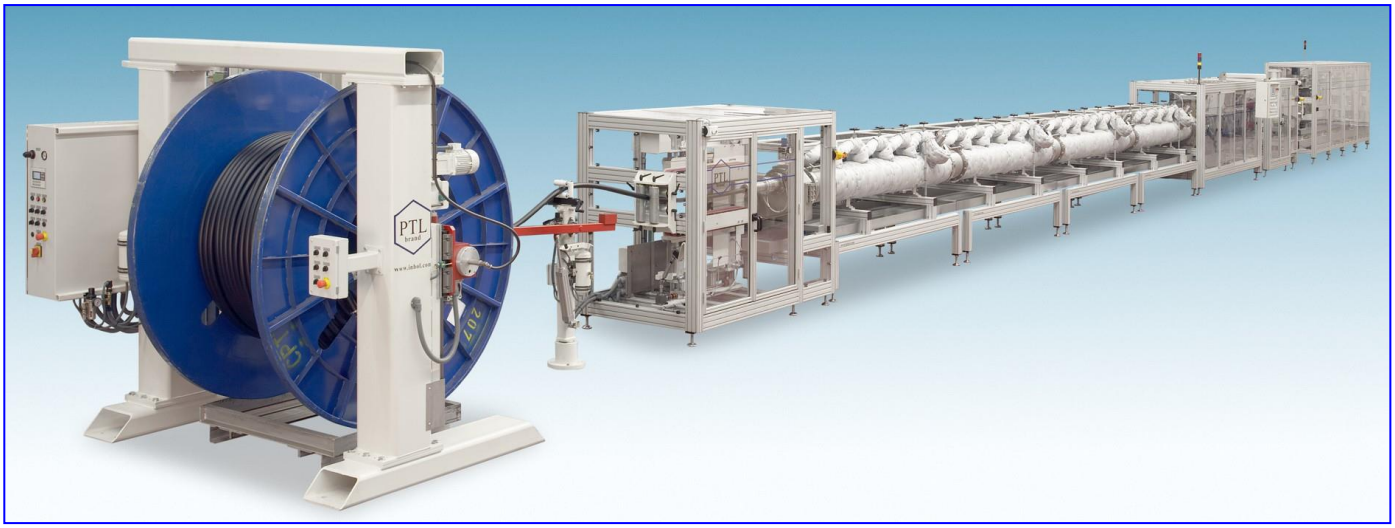
- Heat-shrink technology
- Test equipment
- Consultancy

Provisional technical description of the PTL NEXA 220 expansion line (*)



(Picture: Impression only)

(*) : A final technical description will be made available after detailed discussions with the customer.

Version: 221128RG-1

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Content.

Part A: Outline of the heat-shrink tubing expansion line NEXA 220.

This NEXA 220 expansion line is designed to expand extruded & crosslinked tubing to diameters up to 220 mm and consists of several sections.
The technical details and definitions of the basic NEXA 220 and the optional devices and other parts of the supply of the NEXA 220 expansion line are defined hereafter.

The Basic NEXA 220 consists of:

- Section 1.1 : Caterpillar Haul-Off 1
- Section 1.2 : Pressurized Heating System
- Section 1.3 : Expansion Module
- Section 1.4 : Caterpillar Haul-Off 2, incl. pinch rolls
- Section 1.5 : Control System

Others

Option 1 : Expansion tool holders and complete sets of expansion tooling

Option 2: Driven, PLC Integrated Unwinder

Option 3 : Cutting line (Guillotine principle).

Option 5 : Small size winder

Option 6: Squeezing system for perfectly round sleeves

Option 7: Outside diameter laser measuring system Type 310

Option 8: Utilities Counters

Option 9: Critical spare parts

Option 10: PTL-UT6050HS Hot-set-elongation test oven

Option 11: Others

Technical details

Other information, pre-acceptance tests, FAT, SAT, installation

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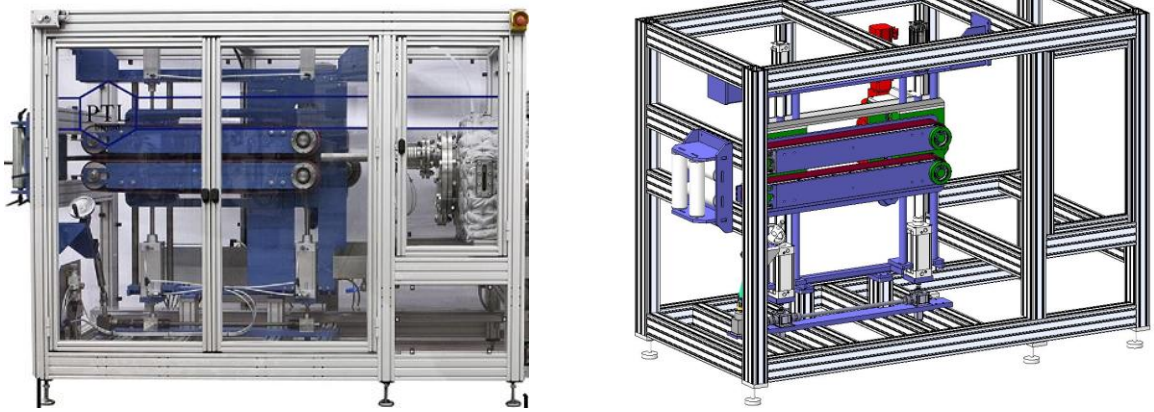
Part B: Technical details of each of the sections of the NEXA 220 expansion line

