CONTENTS

A *Generalities*

The sizing process is an essential element in the production of a warp yarn which will weave at high rates and produce top quality fabric.

Although many filament yarns could be woven unsized, albeit at poor efficiency, it is not the case of the majority of spun yarns around the world. In most applications the abrasion resistance of the yarn is not high enough to withstand the high speed of the loom.

Crossing of warp yarns also causes severe abrasion, accentuated in a dense sheet. Guide teeth on Sulzar looms, the confuser system on air-jet looms beside the dropwires, backrest and weft carrier will also increase this problem.

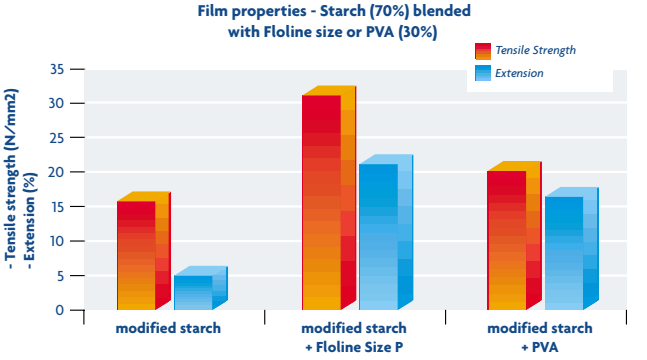
The sizing process is an essential element in the production of warp woven at high speeds.
FLOLINE SIZE polymers have been developed by SNF to increase weaving efficiency, which is of great importance in the economics of a textile mill.

B *Requirements of a spun yarn size*

Cohesion and adhesion

The size should be capable of film forming. It should dry into a strong robust flexible film that adheres to the fiber. It will act as a substantial protective film between loom parts and the yarn to prevent it from being damaged and will avoid production breakdowns.

Starch lacks fundamental adhesion to many hydrophobic substrates and that is why **FLOLINE SIZE** can be used alone or as additive for starch.



Rheology and viscosity

The viscosity of the size should be low enough for easy handling and high enough to give an accurate distribution.

The yarn must be encapsulated in a coherent film of size that penetrates sufficiently in the yarn structure to make full use of the cohesive power of the size.

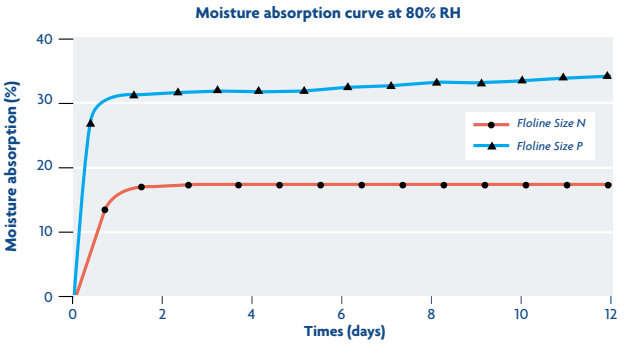
Too much penetration will leave the surface unprotected and too little penetration could result in size shedding during splitting or weaving on the sizing machine.

With **FLOLINE SIZE**, viscosity is achieved rapidly and is maintained steadily during cooking, therefore the penetration rate is easily controlled.

Moisture sensitivity

Absorption of moisture in a humid environment results in plasticization of the size film. Desorption of moisture at low humidity levels results in a brittle size film. Both reduce the cohesive power of the size and lower the tensile strength.

FLOLINE SIZE N has the unique property of being resistant to high humidity. Unlike practically all other acrylic sizes it may be used alone even at 80% humidity.



Removability

The size must be easily removed in a process acceptable to the finisher and in which the fabric is not damaged. The size should be soluble at the end of the weaving process. This entails the removal of size after it has been through the drying process and possibly after singeing or the heat setting process.
FLOLINE SIZE improves significantly the solubility of the size.

C *Parameters affecting the sizing process*

Size on yarn

The quantity of dry size on a warp yarn is the most important factor in the determination of its weavability. It can be affected by the following parameters.

Viscosity and size concentration

The wet pick-up of size by the yarn is affected by viscosity of the size solution. Changes in concentrations of a single sizing product will cause changes in viscosity, which in turn will affect the wet pick-up. A small change in concentration will cause an important change in size on yarn, particularly when the size viscosity is high.

