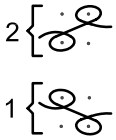
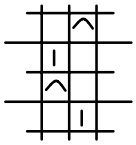
| Term No. | Term | Definition, example[a] |
|---|---|---|
| **3.3.1.1** | **square grid** | grid with regular field divisions at right angles  |
| **3.3.1.2** | **special grid across** | grid, applicable to rib-based fabrics, with irregular field divisions at right angles made up of a large horizontal and a small vertical rectangle at a time, arranged next to each other and alternately in parallel lengthwise rows<br>NOTE The large horizontal rectangles are used to mark stitch elements or processes on the front needle carrier. The small vertical rectangles are used to mark stitch elements or processes on the rear needle carrier.  |
| **3.3.1.3** | **special grid vertical** | grid, applicable to interlock-based fabrics, with irregular, rectangular field divisions (as per 3.3.1.2 but rotated by 90°)<br>NOTE The large vertical rectangles are used to mark stitch elements or processes on the front needle carrier. The small horizontal rectangles are used to mark stitch elements or processes on the rear needle carrier.  |
| [a] The examples given show three frequently used pattern grids. Depending on requirements, the line distances are different for individual pattern grids. | | |

### 3.3.2 Pattern grids for yarn path representation

| Term No. | Term | Definition, example[a] |
|---|---|---|
| **3.3.2.1** | **dot matrix straight-line** | grid, applicable to single jersey-based, purl-based and interlock-based fabrics, with parallel rows of dots according to the needle arrangement in the needle carriers  |
| **3.3.2.2** | **dot matrix transposed** | grid, applicable to rib-based fabrics, with transposed rows of dots according to the needle arrangement in the needle carriers  |
| [a] The examples given show two frequently used pattern grids. Depending on requirements, the dot distances are different for individual pattern grids. | | |

## 3.4 Symbols for representation

| Term No. | Term | Loop structure | Yarn path representation | Two-dimensional representation |
|---|---|---|---|---|
| **3.4.1** | **needle welt** |  |  |  |
| **3.4.2** | **stitch**<br>— technical face side<br>— technical reverse side |  <br>  |  <br>  |  <br>  |
| **3.4.3** | **tuck loop**<br>— technical face side<br>— technical reverse side |  <br>  | <br>  |  <br>  |
| **3.4.4** | **float** |  |  |  |
| **3.4.5** | **weft inlay** |  |  |  |
| **3.4.6** | **warp inlay** |  |  |  |
| **3.4.7** | **transfer stitch** |  |  |  |
| **3.4.8** | **semi-transferred stitch; split stitch** |  |  |  |

| Term No. | Term | Loop structure | Yarn path representation | Two-dimensional representation |
|---|---|---|---|---|
| **3.4.9** | **expanded stitch** |  |  |  |
| **3.4.10** | **transferred sinker loop** |  |  |  |
| **3.4.11** | **plated stitch** |  |  |  |
| **3.4.12** | **pile loop closed** |  |  |  |
| **3.4.13** | **long stitch**<br>— technical face side |  |  |  |
| | — technical reverse side |  |  |  |
| **3.4.14** | **rib, 1/1** |  |  |  |
| **3.4.15** | **interlock** |  |  |  |

## 3.5 Auxiliary signs

### 3.5.1 Racking

On a dot matrix transposed grid, racking is indicated by a horizontal arrow pointing in the direction of the racking. The length of the arrow indicates the number of needles for the displacement. Vertical lines indicate the relationship to the racked needle carrier (see Figure 1).

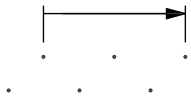
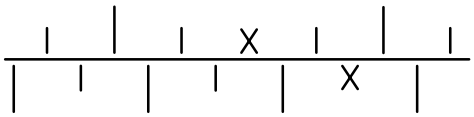


**Figure 1 — Racking of the rear needle carrier by two pitches to the right**

### 3.5.2 Needle position and needle application

A line in the lengthwise direction is used to indicate a needle in the working position. A horizontal cross is used to indicate a needle in the idle position (see Figure 2).



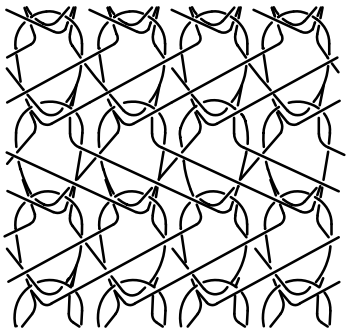
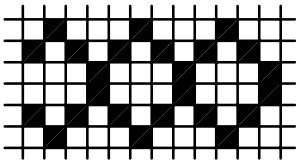
**Key**

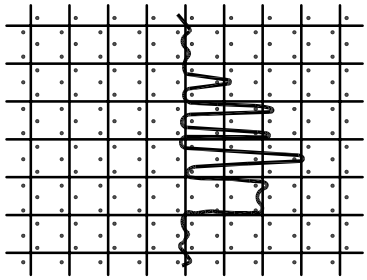
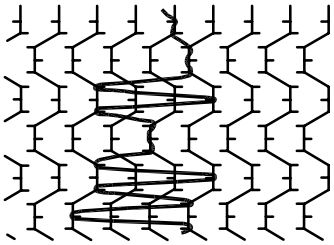
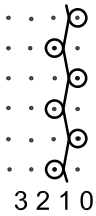
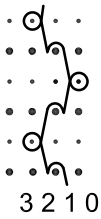
| | long needle
ı | short needle
× | needle in idle position

