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M&A DIETERLE

MASCHINEN- & APPARATEBAU GMBH

Work specification
Filling of spial fabrics

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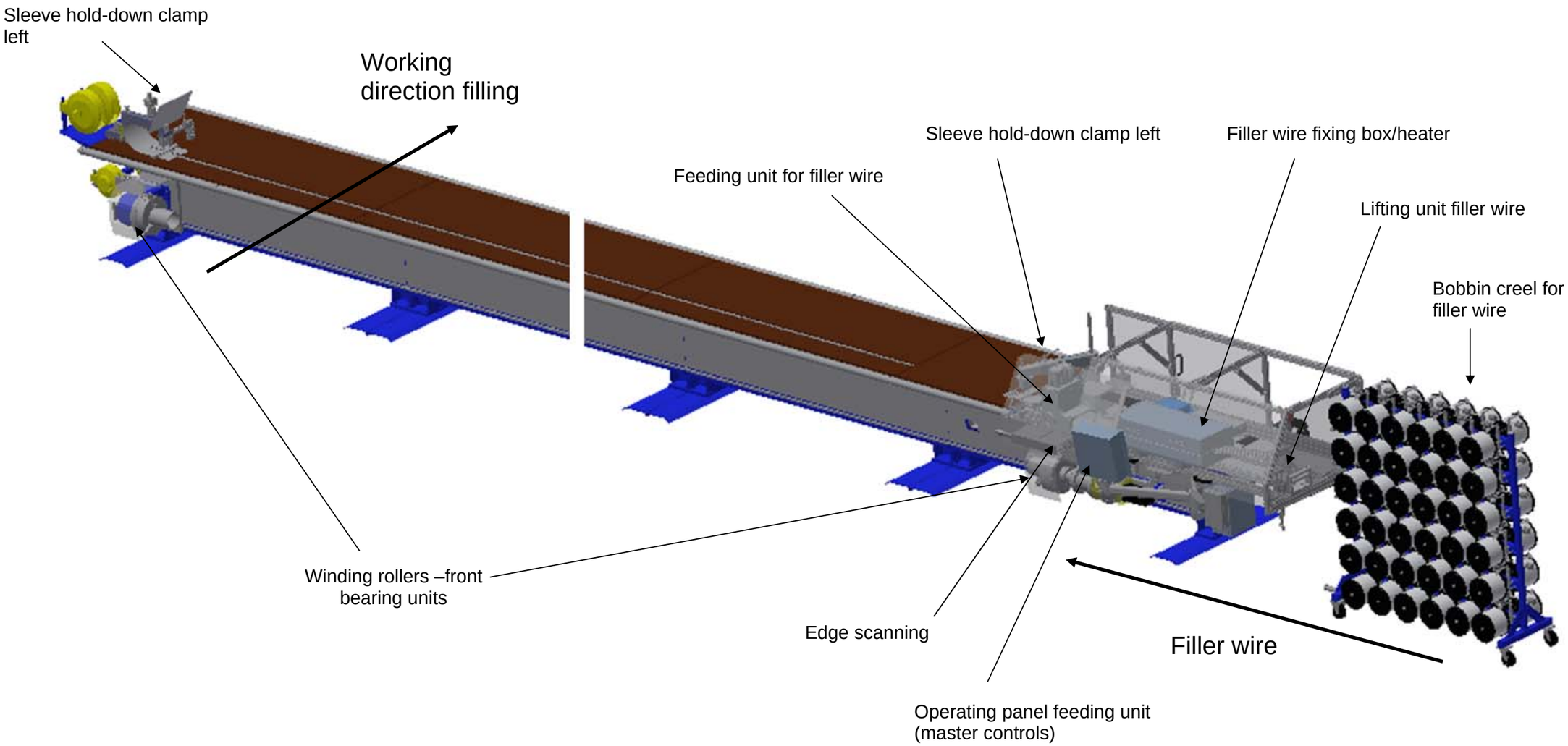
Work specification
Filling of spiral fabrics

1.0 Layout of the filling table

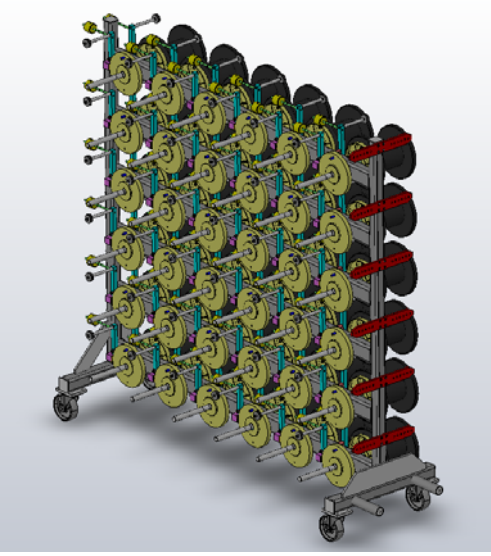


2.0 Functioning of the filling table and process flow

2.1 Overview and terms

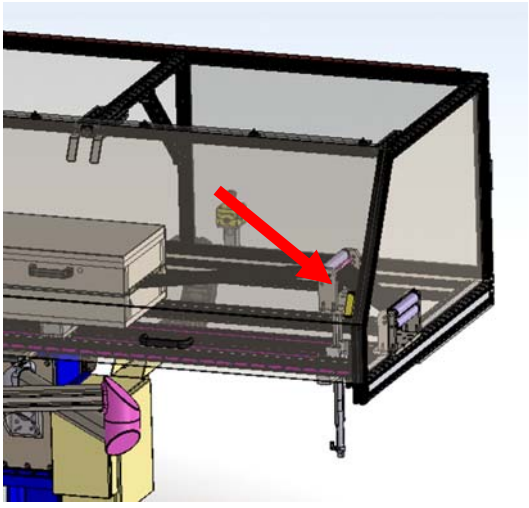
2.1.1 Bobbin creel

Up to 64 type K 250 coils can be placed on the creel.



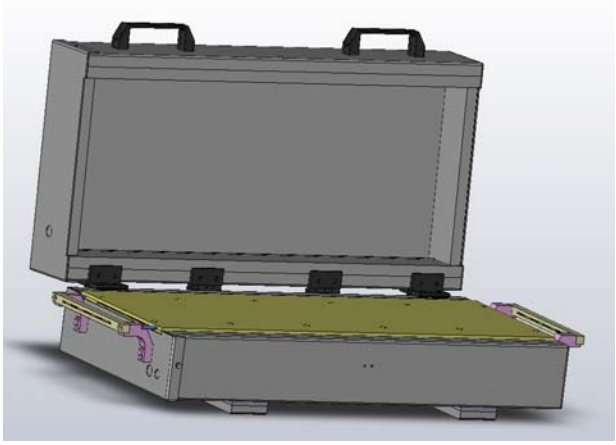
2.1.2 Lifting unit for filler wire

When retracting the feed unit, the pneumatic cylinder is moved upwards and out and holds the filler wire under light tension.



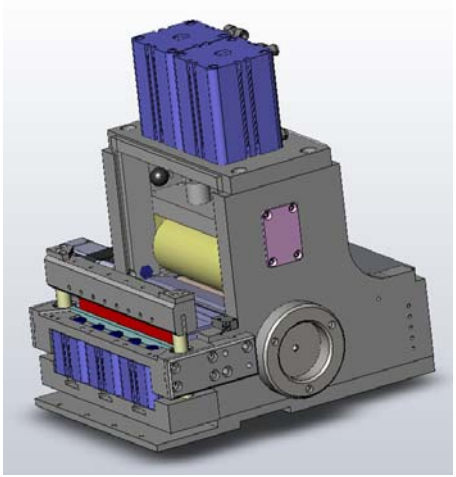
2.1.3 Heater

In order to ensure smooth insertion of the filler wire, the wire traverses a filler wire fixing box in which it is heated and straightened.

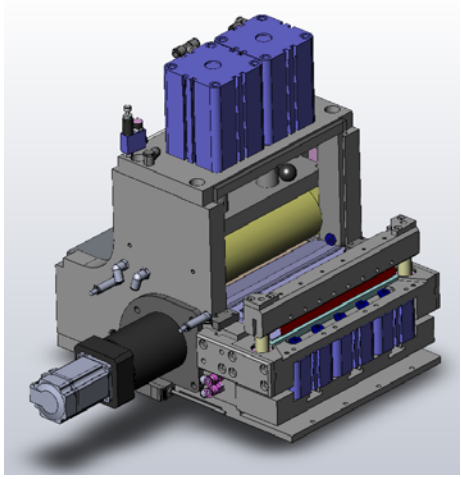


2.1.4 Feed unit

The feed unit for the filler wire primarily consists of a pair of transport rollers, a cutting unit and a matrix that divides the wire into the exact pitch of the spirals. The transport roller pair consists of one rubber roller and one hard roller which are pressed against one another. This ensures that the wire feed is carried out with very little slippage. As soon as the filler wire (i.e. once it has reached the length pre-set in the controls) has been completely pushed through the sleeve, it is cut off by the cutting unit.

