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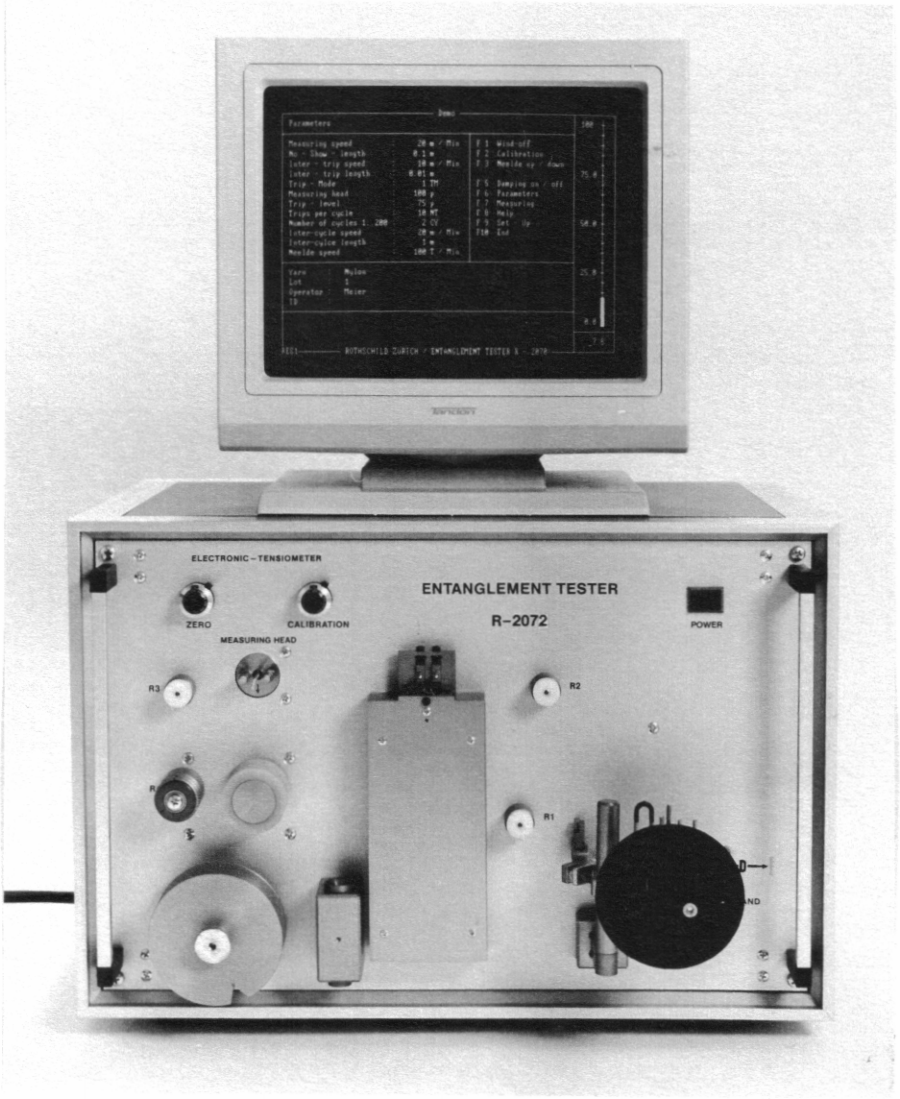
ENTANGLEMENT - TESTER
R - 2072

AUTOMATIC NEEDLE PULL TESTER FOR INTERMINGLED YARNS



ENTANGLEMENT TESTER based on microprocessors with incorporated ELECTRONIC-TENSIOMETER and yarn tension MEASURING HEAD. Control and display of the entire measuring process by PC – with "WIN 98 / 2000". Entry of all parameters and specific measuring data in a dialog with the PC monitor..

AUTOMATIC - Fully automatic measuring of the entanglement-distance and number of compaction points per meter. Statistical evaluation of all registered measuring data. Display on the monitor and/or print-out. All data can be stored on harddisc or disc.