**Figure 2 — Needle position and application**

# 4 Warp-knitted fabrics

## 4.1 Representation

| Term No. | Term | Definition, example |
|---|---|---|
| **4.1.1** | **loop structure** | magnified, two-dimensional line representation of the yarn path in a knitted construction<br>EXAMPLE Single-face cord ($2 \times 1$)–tricot ($1 \times 1$) (closed stitches, counter-lapped).<br>  |
| **4.1.2** | **graphic pattern draft** | two-dimensional representation of warp-knitted fabric pattern by symbols (colour, signs) on regular, often square grids, used in particular for jacquard patterning<br>  |

| Term No. | Term | Definition, example |
|---|---|---|
| **4.1.3** | **lapping pattern draft** | line representation, read from bottom to top, of lapping of pattern threads in a regular, mostly openwork background<br>NOTE The pattern grid roughly represents the structure of the background.<br>EXAMPLE 1 Lapping pattern draft for quadrangular net (e.g. curtain).<br>  <br>EXAMPLE 2 Lapping pattern draft for hexagonal net (e.g. tulle).<br>  |
| **4.1.4** | **lapping diagram** | schematic representation, read from bottom to top, of the movement of one or more yarn guides around the needles, drafted above each other in rows (dot matrix)<br>EXAMPLE<br>Single-face tricot (1 × 1)<br>  <br>3 2 1 0<br>Double-face atlas<br>  <br>3 2 1 0<br>**Key**<br>• front needle bar (F)<br>· back needle bar (B)<br>NOTE 1 It is common practice to number the gaps below the lapping representation on the dot matrix (equals needle gaps). The type of numbering is dependent on the machine used for manufacture. Numbering starts from the left or right side according to the position of the pattern drive as specified in ISO 8640-3.<br>NOTE 2 For many single-face constructions, this representation corresponds approximately to the path of the yarn when viewed from the back of the stitch. |

| Term No. | Term | Definition, example |
|---|---|---|
| **4.1.5** | **lapping notation** | numeric row-by-row description, read from top to bottom and, when continued, from left to right, of the yarn guide's movement around the needles needed for a repeat<br><br>NOTE The numbering of guide bars in flat warp knitting machines is specified in ISO 10223.<br><br>EXAMPLE 1 Lapping notation for guide bar GB1:<br><br>Single-face tricot: GB1: 1 / 2 / 1 / 0 / =<br><br>Double-face atlas: GB1: F 1 — 2 — B 2 — 3/F 2 — 1 — B 1 — 0 / =<br><br>It is common practice to enter two numbers per course, a hyphen after each course and a double bar after the end of the repeat.<br><br>Depending on the machine and lapping, the lapping notation can also be entered by using only one number (e.g. in an inlay stitch construction) or more than two numbers (e.g. when the working mode of the pattern gear is multi tempi) per course.<br><br>The lapping notation can also be written horizontally, from left to right. In this case, a slash is entered after each course and a double slash is entered after the end of the repeat.<br><br>EXAMPLE 2 Lapping notation written horizontally:<br><br>Single-face tricot ($1 \times 1$) GB1: 1 — 2/1 — 0 //<br><br>Double-face atlas GB1: F 1 — 2 — B 2 — 3/F 2 — 1 — B 1 — 0 // |
| **4.1.6** | **threading notation** | symbolic representation of the presence or the absence of yarn ends in the guides of each bar<br><br>NOTE 1 Depending on the handling of the threading, the description starts either on the right or left.<br><br>NOTE 2 A slash is entered after each threading change and a double slash is entered after the end of the threading repeat.<br><br>EXAMPLE 1 Full and odd threading notation starting from the right.<br><br>GB1: full \| \| \| \| \| \| \| \|<br><br>GB2: 3 out/3 in/1 out/1 in// \| . \| \| \| . . .<br><br>**Key**<br><br>\| yarn in, threaded<br>. yarn out, not threaded<br><br>EXAMPLE 2 Threading representation starting from the left with three different yarns, A, B and C.<br><br>GB1:10A/28B/18C// |

## 4.2 Basic rules for representations and denominations

**4.2.1** Representations shall be chosen according to construction and manufacture and in a way that makes them unambiguous. For this purpose, representations can be used individually or simultaneously.

**4.2.2** For constructions involving few guide bars, it is preferable to enter a lapping diagram, a lapping notation and a threading notation. The lapping diagram of the individual guide bars shall be represented by starting from the bottom for at least one yarn.

**4.2.3** The denomination or abbreviation of a structure shall be entered in the order: base construction — stitch construction.

The construction combinations shall be entered by starting from the construction resting above to the constructions positioned underneath when the fabric is viewed from the technical reverse side.

EXAMPLES

Single-face tricot (1 × 1)

Single-face cord (2 × 1)-tricot (1 × 1)

Single-face pillar stitch inlay

Single-face velvet (4 × 1)-tricot (1 × 1)-cord (2 × 1)

**4.2.4** Additional details relative to the direction of the underlaps (equal/counter lapped), to open or closed stitches (open/closed), to the rows of atlas or shift pillar stitch ($n$ rows) as well as openwork structures (mesh) can be entered to follow a structure denomination.

**4.2.5** A denomination only gives information on essential construction characteristics; it shall therefore be complemented by a representation as given in 4.1.

# Bibliography

[1] ISO 7839, *Textile machinery and accessories — Knitting machines — Vocabulary and classification*

[2] ISO 8388:1998, *Knitted fabrics — Types — Vocabulary*

[3] ISO 8640-3, *Textile machinery and accessories — Flat warp knitting machines — Part 3: Vocabulary of patterning devices*

[4] ISO 8640-4, *Textile machinery and accessories — Flat warp knitting machines — Vocabulary — Part 4: Stitch bonding machines and stitch bonding devices*

[5] ISO 10223, *Textile machinery and accessories — Flat warp knitting machines — Numbering of guide bars*

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