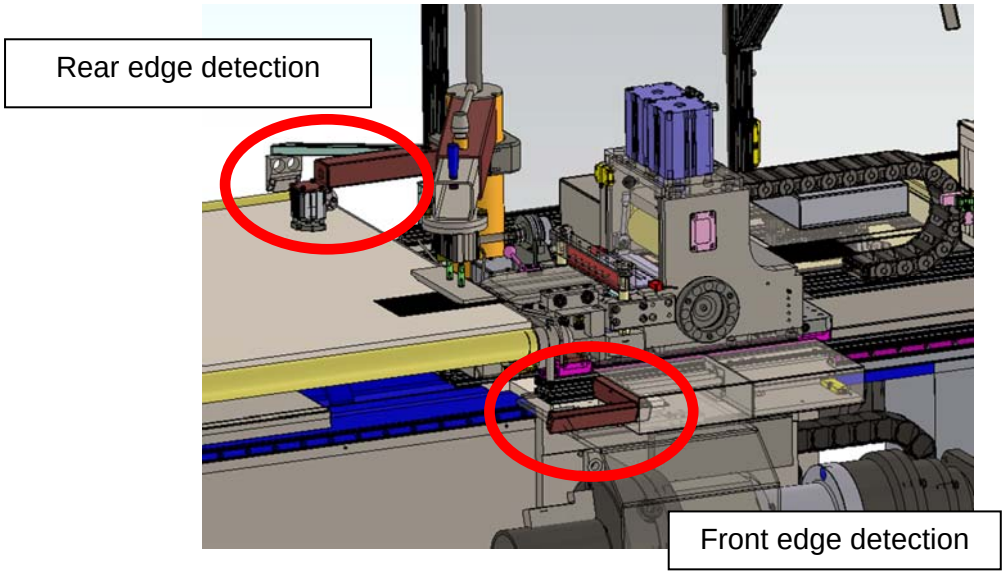


Operator side

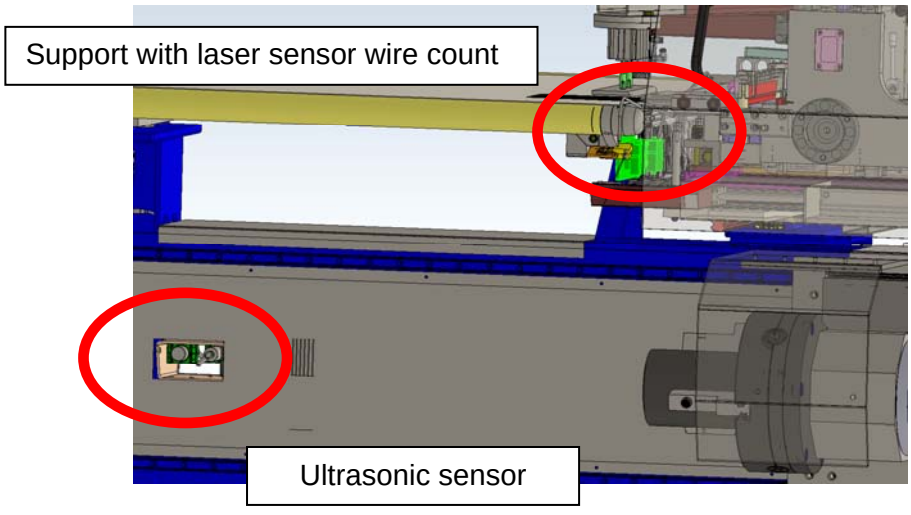


Drive side

2.1.5 Edge detection and wire counting



Using edge detection, the even feeding of the sleeve/sleeve edge is monitored during the entire process. If the sleeve slips out of place, it is corrected in the controls so that the sleeve edge always maintains the same distance from the filling matrix.

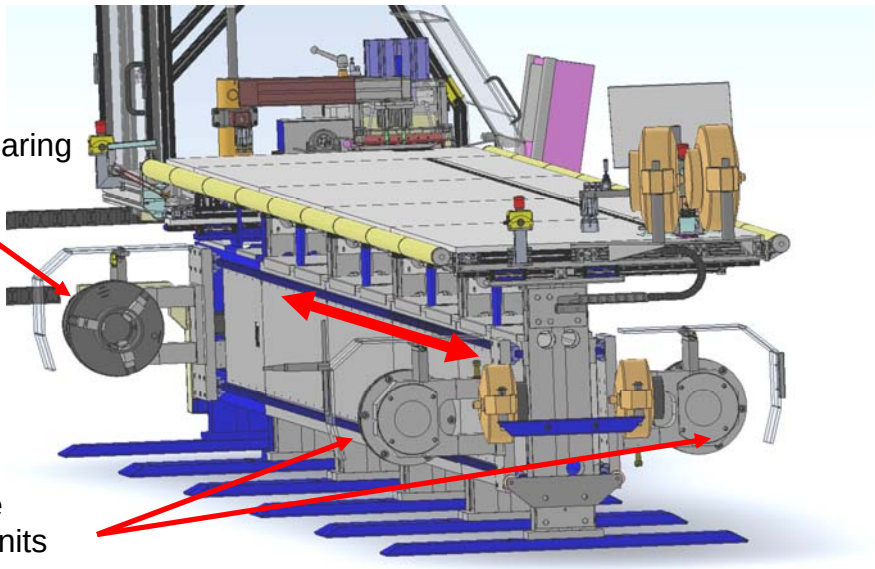


The laser sensor detects every single pintle wire and counts the spirals until the next unfilled spirals reach the height of the matrix and the necessary feed has been reached in order to continue the filling process without interruption.

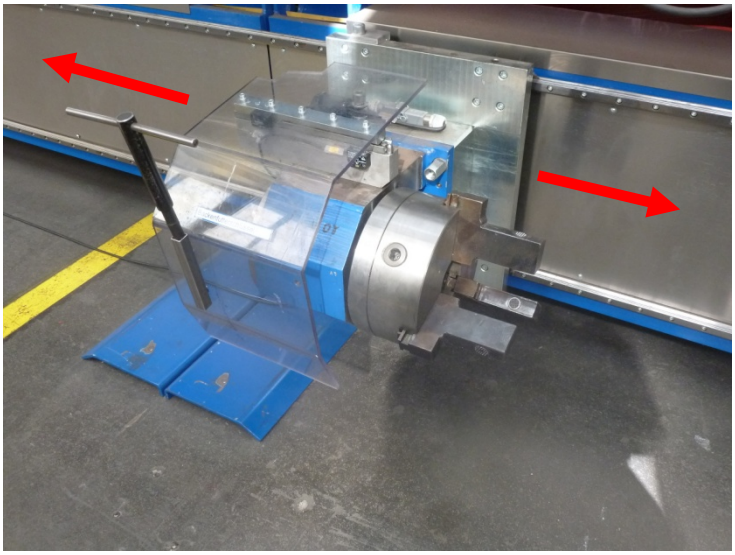
The controls use the ultrasonic sensor to determine the current diameter of the sleeve rolls. This ensures constant sleeve tension throughout the entire filling process.

2.1.6 Winding rollers bearing unit front/back

The bearing units are used for winding and unwinding, as well as stretching and tensioning of the sleeve during the filling process.
The user side and the back side of the filling table each have one pair of bearing units equipped with a drive motor on the pintle wire side, whereas the opposite non-driven unit can be moved across the entire length of the joining table to allow for tubes of varying lengths.



The bearing units, which are equipped with jaw chucks, can also be moved laterally so that the position of the uncoiled sleeve can be laterally corrected via edge detection during the filling process.

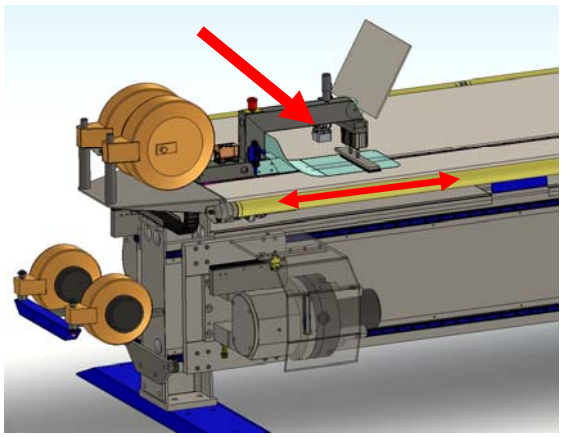


Sliding bearing unit with jaw chuck on the operator side

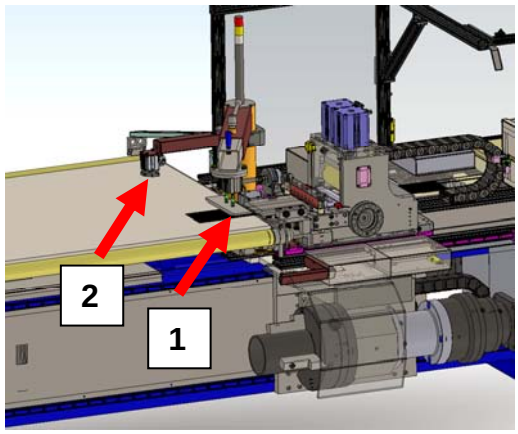
Driven bearing unit with jaw chuck on the operator side

2.1.7 Hold-down clamp

Hold-down clamps are installed on both sides of the filling table that hold the sleeve and the compressive forces acting on the sleeve in the correct position during the filling process.



