Knitting Parameters

The Knitting Parameters define the knitting production specification for the grey fabric. They include the choice of Yarn Type and the Values entered for the grey Yarn Count and Stitch Length.

For a specific combination of Knitting Machine, Wet Process and Depth of Shade it is the choice of Yarn Type, together with the Knitting Quality Values that determine the Reference Dimensions of the Finished Fabric.

The Finished "as delivered" dimensions are calculated from the Finished Reference Dimensions using the Finishing Quality Target Values that have been entered for the two properties of the Finished Fabric chosen as Finishing Targets.

Within each Fabric Model, only one Yarn Type can be selected at a time but up to nine different Values for Yarn Count can be entered for simultaneous evaluation.

In STARFISH, each Quality is defined primarily by the Value entered for the Yarn Count. An individual Knitting Quality is specified by the Value entered for Yarn Count **and** the Value entered for the Stitch Length. Stitch Length can also be specified in terms of the Course Length or the Tightness Factor.

A different Stitch Length can be specified for each Yarn Count on each Knitting Machine, but the range in the Values that can be entered depends primarily on the Fabric Type and the choice of Units.

The Knitting Parameters and the Finished Fabric Properties are presented in the chosen Units. When a change is made either to the Fabric Manufacturing System, the Working Environment or to the individual Quality Values STARFISH recalculates the data and displays the results.

The following topics provide background information on the options available and the limits that apply.

- Yarn Type
- Yarn Count
- Stitch Length
- Course Length
- Run-in Ratio
- Tightness Factors

Yarn Type

The Yarn Type is one of the selections that specify the Fabric Manufacturing System. The choices made for the Fabric Manufacturing System affect the Reference Dimensions of the finished fabric. The Reference Dimensions determine the balance of fabric properties that can be obtained in the finished as delivered fabric.

The choice of Yarn Type, together with the selections for the Wet Process and Depth of Shade determine which of the standard STARFISH Prediction Equations will be used to calculate the Reference Courses, Wales, Weight, Yarn Count and Stitch Length in the Finished Fabric.

For this reason, only one Yarn Type can be selected for use in a Model at a time. The chosen Yarn Type is applied to all Qualities. However, within each Model the Yarn Type selection can be changed repeatedly and independently of any other selections.

The standard Yarn Type options provided model the effect of different Fibre Preparation and Spinning Systems, the ply of the yarn, and the influence of normal variations in Twist and Fibre Quality, on the finished Fabric Properties.

They represent average Yarn Qualities that have been derived from all of the yarn data available in the current STARFISH database.

Yarn Type Classifications

In the current version of STARFISH, four different 100% cotton standard Yarn Type options are provided.

STARFISH Model Environment
Knitting Parameters

The options are classified according to the method of Fibre Preparation, the Spinning System and the ply of the yarn.

The standard Yarn Type options provided are:

Single, combed ring-spun

A single ply yarn spun from combed fibres and produced on the ring spinning system.

Single, carded, ring spun

A single ply yarn spun from carded fibres and produced on the ring spinning system.

Single, carded, rotor-spun

A single ply yarn spun from carded fibres and produced on the rotor spinning system

Twofold, combed ring-spun

A two ply yarn produced from two single yarns twisted together in one operation. The component single yarns are produced from combed fibre and spun on the ring spinning system.

Yarn Type Selection

The Yarn Type is one of the primary selections that define a STARFISH Model. Only one Yarn Type can be Active in a Model at a time. However, the Yarn Type can be changed repeatedly and independently of all the other selections.

The chosen Yarn Type is used together with the selections for the Wet Process and Depth of Shade to calculate the finished Fabric Properties for all of the Knitting Qualities in a Model.

The Yarn Type options provided are:

- Single, combed, ring yarn
- Single, carded, ring yarn
- Single, carded, rotor yarn
- Twofold, combed, ring yarn

Active Model

The Active Yarn Type is chosen from the option list in the Active Yarn Type dialog.

▷ **Note:**

When the Active Yarn Type is changed, STARFISH recalculates the Finished Fabric Properties data automatically.

Use as Default check box

The Active Yarn Type can also be designated the Default Yarn Type for the Active Fabric Type by turning ON the Use as Defaults check box.

To change the Default Yarn Type for any other Fabric Type use the Default Yarn Types dialog.

Default Models

The Yarn Types for the Default Models are chosen from the Default Yarn Types dialog.

▷ **Note:**

Changing the Default Yarn Type Selections affects only the Default Models for the selected Fabric Types. The Yarn Type currently selected for use in the Active Model or in any of the Current Models is not affected.

Yarn Type Calibration

The Standard Yarn Type options provided refer to 100% cotton yarn. They model the effect of different Fibre Preparation and Spinning Systems, the ply of the yarn, and the influence of normal variations in Twist and Fibre Quality, on the finished Fabric Properties.

They represent average Yarn Qualities that have been derived from all of the yarn data available in the current STARFISH database.

STARFISH Model Environment
Knitting Parameters

Most of the time one of the Standard Yarn Type options will predict the average properties of the finished fabric with sufficient accuracy. However, it is important to establish, from measurements made on representative samples taken from actual production, the influence that the specific Yarn Qualities in use in a mill may have. This is because for a given Yarn Type differences in the basic Fibre Quality or level of Twist can have a significant effect on the Reference Dimensions of the finished fabric.

To allow for those occasions when the average results observed from a particular Yarn Quality are found to be significantly different from those predicted by any of the Standard Yarn Type options a Calibration facility is provided.

Calibration is carried out in the Prediction Window: Seek Calibration by adjusting the Standard STARFISH Predicted Values for the Finished Reference Courses, Wales, Weight, Width, Yarn Count and Stitch Length for one specific Fabric Quality in the Active Model.

The Active selections for the Yarn Type, Wet Process and Depth of Shade determine which of the Standard STARFISH Equations provide the basis for the Calibration.