QUALITY of the KNOTS - The ENTANGLEMENT TESTER R - 2072 is the only existing instrument, which has the feature to register not only *quantitative,* but also *qualitative* measurements of the entanglement knot.

"Weak or soft entanglements" are shown in the statistics and in the graphic display or print-out.

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AUTOMATIC NEEDLE PULL TESTER FOR INTERMINGLED YARNS

General Remarks

The production-control of intermingled yarns in spinning and texturizing calls for the latest measuring techniques to determine the distances between compaction points and their quality.

The old traditional method

The yarn was pierced by a needle inserted by hand, whereupon the needle was pulled through the yarn, parallel to the filaments, till it encountered a compaction point. The distance covered by the needle was then measured. By repeating this measurement several times, an average of the distances between compaction points was obtained.

Quite obviously this method has the following drawbacks:

- It ist most time-consuming and demands a technician with excellent eye-sight as well as deft hands.
- It is not very accurate, as - when the needle is pulled through, minor compaction points can either be broken through or bunched up, so that the original distances between compaction points can no longer be ascertained and are distorted.
- After each test, the respective distance has to be measured and entered into the table, a time consuming part of the test.
- So as not to damage the individual filaments and to carry out tests in invariable conditions, both, the yam tension and the trip level tension (which heralds a compaction point), must always be exactly maintained. This is not possible with this method.
- Mayor yarn lengths cannot be or are most impractical to be tested. On the other hand, the testing of short lengths often gives non-representative or distorted results.
- This measuring method is very labour-intensive. Measurement and evaluation take several minutes for each test and call for a skilled technician.

An other method works on the principle of measuring the thickness of yarn, accepting that an Entanglement - Knot has a slightly larger diameter than the average yarn. Problems with finer yarns and the presetting of the thickness for the reaction of the feelersprings slow down the tests and do not allow qualitative tests of the knot.

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So as to overcome the short-comings of the above methods and speed up measurement and evaluation considerably,

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have developed and brought on the market an instrument automating the whole measuring process within adaptable predefined principles., the

Measuring Process:

The yarn to be tested:

- first passes a yarn brake for pre-tensioning to 0,1 cN / den.
- It then passes the yarn piercing unit where it is pressed down by two yarn guides, spread into two grooves and pierced by the needle.
- It then advances at a speed, adjustable as required, while a measuring unit continuously controls the yarn tension.
- As soon as the needle encounters a compaction point, the yarn tension increases and at the preselected peak tension "TRIP LEVEL" , the length measuring process between compaction points is triggered and the needle withdrawn. The data of the length and tension up to this point is registered and stored giving the Q U A N T I T A T I V E measurements.
- The measured yarn length is displayed on the monitor and printed. The measured values from the memory are being stored for statistical evaluation at the end of the measuring cycle along with other values.
- The yarn then advances by a short adjustable length corresponding to the length of the compaction point.
- "INTERTRIPS" which are weak or soft entanglement points and are opened up by the needle when the yarn tension is building up before the "TRIP LEVEL" is reached, are also registered when they reach the INTERTRIP - yarn tension level which can be preset at 20 - 90% of the TRIP-LEVEL, representing the Q U A L I T A T I V E measurements.

This process (needle piercing, yarn advancement, needle withdrawal etc.) is repeated till the preselected number of measurements (= 1 measuring cycle) has been registered. Such a measuring cycle can be repeated up to 200 times.

At the end of the measuring series, overall statistics, quantitative and qualitative frequency graphs and a histogram can be called up and printed.

Measuring Speed:

Up to 2' 500 measurements - corresponding to an average distance of 20 - 60 mm (between compaction points) - can be carried out per hour.

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The PC with "Windows 98 / 2000 (and following)" :

The ENTANGLEMENT TESTER R - 2072 is connected to the P C and printer. With the programmed Software based on "WINDOWS 98 / 2000 (and following)", all commands, displays and evaluations can be operated from the keyboard and shown on the monitor and a protocol giving the resulting data is printed.