Hold-down clamp left. Can be moved laterally to adjust to sleeve width



Hold-down clamp (1) right. Engaged directly on filling area.
Sleeve bracket (2) for fixing sleeve during setting up

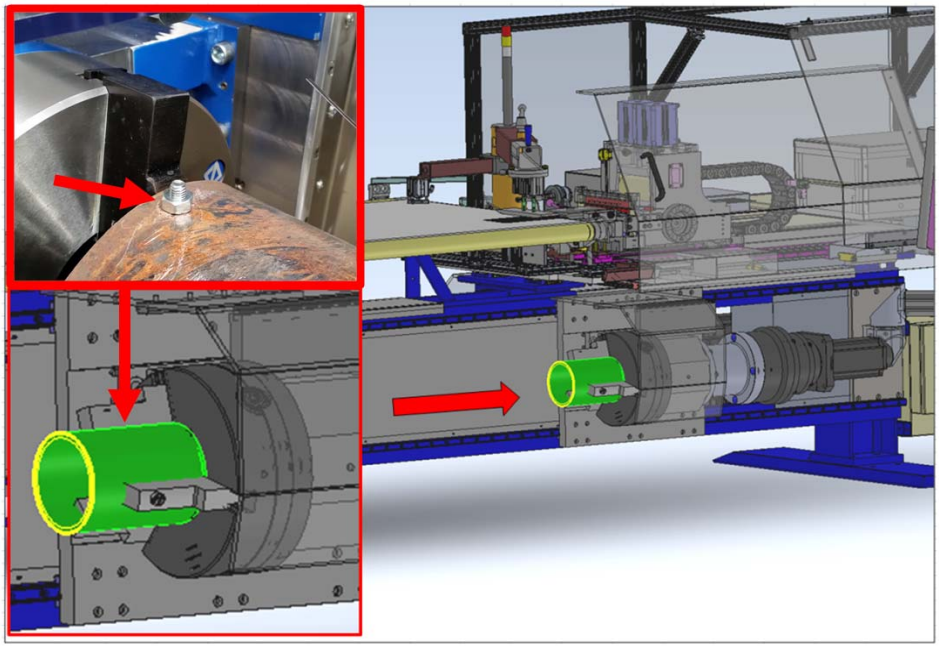
2.2 Preparatory work

In addition to (with precursors) the unfilled sleeve wound onto a tube, a second tube (also with precursor) is required for winding. The lengths of the tubes used can vary but must be at least 1m longer than the width of the sleeve.

To prevent slippage of the winding tubes in the both driven bearing units, a locking bore with screwing (e. g. M12) at minimum one end of the tubes is needed. The tube end with the screwing has to be mounted each at the drive side of the bearing units.

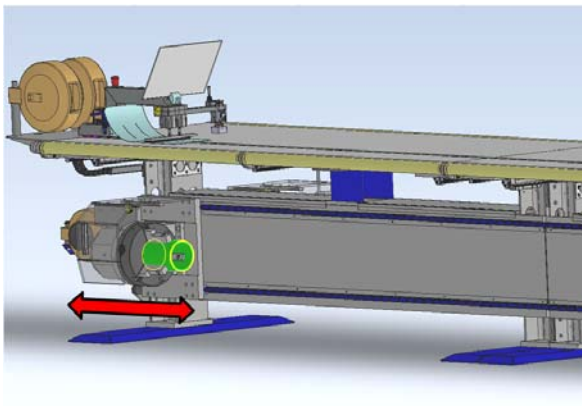
2.2.1 Inserting the unfilled sleeve roller into the front of the bearing unit

The jaw chucks of the front winding roller bearing unit (on the user side) are set using corresponding square key wrenches so the diameter of the winding tube with the unfilled sleeve fits above or in the clamping jaws with smaller tube diameters.

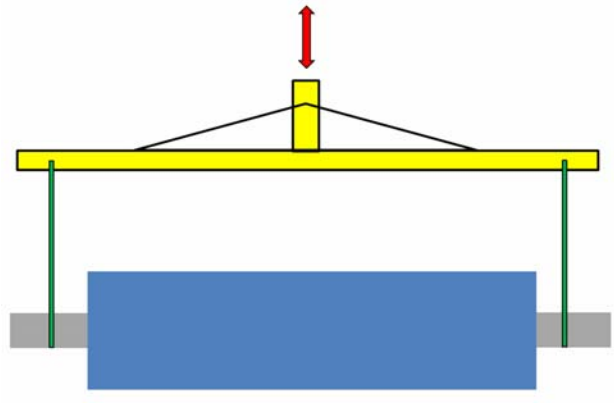


Winding tube (displayed in cross-section) inserted into the clamping jaws of the driven bearing unit (user side)

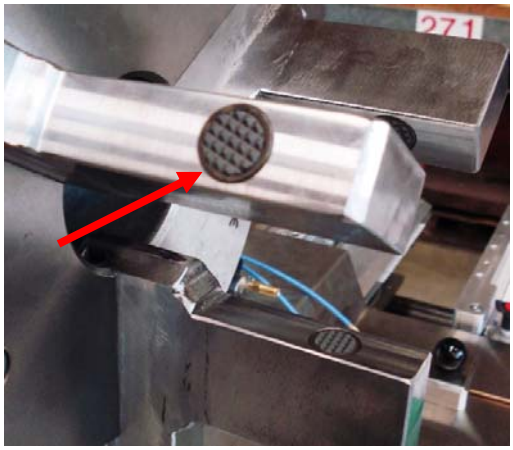
The moveable bearing unit is pushed to the left until the winding tube can be stuck onto the jaw chuck of the drive unit using a crane and traverse. After aligning the sleeve roller horizontally and gently applying the clamping jaws, the console can be pushed to the winding tube until the clamping jaws are as deep into the tube as possible. The tube may only lie on the clamping surfaces of the clamping jaws. The locking bore with screwing has to be posted at a clamping jaw. The clamping jaws of the console are now also lightly applied. The jaw chucks are then firmly tightened on both sides. The jaw chuck keys are then placed in their holders. Leaving the keys in place can result in damage of the system during winding.
The larger the distance between the jaw chucks the larger the diameter of the winding tube has to be (max. Ø 250mm).



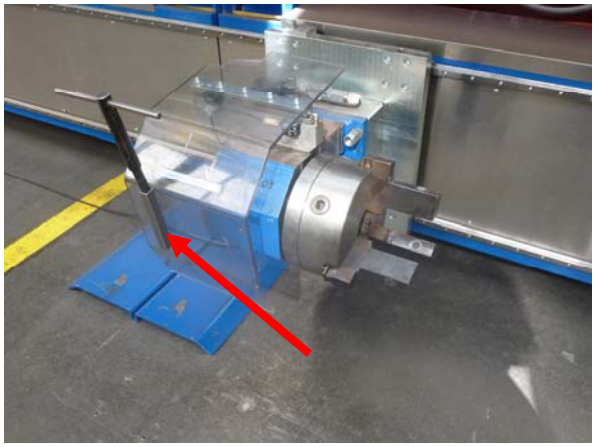
Sliding bearing unit (left) for individual adjustment to various lengths of winding tubes (operator side)



Schematic representation: sleeve roll transport using traverse



Hardened clamping inserts on the clamping jaws



Holder for jaw chuck keys

2.2.2 Inserting the second winding tube into the back of the bearing unit

The jaw chucks of the rear winding roller bearing units are set using a corresponding square key wrench so the diameter of the winding tube with the precursors fits above or in the clamping jaws with smaller tube diameters. Insertion is carried out in the same manner, as described under 2.2.1.

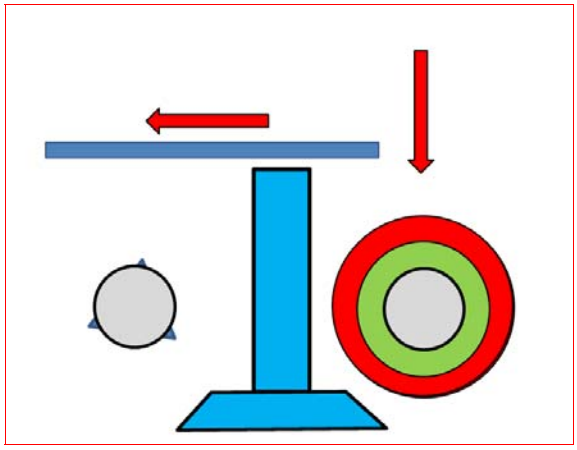
2.2.3 Setup work steps

The entire setup process for sleeve filling is carried out in the steps described below:

For better visualization, a cross section of the filling table is schematically displayed with all of the important components in the following. The operator side is on the right of the table display. Precursors are shown in GREEN; the sleeve is RED.

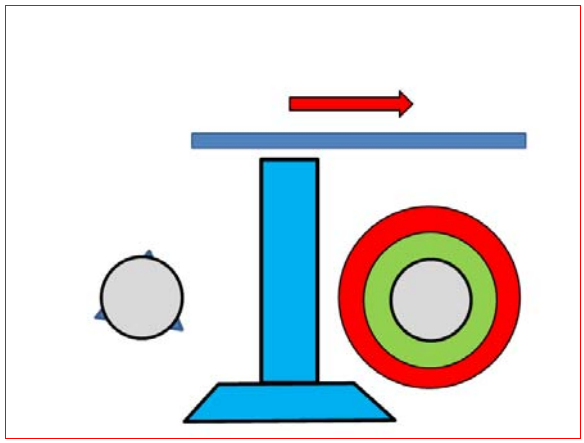
Step 1

The table module is moved to the rear to allow for unobstructed insertion of the unfilled sleeve roller.
Insert the sleeve roller into the jaw chuck, as described in 2.2.1.



