TTS10S SPUN SIZING MACHINE
TW10S WARPER
TCR-V/SV CREEL

TTS10S SPUN SIZING MACHINE

Weaving quality spun fabric on a high speed loom, such as an air jet loom, requires yarns which are evenly sized, have even moisture percentage, and even elongation with little fluff or yarn breakage.

The TTS10S breaks tradition. With a new structure and control for the size boxes and drying cylinders, the TTS10S produces the best sized yarns for an air jet loom.

Drying

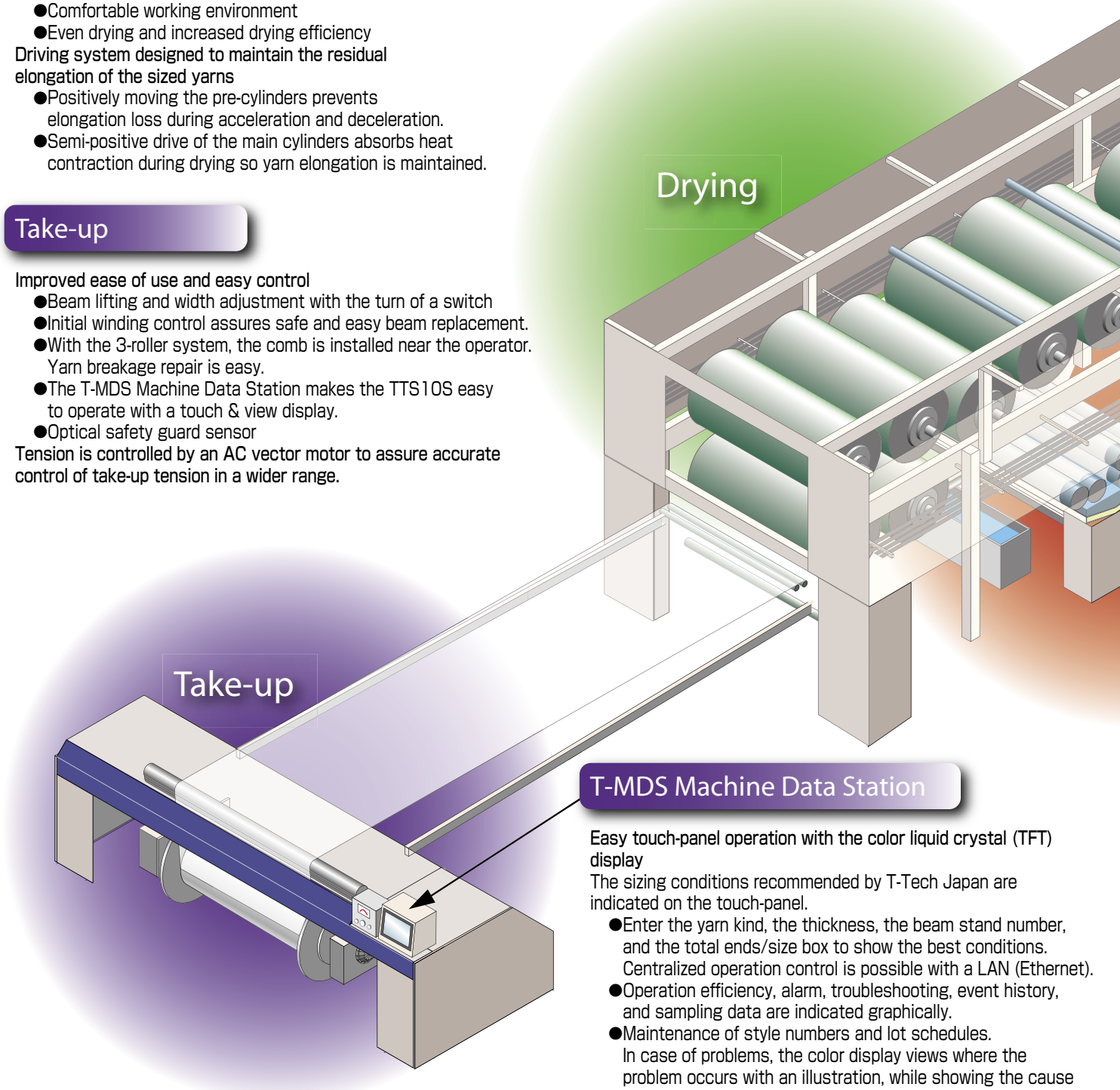
Cylinders located over the size boxes
- ●Comfortable working environment
- ●Even drying and increased drying efficiency

Driving system designed to maintain the residual elongation of the sized yarns
- ●Positively moving the pre-cylinders prevents elongation loss during acceleration and deceleration.
- ●Semi-positive drive of the main cylinders absorbs heat contraction during drying so yarn elongation is maintained.

Take-up

Improved ease of use and easy control
- ●Beam lifting and width adjustment with the turn of a switch
- ●Initial winding control assures safe and easy beam replacement.
- ●With the 3-roller system, the comb is installed near the operator. Yarn breakage repair is easy.
- ●The T-MDS Machine Data Station makes the TTS10S easy to operate with a touch & view display.
- ●Optical safety guard sensor

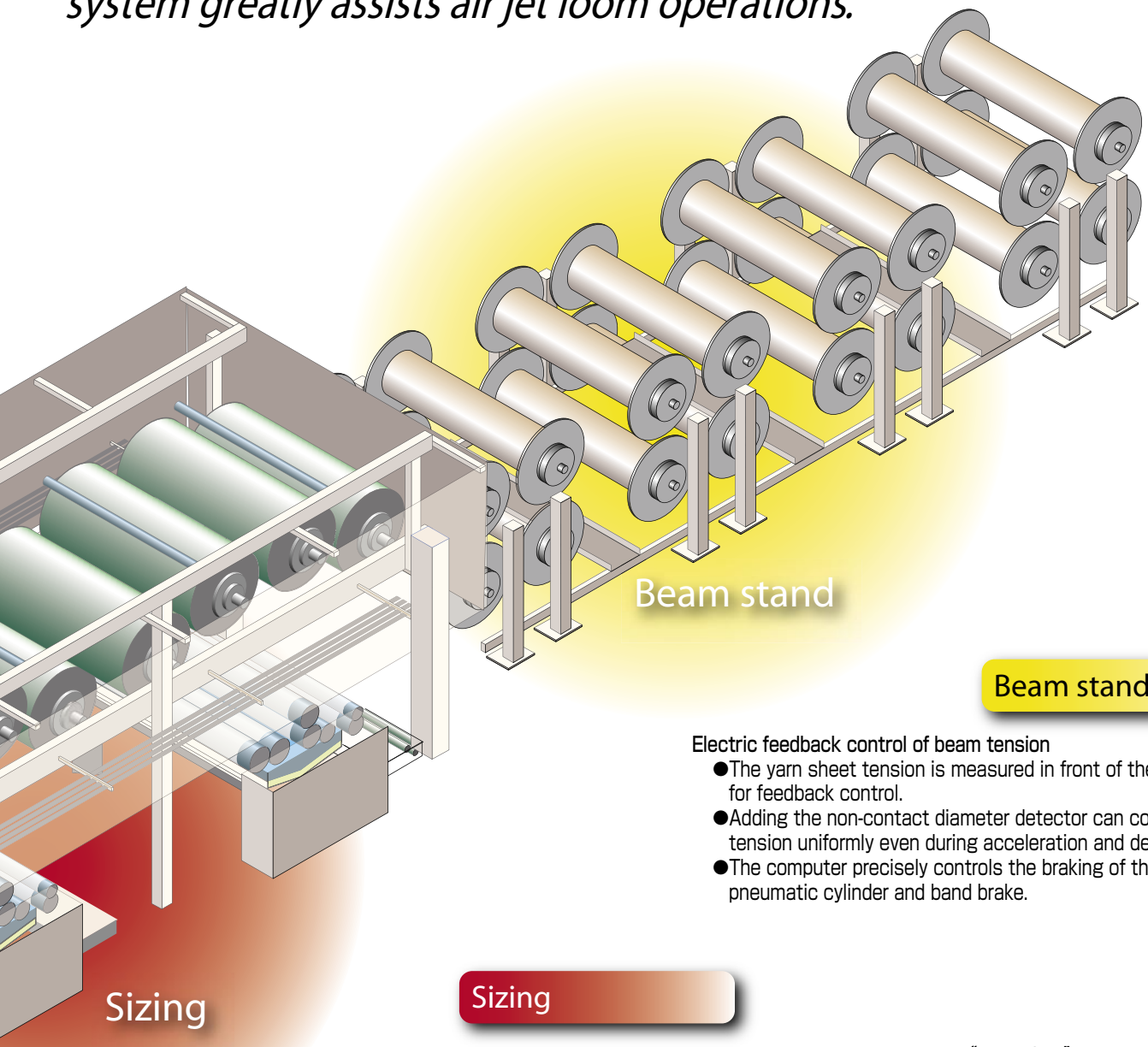
Tension is controlled by an AC vector motor to assure accurate control of take-up tension in a wider range.