Section 1 : The Basic NEXA 220

The basic NEXA 220 expansion line consist of:

- **Section 1.1** : **Caterpillar Haul-Off 1**



Impression of the dual belt Caterpillar Haul-Off 1.

This precisely controlled dual belt caterpillar haul-off 1 *(see picture above)* at the frontside of the expansion line, takes the extruded and crosslinked tubing from the drum on the optional motor driven portal unwinder *(see section 2)* and transports the tubing into the pressurized tubular heating system.

The speed of the Caterpillar haul-off 1 can be set individually. A master-slave function is incorporated for a perfect control of the speed of all other sections in the NEXA 220 expansion line.

The caterpillar haul-off 1 consists of a firm framework construction and smoothly guides the tubing into the pressurized tubular heating system. A pneumatic cylinder opens or closes the upper and lower belt. The belts can be moved in a vertical direction for perfect centring of the tubing.

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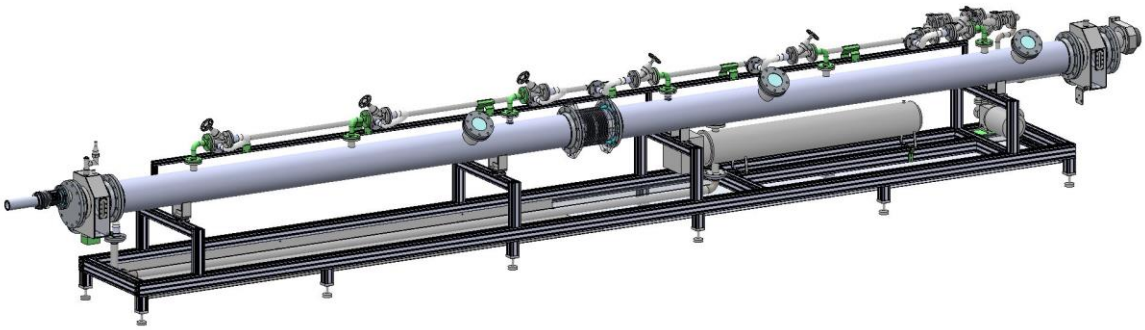
Section 1.2 : Pressurized Heating System

This system consist of two high grade stainless steel and well insulated tubular heating tanks, of 4.5 meter each.



Impression of the pressurized heating system

The tubular and pressurized heating system has 2 major functions:

1. To heat the tubing to a temperature, which is well above the highest DSC melting point *(of the polymers in the compound-composition of the tubing)*.

2. To keep a continuous and consistent air-pressurize on the outside surface of the non-expanded tubing, which is transported through the two heating tanks.

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At the entrance of the pressurized heating system, an innovative sealing device keeps the air-pressure inside the heating system at a consistent level.
The heating tanks are designed to withstand an internal pressure of maximum 2,5 bar.
A well balanced control of the internal *(inside the tubing)* and external *(inside the heating system)* air-pressure avoids expansion of the tubing prior to exiting the heating system and prior to entering the expansion system.
The internal and external air-pressure can be set and controlled on the central control cabinet, which is positioned near the exit port of the heating modules and the entrance of the expansion cabinet.

Air-pressure for inside the non-expanded tubing, can be provided by a system, which can be mounted on the (optional) unwinder.

Between the two tubular heating tanks a stainless-steel expansion bellow *(compensator)* is installed, to compensate for the linear thermal expansion of each of the 4,5 meter long heating tanks.

Example of a stainless steel expansion bellow

Three robust glass viewing windows are incorporated in the heating tanks to observe the tubing during production. Each viewing window is provided with a lamp and a wiper.
Two glass windows (one near the entrance area and one near the exit area) allow for visual control of the fluid level.

A heat-transfer fluid *(typically poly-ethylene-glycol (PEG), glycerine or another heat-transfer fluid)* circulates through a system of stainless-steel tubes and nozzles, which spray the fluid on the tubing in the pressurized heating system.
A pump ensures consistent circulating of the fluid, which is heated by separate heater.
The temperature of the fluid can be set and controlled on the central control cabinet.