▷**Note:**

When a User Defined Process is selected as the Active Wet Process STARFISH checks the Active Yarn Type. If the User Defined Process was originally created for a different Yarn Type a Warning Message is generated and the Yarn Type corresponding to the selected UDP is restored to the Active Model. If the Active Yarn Type is subsequently changed, STARFISH recalculates the User Defined Calibration Ratios automatically for the different Yarn Type.

Yarn Count

Yarn Count is the term used to describe the Units for defining the length per unit weight or the weight per unit length of a yarn.

Yarn Count is also often used as shorthand for the actual Yarn Count Values. Units and Values for Yarn Count may also be referred to as Yarn Number or Yarn Size.

The Yarn Count Value is a key Dimensional Control Parameter for a knitted fabric, second only to Stitch Length in importance. It must be correctly specified and consistently maintained to ensure that the Properties of the finished fabric will be as expected.

In STARFISH, each Quality in a Model is defined primarily by the Value entered for the Yarn Count.

Yarn Count Units

STARFISH supports three different Units for Yarn Count.

The Units provided are

- English cotton count (Ne)
- Tex Count (tex)
- Metric Count (Nm)

Conversions

tex = 590.5 / Ne;   Nm = Ne * 1.6935
Ne = 590.5 / tex;   Nm = 1000 / tex
Ne = Nm / 1.6935;   tex = 1000 / Nm

Active Model

The Active Yarn Count Units are chosen from the option list in the Active Yarn Count Units dialog.

▷ **Note:**

Yarn Count Values are displayed in the chosen Yarn Count Units. If the Active Yarn Count Units are changed, the Active Yarn Count Values are converted automatically to correspond to the new Unit.

Use as Default check box

The Active Yarn Count Unit can also be designated the Default Yarn Count Unit for the Active Fabric Type by turning ON the Use as Default check box.

To change the Default Yarn Count Unit for any other Fabric Type, use the Default Units dialog.

Default Models

The Yarn Count Units for the Default Models are chosen from the Yarn Count Tab on the Default Units dialog.

▷ **Note:**

Changing the Default Units selections affects only the Default Models for the selected Fabric Types. The Yarn Count Units currently selected for use in the Active Model or any of the Current Models are not affected.

Yarn Count Values

Each Quality in a STARFISH Model is defined primarily by the Value entered for the Yarn Count and is identified by a Quality Number.

▷ **Important Note:**

STARFISH does not check that the Yarn Count Values entered are appropriate for the specified Knitting Machines. It is the responsibility of the User when entering Values for Yarn Count or selecting Knitting Machines that practical and commercial limitations are observed.

Active Model

Qualities are Added to, Replaced or Deleted from the Active Model using the Active Yarn Count Values dialog.

When a New Quality is added or an existing Quality replaced STARFISH uses your Default Values to make the initial calculations.

Two-thread Fleece

For Two-thread Fleece fabrics Values for the Face Yarn and the Inlay Yarn are entered separately.

Tip:

To change the Yarn Count Value of an existing Knitting Quality without resetting to Default Values use the Yarn Count Values data entry box adjacent to the Knitting Qualities section of the Predictions Table in the View By Quality and the View By Machine.

When the Yarn Count Value is changed the Values for Tightness Factor and the Finished Fabric Properties data are recalculated.

▷ **Notes:**

❑ Yarn Count Values are displayed in the chosen Units. If the Active Yarn Count Unit is changed, the Active Yarn Count Values are converted automatically to correspond to the new Unit.

❑ When the Default Yarn Count Values are Restored to the Active Model the Default Values are converted to correspond to the Active Unit.

Default Models

Qualities are Added to, Replaced or Deleted from the Default Models using the Default Yarn Count Values dialog. Entered Values correspond to the Default Yarn Count Units.

Two-thread Fleece

For Two-thread Fleece fabrics Values for the Face Yarn and the Inlay Yarn are entered separately.

▷ **Notes:**

❑ Changing the Default Yarn Count Values affects only the Default Models for the selected Fabric Types. The Yarn Count Values that have been entered for use in the Active Model or in any of the Current Models are not affected unless the Restore Default Yarn Count Values option is chosen.

❑ If the Default Yarn Count Unit is altered, the Default Yarn Count Values are converted automatically to correspond to the new Unit.

Yarn Count Limits

The actual range of Yarn Count Values that can be entered depends on the chosen Yarn Count Unit. The range is wide enough to allow room for experimentation and evaluation of qualities outside of normal practice.

This means that within the normal range of practical and commercial limits any value can be entered, so that the effect of changing the Yarn Count Values on the Finished Fabric Properties can be evaluated.

▷ **Important Note:**

To provide maximum flexibility, the range of Yarn Count Values that can be entered is not restricted by the selections for Fabric Type, Yarn Type, or Machine Gauge. It is the responsibility of the user to ensure that the practical and commercial limitations of spinners and of knitting machinery are taken into account when specifying Yarn Count Values.

The Limits placed on the entry of Yarn Count Values are:

Ne	5.0	to	100
Tex	118.11	to	5.905
Nm	8.47	to	169.34

Values outside these limits cannot be entered.

Stitch Length

Stitch Length is defined as the length of yarn in a single loop or stitch.

The Stitch Length is the primary Dimensional Control Parameter for a knitted fabric. It must be correctly specified and consistently maintained to ensure that the Properties of the finished fabric will be as expected.

In STARFISH, each Knitting Quality on each Knitting Machine is defined by the specific Values that are entered for the Yarn Count and the Stitch Length.

The average knitted Stitch Length together with the Total Number of Needles knitting determines the Course Length. The Course Length is the key Production Control Parameter of a knitted fabric.

Course Length = Stitch Length * Needles

In STARFISH, the knitted Stitch Length can be specified in three different ways.

1. By entering a Value for Stitch Length directly
2. By entering a Value for the Course Length
3. By entering a Value for the Tightness Factor.

Whichever option is chosen STARFISH calculates the Value for each of the other two Knitting Parameters automatically.