T-MDS Machine Data Station

Easy touch-panel operation with the color liquid crystal (TFT) display
The sizing conditions recommended by T-Tech Japan are indicated on the touch-panel.
- ●Enter the yarn kind, the thickness, the beam stand number, and the total ends/size box to show the best conditions. Centralized operation control is possible with a LAN (Ethernet).
- ●Operation efficiency, alarm, troubleshooting, event history, and sampling data are indicated graphically.
- ●Maintenance of style numbers and lot schedules. In case of problems, the color display views where the problem occurs with an illustration, while showing the cause and checking procedure.

The T-Tech Japan-developed "Touchfree" vertical yarn sheet pull-out system greatly assists air jet loom operations.



Beam stand

Electric feedback control of beam tension

- The yarn sheet tension is measured in front of the size box for feedback control.
- Adding the non-contact diameter detector can control the tension uniformly even during acceleration and deceleration.
- The computer precisely controls the braking of the combined pneumatic cylinder and band brake.

Sizing

The running yarn sheet has less disarrangement with the "Touchfree" vertical pull-out system.

- Improvement in operation and machine patrol
- Great reduction in yarn-end problems (doubled yarn, taped yarn, sheet widening)

Quality beams with an even size pick-up are produced.

- The double-jacket size box together with the size liquid mixing and recirculation system for both the 1st and the 2nd size boxes produces size with an even concentration and viscosity.
- The high-precision feeding device properly controls the stretch of the yarn sheet while it is wetted in the sizing process.
- The roll for uniform squeeze produces widthwise even squeezing pressure and even size pick up amount.
- The SQ squeezing pressure control automatically controls the squeezing pressure for stop, low speed, high speed, acceleration, and deceleration.

Multi-section drive

AC vector motors individually drive each section. Accurate and repeatable control is attained.

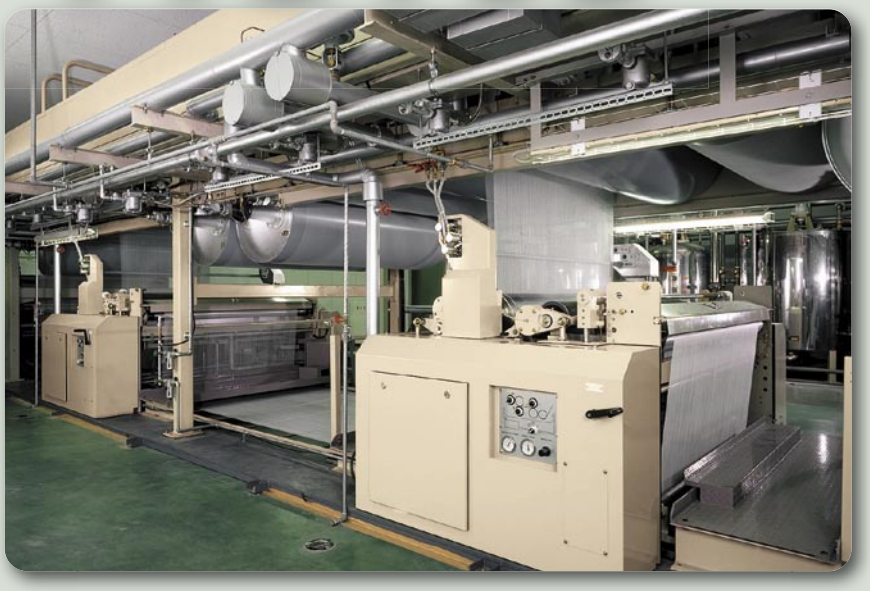
- Stretch can be individually set for the 1st and the 2nd size boxes.
- Using one or both size boxes is possible with the flip of a switch.

Easy maintenance and minimum power consumption

- Because there is no mechanical frictional drive, maintenance is easy.
- One direct current power supply controls the AC vector motors, so there is no wasted power consumption.

TTS10S

A mechanism gentle to the yarns
Two size boxes and the "Touchfree" vertical yarn sheet pull-out system



The size liquid in two size boxes circulates through the cavity box and is mixed so the size concentration and the viscosity are even in both boxes. The amount of size pick up on the yarn sheets that pass through the boxes is even.

The stretch can be independently controlled for the 1st and 2nd sizing sections by the multi-section drive system. The yarn sheet is pulled out of the size boxes to the pre-cylinders vertically without using a guide roll. Nothing touches the yarn sheet. This "Touchfree" system reduces fluff and yarn breakage. The lower frame configuration arranges pre-cylinders close to the size boxes so the free length of the yarn sheet is short. A wide range of yarns from thick to super fine (6S/1~200S/1) can be handled.

■ Size liquid gently touches the yarns without causing yarn sheet disturbance

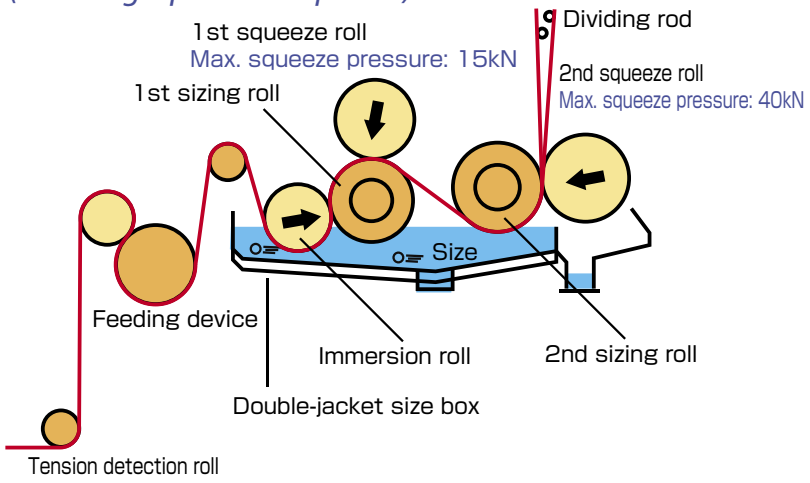
● Nip & twin squeeze (40kN squeeze)

An indirect heating system due to the double-jacket structured size box reduces dilution of size liquid caused by low temperature of size liquid. The result is a more even size concentration and viscosity.
With a high-precision feeding device, the stretch of yarn sheet is properly controlled while the yarn sheet is wetted in the sizing process. As a result, various kinds of sizing methods are available.
Less size gathers around the contact area of the 2nd squeeze roll and stop marks are reduced. Arranging the 2nd sizing roll in the size liquid keeps the roll clean. The size on the roll surface does not dry out quickly. This reduces size film on the roll surface. Even without a contact roll, the yarn sheet is neat because the rolls are arranged so that the yarn sheet enters in the size after touching the 2nd squeeze roll.

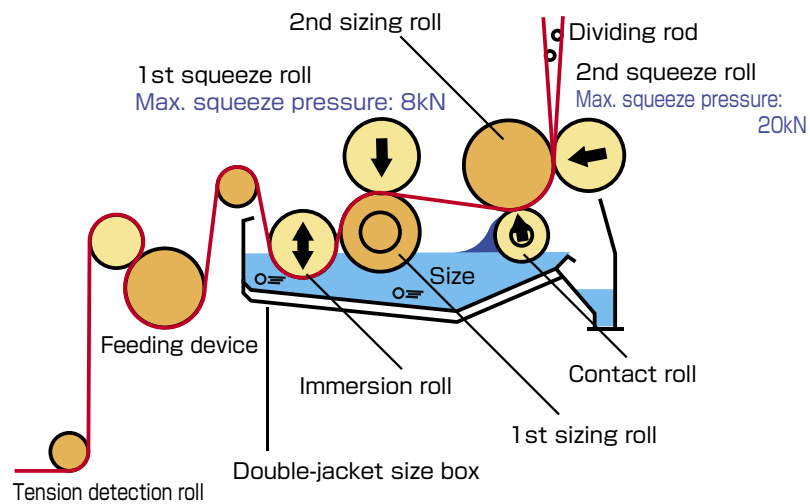
● Dip & twin squeeze (20kN squeeze)

The immersion roll of the dipping type produces a yarn sheet with little disarrangement. Since the 2nd sizing roll and the contact roll are eccentrically arranged, the size liquid brought up by the contact roll gently touches the yarn sheet. This enables the yarn sheet to run smoothly without disturbance or disarrangement. It reduces doubled yarn or taped yarn.
After the contact roll penetrates the yarns with size and removes extra size, the final squeeze is done without supplying size. This obtains a squeezing effect that is as large as a high-pressure squeeze (Max. 40kN) though it is only medium pressure (Max. 20kN). The medium-pressure squeeze produces soft sized yarns with sufficient penetration. For medium and fine count yarns, fluff or yarn breakage is reduced.