Also all data can be exported in A S C II Code.

Test values and Evaluation:

- Distance between Entanglements
- Number of Compaction Points per meter.
- MAXimum - entanglement distance
- MINimum - entanglement distance
- Average Value
- Number of INTERTRIPS (weak or soft entanglements)
- Coefficient of variations
- Histogram
- Frequency graphs
- Statistic - Cycles
- Statistic - Overall
- "NO - SHOW" - Trips

The Print-out of the protocol can contain all or only specific selected values. The attached protocols show part of the possible evaluations. (Refer to enclosed Annex)

Measuring Parameters to be preselected:

- Yarn Tension Measurement
  Yarn tension of 0,1 to 1'000 cN or 40 (30) - 8000 den can be measured with corresponding interchangeable Measuring Heads

- Yarn speed
  Setting of 0,02 - 50 m / min

- Intermediate Yarn Transport length
  Length of free yarn-run between Measuring Cycles 0,001 - 100 m

- Yarn Pre - Tension
  Standard Compensation Brake 3 - 50 cN
  Reinforced Compensation Brake 15 - 150 cN

- Number of measurements and Measuring Cycle
  1 - 250 Individual measurements can be preselected per measuring cycle.
  1 - 200 Measuring Cycles can be repeated automatically.

- TRIP - LEVEL and the Yarn Piercing Unit:
  The Yarn piercing unit is an electro-mechanical system of the highest precision. The piercing process is controled by two program-disks and the TRIP - LEVEL - tension can be set at 0,1 - 1'000 cN, The appropriate interchangeable Measuring Head has to be fitted.
  When the needle encounters a compaction point at the preset TRIP - LEVEL it is withdrawn and the yarn released for free passage of the length of the compaction knot.

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(Cont.: PRESELECTION OF MEASURING PARAMETERS)

- Length of compaction knot:
  The setting of the estimated length of the compaction knot is to be made within the range of 1 - 50 mm

- INTER - TRIP - LEVEL
  For the registration of Q U A L I T A T I V E measurements the INTER - TRIP - LEVEL has to be set at 20 - 90 % of the preselected value of the TRIP - LEVEL.

- " NO - SHOW ", False Measurement - No compaction
  It may happen that no measurement is being registered during a yarn passage and this may be the result of one of the following causes:

  1. The filaments remain parallel over some length of yarn with no compaction and no build-up of yarn tension being registered.

  2. For one reason or another (e. g. very fine yarn is being tested) the needle did not pierce the yarn and it is pulled past the needle.

  To prevent a distortion of the measurements, a "NO - SHOW" value is to be preselected out of a yarn length of between 0,1 and 10 m, after which this particular measurement is broken off, the needle withdrawn and the measuring process continues. Such "NO - SHOW" incidents are being recorded and show up in the protocol.