Raw starches have very often a high viscosity preventing the use of concentrated solutions. This is a serious weakness when difficult warps are to be woven and high size loadings are required. They also tend to 'retrograde' or gel on cooling which can be a problem if cooked size is allowed to cool in vessels or pipes. That is why **FLOLINE SIZE N** is recommended for unmodified starches or starches slightly modified by simple techniques.

Temperature and cooking time

The viscosity of the size bath will change with temperature. All solutions will tend to increase in viscosity to some degree if the temperature is allowed to fall and this will influence the wet pick-up.

For starch-based mixes it is important to cook long enough to obtain a stable viscosity.
However, there may be a fall in viscosity when prolonged boiling with live steam is applied. Condensation also reduces the viscosity by lowering the concentration.

Squeeze pressure

Size pick-up is inversely proportional to pressure. Thus minor changes in low pressure processes can cause much greater changes in size pick-up than high-pressure squeeze sizing.

Sizing speed

An increase in size pick-up is observed when the machine running speed is increased. The squeezing is less effective at high running speeds due to the reduced contact time of the yarn with the nip. It is common to have two pressure settings, one for 'creep' and another for 'run' or a variable pressure setting linked to the machine speed.

Warp density

The density of the warp threads in the nip can affect the size pick-up. As the density increases the pick-up increases also until, at high density, penetration is reduced and pick-up goes down. This is the reason why a 'stang' might be used to concentrate low density warps into areas of medium density and, on warps of very high density, it is more suitable to size two separate warp sheets using a double size box arrangement.

Property	Effect	Cure
Viscosity	Increase in viscosity increase wet pick-up	Maintain constant viscosity
Concentration	Increase in concentration increase viscosity	Maintain constant size concentration
Temperature	Increase in temperature reduce viscosity	Maintain constant bath temperature
Cooking time	Longer cooking time reduce viscosity	Maintain constant cooking time
Squeeze pressure	Increase in squeeze pressure reduce size pick-up	Maintain constant squeeze pressure
Speed	Increase in speed increase size pick-up	Maintain constant running speed and reduce squeeze pressure at creep
Roller hardness	Increase in hardness reduce size pick-up	Grind rollers regularly if required
Warp density	Increase in warp density generally reduce size pick-up	Use 2 boxes for warps over 4000 ends (if available)

D *The advantages of* FLOLINE SIZE

General

Synthetic yarns

Starch is the most frequent size for a number of reasons. They are generally a good film former and cheap. They are often produced locally making them even more economical. They can often do a very good job on cotton yarns, for many other fibers starch alone is not quite up to mark, they lack fundamental adhesion to many hydrophobic substrates where **FLOLINE SIZE** is strongly recommended.

Starch blends

The high viscosity of unmodified starches is a serious weak point when difficult warps are to be woven and high size loadings are required. They also tend to 'retrograde' or gel on cooling which can be a problem if cooked size is allowed to cool in vessels or pipes. **FLOLINE SIZE N** is specially recommended for unmodified starches or starches slightly modified by simple techniques.

PVA blends

Polyvinyl alcohol is produced by hydrolysis of polyvinyl acetate. The fully hydrolized grade is used for 100% cotton and the partially hydrolyzed for spun polyester or polyester blends. When prepared at the correct viscosity, the compromise between these two grades is the medially hydrolyzed type.

Polyvinyl alcohol is prone to two problems which can prevent the smooth running of the sizing machine. The first is skinning. This is a problem in storage as well as in the size box. Strong skinning in the size box can be picked up by the headstock. The second is foaming. This is more of a problem with the partially hydrolized grade and can cause inconsistent sizing and a problem of skin formation on the foam.

Heat treatment at temperatures in excess of 140°C "crystallize" the polyvinyl alcohol making it much more difficult to remove. This puts many customers off using it mainly in Europe and South America.

Polyvinyl alcohol is generally used in conjunction with starch. The combination is often incompatible resulting in possible separation of the two components. Improvement of compatibility is achieved when **FLOLINE SIZE** is used.

Size preparation

FLOLINE SIZE is easy to handle. These products are free flowing and dust-free bead polymers. The viscosity obtained is achieved rapidly and is maintained steadily throughout prolonged cooking. Used alone, **FLOLINE SIZE** does not skin at all, and when blended with starch it reduces drastically skin formation.