TTS10S nip & twin squeeze system (40kN high-pressure squeeze)



TTS10S dip & twin squeeze system (8 & 20kN low • medium-pressure squeeze)



■ T-MDS Machine Data Station

Reliable and User-Friendly Computer Control System

The T-MDS Machine Data Station integrates control of the TTS10S. The T-MDS touch-key operation with its color graphic display is easy to use and facilitates troubleshooting. The automatic setting function provides you with the optimum sizing conditions recommended by T-Tech Japan in a simple operation on the display.
LAN communication (Ethernet) is possible on the T-MDS. Operation controls such as the operation check and schedule setting can be made easily from the host computer located in the office.
If the T-MDS fails, a fail-safe system instantly allows continual operation of condition setting and viewing of all indicators.

[Standard functions of the T-MDS]

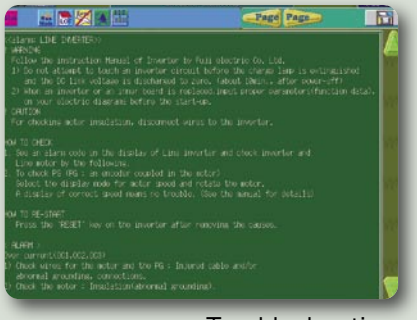
- Individual indication and setting of the temperature, the tension, the stretch and the squeezing pressure
- Monitoring the operating status to find the checkpoints for troubleshooting
- The operating conditions are automatically set, controlled, and monitored. Changing the conditions during operation is also possible.
- Recommended sizing conditions are displayed by entering the yarn kind, the thickness, the beam stand number, and the total ends/size box.
- Up to 300 operating conditions can be registered. Mis-operation is prevented.
- Ethernet (LAN) communication is available.

[Optional device for the T-MDS]

- The best moisture is kept with the combination moisture control.
- The SPM Size Pick Up Monitor detects and shows the size pick up amount in real time.
- The size concentration control system keeps the size concentration at the set value to obtain even size concentration.
- The SST sub-terminal helps to set and indicate the conditions easily in case the T-MDS is defective.
- The T-PMS T-Tech Japan Preparation Management System controls operation by the host computer.

Drive condition

Illustration monitor

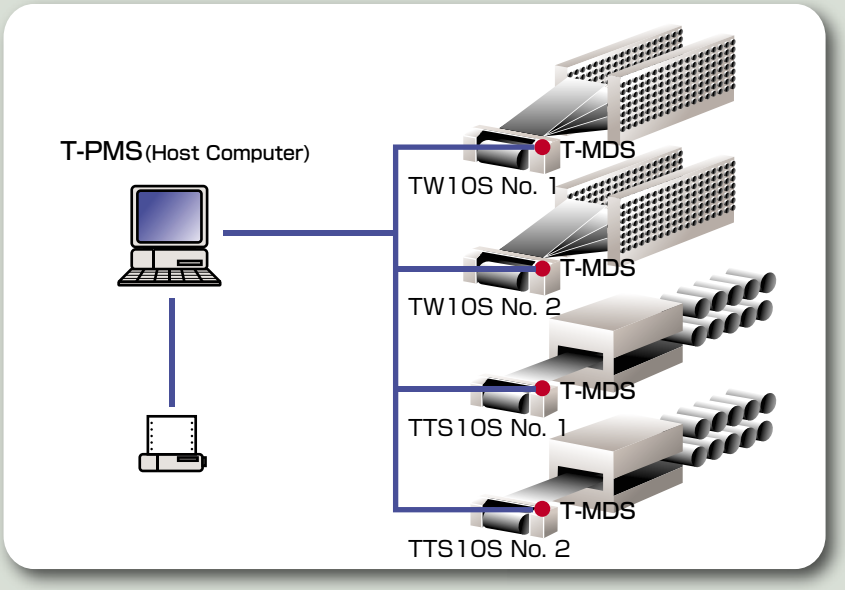


Troubleshooting

■ T-PMS (Optional)

T-Tech Japan Preparation Management System

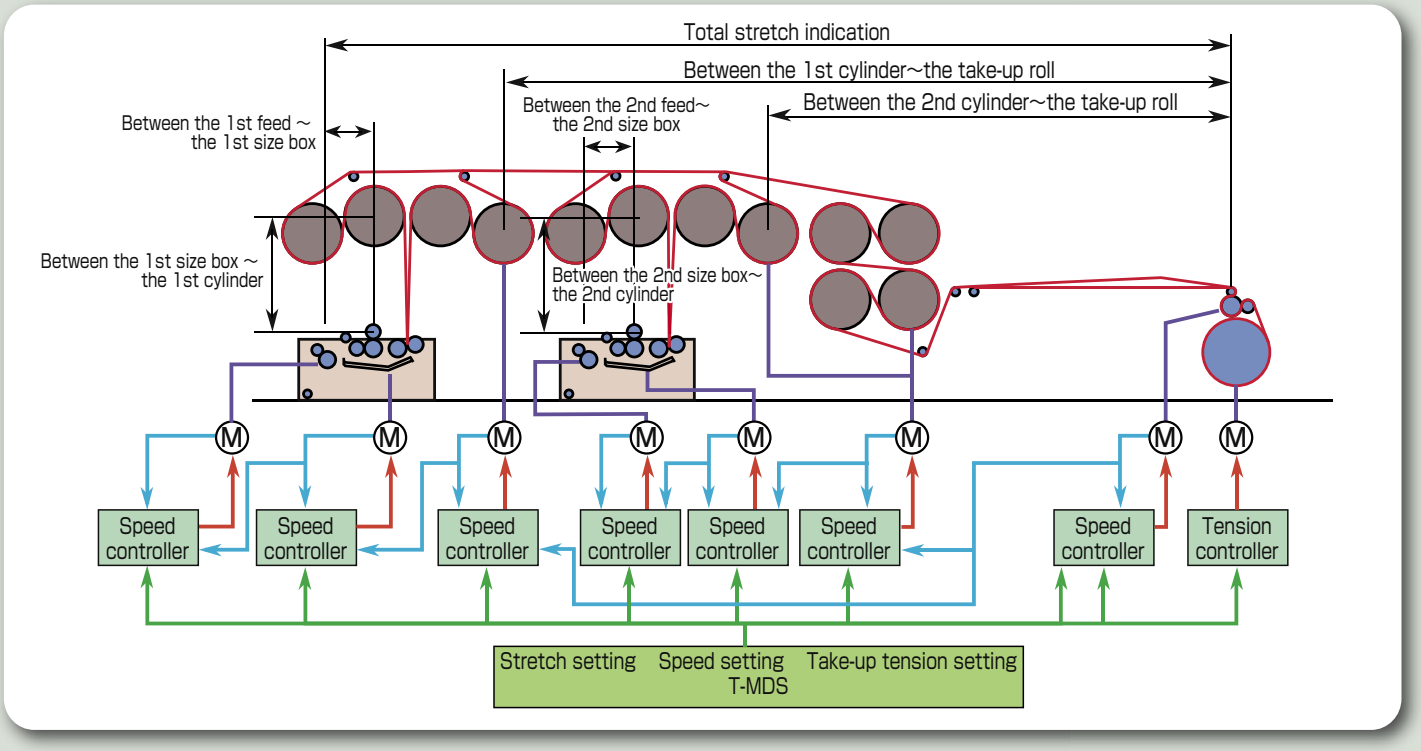
By installing the T-PMS T-Tech Japan Preparation Management System in the host computer, the centralized control over machines from the office can be achieved.
The T-PMS helps unify the master control for setting conditions between machines, resulting in fewer mistakes in data setting and better production control.
Data collected by the T-MDS is available on the host computer. It is possible to control the operation efficiency as well as to monitor the alarm and problem status.
Data communication between each process is also available.



Easy Operation and Quick Response

■ Digital stretch control with a multi-section drive system

The individually driven AC vector motors are located in each take-up, drying, and sizing section. Stretch is digitally controlled using the T-MDS Machine Data Station. The digital electric control provides high repeatability and control accuracy. Because of the individual motor control, choosing to use one or both size boxes is simple. Sizing a small quantity of yarns or high-twist yarns suitable for one size box is a breeze. Moreover, the 1st and 2nd size boxes are controlled under different stretch settings. This makes sizing different kinds and different thickness yarns easy. A 2-mode stretch setting for low or high speeds prevents irregular tension due to heat contraction in low speed operation, producing sized warps of high quality. The stretch setting and its indication are done on the T-MDS Machine Data Station. Higher reproductivity of stretch settings without errors maintains the quality of sized warps.



Even sizing

The TTS10S uses an indirect size heating system by the double-jacket size box together with a size liquid mixing and circulation system where the size liquid flows from two size boxes to a single cavity box to make the size concentration & viscosity even. Lint and size residue are easily removed by the large exchangeable filter.
The original roll arrangement prevents the yarns from snarling, enabling sizing of a small number of ends like 500 ends/size box. Since all the roll shafts are located over the size liquid, the size liquid flows smoothly in the size box to decrease size film and residue. Size liquid does not enter the roll shaft bearings so the durability of the bearings is high and maintenance is easy.