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AUTOMATIC NEEDLE PULL TESTER FOR INTERMINGLED YARNS

COMPLETE SCOPE OF SUPPLY

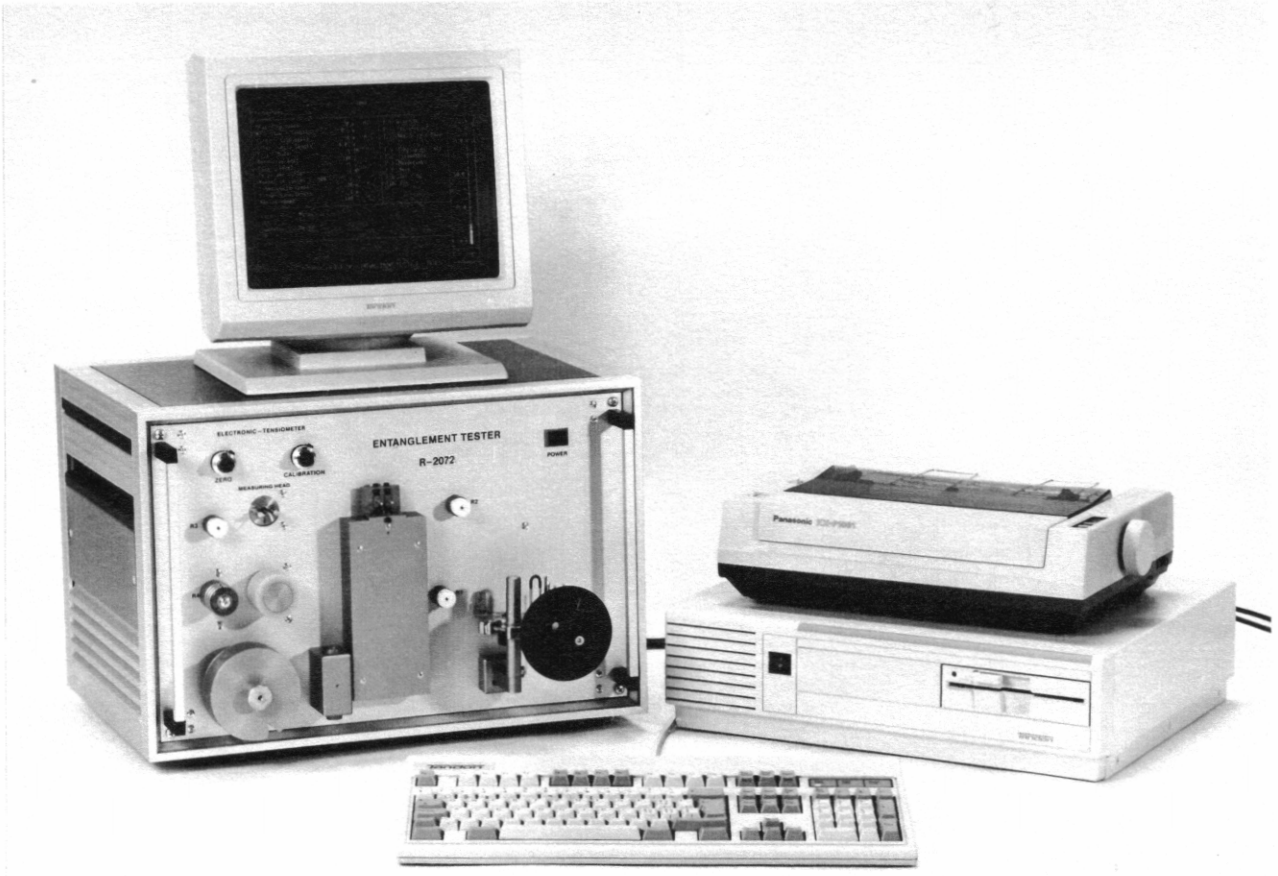
1 ENTANGLEMENT TESTER R - 2072 with built-in Electronic Tensiometer and Measuring Head (Standard = 100 cN)

1 PC with "WINDOWS 98/2000 (and higher)" installed with Monitor and Keyboard

1 PRINTER

1 SOFTWARE PACKAGE

Div. Connecting cables, Operation Manual



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TECHNICAL DATA

Measuring Method:
- Rothschild needle-piercing-system for yarns of 40 (30) - 8'000 dtex.

Evaluation of measured values
- By PC and special software-program based on "WINDOWS 98/2000 (and higher)" , in metric- or inch - system

Measuring speed:
- approx. 2'500 measurements / hour

Measuring results:
- Compaction points per meter or inch
  Entanglement distance with:
  - Number of compaction points
  - Number of Intertrips (weak or soft entanglement points)
  - Distance of compaction points
  - No-show

- Measuring cycle information:
  - MAX. value
  - MIN. value
  - Average value
  - Standard differences
  - Coefficient ov variations

- Overall statistic with:
  - Printout histogram
  - Frequency graphs
  - Cycles graphs
  - Intertrip statistic
  - Intertrip graph

Preselection of measuring parameters:

- Measuring Cycles	1 - 250 individual measurements
- Cycles per series	1 - 200
- Measuring speed	1 - 20 m / Min.
- No - Show distance	0,1 - 10 m
- Compaction knot-length	1 - 50 mm
- Nom. value measuring head	10 - 1'000 cN
- Trip - level	0,1 - 1'000 cN
- Intermediate Yarn Transport	0,001 - 100 m
- Needle speed	10 - 200 p. min.
- Data - setting	in meter or inch
- Print-out	monitor / printer
- Yarn pre-tension	1 - 60 cN
- Intertrip	20 - 90 % of trip-level

Weights:

- ENTANGLEMENT TESTER	25 kg
- PC, Monitor and Printer approx.:	20 kg

Dimensions:
- ENTANGLEMENT TESTER 52 x 45 x 35 cm

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AUTOMATIC NEEDLE PULL TESTER FOR INTERMINGLED YARNS

IMPROVEMENTS TO THE FORMER MODEL R - 2071

ACCURACY OF MEASUREMENTS:

Quantitative Measurements:

Both, the distances between the individual entanglement knots, as well as the number of knots per meter are recorded, statistically evaluated and graphically displayed.

In order to obtain reliable measuring values over great yarn lengths, any number of measuring cycles (with up to 250 individual measurements each) can be set. Between the cycles, the yarn passes at a fast pace (settings between 0,001 and 100 m).

The statistical values of every single cycle are processed and printed. The overall statistic, the result of the combined data from the total number of cycles, is also displayed and can be printed.

Qualitative Measurements

The ROTHSCHILD ENTANGLEMENT TESTER is the only instrument capable of measuring the K N O T - Q U A L I T Y (mechanical strength of the knot).

On each trip the inserted needle checks the stability of the knot. Only when it withstands a pre-set testforce, is it considered as "good".

As a new criterion we introduced the measuring unit " I N T E R T R I P ". An INTERTRIP occurs when the pre-set testforce of the Trip-Level is not reached as a result of a soft or weak entanglement. This information is stored and statistically evaluated. The parameter value of the " INTERTRIP " can be set at any value within the range of 20 - 90% of the Trip-Level tension value.

The progress of the yarn tension of each trip is stored and after the measurement it is shown on the monitor. The yarn tension diagram of a whole cycle or of each individual trip can be shown and printed .

OPERATION OF THE ENTANGLEMENT - TESTER R - 2072

- The operation of the instrument has become extremely easy. All settings are entered by following a dialog with the programmed display on the monitor.

- 14 different measuring parameters can be set and the whole group of parameters can be entered in the memory for repeat application at any later date.

- It is now possible to block individual paramaters to prevent unwanted changes.

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Cont.: of **IMPROVEMENTS TO THE FORMER MODEL R - 2071**

- Data - limits are shown on the display when setting parameters. Entries outside these limits are not accepted.
- Presetting for different print-systems
- Option to display and print measured data in " inches " or " meters "
- Option to print in columns or line by line
- Fast setting of yarn-specific IDENTIFICATOR data.
- The system is prepared for the programming of an automatic knotter system.
- For R + D applications, measurements of up to 50'000 trips per sample can be taken. All measured values are stored and evaluated.

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EXAMPLES of MEASURING PROTOCOLS based on " WINDOWS 98/2000 (and higher) " - Software

Pro Memoria:

Cycle	=	a preset number of trips
Trip	=	a single measurement
Intertrip	=	a single measurement encountering a weak knot which has been opened by the needle
Intertrip-level	=	a tension limit preset in percentage of the Trip-level (60%)

Page TP - 2
A Typical Measuring Protocol listing the Final-Results

A - Parameters
B - Results of Cycle-measurements (5 cycles of 20 trips each)
C - Overall Statistics

Page TP – 3 A Measuring Protocol listing in addition the single trip data

A - Parameters
B - Single data per Cycle
C - Cycle Statistics
D - Overall Statistics