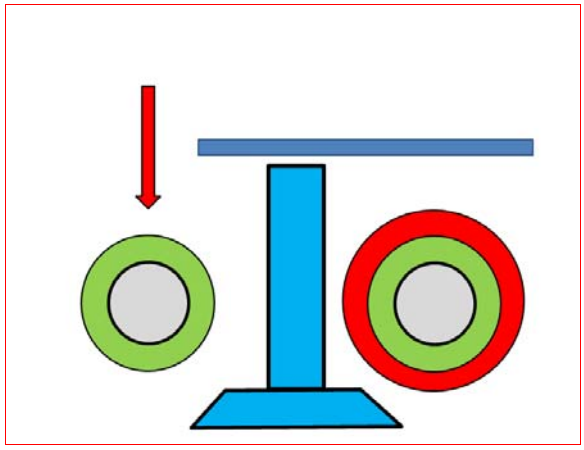
Step 2

The table module is moved to the front in order to make the rear bearing units accessible from above for the second winding tube.



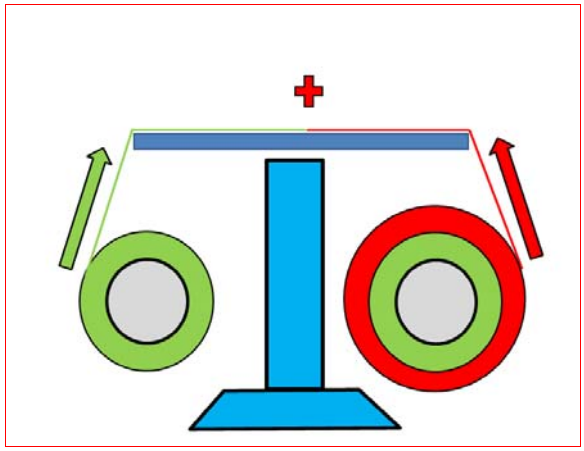
Step 3

The second winding tube with the precursor is inserted into the jaw chuck rear bearing units.

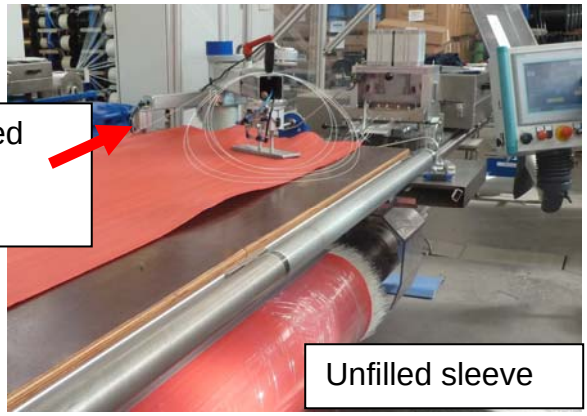


Step 4

After the table module has been moved into process position, the precursor is wound off of the rear tube and fixed on the table with the hold-down clamp (right side) and the sleeve bracket (right side) so the sleeve unwound from the front tube can easily be attached to the precursor.

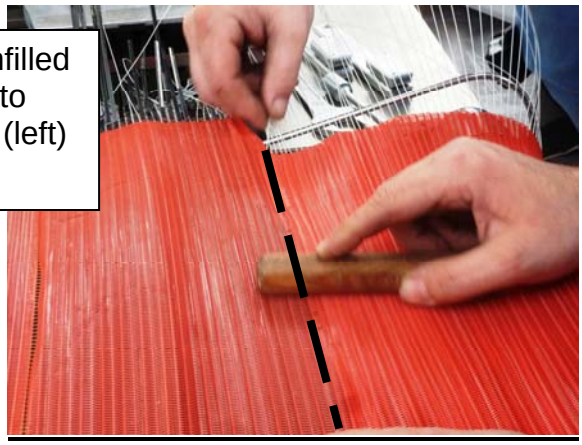


Precursor (fixed with sleeve bracket)



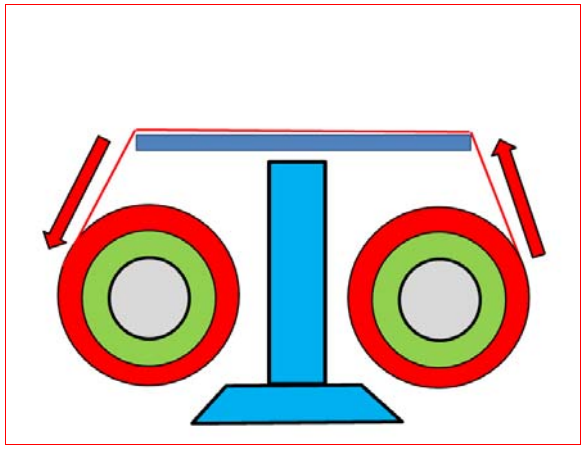
Unfilled sleeve

Joining the unfilled sleeve (right) to the precursor (left)



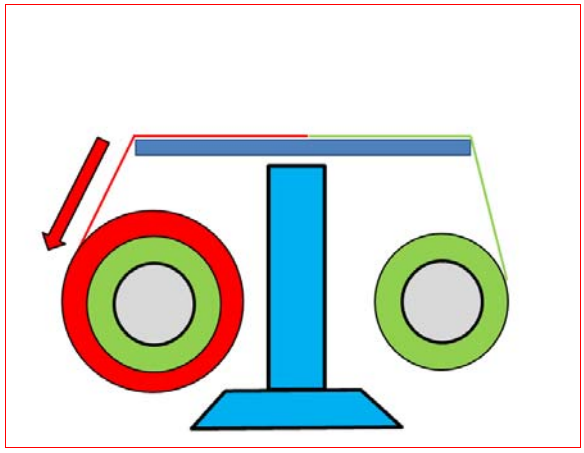
Step 5

The sleeve is now completely wrapped backwards under tension. Make sure that it is wound without diagonal pull. If necessary, correct with side adjustment.
(See also 2.4.2)



Step 6

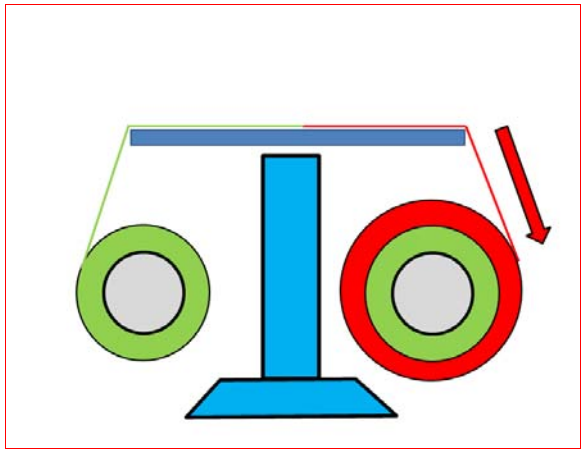
The complete sleeve is now on the rear tube.
Before rewinding it again, the sleeve must be moved laterally so that the sleeve edge matches the table edge.

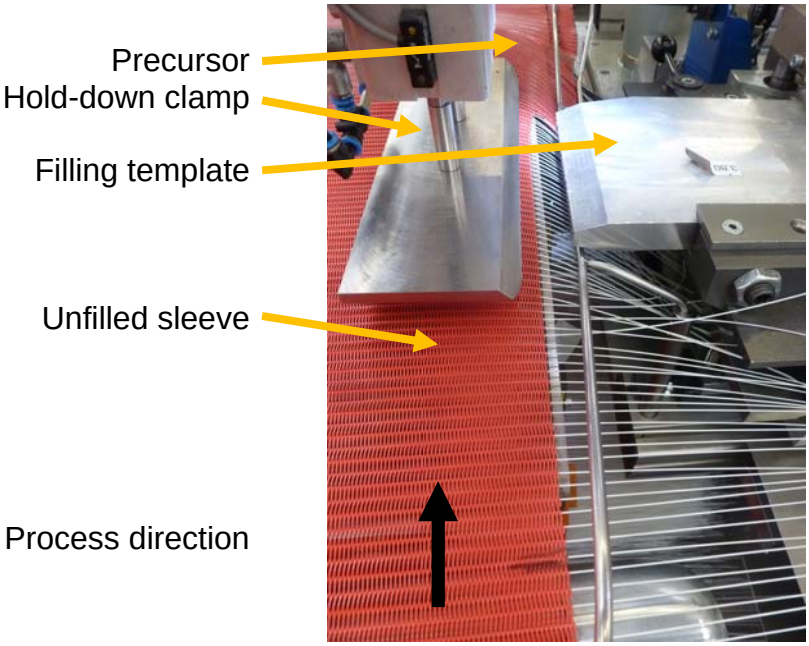


Step 7

When rewinding, the right edge of the sleeve must be precisely aligned with the right edge of the table across the entire length so the sleeve edge always maintains the same distance from the filling template during the filling process.

The sleeve is now in the start position for the filling process.




Precursor
Hold-down clamp
Filling template
Unfilled sleeve
Process direction

2.2.4 Setting up the bobbin creel

The wire coils are placed on the intakes of the creel so the driving pin grips between the ridges and the coil after overcoming the resistance of the barrel springs (see image 3).
The wires are now guided around the deflection roller onto the brake lever and further to the guide eyelets (see images 4 through 6).