Perfect fluff lay-down

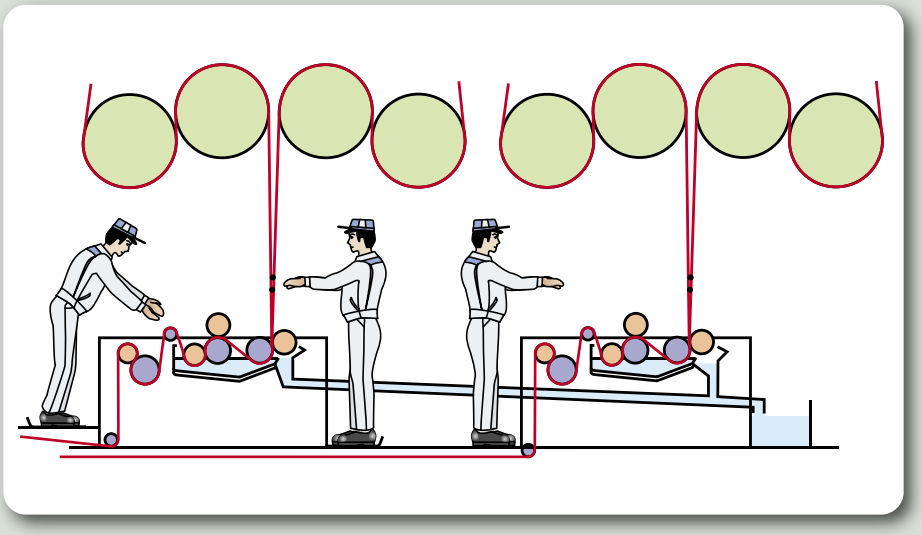
The pre-cylinders have sufficient contact length with the yarns and prevent rapid drying of the sized yarns. This makes 4-sheet drying possible. Combined with water-cooled dividing rods, perfect fluff lay-down is obtained. The short distance between the 2nd squeeze roll and the cylinder prevents yarns from snarling. Even weak yarns or additionally twisted yarns can be easily sized by using two size boxes.

The 2-rod system reduces accumulated size residue and lint on the rod by making the yarn sheet contact with the dividing rod on one side.

Great improvement in operation

The size box can be accessed from any direction.
Access to rolls is easy. Thus, yarn repair work and lint removal from roll surfaces can be carried out in a comfortable posture, so that safety and operation are noticeably improved.

Improved environment with an exhaust fan
The airflow generated by the exhaust fan installed above the size boxes provides an improved working environment.



Even drying

The drying cylinders are arranged horizontally to make drying conditions uniform for each sheet, while also keeping the length of each yarn sheet of each size box the same from the sizing section to the take-up. This results in an excellent warp yarn with even drying.

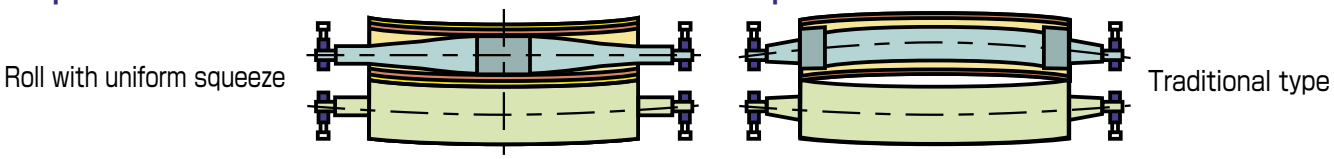
SQ Automatic Squeezing Pressure Controller

Individual squeezing pressure for "STOP", "LOW SPEED" and "HIGH SPEED" can be set, and all can be controlled and displayed, ensuring stable size pick up. Squeezing pressure for "HIGH SPEED" is automatically adjusted according to yarn speed.

A squeeze roll for uniform squeeze

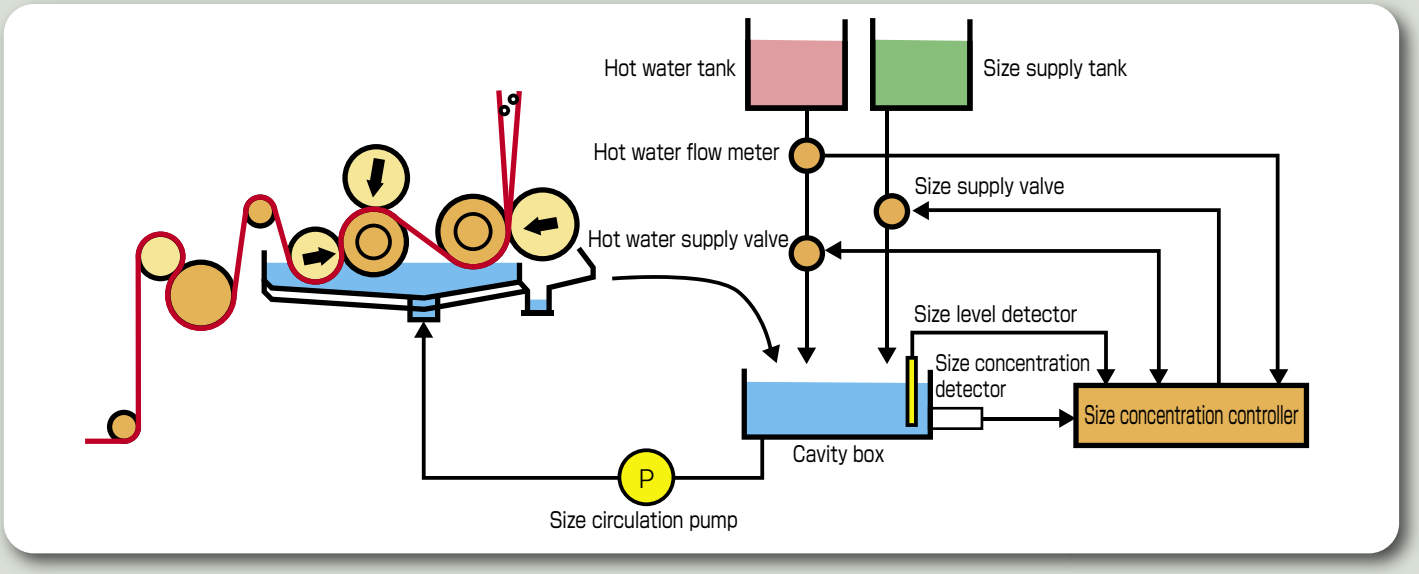
It is important for sizing to apply widthwise uniform squeezing pressure and to make the size pick up amount even. The TTS10S employs a squeeze roll with a structure for uniform squeeze. Even widthwise nipping is obtained at any squeezing pressure.

Squeeze roll with a structure for uniform squeeze



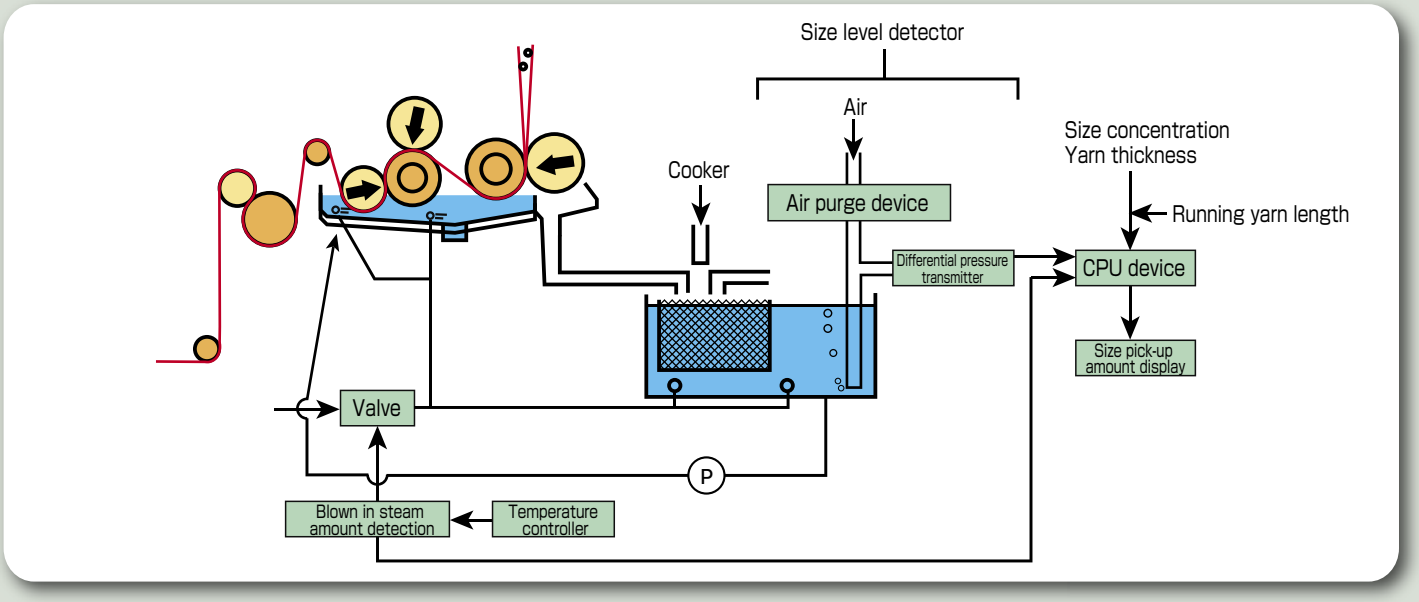
■ Size Concentration Control (Optional)

The size concentration is automatically controlled according to the set value. Differences in the size concentration - which greatly influences the size pick up amount - are reduced to achieve quality sizing.