FLOLINE SIZE	Polyvinyl alcohol (PVA)
Totally compatible with starch	Incompatible with starch and separation can occur
Improves the compatibility of PVA/starch	
Floline/starch blends form a brittle film when dry, but tough flexible films when conditioned	Forms strong tough films which are difficult to split and can damage the yarn
Floline/starch blend do not foam	PVA/starch blends often foam badly
Floline does not skin and can effectively reduce skinning in blend	PVA skins terribly

Sizing

The non-skinning properties of **FLOLINE SIZE** prevent the necessity for skin removal of the bath or the use of boiling. The risk of size bars across the warp that smash at the dry split is prevented.

Weaving

FLOLINE SIZE products improve the flexibility and strength of starch films. This also improves abrasion resistance during weaving and reduces warp-breaking.

Desizing

Prior to dyeing and finishing, it is necessary to remove the size. Very important problems can occur if the size is not removed efficiently. Addition of **FLOLINE SIZE** will improve greatly the solubility of the size.

E *Description of* FLOLINE SIZE

FLOLINE SIZE P is a water soluble, anionic polymer. It shows major advantages in two areas when blended with starch. First, improvements of film strength in excess of 100% are easily obtained with additional improvement in extensibility and flexibility by enhancing moisture absorption. Second, very large improvements in adhesion rates are observed. **FLOLINE SIZE P** is used especially for high speed weaving in combination with starch where lower viscosities are a necessity since higher concentrations are employed.

FLOLINE SIZE N, is a water soluble, non-ionic polymer which yields a tough, flexible film at high humidity. It is specially recommended for unmodified starches or starches modified by simple techniques and does not increase the viscosity of starch when used in blends. **FLOLINE SIZE N** has the very usefull properties of being resistant to high humidity levels and to be easily recyclable.

F *Typical recipes*

FLOLINE SIZE P

Yarn	Tex (Ne)	Ends/cm(inch)	Target size on yarn	FLOLINE SIZE P	PVA	Starch	Wax
Cotton	15(40)	45(115)	9%	5.0	-	2.5	-
	12(50)	45(115)	10%	6.0	-	2.0	-
	42(16)	32(80)	9%	2.0	-	6.5	0.5
	25(24)	40(100)	11%	2.5	-	7.0	0.5
	15(40)	48(120)	12%	3.0	-	7.5	0.5
	10(60)	56(140)	15%	3.5	-	8.5	0.5
Polyester/ Cotton 65:35	30(20)	28(70)	8%	5.0	-	3.0	-
	20(30)	30(75)	10%	7.0	-	3.0	-
	42(16)	32(80)	12%	4.0	-	8.0	0.5
	30(20)	40(100)	12%	1.0	3.0	8.0	0.5
	15(40)	48(120)	15%	1.5	3.0	8.5	0.5
	10(60)	56(140)	16%	2.5	4.0	8.0	0.5

FLOLINE SIZE N alone

Yarn	Tex (Ne)	Ends/cm (inch)	Target size on yarn	FLOLINE SIZE N	PVA	Starch	Wax
Rayon	33(18)	24(60)	3%	2.0	-	-	-
Cotton	(85)7	12(30)	3%	2.5	-	-	-
	30(20)	20(50)	4%	3.0	-	-	-
	20(30)	32(80)	6%	5.0	-	-	-
	12(50)	52(130)	9%	8.0	-	-	-
Polyester/ Cotton 65:35	30(20)	28(70)	8%	7.0	-	-	-
	20(30)	30(75)	9%	8.0	-	-	-
	15(40)	40(100)	12%	11.0	-	-	-

FLOLINE SIZE N with starch

Yarn	Tex (Ne)	Ends/cm (inch)	Target size on yarn	FLOLINE SIZE N	PVA	Starch	Wax
Cotton	20(30)	32(80)	8%	2.0	-	5.0	0.5
	20(30)	52(130)	10%	3.0	-	6.0	0.5
	12(50)	52(130)	12%	3.5	-	7.5	0.5
Polyester/ Cotton 65:35	30(20)	28(70)	12%	3.0	-	8.0	1.0
	20(30)	30(75)	14%	4.0	-	9.0	1.0
	15(40)	40(100)	16%	5.0	-	10.0	1.0

The above figures refer to kg/100 litres (lbs/10 gals) final volume of size liquor