Inlay Stitch Length

Inlay Stitch Length applies only to Two-thread fleece fabrics. It is defined as the average length of Inlay Yarn consumed by one feeder during one complete revolution of the knitting machine cylinder divided by the number of cylinder needles.

Stitch Length Units

STARFISH supports three different Units for Stitch length

The Units provided are:

- Millimetres
- Centimetres
- Inches

STARFISH Model Environment
Knitting Parameters

Active Model

The Active Stitch Length Units are chosen from the option list in the Active Stitch Length units dialog.

▷ **Notes:**

❑ Stitch Length Values are displayed in the chosen Units. If the Active Stitch Length Units are changed, the Active Stitch Length Values are converted automatically to correspond to the new Unit.

❑ The Active Stitch Length Units also determine how the Values for Course Length are displayed. i.e. if millimetres or centimetres are chosen as the Units for Stitch Length then centimetres are used as the Units for Course Length. If inches are chosen as the Units for Stitch Length then inches are used as the Units for Course Length.

❑ The Units that are used to display the Knitted Tightness Factor can be chosen independently. The Units that are used for the Inlay Tightness Factor are STARFISH Global Default Units and cannot be changed.

Use as Default check box

The Active Stitch Length Unit can also be designated the Default Stitch Length Unit for the Active Fabric Type by turning ON the Use as Default check box.

To change the Stitch Length Unit for any other Fabric Type, use the Default Units dialog

Default Models

The Stitch Length Units for the Default Models are chosen from the Stitch Length Tab on the Default Units dialog.

▷ **Note:**

Changing the Default Units selections affects only the Default Models for the selected Fabric Types. The Units currently selected for use in the Active Model or any of the Current Models are not affected.

Stitch Length Values

The Stitch Length is the primary Dimensional Control Parameter for a knitted fabric. It must be correctly specified and consistently maintained to ensure that the Properties of the finished fabric will be as expected.

The Value entered for Stitch Length together with the Value entered for Yarn Count specifies each individual Knitting Quality on each individual Knitting Machine.

▷ **Note:**

Stitch Length Values are displayed in the chosen Units. If the Stitch Length Units are changed the Values for Stitch Length and Course Length are converted automatically to correspond to the new Unit.

Active Model

Values for Stitch Length are entered for each Quality and each Knitting Machine using the Edit Column data entry boxes adjacent to the Knitting Quality section of the Prediction Tables in the View By Quality and the View By Yarn.

The Values for Stitch Length can be specified in three different ways.

1. By entering a Value for Stitch Length directly in the Stitch Length data entry box.
2. By entering a Value for the Course Length in the Course Length data entry box.
3. By entering a Value for the Knitted Tightness Factor in the Tightness Factor data entry box.

Whichever option is chosen STARFISH calculates the Values for the other two Knitting Parameters automatically.

Single Crosstuck, Six-thread Crosstuck

For Crosstuck constructions that include an all-knit course, different values for Stitch Length can be specified for the all-knit courses and the knit and tuck courses. This is achieved either by entering different values directly in the appropriate data entry boxes or by changing the Run-in Ratio.

Two-thread Fleece

For Two-thread Fleece fabrics Stitch Length Values for the Face Yarn and the Inlay Yarn are entered separately.

Default Models

The starting Values for Stitch Length are calculated for each Default Quality from the Values entered for the Default Tightness Factors.

Single Crosstuck, Six-thread Crosstuck

The STARFISH Default Run-in Ratio is 1.0. Therefore the starting Stitch Length Values are the same for the all-knit courses and the knit and tuck courses.

Two-thread Fleece

For Two-thread Fleece fabrics, the starting values for the Inlay Stitch Length are calculated for each Default Machine from the Value entered for the Inlay Tightness Factor.

Stitch Length Limits

The range of values that can be entered for Stitch Length depends on the Fabric Type, the Knitting Machine selections, the Values entered for Yarn Count, and the chosen Units. The range is wide enough to allow room for experimentation and evaluation of qualities outside of normal commercial practice.

This means that for most practical and commercial purposes any value can be entered, so that the effect of changing the knitted Stitch Length on the finished Fabric Properties can be evaluated.

Maximum Range

Certain limits have however been imposed on the range in Stitch Length Values that can be entered. These limits are calculated for each Yarn Count from the maximum allowed range in the values for the Knitted Tightness Factor.

If a Value for Stitch Length is entered that exceeds the maximum range, a Warning Message is generated. This message provides information on the actual range allowed for the selected Fabric Quality. Values outside these limits cannot be entered. The last value entered that was within the maximum range is restored to the data entry box.

Normal Range

Guidelines are also provided on the "normal" practical or commercial range in Stitch Length Values. These guidelines are calculated from the "normal" range in Tightness Factor. When a Value for Stitch Length is entered that exceeds the normal range of Tightness Factor expected for the chosen Fabric Type and Yarn Count a red question mark appears next to the Tightness Factor data entry box and the Value in the box changes to red.

To obtain information on the range of Tightness Factor Values allowed for the Active Fabric Type, click on the red question mark when it appears in a Prediction Window. Values outside of the normal range can still be entered providing they do not exceed the maximum values. The ranges are displayed in the chosen Tightness Factor Units.

Single Crosstuck, Six-thread Crosstuck

For Single Crosstuck and Six-thread Crosstuck fabrics the limits imposed on the all-knit and knit and tuck Stitch Length take into account the maximum range in Values allowed for the Run-in Ratio

Two-thread Fleece

For Two-thread Fleece fabrics the limits on the Inlay Stitch Length are imposed primarily by the physical dimensions of the knitting machine and are calculated from the maximum range allowed for the Inlay Tightness Factor.

STARFISH Model Environment
Knitting Parameters

Course Length

Course Length is defined as the total length of yarn consumed by one feeder during one complete revolution of the knitting machine. In some countries, it is also known as Draw or Ravel Length.