■ SPM Size Pick-up Monitor (Optional)

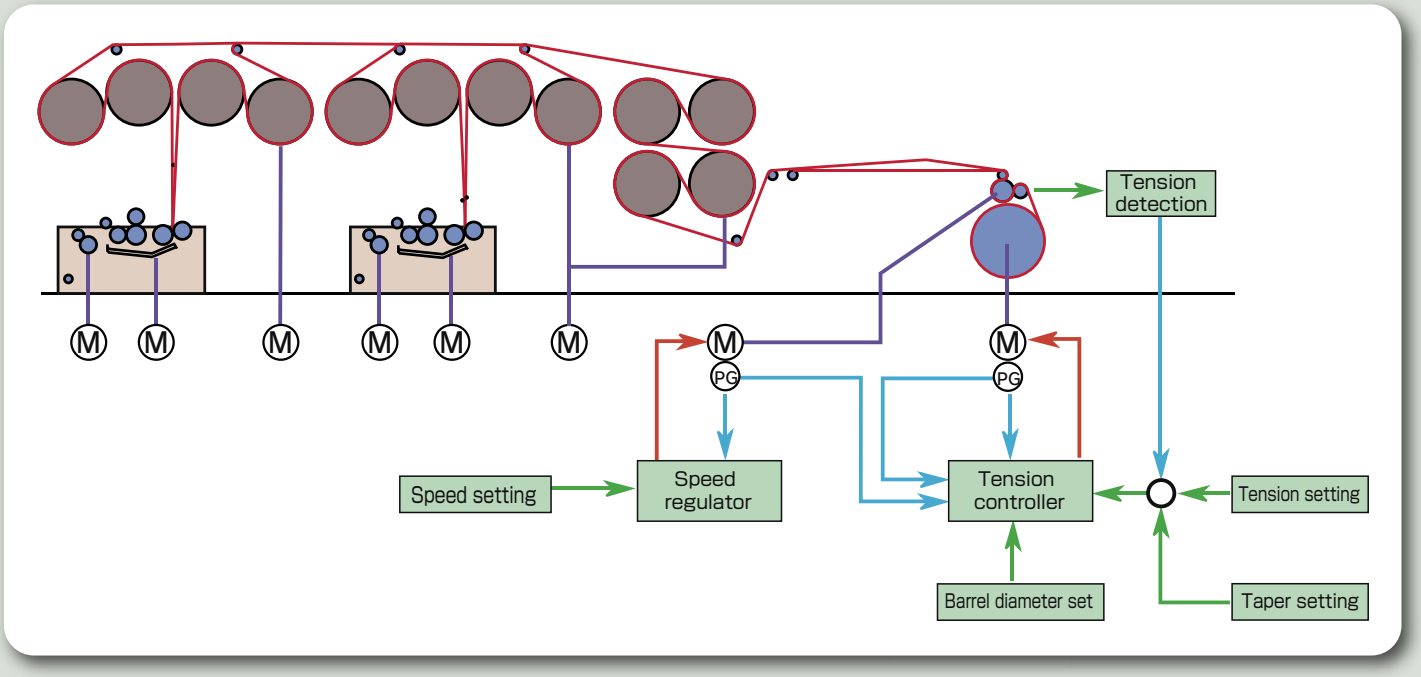
The SPM Size Pick-up Monitor uses air pressure to detect the amount of size liquid consumed in real time. Because the size pick up amount is detected and displayed without delay, abnormalities can be prevented, making control accurate, simple, and productive.



Highly Accurate Tension Control

■ Take-up tension control with AC vector motor

The AC vector motor precisely controls the take-up tension in a wide range up to 6000N (125m/min.) or 7500N (100m/min.). The take-up tension can be set from the T-MDS. The tension control allows any take-up diameter for the loom beam barrel. For initial winding at loom beam exchange, the initial winding controller assures simple and safe winding by controlling the feeding roll synchronously to the beam barrel diameter and beginning tension control after completing the initial winding.



■ High-precision beam stand pull-out tension control

The pneumatic cylinder precisely controls the individual band brakes with tension feedback.
Using air pressure related to the beam diameter, the feedback control stabilizes tension control even during acceleration and deceleration. The feedback control uses a combination of accurate and quick-response electric tension detection and touch-free winding diameter detection.
The independent and exclusive ruffles (brake wheel) on the stand frame are also available. The vibration from warper's beam can be absorbed at the joint section between the beam and the clutch for stable tension control. (Optional)

Movable-type beam stand (Optional)

■ Tension control with two systems (Optional)

Different tension control systems are applied for the 1st and 2nd size boxes.

■ Operation Lifter (Optional)

Built in the front of the take-up section for easy operation.

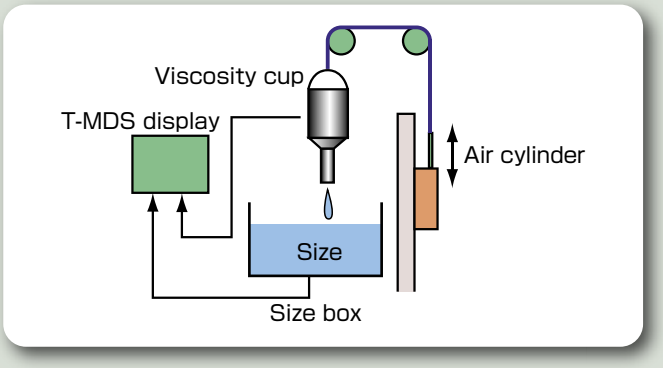
■ Centralized Lubrication Device (Optional)

Automatic oil lubrications results in labor savings.

■ Size Cooking Device (Optional)

■ Automatic size viscosity measuring device (Optional)

Size dripping from the viscosity cup is detected with a minute electric current and the size viscosity is automatically measured and displayed. It is indispensable for quality sizing to accurately measure and control the size viscosity.



Reducing The Running Costs with Pre-Wet Sizing (Special Design)

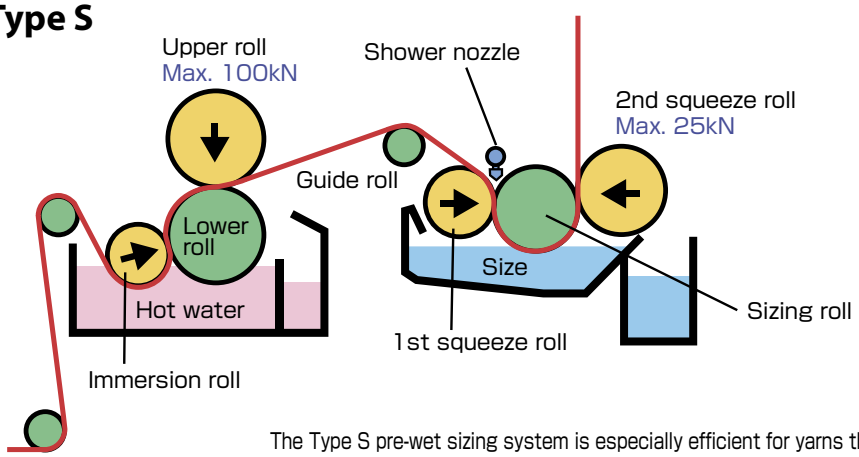
■ A 20 ~ 40% reduction in the size pick up amount is possible.

Pre-wetting the yarns makes it easy to penetrate them with size. Plus, size evenly and efficiently adheres to the yarn surface, which reduces size pick up amount. The sized yarns are soft and have less decrease of elongation. They help increase productivity on air jet looms. Preventing the dilution of size by the moisture brought by the wet yarns is an important technique. Adequate control can handle the wide range of yarn thicknesses from thick to thin (6S/1 to 60S/1).
(The pre-wet sizing system might not be effective for some kinds of yarns.)