Image 1

Setup creel

Image 2

Wire guide through the guide eyelets

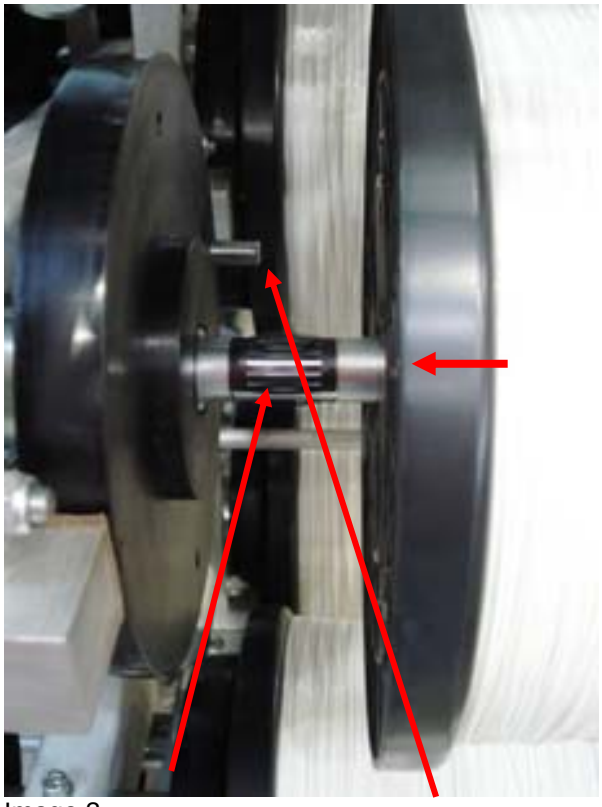


Image 3

Barrel spring and drive pin
Placing on the wire coil

Image 4

Axis to fit coil with brake lever, deflection roller and adjustable tension weight

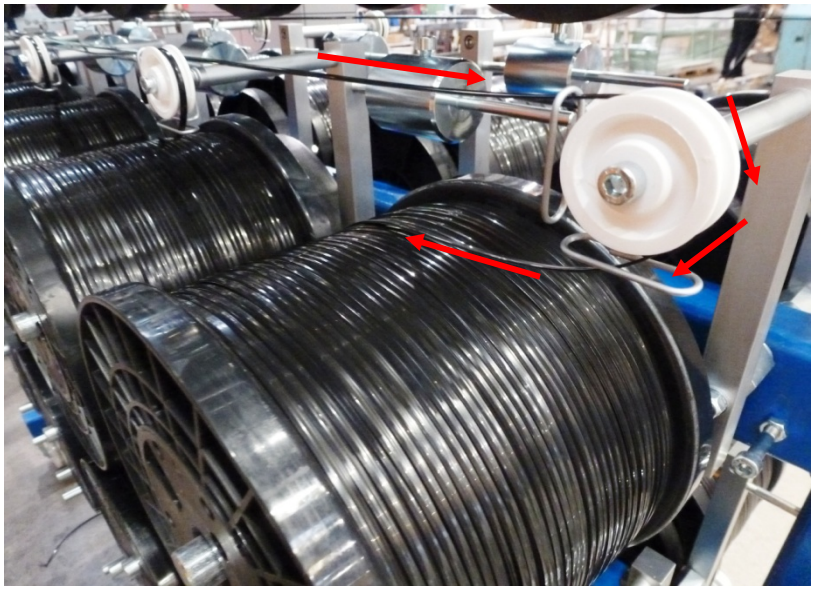


Image 5

Wire guide over the deflection roller of the brake lever

Image 6

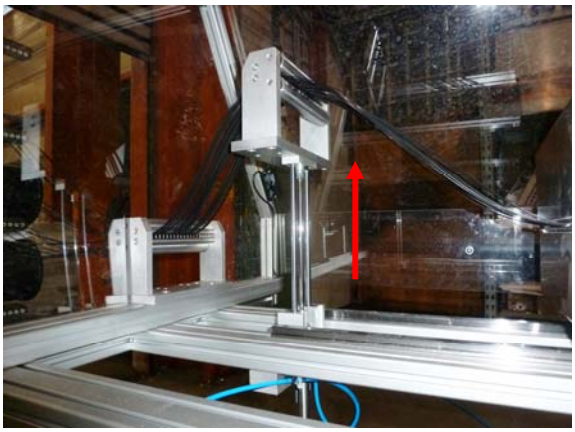
Guide eyelets

2.2.5 Setting up the wire feed unit

To insert the filler wires, the drive roller in the drive unit is moved upwards (menu, “fill”, button “lift roller”).
The filler wire can now be pulled out of the creel and inserted into the drive unit. The protective panels of the drive unit can also be opened or removed.
Starting above on the guide side, the filler wires are taken in by the guide eyelets and guided through the separating rakes and the lifting unit. The wires are then fed through the fixing box (heater), the drive unit and the filling template in the same order. After the protective panels of the drive unit have been closed again, the drive roller can be lowered back down (button “lower roller” in menu “setup”).
The filler wires are cut into uniform output dimensions by pressing the “cutter” button.

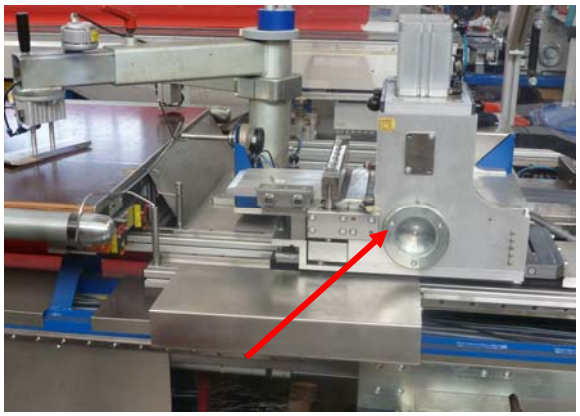
Separating rakes

Filler wire lifting unit, lowered
(view from rear side)



Filler wire lifting unit, lifted
Drive unit in back position
(view from rear side)

Filler wire fixing box
(view from operator side)



Filler wire drive unit

Drive unit with open protective panel
(pintle wire side)

Drive unit with cutting unit and template (sleeve side)

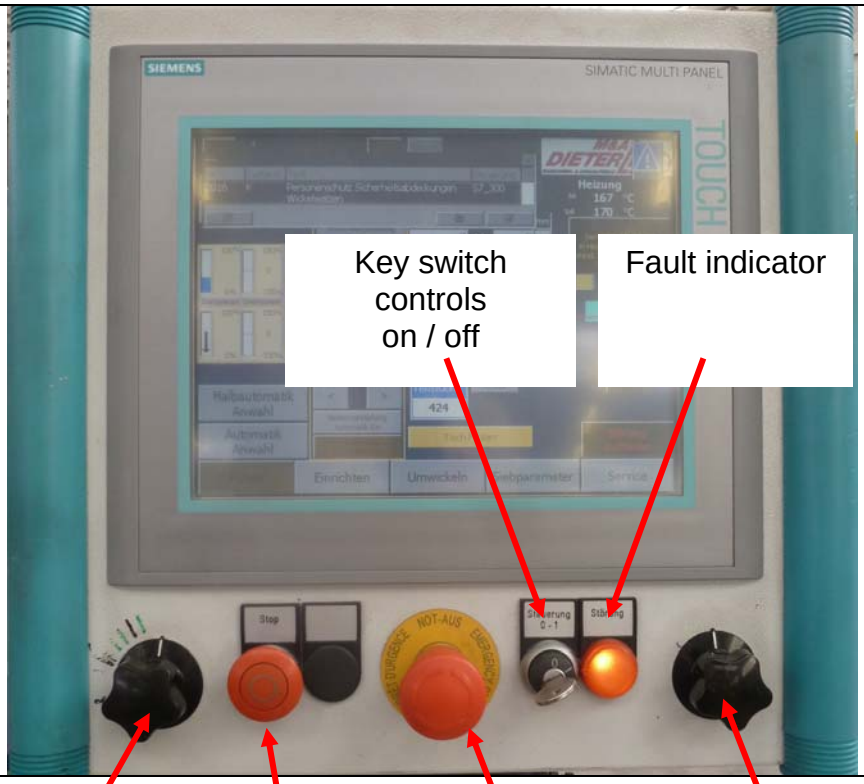
Filler wire monitoring with photocell

The wire feeding unit is designed as a removable unit, but the sleeve type does not have to be changed when replacing. The exchange is described in chapter 3 (operation, maintenance and service). When manufacturing a different sleeve type, only the matrix has to be changed.

2.3 Description of the button and switch functions

Control panel for machine controls. Buttons on either side for operation with both hands.	

Filling table control panel with touch screen.