Course Length = Stitch Length * Needles

The Course Length is the Key Production Control Parameter for a knitted fabric. It must be correctly specified and regularly monitored to ensure that the average stitch length in the fabric is correct and maintained consistently.

In STARFISH, each Knitting Quality on each Knitting Machine is defined by the specific Values that are entered for the Yarn Count and the Stitch Length.

The average knitted Stitch Length together with the Total Number of Needles knitting determines the Course Length. The Course Length is the key Production Control Parameter of a knitted fabric.

Stitch Length = Course Length / Needles

In STARFISH, the knitted Stitch Length can be specified in three different ways.

1. By entering a Value for Course Length directly
2. By entering a Value for the Stitch Length
3. By entering a Value for the Tightness Factor.

Whichever option is chosen STARFISH calculates the Value for each of the other two Knitting Parameters automatically.

Inlay Course Length

Inlay Course Length applies only to Two-thread fleece fabrics. It is defined as the average length of Inlay Yarn consumed by one feeder during one complete revolution of the knitting machine cylinder.

Course Length Units

STARFISH supports two different Units for Course Length.

The Units for Course Length provided are:

- Centimetres
- Inches

Active Model

The Active Course Length Units are chosen together with the Stitch Length Units from the option list in the Active Stitch Length units dialog.

If millimetres or centimetres are chosen as the Active Stitch Length Units then centimetres are used as the Course Length Units. If inches are chosen as the Active Stitch Length Units then inches are used as the Course Length Units.

▷ **Note:**

If the Active Stitch Length Unit is changed then the Values for Stitch Length and Course Length are converted automatically.

Default Models

The Units for Course Length used by the Default Models are determined by the Units chosen for Stitch Length using the Stitch Length Tab on the Default Units dialog.

▷ **Note:**

Changing the Default Units selections affects only the Default Models for the selected Fabric Types. The Units currently selected for use in the Active Model or any of the Current Models are not affected.

Course Length Values

The Course Length is the Key Production Control Parameter for a knitted fabric. It must be correctly specified and regularly monitored to ensure that the average Stitch length in the fabric is correctly set-up and maintained consistently.

The Value entered for Course Length together with the Total Number of Needles knitting determines the Stitch Length.

Stitch Length = Course Length / Needles

The Value for Stitch Length together with the Value for Yarn Count specifies each individual Knitting Quality on each individual Knitting Machine.

▷ **Note:**

Course Length Values are displayed according to the Active Stitch Length Units. If the Active Stitch Length Units are changed then the Values for Stitch Length and Course Length are converted automatically.

Active Model

Values for Course Length are entered for each Quality and each Knitting Machine using the Edit Column data entry boxes adjacent to the Knitting Quality section of the Prediction Tables in View By Quality and View By Yarn

The Values for Course Length can be specified in three different ways.

1. By entering a Value for Course Length directly in the Course Length data entry box.
2. By entering a Value for the Stitch Length in the Stitch Length data entry box.
3. By entering a Value for the Tightness Factor in the Tightness Factor data entry box.

Whichever option is chosen STARFISH calculates the Values for each of the other two Knitting Parameters automatically.

Single Crosstuck, Six-thread Crosstuck

For Crosstuck constructions that include an all-knit course the Course Length Values can be different for the all-knit course and for the knit and tuck course. This is achieved either by entering different values directly or by changing the Run-in Ratio.

Two-thread Fleece

For Two-thread Fleece fabrics Course Length Values for the Face Yarn and the Inlay Yarn are entered separately.

Default Models

The starting values for Course Length and Stitch Length are calculated for each Default Quality and Default Knitting Machine from the Values entered for the Default Tightness Factor.

Interlock, Plain Jersey and Double Crosstuck Fabrics

Course Length = average Stitch Length * Needles Knitting (cylinder only).

Single Crosstuck, Six-thread Crosstuck Fabrics

The STARFISH Default Run-in Ratio is 1.0. Therefore the starting Course Length Values are the same for the all-knit courses and the knit and tuck courses. The Default Run-in Ratio cannot be changed.

For 1x1 Rib, 2x2 Rib Fabrics

Course Length = average Stitch Length * Needles Knitting (cylinder and dial).

For Two-thread Fleece Fabrics

The starting value for the Face Course Length is calculated for each Default Knitting Machine from the Default Face Yarn Count Value and the Default Tightness Factor.

The starting value for the Inlay Course Length is calculated for each Default Knitting Machine from the Default Inlay Tightness Factor.

Inlay Course Length = ITF * π * Diameter

Course Length Limits

The range of values that can be entered for Course Length depends on the Fabric Type, the Knitting Machine selections, the Values entered for Yarn Count and the chosen Units. The range is wide enough to allow room for experimentation and evaluation of qualities outside of normal commercial practice.

This means that for most practical and commercial purposes any value can be entered, so that the effect of changing the knitted Course Length on the finished Fabric Properties can be evaluated.

Maximum Range

Certain limits have however been imposed on the range in Course Length Values that can be entered. These limits are calculated from the maximum allowed range in the Values for the knitted Tightness Factor and the parameters of the selected knitting machine.

If a Value for Course Length is entered that exceeds the maximum range, a Warning Message is generated. This message provides information on the actual range allowed for the selected Fabric Quality. Values outside these limits cannot be entered. The last value entered that was within the maximum range is restored to the data entry box.

Normal Range

Guidelines are also provided on the "normal" practical or commercial range in Course Length Values. These guidelines are calculated from the "normal" range in Tightness Factor. When a Value for Course Length is entered that exceeds the normal range of Tightness Factor expected for the Active Fabric Type and Yarn Count a red question mark appears next to the Tightness Factor data entry box and the Value in the box changes to red.

To obtain information on the range of Tightness Factor Values allowed for the Active Fabric Type, click on the red question mark when it appears in a Prediction Window. Values outside of the "normal" range can still be entered providing they do not exceed the maximum values. The ranges are displayed in the chosen Knitted Tightness Factor Units.