A stainless-steel oil-filter ensures continuous filtering and cleaning of the heat-transfer-fluid, to avoid blocking of the nozzles, should the fluid get contaminated. This filtering system consists of 2 identical filters. By means of a bypass continuous production is guaranteed, should a filter need to be replaced or cleaned. Optional oil-flow meters can be mounted on the filters to monitor the flow of oil and to monitor the clogging of the filters.

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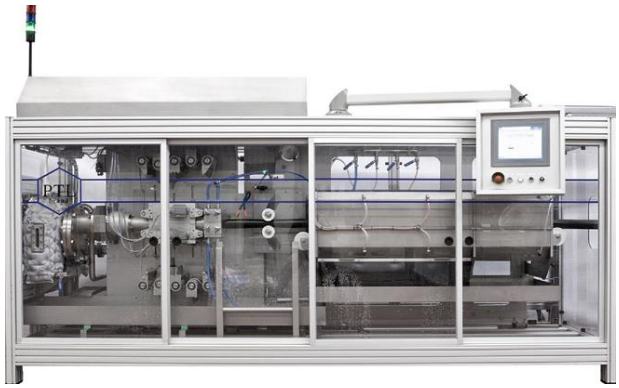
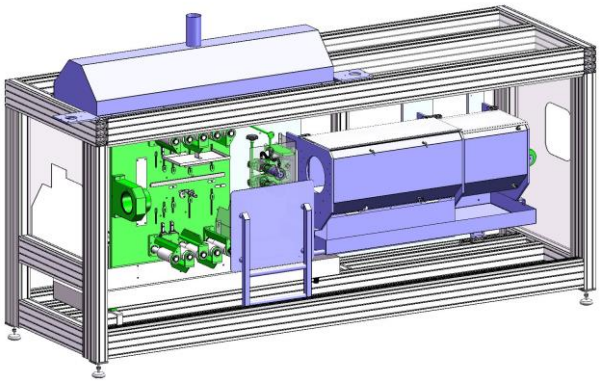
In each heating tank three spraying nozzles are mounted for optimal heating of the tubing.
Each spraying nozzle can be adjusted individually and are easily accessible for maintenance purposes, should this be required. Optional oil-flow meters can be mounted on the filters to monitor the flow of oil and to monitor the clocking of the nozzles.

Three (3) optional thermocouples can be installed in the heating system. One at the entrance section, one in the middle section and one at the exit section to monitor the temperature of the heating medium in the system.

- **Section 1.3: Expansion Module**





Impression of the Expansion System

The Expansion Module is the heart of the unique NEXA expansion line and has 3 major functions:

1. To expand the heated tubing to a well-defined outside (and thus inside) diameter.

2. To control the longitudinal change.

3. To cool, rinse and dry the tubing.

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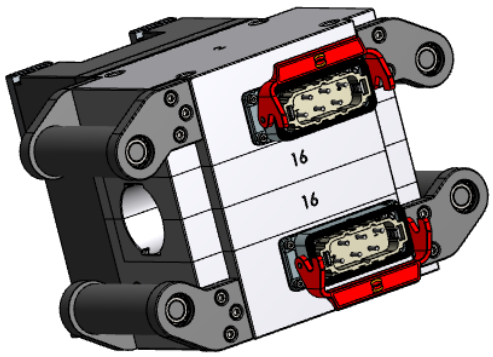
The Expansion Module is provided with a stainless-steel hood for extracting vapours from the expansion module. This hood can be connected to a vapour extraction system, which shall be provided by the customer.

- The entrance section
  - Has provisions for the mounting of 3 different sized expansion tool holders.
    Each of these heated holders can hold a range of different sizes of expansion tools. Each expansion tool consists of two 2 parts (inserts), which can be easily inserted in the expansion tool holder, for easy and quickly changing from one size to the other. *(*)*
  - Is equipped with a motorized drive, which drives an upper and a lower belt. These belts allow for a maximum grip and a smooth transportation of the tubing in the expansion tool.
  - Is provided with two tension control systems for optimizing the tension of each belt.
  - Holds the water-cooled cooling calibre, which is positioned at the exit of the expansion tool;
    the cooling calibre functions as the final instrument to control the outer diameter of the expanded tubing.

(*) A complete set of expansion tooling, consists of: 1 adaptor, 2 inserts, 2 belts and 1 cooling calibre.
Both the expansion tool holders and complete sets of expansion tooling are not included in the supply of the basic NEXA 220 expansion line. These should be ordered separately (see option 1).