■ Size Concentration Control Device

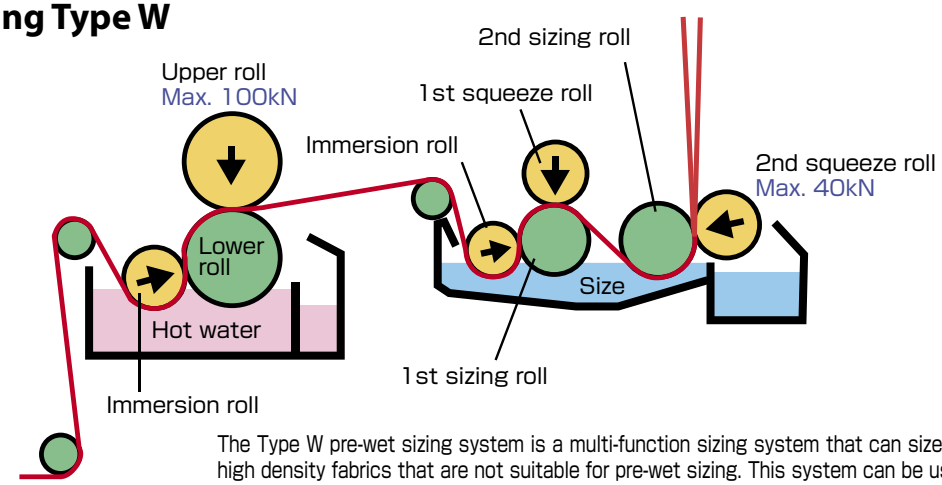
The moisture brought by wet yarns is very different depending on the yarn kinds and the yarn quantity even if the pressure is the same. Keeping the size concentration is an indispensable technique for pre-wet sizing. It must be controlled for each style. Use of the size concentration control device prevents size dilution and allows sizing with constant size concentration. It makes pre-wet sizing control easy.

■ Pre-wet sizing Type S



The Type S pre-wet sizing system is especially efficient for yarns thicker than 30S.

■ Pre-wet sizing Type W

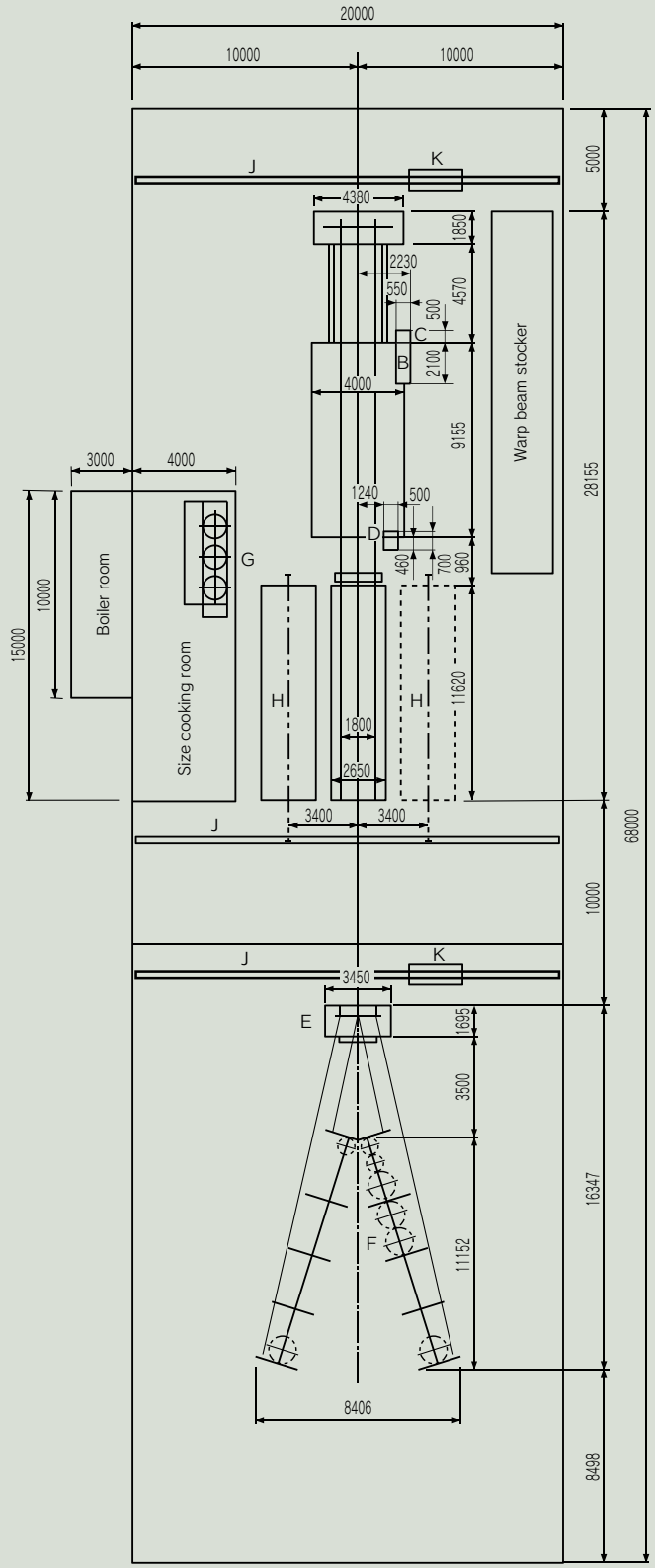


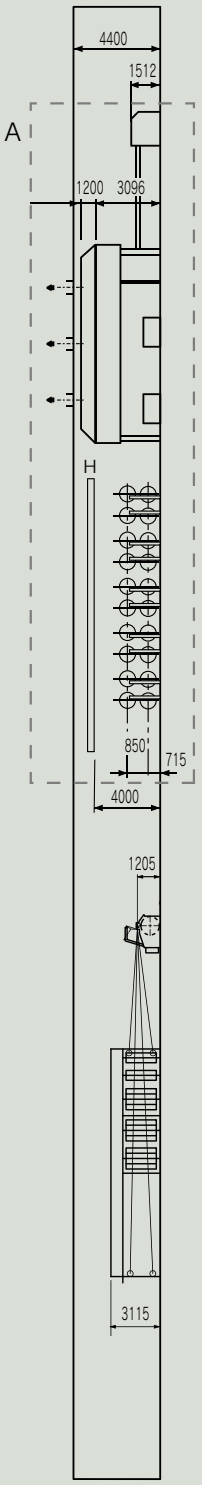
The Type W pre-wet sizing system is a multi-function sizing system that can size thin yarns for high density fabrics that are not suitable for pre-wet sizing. This system can be used as the nip & twin squeeze sizing system with a feeding device by letting water out of the pre-wet tank.

TTS10S SPUN SIZING MACHINE

Dimensions

Unit: mm





A: TTS10S type sizing machine
Take-up: for AJL (190 cm)
Beam stand: for 20 beams with 800 mm flanges, 4 block type (Movable)
B: TTS10S control box
C: Transformer for power supply
D: Beam stand control box
E: TW10S warper (180 cm)
F: TCR-V creel: 774 spls.
Spindle pitch: 240 mm
G: Size cooking equipment
High pressure cooker: 1000 liters
Storage tank: 1200 liters
Return tank: 1000 liters
H: Overhead rail: for 1.5~2.0 tons
J: Beam conveyor
K: Beam weighing device