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A - Histogram of the total measurements (5 cycles of 20 trips ea = 100 measurements)
B - Graph showing deviation of measurements per cycle with
Maxi - Mini values (represented by the upper and lower lines of the rectangles)
- Mean - values (represented by the black line)

Page TP – 5 A graphic display of the measuring procedure

A - Cycle Nr. 5 = 20 trips
The mark below the line at trip Nr. 11 signals an INTERTRIP
- Line "TL"shows the TRIP-LEVEL limit
- Line "IT" shows the setting of the INTERTRIP - limit (60% of TRIP-LEVEL)

Page TP - 6
TRIPS projected in ZOOM mode

A - Trip Nr. 12 projecting a normal entanglement knot
B - Trip Nr. 11 projecting a weak entanglement knot
(3 x INTERTRIP, 3 x weak knot was opened)

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ENTANGLEMENT - TESTER R-2072

ROTHSCHILD INSTRUMENTS ZUERICH **PARAMETER**

DATE	11:03:1998 / 16:30			VERS
FILE	031198A			
YARN	POLYESTER			
LOT	150/7			
OPERATOR	MOSBACHER			
ID	DERA			
MEASURING SPEED		10.00	m / Min	A
NO-SHOW LENGTH		0.50	m	
KNOT LENGTH		0.005	m	
TRIP LEVEL		18.0	cN	
INTER TRIP		60	%	
TRIPS PER CYCLE		20		
NUMBER OF CYCLES		5		
INTER CYCLE LENGTH		10.00	m	

CYCLE NR	TRIPS NO	NO SHOW	INTER TRIPS	MIN mm	MAX mm	X mm	KNOTS / m	S mm	CV %	
1	20	0	4	33	268	106	13.24	78	74.07	
2	20	0	3	25	411	90	15.71	90	99.51	B
3	20	0	7	26	306	95	13.85	70	74.05	
4	20	0	3	15	332	114	13.88	88	76.95	
5	20	0	2	31	259	82	14.82	55	67.46	
MAX	20	0	7	33	411	114	15.71	90	99.51	
MIN	20	0	2	15	259	82	13.24	55	67.46	C
X	20	0	3	26	315	97	14.30	76	78.41	
OVRL	100	0	15	15	411	97	14.30	77	78.72	

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TP 3

ENTANGLEMENT - TESTER R-2072

ROTHSCHILD INSTRUMENTS ZUERICH **PARAMETER**

VERS. 1.02

DATE	11:03:1998 / 16:30		
FILE	031198A		
YARN	POLYESTER		
LOT	150/7		
OPERATOR	MOSBACHER		
ID	DERA		
MEASURING SPEED		10.00	m / Min
NO-SHOW LENGTH		0.50	m
KNOT LENGTH		0.005	m
TRIP LEVEL		18.0	cN
INTER TRIP		60	%
TRIPS PER CYCLE		20	
NUMBER OF CYCLES		5	
INTER CYCLE LENGTH		10.00	m

A

STATISTIC

SINGEL TRIPS NR 1 (mm)

n	1	2	3	4	5	6	7	8	9	10
1	101	46	203	33	268	88	58	64	64	253
11	57	55	74	186	39	53	126	34	237	64

SINGEL TRIPS NR 2 (mm)

n	1	2	3	4	5	6	7	8	9	10
1	25	46	38	120	411	60	66	46	224	56
11	104	40	61	72	62	31	47	173	47	61

B

SINGEL TRIPS NR 3 (mm)

n	1	2	3	4	5	6	7	8	9	10
1	83	49	213	76	138	44	306	53	44	41
11	161	79	173	74	64	26	62	98	53	60

SINGEL TRIPS NR 4 (mm)

n	1	2	3	4	5	6	7	8	9	10
1	119	49	46	250	172	36	332	55	78	272
11	117	111	59	41	41	66	187	92	15	146

SINGEL TRIPS NR 5 (mm)

n	1	2	3	4	5	6	7	8	9	10
1	50	101	46	44	60	139	62	70	136	51
11	259	162	33	62	77	31	67	73	70	40