Impression of the expansion tool holder, incl. 2 inserts

- The middle section
  - is equipped with two motor driven rolls, which will allow the operator to precisely control the longitudinal change of the expanded tubing,
  - is provided with two nozzles for spraying cooling water on to the surface of the expanded tubing

- The exit section
  - consists of a tank, which allows for further cooling and rinsing of the tubing.
  - is provided with flexible rubber seals and air-wipers, to ensure to remove the water from the surface of the tubing

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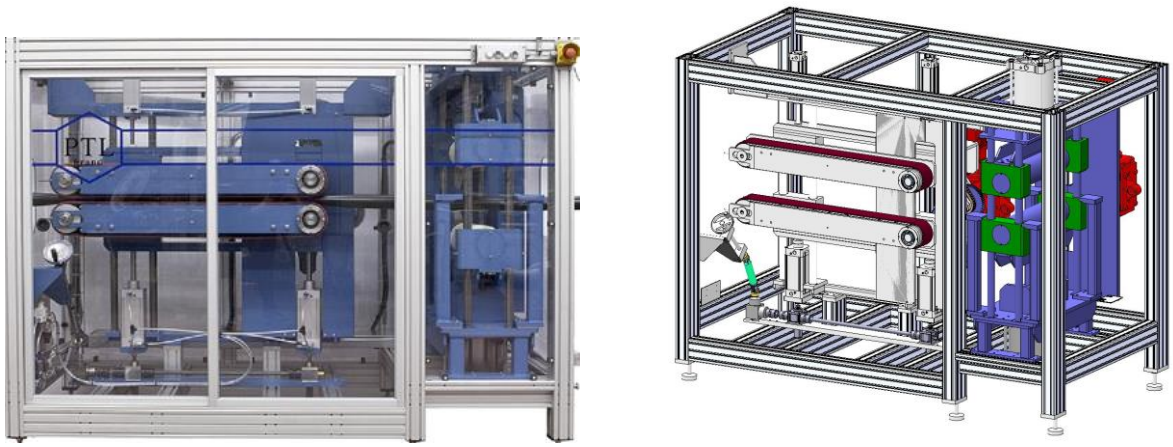
Section 1.4: Caterpillar Haul-Off 2 with built-in pinch/squeezing rolls



Impression of the dual belt Caterpillar Haul-Off 2.

The precisely controlled dual belt caterpillar haul-off 2 *(see above),* which is installed at the end of the basic expansion line, consists of a firm framework construction and pulls the expanded tubing from the expansion module.
A pneumatic cylinder opens or closes the upper and lower belt. The belts can be moved in a vertical direction for perfect centring of the tubing.

The speed of the caterpillar haul-off 2 can be set individually. A master-slave function is incorporated for a perfect control of the speed of all other sections in the NEXA 220 expansion line.

To ensure that the air-pressure inside the tubing is kept at a consistent level, two motor driven pinch/squeezing rolls are installed (close to the exit of haul-off 2) and function as an air-tight seal. Each pinch/squeezing roll consist of metal centre roll which is covered by a durable one-layer surface.

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Section 1.5: Control Cabinet and Operator Panel

1.5.1 Control Cabinet

The heart of the control cabinet is the Jetter JC-350 Controller. This high-performance compact controller, can be easily expanded and makes this controller an excellent choice for complex tasks in the NEXA expansion line. The JC-350 combines high functionality with optimum performance.

The JC-350 has following features:

- 2 ethernet ports, with integrated switch
- Powerful programming language JetSym STX
- 30.000 non-volatile registers
- 2 Mb program/data memory
- 1 RS-232/422/485 serial port
- 1 JX2 system bus interface
- Real-time clock
- Modbus/TCP
- SD card

JC-350 Controller

External access for watching the total process and resolving any malfunctioning, should this occur, Is possible, provided that an IP-address to internet is made available by the customer.

The system has 2 levels:

- Level 1: This is the operator level.
- Level 2: This level is protected with a password and is only available for people who are allowed to enter this level for maintenance and programming purposes.

  Level 2 has 2 functions:
  # Manual mode. This mode is code-protected and is only available for qualified employees.
  # Service mode. This mode is mode is also code-protected and can only be entered by qualified employees, to resolve mal-functions and process functions.

Alarms: The machine is equipped with an acoustic and light signal.
Safety: The basic machine is shielded with sliding doors that are secured with safety contacts.