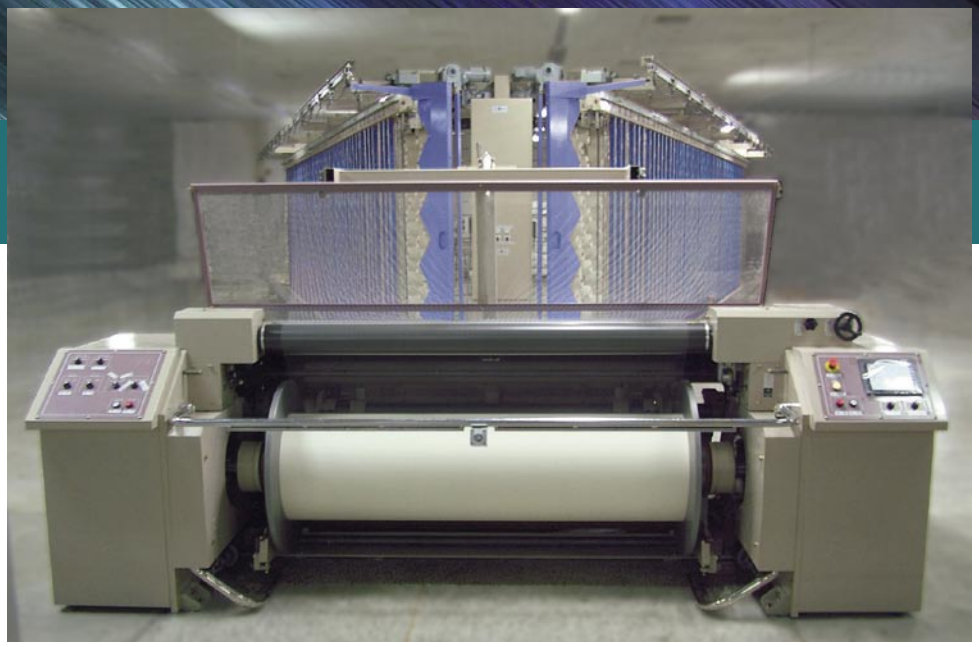
Specifications

	Item	Specifications		Optional equipment
General	Model	TTS10S		1400, 2400 mm
	Sizing system	"Touchfree" vertical pull-out system with 2 size boxes		
	Nominal take-up width	1700, 1900, 2100, 2300, 2500, 2800, 3400, 3600, 3900 mm		
	Sizing and drying width	1600, 1700, 1800, 2000, 2200 mm		
	Max. yarn speed	100 m/min., 125m/min.		
	Stretch control system	Digital stretch control with multi-section drive system		
Beam stand	Stand type	Double deck system (Yarn feeding from the upper and the lower decks), 4-block system.		Beam stand for sectional warper Movable type beam stand Special ruffle Tension control with two systems
	No. of stands	12 to 24		
	Pull-out tension control	Individual pneumatic band brake system, Air pressure simultaneous control system, Feedback control		
Sizing	Size box	2 size boxes		Size viscosity monitor Size pick up monitor Size concentration control Feeding device Double-jacket size box
	Sizing system	Dip & twin squeeze system	Nip & twin squeeze system	
	Squeezing pressure	1st squeeze roll: Max. 8kN 2nd squeeze roll: Max. 20kN	1st squeeze roll: Max. 15kN 2nd squeeze roll: Max 40kN	
	Squeezing pressure control	With SQ squeeze pressure controller Control range: 1~20kN	With SQ squeeze pressure controller Control range: 1~40kN	
Drying	Cylinder location	Located above sizing section		Combination moisture control Main cylinder: 6
	No. of cylinders	Pre-cylinder: 4 x 2 units Main cylinder: 4		
	Cylinder drive system	Pre-cylinders: Positive chain drive system with stretch regulator Main cylinder: Negative chain drive system with chain tension adjuster		
Take-up	Take-up system	AC vector drive		Operation lifter Cut mark device Static electricity eliminator Mirror Contact bar lifting device Automatic wax supply
	Waxing device	Kiss roller system (With a dissolving unit and an wax-supplying unit)		
	Take-up tension range	Max. 6000N (125m/min.), Max. 7500N (100m/min.)		
	Loom beam mounting	Exclusive adapter system, With automatic loom beam doffing device using vertical lifting by hydraulic cylinder and horizontal doffing by motor, With initial winding controller		
	Max. flange diameter	1016 mm		
	Installed beam weight	Max. 2,500 kg		
	Safety equipment	With photoelectric beam and swinging safety guard		
Others	Operation display	T-MDS Machine Data Station		Centralized lubrication device Pre-wet sizing
	Steam installation capacity	1200 kg/H		
	Electrical installation capacity	25kVA	30kVA	
	Special design			

Note 1: Drawings, data, and photos in this brochure are subject to change without notice for improvements.
Note 2: The photos in this brochure partly include options.

Optimum for air jet looms.
Superb combination of warper and creel for spun yarns.

TW10S
SPUN WARPER



High speed
Yarn speeds up to 1300 m/min. can be set with the T-MDS.

Safety
A powerful brake and safety bar ensure safe operation.

Operationality
Operation control is easy with the T-MDS.

Even beam surface
A straight expansion comb is used. It is attached close to the rolls making warp drawing into the comb easy. The pitch of the comb dents can be uniformly kept by extending or shortening the comb with a handle and the beam surface becomes more even. An even beam surface promises steady and uniform tension in the next process.

Press roll
The press roll presses the surface of the warps on the warper's beam, resulting in optimum hardness and a smooth surface on the warps. The kickback device protects yarns from generating fluff at stoppage.

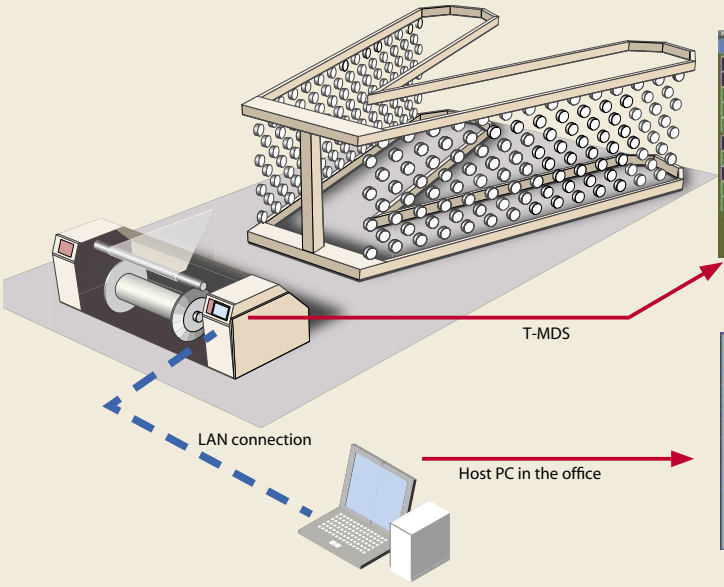
Quick machine stop
The warper's beam and every roll can be stopped immediately by either the stop buttons, a yarn dust detector, or by the yarn breakage sensors on the creel. The safety brake works even when the electric power is off.

Warper's beam lifting device (Optional)
The beams are lifted by a pneumatic cylinder and beam doffing is driven by the brake motor. These operations are easily made by the selector switches. Manual handling is not necessary.

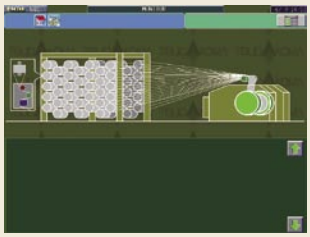
Accurate measuring
Because the wound length is measured with the press roll, the measurement is accurately done without slippage. The accurate measurement minimizes waste yarns in the next process.

T-MDS Machine Data Station *Computer control*

Using a color liquid crystal (TFT) display and a touch panel, the T-MDS allows easy operation control. When a problem occurs, the color display shows where the problem occurs with an illustration while showing the cause and checking procedure, resulting in easy maintenance.
Ethernet (LAN) communication is available on the T-MDS. Operation control including operation check and schedule setting can be made easily from the host computer in the office.
A fail-safe system is adopted for condition setting and viewing indicators if the T-MDS is in trouble.




Drive condition


Trouble display


Production schedule


Drive condition

Reliable non-contact yarn breakage detection, which is kind to yarns.

TCR-V/SV CREEL

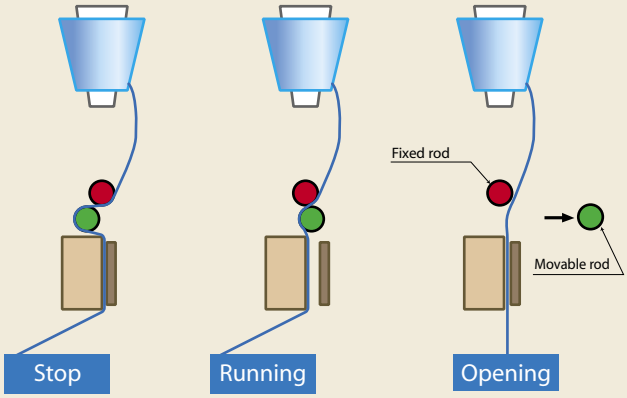
Automatic yarn package frame replacement device (Optional)

The yarn packages are turned at the same time by driving motors.

Tensioner

A rod tensioner system with a movable rod is used. By setting three positions of the movable rod at stopping, running and opening, tension is equalized, and the yarn breakage is easily repaired.

Softly brakes the yarn according to the machine stop/start setting to prevent the yarn from loosening in acceleration and deceleration.



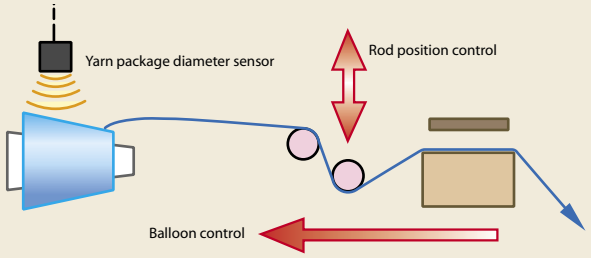
The above figure shows the 2-rod type. A 3-rod or 4-rod type is also available.

Tension control device (Optional)

The creel tension is detected on the warper's main body section. From the beginning to the end of the package, the combined use of the rod position control and the speed control pulls out the yarns at a stable tension for winding yarns on the beam. Even and stable pull-out tension contributes to fewer yarn breakage, resulting in a remarkable effect, especially for fine yarns.

Automatic adjustment for ballooning distance (Optional)

The best distance between the yarn package and the tension rod is calculated based on the yarn package diameter detected by the yarn package diameter sensor, and the tension rod is brought close to the yarn package. As the distance between the package and the tension rod is properly kept to prevent multiple balloons, yarn breakage is decreased.



Cutting device

When exchanging yarn packages, a movable electric cutter cuts yarns precisely and immediately.

Yarn breakage inspection

By adopting a photoelectric yarn breakage sensor, fewer yarn guides are needed and fluff decreases.
It detects even fine yarn in low tension.
Because the detection part is automatically cleaned with intermittent blown air, lint does not accumulate.
Running yarns are detected without being touched. When yarn breaks, the T-MDS monitor displays the position, and the indication lamps on the top of each row of the creel light up so that broken yarn can be immediately checked and repaired.