Single Crosstuck, Six-thread Crosstuck

For Single Crosstuck and Six-thread Crosstuck fabrics the limits imposed on the all-knit and knit and tuck Course Length take into account the maximum range in Values allowed for the Run-in Ratio.

Two-thread Fleece

For Two-thread Fleece fabrics the limits on the Inlay Course Length are imposed primarily by the physical dimensions of the knitting machine and are calculated from the maximum range allowed for the Inlay Tightness Factor.

Run-in Ratio

Run-in Ratio is used in STARFISH specifically for Crosstuck fabrics containing an all-knit course. It is the ratio obtained by dividing the length of the knit and tuck course by the length of the all-knit course. e.g.

- A run-in ratio greater than 1.0 means that the knit and tuck course is longer than the all-knit course.

- A run-in ratio less than 1.0 means that the knit and tuck course is shorter than the all-knit course.

The Run-in Ratio affects not only the dimensions but also the appearance of the fabric. For this reason knitters sometimes alter the run-in ratio to enhance the appearance of the small diamond pattern that is produced by the repeating pattern of knit and tuck loops in crosstuck constructions.

Important Note:

Although STARFISH can calculate the effect of changing the Run-in Ratio on the finished Fabric Properties, it should be remembered that STARFISH predictions do not take account of the relative effect on the fabric appearance. Fabric manufacturers should establish for themselves the influence that changes to the Run-in Ratio can have on the fabric appearance as well as the

fabric dimensions in the context of their own production and processing conditions and the requirements of their customers.

Run-in Ratio Units

Run-in Ratio is dimensionless.

The values for Stitch Length and Course Length that are calculated when the Run-in Ratio is altered are determined by the Units that have been chosen for Stitch Length.

The Units for Stitch Length provided are:

- Millimetres
- Centimetres
- Inches

If the Stitch Length Unit is altered the Course Length Units and the Values for Stitch length and Course Length are converted automatically. The Run-in Ratio is not affected.

Run-in Ratio Values

In STARFISH, the option to change the Run-in Ratio is provided only for crosstuck fabrics that contain an all-knit course. i.e. Single crosstuck and Six-thread crosstuck. When any other Fabric Type is selected as the Active Fabric Type the Run-in Ratio option does not appear in the Predictions Tables.

The STARFISH Default Value for Run-in Ratio is 1.0. This means that the starting Values for the Stitch Length and Course Length of the all-knit course are always the same as the starting Values for the Stitch length and Course Length of the knit and tuck course.

Active Model

The Active Value for Run-in Ratio can be changed for each Quality and each Knitting Machine using the Edit Column data entry boxes adjacent to the Knitting Quality section of the Predictions Tables in View By Quality and View By Machine.

The Values for Run-in Ratio can be specified in three different ways.

1. By entering a new Value directly in the Run-in Ratio data entry box.
2. By changing the Value of the knit and tuck Stitch Length relative to the all-knit Stitch Length.
3. By changing the Value of the knit and tuck Course Length relative to the all-knit Course Length.

Whichever option is chosen STARFISH recalculates the other values automatically.

Default Models

The STARFISH Default Run-in Ratio is 1.0. This value is used to make the starting calculations when a Default Model is first loaded. The Default Value cannot be changed.

Run-in Ratio Limits

The maximum allowed range in the values that can be entered for Run-in Ratio is 0.8 to 1.2 of the all-knit Stitch Length.

Tightness Factors

STARFISH provides two different types of Tightness Factor; Knitted Tightness Factor and Inlay Tightness Factor.

Knitted Tightness Factor

Knitted Tightness Factor (also referred to as Cover Factor) is a number that indicates the relative tightness of knitting taking account of both the thickness of the yarn and the length of the loops. The higher the number the tighter the fabric. It also indicates the extent to which the area of a knitted fabric is covered by the yarn.

Inlay Tightness Factor

Inlay Tightness Factor is a number that indicates the relative length of the Inlay Yarn in a Two-thread Fleece fabric taking account of both the gauge of the knitting machine and the length of the loops. The higher the number the longer the inlay loop.

Knitted Tightness Factor

Knitted Tightness Factor (also referred to as Cover Factor) is a number that indicates the relative tightness of knitting taking account of both the thickness of the yarn and the length of the loops. The higher the number the tighter the fabric. It also indicates the extent to which the area of a knitted fabric is covered by the yarn.

Knitted Tightness Factor is a well-known and well-established parameter for researchers in the field of knitted fabric geometry. Unfortunately, however, its usefulness and relevance to the practical knitted fabric technician is less well known or appreciated.

The Knitted Tightness Factor is an extremely useful parameter for fabric development for two main reasons.

- It provides a means for comparing or evaluating different Knitting Qualities, i.e. fabrics of the same type but knitted from different Values of Yarn Count and Stitch Length, with respect to their fabric properties.

- It provides a means for evaluating different Knitting Qualities in terms of their knitting and processing efficiency.

In STARFISH, the Knitted Tightness Factor is easy to use since it is calculated automatically in the chosen Units for every Yarn Count and Stitch Length that is entered. Conversely, if a Value for Tightness Factor is entered STARFISH will automatically calculate the equivalent Stitch Length and Course Length for each Yarn Count and each Knitting Machine.

Comparing different Knitting Qualities

For a given Fabric Type, the Knitted Tightness Factor provides a means for comparing Fabric Qualities produced with different Values for Yarn Count and Stitch Length. The Values for the Knitted Tightness Factor of the different Knitting Qualities indicate the relative tightness (cover) of the different fabrics.

For example, in order to produce a similar level of cover, fabrics produced from Yarns with different linear densities (Yarn Counts) must be knitted with different Stitch Lengths. By keeping the Knitted Tightness Factor constant it is very easy to calculate what the appropriate Stitch Length should be for any given Value of Yarn Count in order to produce fabrics with similar relative tightness (cover).