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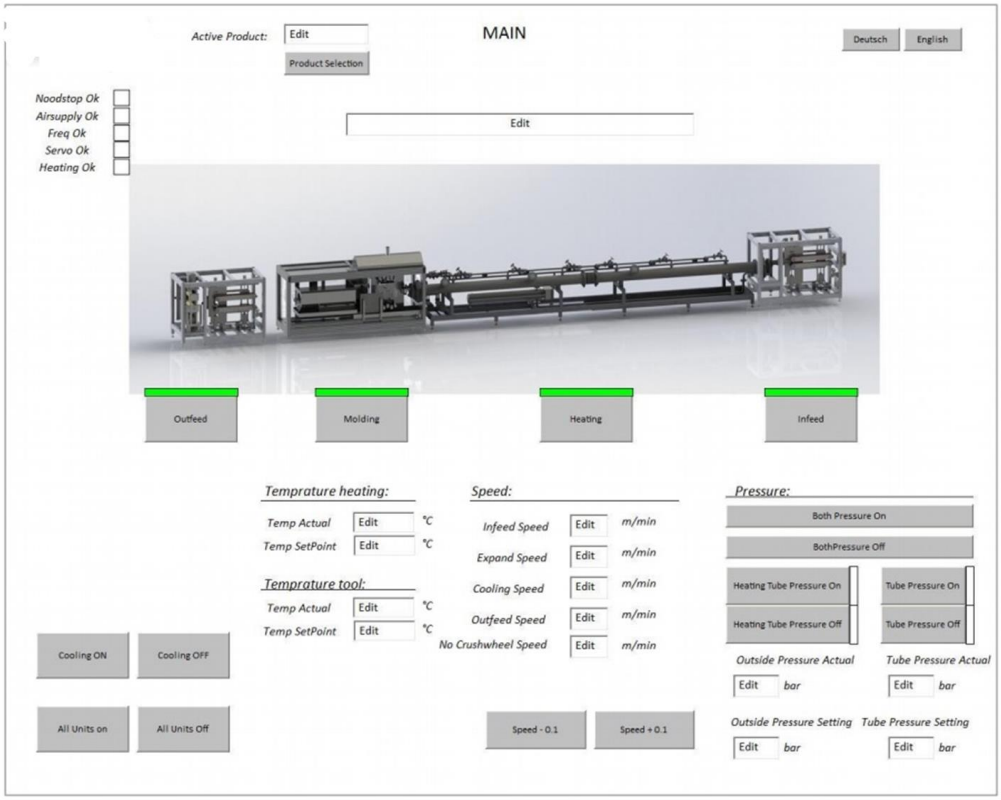
1.5.2 Operator Panel

The touchscreen display is provided with a keyboard and mouse, for those moments that various parameters need to be entered.

The Human-Machine Interface (HMI) connects the operator to the NEXA expansion line and the production process. The system has an operating friendly and clear display , which can show the actual status of the total line or, if desired, the status of any individual device or specific process parameters in the NEXA expansion line.



Example of the layout of the touchscreen display

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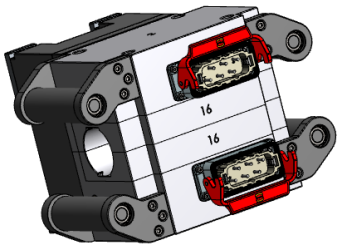
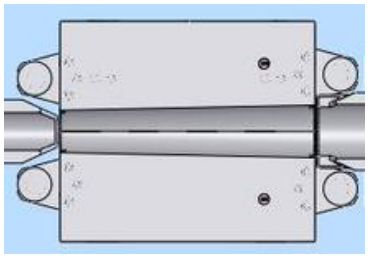
Option 1: Expansion tool holders and complete sets of expansion tooling

The expansion module, as per section 1.3, is able to hold 3 different sizes of expansion tool holders, which are electrically heated.





Expansion tool holder including inserts.

- Expansion tool holder # 1
  This fixture can hold sets of expansion tools for expanded outside diameters from 20 to 60 mm.

- Expansion tool holder # 2
  This fixture can hold sets of expansion tools for expanded outside diameters from 60 to 120 mm.

- Expansion tool holder #3
  This fixture can hold sets of expansion tools for expanded outside diameters from 120 to 200 mm (*).

(*): for larger outside diameters, special size expansion tool holders can be supplied.

Each size of tubing requires a complete set of tooling, which consists of:

- 1 adaptor
- 2 inserts (which form the actual sizing-tool), which can be easily inserted in the expansion tool holder to form a tubular-shaped sizing-tool
- 2 endless belts, which allow maximum grip and a smooth transportation of the tubing in the sizing-tool.
- 1 cooling calibre, which functions as the final instrument to control the outer diameter of the expanded tubing.

The exact number of tool holders and sets of expansion tooling is specified in the list of products, as defined in **Part C** of this document.