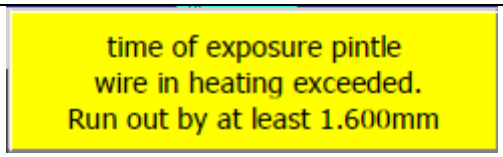
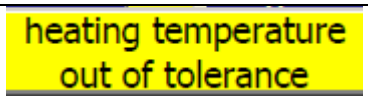
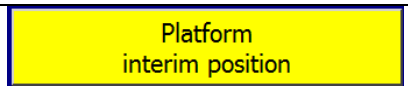
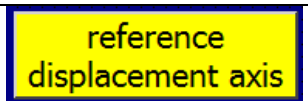


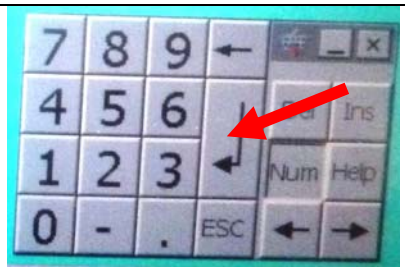
After turning on the controls with the key switch on the control panel, the “fill” menu (manual) is displayed.

Main display of filling table controls, identical for all menu images

Filling	Set up	Winding	Screen parameters	Service
>> 2.4.4 - 2.4.6	>> 2.4.1	>> 2.4.2	>> 2.4.3	>> 2.3.7 >> 2.4.8

General/messages

Working lamp switch on / off	
Emergency stop pressed	
General error messages are highlighted in red	
Confirm error message	
Error message: System shut off by filler wire monitor	
No response of the process-monitoring devices within the specified time in the control system.	
Messages highlighted in yellow show status deviations from the process specifications.	
Pre-set parameter time value was exceeded. To avoid a loss of quality to the filler wire in the heater, a maximum time is set, after which the filler wire may no longer be used.	
The actual heater temperature does not match the stored max./min. values. Verification required.	
The platform is not in process position. Use the direction keys to move it manually to process position.	
Approach the reference point (e.g. after a malfunction)	

Two-hand operation is required for this function.	
Safety cover open	
Limit switch has been initiated	
Number pad for entering parameter values. Appears by touching the parameter field. By confirming the new value with “enter” (arrow), the new value is accepted by the controls.	

2.4 Control menus, settings and filling process sequence

The setting sequence and the filling process in the “manual”, “semiautomatic” and “automatic” modes are described in the following sections.

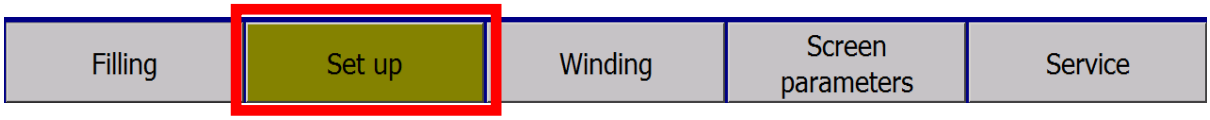
Before starting setup, the heater has to be turned on to allow enough time for heating up. See 2.4.3.

All settings are made in “manual” mode and in the *setup* menu.

Preparation work and the filling process are described in the corresponding sequence in the following.

Changes in the service menu (2.4.7) and in the “parameter setting and adjustment” menu (2.4.8) are usually not required.

2.4.1 Setting



The menu for setup mode is accessed via the “setting” button on the main display of the controls. All machine functions required during setup can be executed here, such as moving the table module back and forth, operating the winding drive individually or synchronously, and laterally adjustment.
The edge sensor functions are also controlled with the buttons in this menu window. Also see *2.2.3 setup steps.*

2.4.1 Menu overview

Setup

Hold-down clamp sleeve lift/lower (right table side)

Sleeve bracket lift/lower (right table side)

Lifting unit for filler wire lift/lower

Edge sensors before/after the table insertion/removal procedure

Manual pull/brake rear winding roller

Manual procedure for bearing unit/winding motor

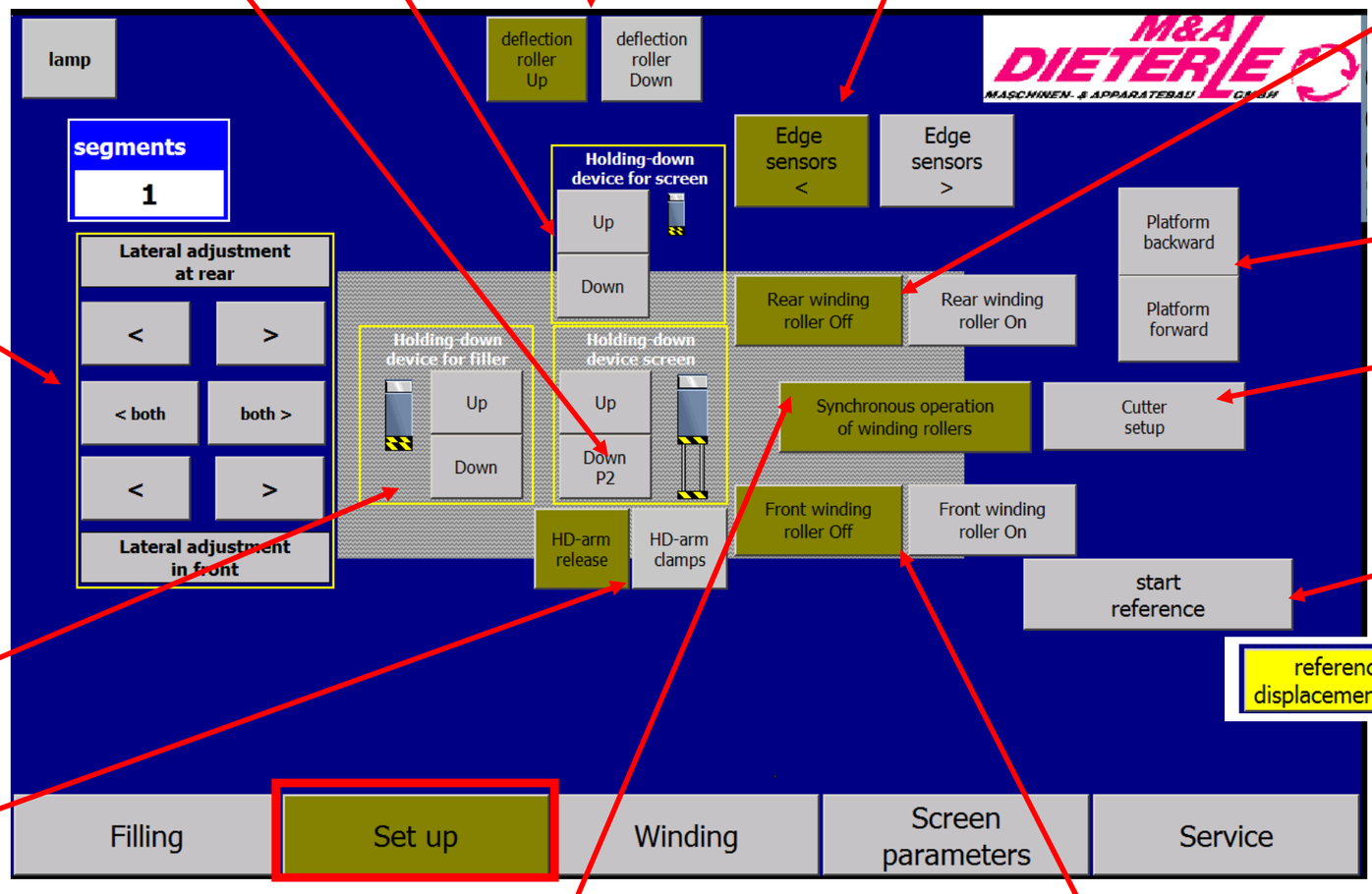
Move table forwards/backwards

Cutter remains lowered during setup until the button is pressed

Display appears after interruption or requirement. By pressing the button, the sliding unit moves to the reference point

Hold-down clamp filler wire lift/lower (left table side)

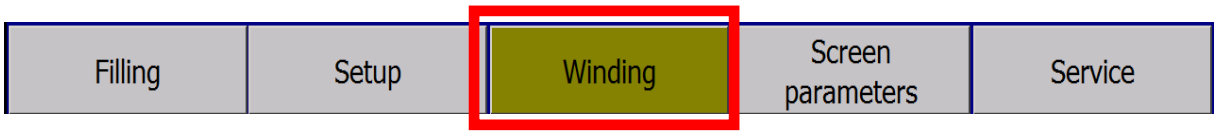
Loosen/clamp rotating hold-down clamp arm (hold-down clamp sleeve)



For synchronous operation, the winding roller always pulls while the wind-off roller brakes to keep the sleeve under tension

Manual pull/brake front winding roller

2.4.2 Winding



After inserting the unfilled sleeve into the front, operator-side winding roller bearing units and the second winding tube into the precursor in the rear winding roller bearing units, the sleeve is connected to the precursor and wrapped according to steps 5 through 7 as described in *2.2.3 setup steps.*

All of the functions required for this process can be controlled through this window.