The relative tightness of a fabric not only provides an indication of such fabric properties as appearance, stiffness, handle etc. but also provides information about fabric extensibility and Spirality. For example, a fabric produced with a high value for Knitted Tightness Factor will exhibit relatively lower levels of spirality and extensibility than one produced from a lower value of Knitted Tightness Factor.

Thus by establishing the Knitted Tightness Factor for known Fabric Qualities that have acceptable cover, appearance, handle, spirality etc. for particular end uses or customers it is possible to erect guidelines for the fabric development team. For example, a minimum Value for Knitted Tightness Factor below which it is known that for given Yarn Qualities the properties of the resultant fabric will be unacceptable.

Establishing Practical Guidelines

The Knitted Tightness Factor can also be used to establish practical guidelines for the fabric development team in terms of knitting and finishing efficiency.

Knitting Efficiency

For any given knitting machine the mechanical effort (wear and tear on mechanical components etc.) required to produce tight fabric will be greater than to produce loose fabric.

Furthermore, the tighter the fabric structure the greater the possibility of producing knitting faults – drop stitches, cut stitches, broken needles etc. For a given Yarn Quality and Yarn Count the smaller the knitted Stitch Length (the higher the Value for the Knitted Tightness Factor) the more susceptible the knitting operation will be to imperfections in the yarn structure.

Machinery wear and tear and fabric faults have a direct impact on the cost and efficiency of the knitting operation and must be minimised.

By analysing different fabric qualities, yarn qualities, and knitting machinery in terms of the Knitted Tightness Factor it will be possible to erect guidelines for the fabric development team. For example, a maximum Value for Knitted Tightness Factor can be established above which it will be known that knitting efficiency will fall and / or fabric faults increase.

Finishing Efficiency

Providing that the grey fabric has been correctly specified and manufactured it requires only that the finished fabric be delivered with the appropriate Course Density and Width for the required Weight and Shrinkage properties to be achieved.

Achieving the required Course Density target in the finished fabric is one of the most difficult tasks that the finisher of knitted fabrics has to accomplish. To be able to do it consistently he must have the latest finishing technology and process control systems installed.

However, regardless of the machinery that is available, it will always be easier for the finisher to achieve the required Course Density target if the fabric he is asked to process is a tight quality rather that a slack one.

Thus, the Knitted Tightness Factor can also be used to provide an indication of how easy a fabric will be to finish to the desired dimensions and properties. The tighter that a fabric is knitted the less distortion will be introduced on the knitting machine and in the preparation and dyeing machines. Therefore, the easier it will be to achieve the required Course Density target in the fully finished fabric.

With experience of the fabric properties required for particular end uses, and with knowledge of the Yarn Qualities, Knitting Machinery and Processing equipment available the fabric development technician can use the Knitted Tightness Factor as an effective guideline for the development of new fabric qualities.

Knitted Tightness Factor Units

STARFISH supports three different Units for Knitted Tightness Factor.

The Units for Knitted Tightness Factor provided are:

- TF (cgs) = √tex / stitch length, cm
- TF (si) = √tex / stitch length, mm
- TF (imp) = 1 / (√Ne * stitch length, inches)

Conversions

TF (cgs) =	TF (si) * 10	TF (cgs) =	TF (imp) * 9.5673
TF (si) =	TF (cgs) / 10	TF (si) =	TF (imp) * 0.95673
TF (imp) =	TF (cgs) / 9.5673	T (imp) =	TF (si) / 0.95673

▷ **Notes**

- ❑ For Crosstuck fabrics containing an all-knit course the Knitted Tightness Factor is calculated from the Stitch Length of the all-knit course.

- ❑ For Two-thread Fleece fabric the Knitted Tightness Factor is calculated from the Values for the Face Yarn Count and Stitch Length and refers to the Face Fabric only.

Active Model

The Active Knitted Tightness Factor Units are chosen from the option list in the Active Tightness Factor Units dialog.

▷ **Note:**

Knitted Tightness Factor Values are displayed in the chosen Units. If the Active Tightness Factor Units are changed, the Knitted Tightness Factor Values are converted automatically.

Use as Default check box

The Active Knitted Tightness Factor Unit can also be designated the Default Knitted Tightness Factor Unit for the Active Fabric Type by turning ON the Use as Default check box.

To change the Default Knitted Tightness Factor Unit for any other Fabric Type, use the Default Units dialog.

Default Models

The Knitted Tightness Factor Units for the Default Models are chosen from the Tightness Factor Tab on the Default Units dialog.

▷ **Note:**

Changing the Default Units selections affects only the Default Models for the selected Fabric Types. The Units currently selected for use in the Active Model or any of the Current Models are not affected.

Knitted Tightness Factor Values

In STARFISH, the Knitted Tightness Factor is used to establish the Maximum and Minimum Values for Stitch Length and Course Length that can be entered for a given Fabric Type, Yarn Count and Knitting Machine.

In addition, the Default Values for Knitted Tightness Factor and Shrinkage are used to make the initial calculations whenever a New Quality is added or an existing Quality replaced in the Active Model.

▷ **Note:**

Knitted Tightness Factor Values are presented in the chosen Units. If the Knitted Tightness Factor Units are changed, the values are converted automatically.

Active Model

Values for the Knitted Tightness Factor are entered for each Quality and each Knitting Machine using the Edit Column data entry boxes adjacent to the Knitting Quality section of the Prediction Tables in View By Quality and View By Yarn

The Values for Knitted Tightness Factor can be specified in three different ways.

1. By entering a Value for Knitted Tightness Factor directly in the Tightness Factor data entry box
2. By entering a Value for Stitch Length in the Stitch Length data entry box
3. By entering a Value for the Course Length in the Course Length data entry box.

Whichever option is chosen STARFISH calculates the Values for each of the other two Knitting Parameters automatically.

▷ **Note:**

If the Active Yarn Count Value is altered, the Knitted Tightness Factor is recalculated for the new Yarn Count Value from the existing Value for the Stitch Length.