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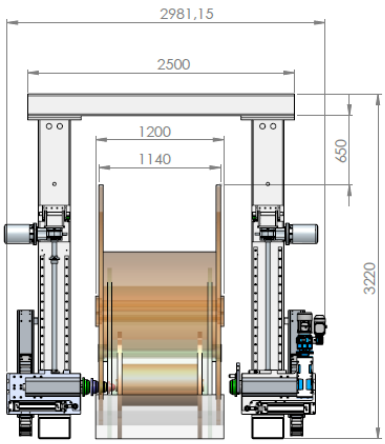
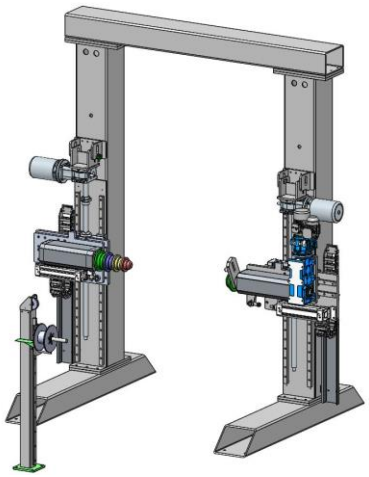
Option 2: Driven, PLC Integrated Unwinder





Impression of the unwinder

This robust unwinder can hold drums, with a maximum flange diameter of 2500 mm, a maximum width of 1330 mm and a maximum total weight (drum + tubing) of 2500 kg

The unwinder is not pulling but is feeding the tube to the inlet/entrance of the pressurized heating system. A "Dancer"-system controls the speed of the tubing to ensure that the tension is not too high or too low. Alarms shall inform the operator if the drum or tubing is stopped by an unforeseen 'force'. The spindle and drum are turning at the same speed to avoid that the compressed air hose is not twisted and/or broken.

The distance between the unwinder, the guiding rolls, dancer, and caterpillar haul-off 1 will need to be defined before accepting the final design.

Reel rotations:
- minimum 0,1 rotations per minute
- maximum 2 rotations per minute

The winder is provided with or has provisions for:
- Air-flow system
- Clamping system
- Lifting system
- Dancer system
- Adapters for various reel sizes (to be specified by customer)

Enough space for lifting of the reels and or rack (on which the reel may be positioned), is available in the unwinder.

Safety: The unwinder comes with a fence for safety purposes.

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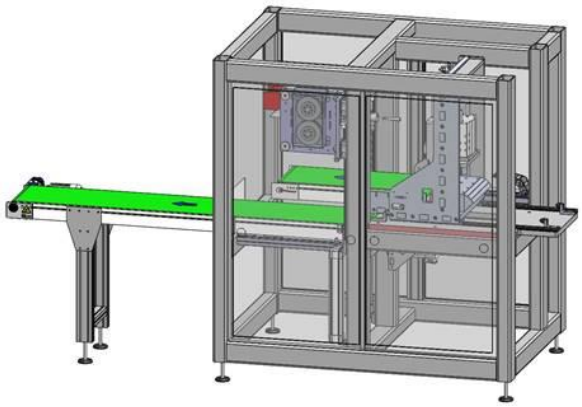
Option 3: Cutting unit for cut pieces of > 100 mm length

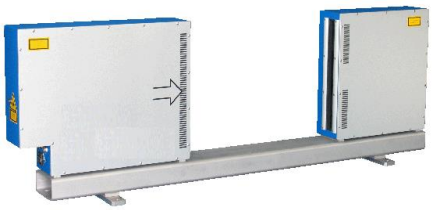
This cutting unit is based on the guillotine principle. While cutting, the complete unit moves/travels with the same speed as the tubing is transported through the expansion line.



Impression of the cutting line.

Option 7: Outside diameter laser measuring system Type 310

Modern single axis laser measuring unit, having high accuracy, robustness, reliability and functionality.



Impression of the laser measuring system

Features:

- Very high scan rate. Measuring frequency: 1000/s.
- High precision measurement
- High insensitivity to dirt and dust
- Measuring Field : 310 mm
- Flexible communication integration :
  - RS (-232 /-422 /-485)
  - PN (Profinet IO V2.3)
  - DP (Profibus DP)
  - EI (EtherNet/IP)
  - EN (Ethernet TCP/IP)
  - J (digital, for connection to processors)

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Option 8: Utilities Counters

Water, power and air pressure measuring devices

- Electrical current (Amp.) measurement with coils
- Flowmeter for air pressure and water.
- Database for saving all the data .
- Readings per day, week, month, and year possible.
- Accuracy around 3%
- Data can be directly saved to the server of the customer.

Option 9: Critical spare parts

Part	Qty	Brand	Type	Delivery Time in wks
Oil pumps	2	WRI-Tech	CY-4281. 1,5KW 2900 rpm CY-6091. 4KW 2900 rpm	6
Helical bevel gear unit Expansion unit	1	SEW	KA37/T AQA100/1	4
Helical bevel gear unit Haul / pay off	1	SEW	KA37/T AQA100/4	4
Servo motor Expansion unit	1	Jetter	JH4-420-530	6
Servo motor Haul / pay off	1	Jetter	JH4-0860-81	6
Servo Drive Expansion unit	1	Jetter	JM 206	6
Servo Drive Haul / pay off	1	Jetter	JM 208	6
Seal for oil spray nozzle	12	Erics	DN32-PN10 GYLON blue S=2mm	4
Belts haul / pay off	4	Spruit	V belt 44PL2477 Multirib VZV 6mmlinatex	4
O Belt Volta V Expansion unit	2	Volta	VL 10 - Z10x6,5 L=600	4

List of recommended spare parts

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Option 10: PTL-UT6050HS Hot-set-elongation test oven

PTL-UT 6050HS hot-set oven with sliding door.