2.4.2 Menu overview

Winding

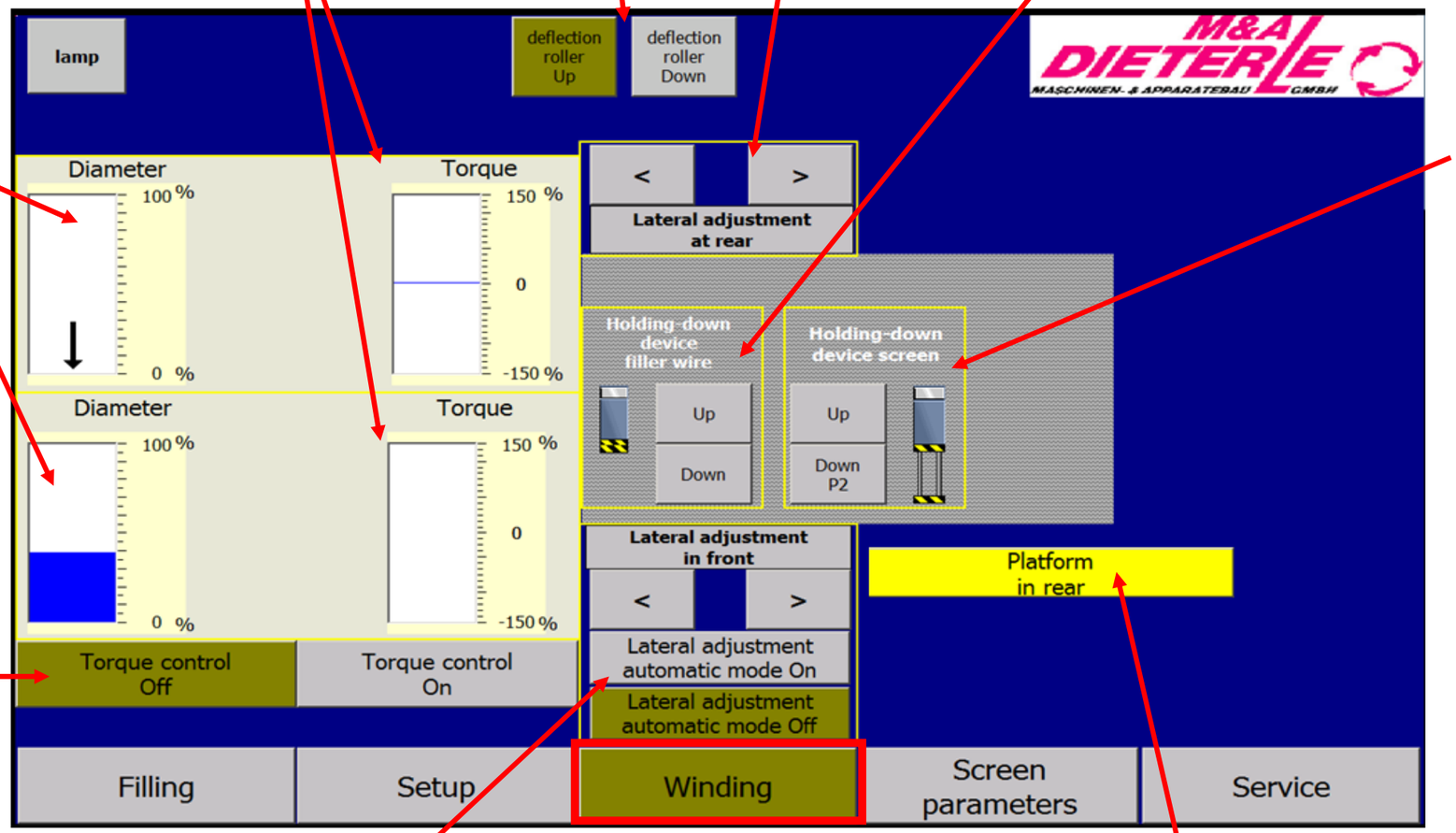
Display of sleeve tension according to percent value determined in sleeve parameters (> 2.4.3)

Lifting unit for filler wire lift/lower

Manual lateral adjustment of rear winding roller

Hold-down clamp sleeve lift/lower (left table side)

Display of winding diameter captured by ultrasonic sensor Front and back



Hold-down clamp sleeve lift/lower (right table side)

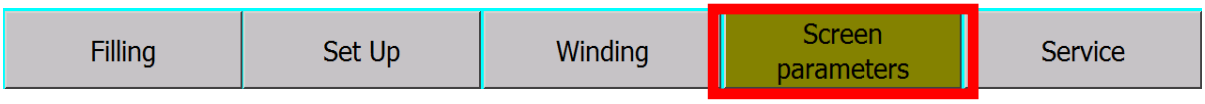
Torque control
OFF = unreeling axle runs without brakes only with traction

On = unreeling axle runs according to parameter settings (> 2.4.3)

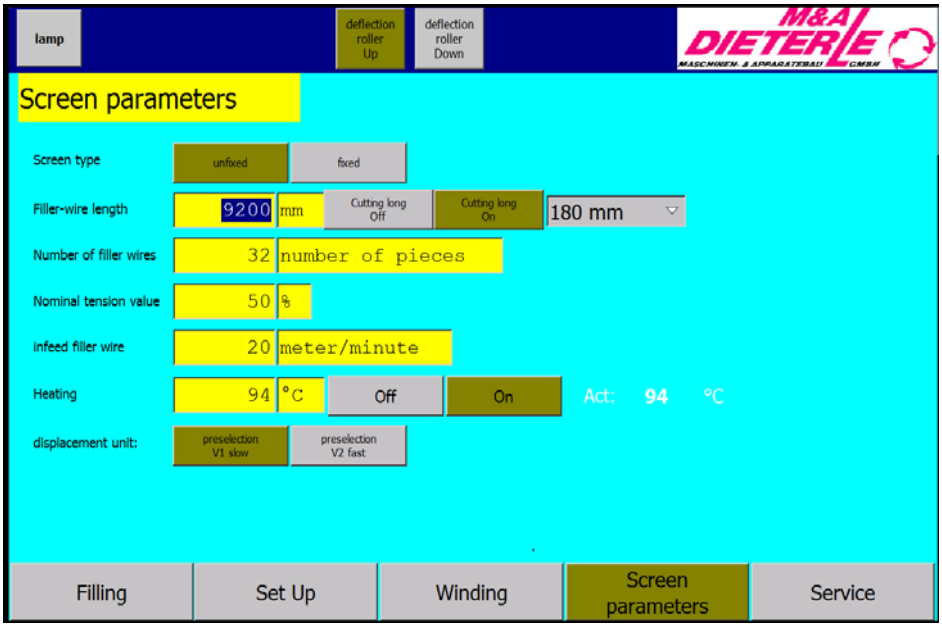
Lateral adjustment
Automatic ON = automatic adjustment by controls
Automatic OFF = manual adjustment

Current table position. Yellow button: current position is not process position

2.4.3 Screen parameters



After inserting and aligning the unfilled sleeve, the job-specific parameters of the sleeve are stored in the controls. The corresponding menu can be reached through the “screen parameters” button



Input-display for the screen parameters

To change and enter values, a numeric keypad opens by touching the corresponding data field. After entering the desired value and confirming with the ENTER button, the entry is accepted by the controls.

Screen type:
Select either a raw sleeve (“unfixed” button) or an thermofixed sleeve (“fixed” button).

Filler wire length:
The filler wire length is standardly set to the width of the sleeve with an addition of 0.40m (0.20m/sleeve side).
The function “cut long” is set to OFF.

When using a high-shrinkage filler wire, you can choose from the drop-down menu by using the function “cut long on” and selecting an additional value (target length filler wire + X% shrinking) according to the percentage specified by the monofilament producer. These extra lengths are taken into account during the feeding process.

Number of filler wires:
This is the number of filler wires resulting from the filling matrix that is used. During feeding, the filler wires are counted; the controls recognise this when the next filling portion is positioned in front of the matrix.

Nominal tension value:
The sleeve tension of the sleeve feeding during the filling process can be influenced via the target tensile strength. For sleeve widths of under 5m, this value can be set to under 50%. For sleeve widths of over 5m, this value is between 50% and 85%.

Infeed filler wire:
The feed rate of the filler wire can be set here in m/min. The rate depends on the size of the filler wire relative to the spiral size. A large filler wire profile relative to spiral size must be inserted at a slower rate (e.g. 10-ma. 15 m/min.) than a small profile (up to 30 m/min.). For medium-sized profiles, a value of 20 m/min. can be set.

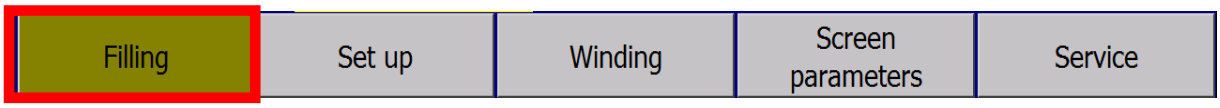
Heater:
Depending on the sleeve material, the TARGET temperature for the heater is set here. A value of 160°C for a low shrink material is selected here by default; a value of 170°C for high-shrink material can be set.
The heater can also be turned on and off here using both buttons. The current ACTUAL temperature is also displayed.

Displacement unit:
Selection buttons for movement** for section positioning.

- Pre-set V1 “slow” - Selection for sleeve tension-related counting errors
- Pre-set V2 “fast” - Selection for ideal conditions

** - The corresponding speeds for V1 and V2 can be set in the “parameter setting and adjustment” menu (2.4.8 point 7 and 8).

2.4.4 Filling mode “manual”



After the sleeve has been inserted and positioned for the first filling and the corresponding sleeve parameters have been set in the controls, the filling process can be started.

Before the first filling, the section counter is set to “0” (image 1). By touching the counter, a window (image 2) opens in which a given value can be increased or reduced (e.g. for corrections during filling) and set to set to “0” at the start of the filling process by pressing RESET.