Specifications

TW10S WARPER

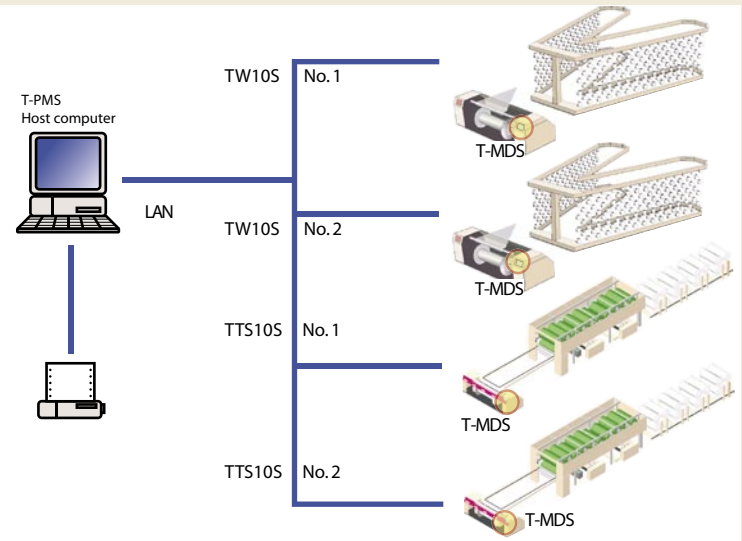
Outline	
Take-up system	Non-drum direct system
Take-up width	1600, 1700, 1800, 2000, 2200, 2400 mm
Yarn speed	20~1300 m/min. 20~1000 m/min
Max. flange diameter	1000 mm (40 inches)
Max. take-up tension	250N
Main machine	
Drive motor	11 kW, 15kW AC vector motor
Beam brake	Hydraulic disc brake
Beam lifting	Automatic operation by brake motor and pneumatic cylinder
Guide roll	Pneumatic disc brake
Windbreak screen	Swinging with operation
Press roll device	Concomitant use of pneumatic disc brake and hydraulic cylinder, with kickback function
Tension	Applied with creel tensioners
Comb section	Straight expansion comb system Expansion, left & right movement: operated with handle Up & down movement: 5 mm (automatic)
Traverse	0~30mm
T-MDS	Counter, yarn speed, tension setting and display, alarm, event display
Options	
Yarn dust detector	Photoelectric type
Yarn accumulating device	

TCR-V/SV CREEL

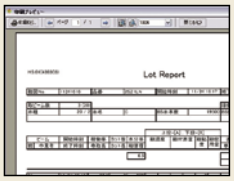
	TCR-V Creel	TCR-SV Creel
Creel shape	V creel	H creel
Tensioner	Rod tensioner	2-post washer type tensioner
Yarn breakage inspection	Photoelectric system (Non-contact type)	Contact type dropper system
Yarn breakage indication	Concomitant use of each spindle and each row	Each step
Overrun prevention	Each spindle has an overrun preventer.	
Cutting device	Electric cutter (Manual slide type)	
Package replacement	Rotary frame type (Electric type is optional.)	Rotary frame type
Lint cleaner (For sensors)	Air blowing system	Air blowing system
Option		
Tension control	Rod tension control	
Ballooning distance control	With yarn package sensor	
Balloon breaker		

T-PMS (T-Tech Japan Preparation Management System)

LAN construction with the T-MDS machines and the computer in the office.
All the T-MDS machines are monitored with the computer in the office.

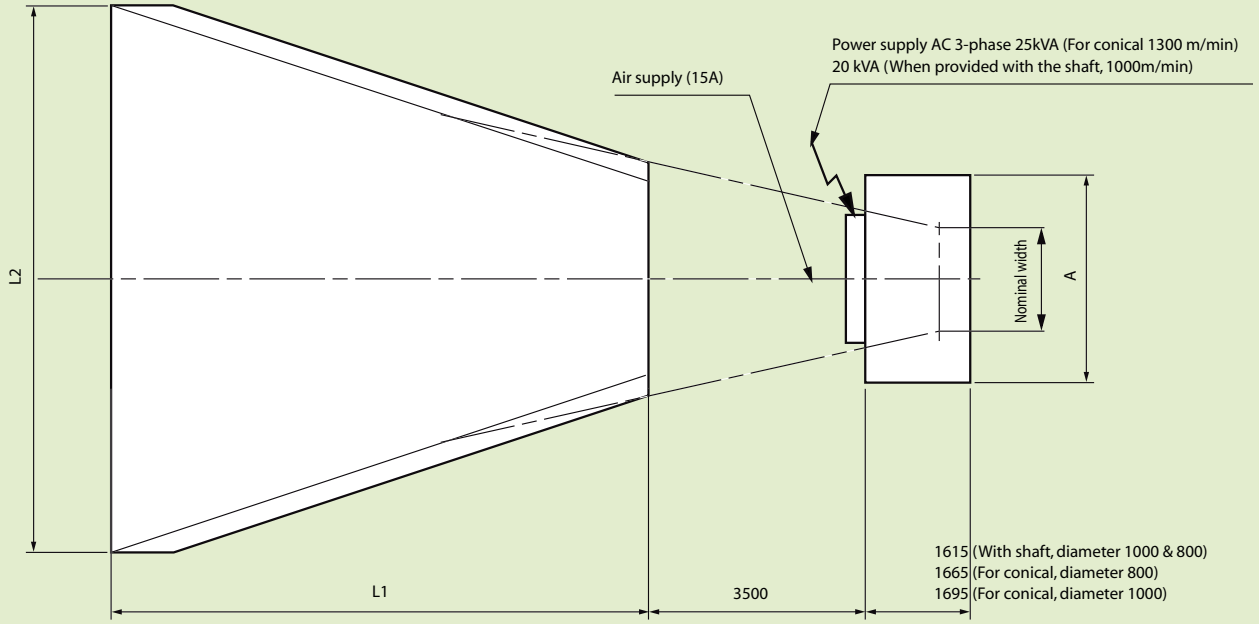


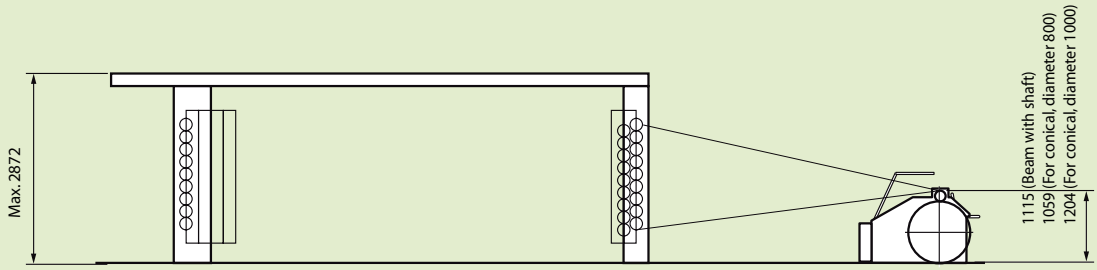
- Monitors the whole plant and the driving conditions of each machine.
- Style data control
- Operating schedule control
- Report creation and control (Beam report, lot report)
- Print function



Dimensions (For the warper with the maximum yarn speed 1300 m/min.)

Unit: mm





Nominal width		1600	1700	1800	2000	2200	2400
A	Conical	3250	3350	3450	3650	3850	4050
	With shaft	3520	3620	3720	3920	4120	4320

Installation space requirements and spindle number for creel

Rows	Horizontal pitch 235 mm						Horizontal pitch 285 mm					
	Vertical pitch		Balloon breaker				Vertical pitch		Balloon breaker			
	240	270	Not provided		Provided		300	330	Not provided		Provided	
	9 steps	8 steps	L1	L2	L1	L2	7 steps	6 steps	L1	L2	L1	L2
29	522	464	7909	7979	7857	8312						
33	594	528	8729	8496	8677	8830	462	396	10256	9459	10203	9425
36	648	576	9531	9001	9478	9335	504	432	11191	10048	11138	10015
39	702	624	10332	9506	10279	9840	546	468	12125	10637	12073	10604
43	774	688	11152	10023	11099	10357	602	516	13155	11287	13103	11254
46	828	736	11953	10529	11900	10862	644	552	14090	11876	14037	11843
49	882	784	12754	11034	12072	11368	686	588	15025	12466	14972	12432
53	954	848	13574	11551	13522	11885	742	636	16055	13115	16002	13082
56	1008	896	14375	12056	14323	12390	784	672	16989	13704	16937	13671
59	1062	944	15177	12561	15124	12895	826	708	17924	14294	17871	14261
63	1134	1008	15997	13079	15944	13412	882	756	18954	14943	18901	14910
66	1188	1056	16798	13584	16745	13918	924	792	19889	15533	19836	15500
69	1242	1104	17599	14089	17546	14423	966	828	20823	16122	20771	16089
73	1314	1168	18419	14606	18367	14940	1022	876	21853	16772	21801	16739
76		1216	19220	15111	19168	15445		912	22788	17361	22735	17328
79								948	23722	17950	23670	17917
83								996	24752	18600	24700	18657

Note: The maximum attachable yarn package diameter = efficient pitch – "a." Standard value of "a" is 20 mm. ("a" changes depending on the yarn kind.)

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