The PTL-UT 6050HS hot- set oven + additional sliding door is a high precision hot-set oven, designed for measuring the hot-set elongation at temperatures of up to 250°C (482°F), according IEC 60811 Part 507 and ICEA T-28-562 . These specifications define the procedures for the hot-set / hot-creep tests, which typically applies to crosslinkable polymeric compounds for insulating and sheathing materials.

This hot-set oven is a perfect QC-tool for measuring the crosslink-level of the tubing prior to expansion.

The PTL -UT 6050HS hot-set oven features a specially designed sliding door in the right side of the oven. The 6 sample holders are part of, and integrated in this sliding door. This design allows for inserting and cutting of the samples, while keeping the heat inside the oven, when samples need to be changed. This provision minimize temperature losses for faster and reliable test results.

A separate brochure for this oven is available.

Option 11: Other optional devices

Following options can be installed as well:

- **Electronic water valves** for the expansion cooling calibre. These valves can be adjusted via the HMI operator panel.
- **A set of sensors** to control slipping or breaking of the belts in the expansion module
- **Special nozzles** in the expansion module, to create a mist of water droplets, for improved rinsing and cooling.
- **One extra water pump** for increased water pressure in the cooling sector.
- **6 Oil-flow meters** on the special nozzles in the pressurized heating tank
- **2 Oil-Flow meters** on the oil filters
- **3 Thermocouples** for measuring the temperature of the heating oil in the system.
- **1 Surface temperature thermometer** for the cooling calibres

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List of technical details and functioning

Description	Unit	Property
min. outer diameter of the extruded tube	mm	8
max. outer diameter of the extruded tube	mm	65
min. outer diameter of the expanded tube	mm	20
max. outer diameter of the expanded tube	mm	220
expansion ratio(*)	Up to 1:4 (depending on compound and wall thickness of the extruded tubing)	
input- and output speeds (of the haul-off 1 and haul-off 2)	m/min	minimum 0,5 ; maximum 6,5 *(actual production speed is also depending on the size of the drums on which the crosslinked tubing is made available)*
average production speed (*)	m/min	Depends on size & material. Typically 1 – 5.
maximum allowed inside tank pressure	bar	2.5
Heat-transfer fluid		Typically: Polyethylene-glycol or glycerine
Maximum volume of heat transfer fluid in the line	Litres	Approx. 400
maximum recommended operating temperature	°C	155 (higher temp. optional)
Location of control desk in downstream direction	From the right to left	
Electrical information	V	3 x 400V, 50 Hz ; 3 phase + neutral Pre-Fuse:125 A; Full Load Current: 110 A
Power	kW	Approx.. 60
air consumption	m^3/h	Approx. 60
recommended air pressure	bar	6
Recommended water supply	bar	2.5
Recommended cooling water temperature	°C	+8 to +12
cooling water consumption at a pressure of 4,5 bar	l/h	600
Total length of basic NEXA line	m	Approx. 20
Total length of machine incl. options	m	Approx. 30
Width of the machine	m	Approx. 3.20
Max. height of the machine / winder	m	Approx. 2.20 / Approx. 3.0 m
Centre height of the machine	m	1.10
Frame		Aluminium frame
Functioning		Double pressure system
Operators needed per shift		1
(*) These data cannot be guaranteed, since these data depend on the material characteristics of the cross-linked tubing		

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C: Additional information

C3: Additional information to Section 1.3: Expansion module

- A closed-water cycle system is possible. Temperature control and alarm on display. The NEXA comes with connections for the water supply. Pipes & tubes, which need to be connected to the NEXA, as well as the water supplies and a chiller to cool the water shall be supplied and arranged by the customer.
- The light(s) in the expansion module are IP 66.

C4: Additional information to section 1.4: Caterpillar Haul-Off 2, incl. pinch/squeezing rolls

We recommend to have a free space (distance) between the exit of the expansion module (section 1.3) and the cater pillar haul-off 2 of 1500 mm. This to install a stand-alone ink-jet printer (responsibility of customer) and to allow for sufficient drying time for the ink.
At the entrance and the exit of the haul-off 2 retractable or movable 'guiding rolls' are installed, to keep centring the tubing during the the expansion process.
The pressure of the pinch/squeezing rolls are adjustable. The normal pressure is typically around 3-4 bar.

C5: Additional information to Option 3 : The (guillotine based) cutting line.

The tubing will be centred in the cutting line. The length tolerance of the cut pieces need to be defined before accepting the final design.
The setting of the length of the cut pieces (in mm) and the number of pieces to be cut (and already cut) can be made visible on the main/central display of the control panel.