CYCLE NR	TRIPS NO	NO SHOW	INTER TRIPS	MIN mm	MAX mm	X mm	KNOTS / m	S mm	CV %
1	20	0	4	33	268	106	13.24	78	74.07
2	20	0	3	25	411	90	15.71	90	99.51
3	20	0	7	26	306	95	13.85	70	74.05
4	20	0	3	15	332	114	13.88	88	76.95
5	20	0	2	31	259	82	14.82	55	67.46
MAX	20	0	7	33	411	114	15.71	90	99.51
MIN	20	0	2	15	259	82	13.24	55	67.46
X	20	0	3	26	315	97	14.30	76	78.41
OVRL	100	0	15	15	411	97	14.30	77	78.72

C

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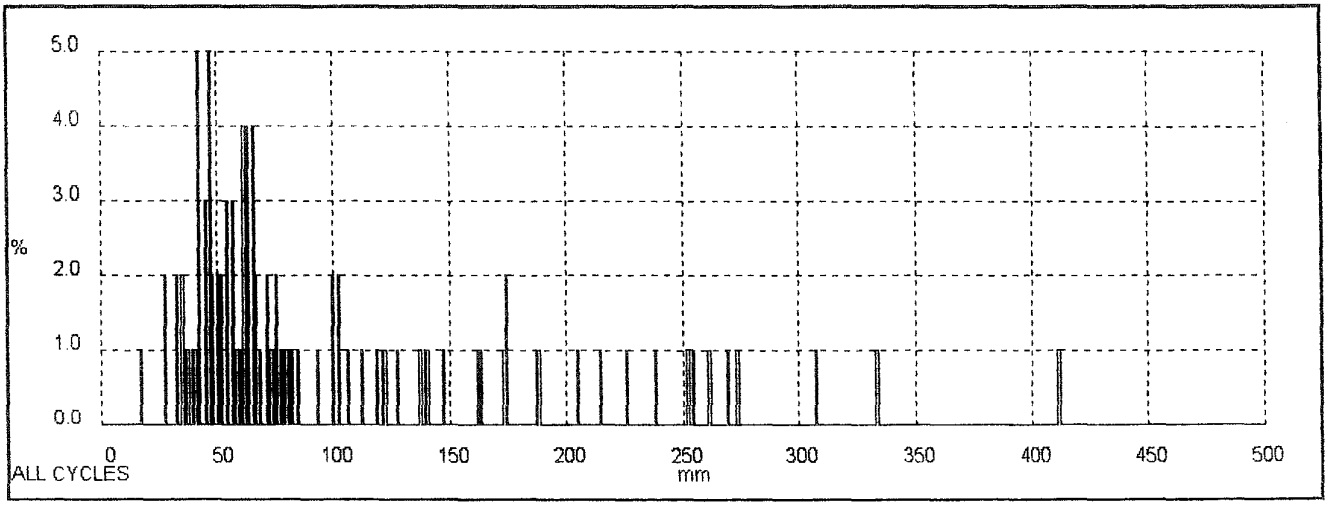
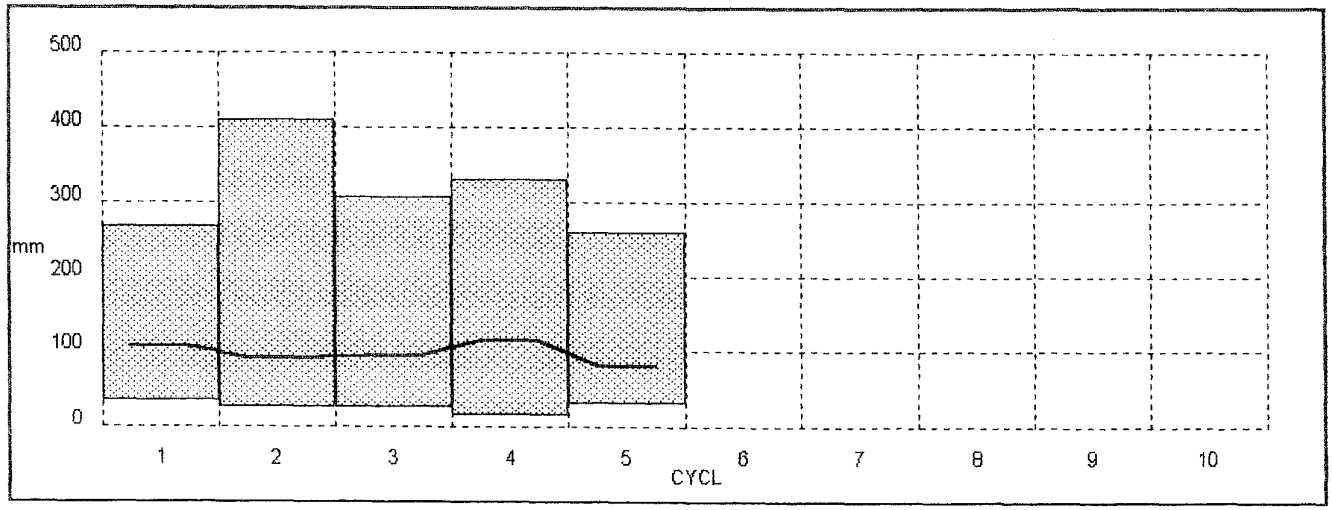
HISTOGRAM