Single Crosstuck, Six-thread Crosstuck

The Knitted Tightness Factor Values for these two Fabric Types are calculated from the average Stitch Length of the all-knit course only. This is because for a given Value of Yarn Count it is the Stitch Length of the all-knit course that has the greatest effect on the fabric dimensions.

The Stitch Length / Course Length of the knit and tuck course and the relative proportion of knit and tuck courses to all-knit courses in the fabric construction has the greatest effect on fabric weight.

Two-thread Fleece

The Knitted Tightness Factor Values for Two-thread Fleece are calculated from the Values for the Face Yarn Count and the Face Stitch Length only. This is because for a given combination of Face and Inlay Yarns it is the Stitch Length of the Face Yarn that has the greatest effect on the fabric dimensions.

The length of the Inlay Yarn affects the fabric weight. Inlay Tightness Factor is specified separately.

STARFISH Model Environment
Knitting Parameters

Default Models

Tightness Factor Values for the Default Models are entered using the Default Tightness Factor Values dialog.

▷ **Note:**

Changing the Default Tightness Factor Values affects only the Default Models for the selected Fabric Types. The Tightness Factor Values that have been entered for use in the Active Model or in any of the Current Models are not affected.

Knitted Tightness Factor Limits

The actual range of Values that can be entered for the Knitted Tightness Factor depends on the Fabric Type selected. The range is wide enough to allow room for experimentation and evaluation of qualities outside of normal commercial practice.

This means that for most practical and commercial purposes any Value can be entered, so that the effect of changing the Knitted Tightness Factor on the finished Fabric Properties can be evaluated.

To provide some practical guidance and to prevent the entry of totally unrealistic Values, two ranges for Knitted Tightness Factor have been established for each Fabric Type. These ranges are used throughout the program to calculate the minimum and maximum values allowed for the Stitch Length and Course Length for a given Yarn Count and Knitting Machine.

Maximum Range

The maximum limits for Knitted Tightness Factor are provided primarily to prevent the entry of totally unrealistic values while allowing room for experimentation. They do not provide any guarantees that values within the maximum limits can actually be achieved in practice.

When a Value is entered that exceeds the maximum range, a Data Out of Range Message is generated. This message provides information on the maximum range in values allowed for the Active Fabric Type. Values outside of these limits cannot be entered. The last value entered that was within the maximum range is restored to the data entry box.

Normal Range

The "normal" ranges in Knitted Tightness Factor provide a guideline for average commercial limits. These Values have been established from the Yarn Qualities and Knitting Machinery used to produce the fabrics within the STARFISH Database.

When a Value for Knitted Tightness Factor is entered which exceeds the "normal" range for the Knitted Tightness Factor expected for the Active Fabric Type a red question mark appears next to the Knitted Tightness Factor data entry box and the value in the box changes to red.

[?] To obtain information on the range of Tightness Factor Values allowed for the Active Fabric Type, click on the red question mark when it appears in a Prediction Window. Values outside of the "normal" range can still be entered providing they do not exceed the maximum values. The ranges are displayed in the chosen Knitted Tightness Factor Units.

Allowed Ranges for Knitted Tightness Factor

TF Units	√tex / SL cm		√tex / SL mm		1 / (√Ne * SL in)	
Fabric Type	Normal	Max.	Normal	Max.	Normal	Max.
Interlock	10 - 14	8 - 16	1.0 - 1.4	0.8 - 1.6	1.05 - 1.46	0.84 - 1.67
Rib 1x1	14 - 18	12 - 20	1.4 - 1.8	1.2 - 2.0	1.46 - 1.88	1.25 - 2.09
Rib 2x2	14 - 18	12 - 20	1.4 - 1.8	1.2 - 2.0	1.46 - 1.88	1.25 - 2.09
Plain Jersey	14 - 18	12 - 20	1.4 - 1.8	1.2 - 2.0	1.46 - 1.88	1.25 - 2.09
Single Crosstuck *	14 - 18	12 - 20	1.4 - 1.8	1.2 - 2.0	1.46 - 1.88	1.25 - 2.09
Double Crosstuck	14 - 18	12 - 20	1.4 - 1.8	1.2 - 2.0	1.46 - 1.88	1.25 - 2.09
Six-thread Crosstuck *	14 - 18	12 - 20	1.4 - 1.8	1.2 - 2.0	1.46 - 1.88	1.25 - 2.09
Two-thread Fleece **	13.5 - 16.5	12 - 19	1.35 - 1.65	1.2 - 1.9	1.41 - 1.72	1.25 - 1.99

*   calculation based on the all-knit stitch length value
**   calculation based on face yarn count and stitch length values, applies to face fabric

▷ Important Note:

Knitted Tightness Factor

The Knitted Tightness Factor is a measure of the relative tightness of the knitted fabric. It takes into account both the thickness of the yarn and the length of the loops. Therefore, the range in Tightness Factor that can be achieved in practice ultimately depends on the Yarn Quality and the Knitting Machine.

Low quality yarn knitted on badly maintained machinery cannot be knitted as tightly or at the same production speeds and with the same fault rates, as high quality yarn on well-maintained machinery.

Individual manufacturers should establish the practical and commercial limits for the Knitted Tightness Factor for their own yarn qualities and knitting machinery.

Inlay Tightness Factor

Inlay Tightness Factor applies only to Two-thread Fleece fabrics. It is a number that indicates the relative length of the Inlay Yarn taking into account both the Gauge of the knitting machine and the length of the loops. The higher the number the longer the inlay loop.

The concept of Inlay Tightness Factor has been developed specifically for STARFISH in order to provide an objective means for comparing and controlling the production of Two-thread Fleece fabrics. As far as we are aware this concept has not been proposed before and is unique to STARFISH.

Inlay Tightness Factor is analogous to Knitted Tightness Factor and similarly provides a useful tool for fabric development and production control.

For example, if an appropriate Value is established for one particular quality on one particular knitting machine it is easy to discover what should be the appropriate Inlay Stitch Length or Course Length for any other Machine Gauge or Diameter in order to produce the same quality.