C6: Data saving

An ethernet cable connection can be made available for saving the monitored data to the customers' server. The monitoring interval is around 10 seconds.

C7: Extra Alarms

Extra alarms can be installed to warn the operator if the belts in the expansion tooling slip or stop.
Problems in frequency transformers can be made visible to inform the operator which transformer is having problems. No process of analysing of the problem will be made available.

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C8: Display

The display will be clear, easy to operate, size of the buttons and a good & logic functionality. Screenshot examples can be provided to the customer. (Some) Adaptions can be made before accepting the final design.
The standard display is 24" and as an option can be made adjustable in height.

Monitoring of following features: pressure (external and internal), pressure of pinch/squeezing rolls, speeds, cutter distance (= length of cut pieces), length measurement (how much material
(= how many meter of the drum the customer has been consuming) program parameters, (parameters, which come from the products), recipes and running parameters can be made available.

C9: Painting

Aluminium, plastic, and stainless-steel parts are not painted.
Metal parts which need to be painted, will be supplied in an off-white colour.

C10: Safety

The NEXA line fulfils the latest work-safety low and meets CE-regulations.

C11: Special tools

No special tools for using and maintaining the NEXA-line are needed.

C12: Documentation

Following documentation will be supplied:
- Main machine drawings will be provided in PDF-format.
- Electrical pictures/ diagrams
- Pressured air and hydraulics
- Spare part list, exploding images, parts scheme.
- A user instruction/manual in English
- A maintenance manual in English

C13: Remote connection.

2 IP-addresses shall be made available by customer for remote access. The responsibility of protection against viruses, etc, is the sole responsibility of the customer.

C14: Software and IPR

No special software is installed and no IPR rights are applicable.

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Machine acceptance

FAT

The working of the NEXA will be shown, by expanding 2 sizes of crosslinked tubing, which are produced at a leading heat-shrink manufacturer in Europe. Both sizes will be expanded during the FAT and shall run for 2 hours. Steady expansion, no stripes or bubbles. Surface quality shall be ok.

SAT

The working of the NEXA will be shown, by expanding the same products as were used during the FAT. Both sizes shall be expanded during the FAT and shall run for 2 hours.

Part E: Inspection, installation, commissioning, training.

In addition to designing, engineering, and manufacturing we will install and commission the equipment we supply after the customer has accepted the machine in our European factory. Successful commissioning and hand-over of the NEXA 220 to the customer is the satisfying culmination of years of concentrated effort and experience of our team and represents the major project milestone. Competent and efficient installation and commissioning are vital to the success of the project followed by an effective hands-on training for the operators and their supervisors.

Roles & Responsibilities

When we are responsible for equipment installation at the plant of the customer, our staff and partners offer detailed product knowledge to ensure a smooth and effective transfer from the design to the manufacturing phase up to the installation phase. Experienced professional engineers provide high quality guidance and know how.

Installation will require the involvement of the customers' technical workforce like electrical and mechanical engineers and workers.

The PTL- team provides the knowledge to bring the NEXA 220 project to life. Our integrated commissioning team offers the advantages of a single point of responsibility for the entire project and ensures that the equipment installed function safely and correctly.

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General conditions for the supply and erection.

PTL BV refers to its general conditions for the supply and erection to the Orgalime SE conditions dated September 2012 which can be read on our website www.ptl-bv.com
We declare these to be applicable to this quote with exception of paragraph 40 and 41. The responsibility of PTL BV, for any reason, is limited to the guarantee for defects conform to paragraph 23.
The equipment is according to following specifications.
Machinerichtlijn 2006/42/EG ; EMC-richtlijn 2004/108/EG ; EN-ISO 12100 (2010) ; EN-ISO 13849-1 (2016); EN-ISO 13849-2 (2012); EN-IEC 60204 (2018); EN-ISO 4414 (2010) ; EN-ISO 10218-1 (2011); EN-ISO 10218-2 (2011); EN-ISO 13850 (2015) ; EN-ISO 13857 (2019) ; EN 614-1 (2006 + A1 (2009) ; NEN 5509 (2016)

Safety

The NEXA 220 will comply to the European CE-norm.

Price corrections

Should prices increase by more than 3%, compared to the time when a quotation will be sent, PTL bv will have the right to charge the extra costs, which will be paid, prior to shipping the NEXA 220 to customer's place.

Covid-19 and other pandemics

Extra costs, which may be the direct or indirect result of quarantine due to Covid-19 or other pandemics, are not included in the above prices. These costs will be charged extra, if applicable.
PTL bv will have the right to adapt the delivery time, if applicable and due to Covid-19, other pandemics or due to delivery and supply issues from suppliers of parts, which are used and installed in the NEXA 220

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