A

DEVIATION



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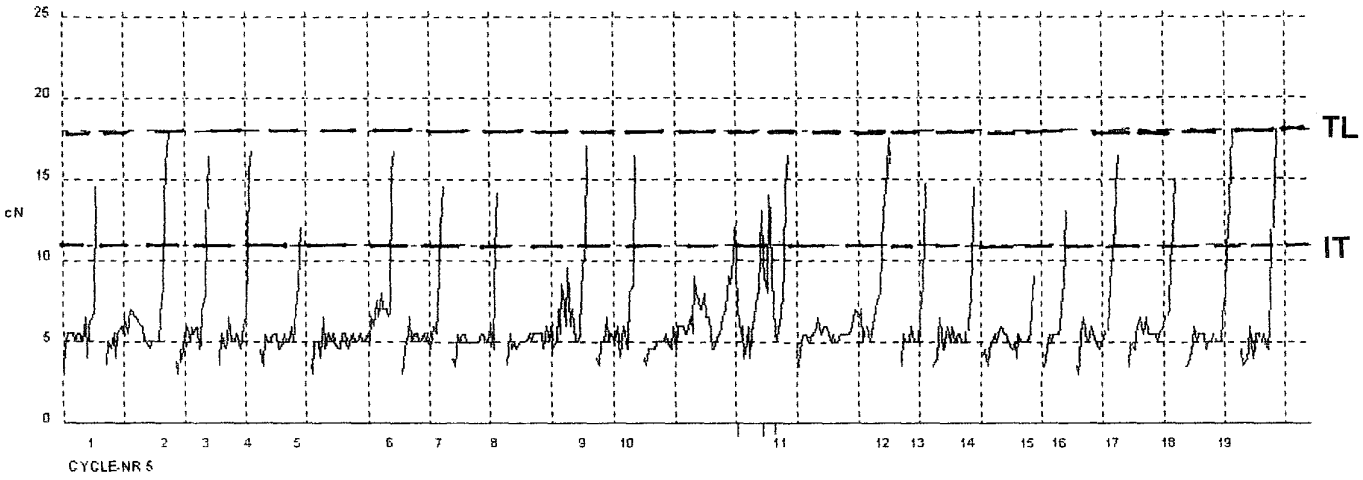
ROTHSCHILD INSTRUMENTS ZUERICH **GRAPHIC** 1



YARN	**POLYESTER**
LOT	**160/7**
OPERATOR	**MOSBACHER**
ID	**DERA**
DATE	**11:03:1998 / 16:30**