In STARFISH, Inlay Tightness Factor is easy to use since it is calculated automatically for every Yarn Count and Knitting Machine that is entered. Conversely, if a Value for Inlay Tightness Factor is entered STARFISH will automatically calculate the equivalent Inlay Stitch Length and Course Length for each Knitting Machine. If the Knitting Parameters (gauge or diameter) are changed then the Inlay Tightness Factor is recalculated automatically.

Inlay Tightness Factor Units

Inlay Tightness Factor applies only to Two-thread Fleece fabrics.

Inlay Tightness Factor (ITF) is the ratio between the Course Length (CL) and the Machine Circumference ($\pi * D$). ITF is a dimensionless unit.

It is conveniently calculated as ITF = SL * G

where,
ITF is the Inlay Tightness Factor, SL is the Stitch Length of the Inlay Yarn in inches, and G is the Machine Gauge in needles per inch.

The same result is obtained provided that CL and D are in the same units and D is the true diameter using the following formula

ITF = Course Length / Machine Circumference, or ITF = CL / ($\pi * D$)

▷ Note:

The Inlay Tightness Factor unit is a STARFISH Global Default Unit and cannot be changed.

Inlay Tightness Factor Values

In STARFISH, the Inlay Tightness Factor option is provided specifically for Two-thread Fleece Fabrics. It does not apply to any other Fabric Type included in the current version of the software. Therefore, if any other Fabric Type is selected as the Active Fabric Type the Inlay Tightness Factor option does not appear in the Predictions Tables.

STARFISH Model Environment
Knitting Parameters

The Inlay Tightness Factor is used to establish the Maximum and Minimum Values for the Inlay Stitch Length and the Inlay Course Length that can be entered for each Knitting Machine.

The Default Value for Inlay Tightness Factor is used together with the Default Values for Knitted Tightness Factor and Shrinkage to make the initial calculations whenever a New Quality or Machine is added or when an existing Quality or Machine is replaced in the Active Model.

Active Model

When the Active Fabric Type is Two-thread Fleece, Values for the Inlay Tightness Factor are entered for each Yarn Count and each Knitting Machine using the Edit Column data entry boxes adjacent to the Knitting Quality section of the Predictions Tables in View By Quality and View By Yarn.

The Values for Inlay Tightness Factor can be specified in three different ways.

1. By entering a Value for the Inlay Tightness Factor directly in the Inlay Tightness Factor data entry box
2. By entering a Value for the Inlay Stitch Length in the Inlay Stitch Length data entry box
3. By entering a Value for the Inlay Course Length in the Inlay Course Length data entry box.

Whichever option is chosen STARFISH calculates the Values for each of the other two Knitting Parameters automatically.

Important Notes:

❑ If the Active Machine Needles are changed or if an Active Machine is Replaced by another Machine with a different number of needles then the Inlay Course Length will be adjusted for the new needles but the Inlay Tightness Factor and the Inlay Stitch Length remain unchanged.

❑ If an Active Machine is Replaced by a Machine with a different Gauge (even though the total number of needles may be the same) then both the Inlay Stitch Length and the Inlay Course Length are recalculated keeping the Inlay Tightness Factor constant.

❑ A change made to the Inlay Stitch Length will also cause a change to the Finished Fabric Properties.

Default Models

The Default Inlay Tightness Factor Value for the Two-thread Fleece Default Model is entered using the Default Tightness Factor Values dialog.

Note:

Changing the Default Inlay Tightness Factor Value affects only the Default Model for Two-thread Fleece. The Inlay Tightness Factor Values that have been entered for use in the Active Model are not affected.

Inlay Tightness Factor Limits

The actual range of values that can be entered for the Inlay Tightness Factor is wide to allow room for experimentation and evaluation of qualities outside of normal commercial practice.

This means that for most practical and commercial purposes any value can be entered, so that the effect of changing the Inlay Tightness Factor on the finished Fabric Properties can be evaluated.

However, to provide some practical guidance and also to prevent the entry of totally unrealistic Values, two ranges for the Inlay Tightness Factor have been established. These ranges are used to determine the minimum and maximum values allowed for the Inlay Stitch Length and Inlay Course Length for a given Knitting Machine.

Maximum Range

The maximum limits for Inlay Tightness Factor are provided primarily to prevent the entry of totally unrealistic values while allowing room for experimentation. They do not provide any guarantees that values within the maximum limits can actually be achieved in practice.

When a Value is entered that exceeds the maximum range, a Data Out of Range Message is generated. This message provides information on the maximum range in values allowed. Values

outside of these limits cannot be entered. The last value entered that was within the maximum range is restored to the data entry box.

Normal Range

The "normal" range for the Inlay Tightness Factor provides a guideline for average commercial limits. It has been established from the Yarn Qualities and Knitting Machinery used to produce the fabrics within the STARFISH Database and through consultation with Machinery builders.

When a Value for Inlay Tightness Factor is entered that exceeds the "normal" range of Inlay Tightness Factor expected for the Active Machine a red question mark appears next to the Inlay Tightness Factor data entry box and the value in the box changes to red.

To obtain information on the range of Inlay Tightness Factor Values allowed for the Active Machine, click on the red question mark when it appears in a Prediction Window. Values outside of the "normal" range can still be entered providing they do not exceed the maximum values.

Allowed Ranges for Inlay Tightness Factor

ITF Unit	SL, in * G, npi	
Fabric Type	**Normal**	**Max.**
Two-thread Fleece	1.25 - 1.6	1.0 - 2.5

Important Note:

The practical limits for the Inlay Tightness Factor are determined primarily by the physical characteristics of the knitting machine.

The range in Inlay Tightness Factor that can be achieved in practice depends on the knitting machinery available.

Individual manufacturers should establish the practical and commercial limits for Inlay Tightness Factor for their own Yarn Qualities, Fabric Qualities and Knitting Machinery.