Section counter in the *fill* menu

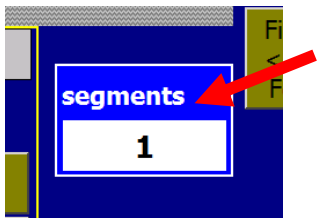


Image 1

Existing number of Sections + 1

Existing number of filled sections

Existing number of sections - 1

Remaining number of sections to be filled

Counter set to “0”

Back to menu

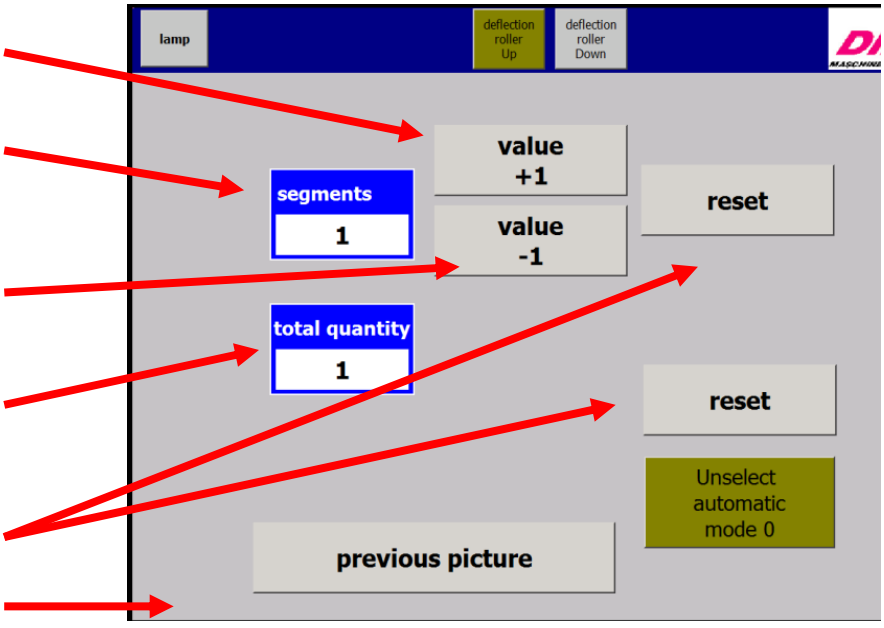
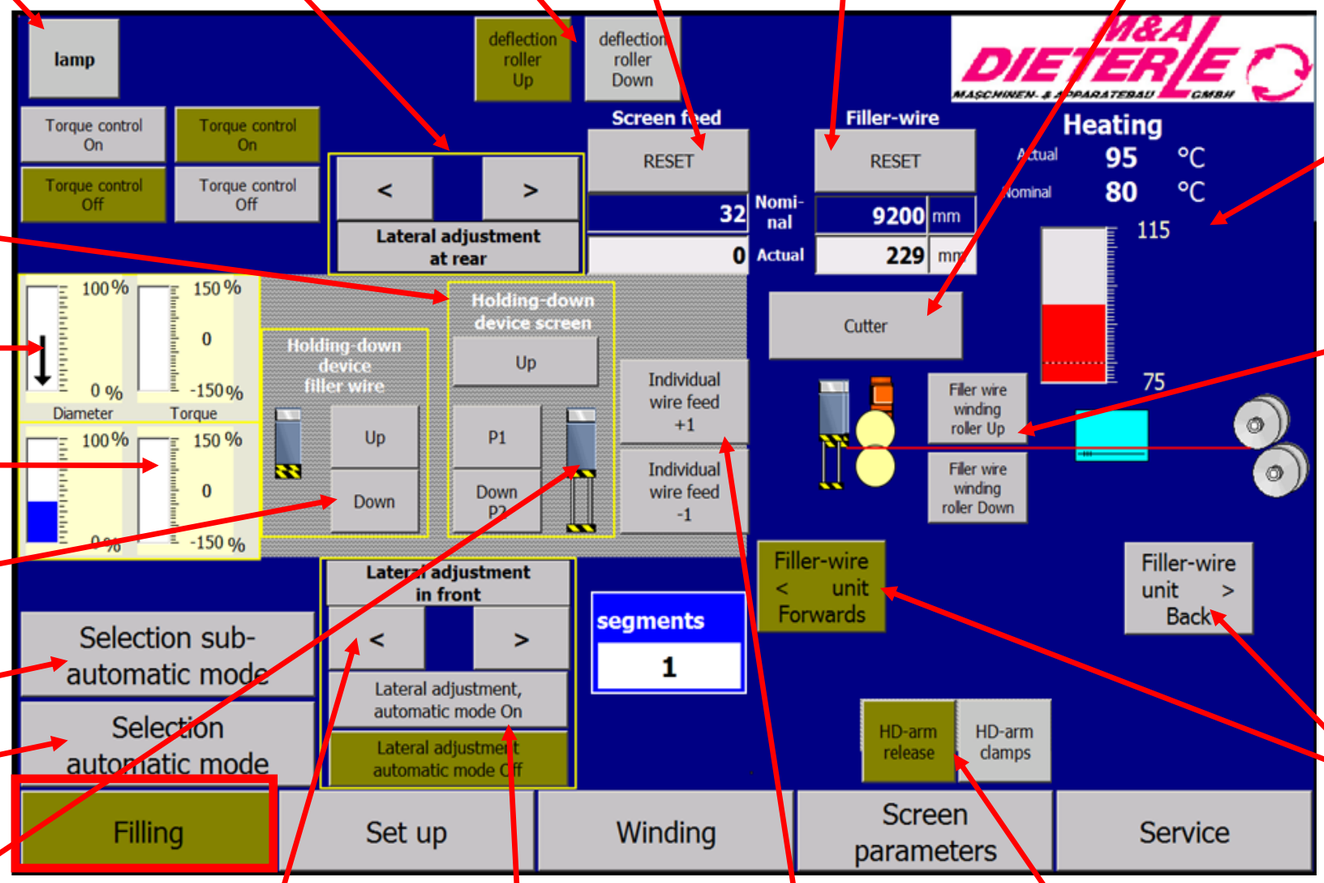


Image 2

2.4.4 Menu Overview

Filling



Filler wire lifting unit lift / lower

Target and actual value filler wire counting for sleeve feed
RESET: reset counter to zero for manual positioning

Target and actual values length of filler wire feed
RESET: reset actual value to 0

Cutting unit remains lowered for setting as long as the button is pushed.
Confirming cutter resets actual values of sleeve feed and filler wire length to 0

Working lamp On/off

Side adjustment rear
manual process

Sleeve hold-down clamp (right user side) manually lift/centre position/lower

Target/actual temperature of heater and additional bar chart for visualising current temperature

Display:

Current winding diameter forwards/backwards and winding direction

Feed roller for drive unit manually lift/lower

Current sleeve tension Forwards/backwards

Filler wire hold-down clamp lift/lower (left operator side

>> Semiautomatic (2.4.5)

>> Automatic (2.4.6)

Sleeve hold-down clamp lift/lower (right table side)

Feed unit manually operate forwards/backwards

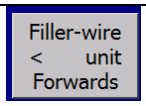
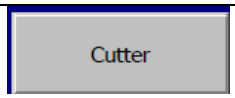
Lateral adjustment forward manually operate

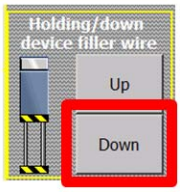
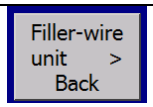
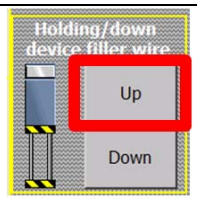
Automatic lateral adjustment on/off

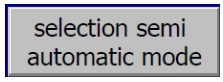
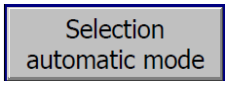
Move sleeve feed manually ONE filler wire forwards/backwards

Loosen/clamp rotatable hold-down arm (sleeve hold-down clamp)

All process steps are executed by the operator in “manual” mode. This operating mode must always be selected for the first sections in order to change the parameter settings if necessary.

Process steps	Controls/ buttons
Step 1: Initiate 0 point on the template sleeve feed. Feed direction and speed with left knob. forwards = counter-clockwise rotation backwards = clockwise rotation	
Step2: Move filler wire unit forward	
Step 3: Slowly insert filler wire approx. 1 cm into sleeve. Feed rate and direction with right knob forwards = counter-clockwise rotation backwards = clockwise rotation Attention! Move filler wire feed **back to a max. of 10mm! Only for making corrections while inserting filler wire**	
Step 4: Insert filler wire at higher speed into the sleeve until the pre-set filler wire length has been reached. Regulate feed rate with right knob.	
Step 5 a: Cut filler wire.	

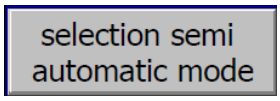
Step 5 b: Lower hold-down clamp filler wire.	
Step 5 c: Reverse filler wire unit.	
Step 5 d: Lift hold-down clamp filler wire.	

If all settings ensure an error-free process when necessary corrections have been made after the filling of the first sections, the operating mode “semiautomatic” (2.6.5) or “automatic” (2.6.6) can be changed.	 

2.4.5 Filling “semiautomatic” mode

After process start in “manual” mode, “semiautomatic” mode can be selected if the filling process is error-free.

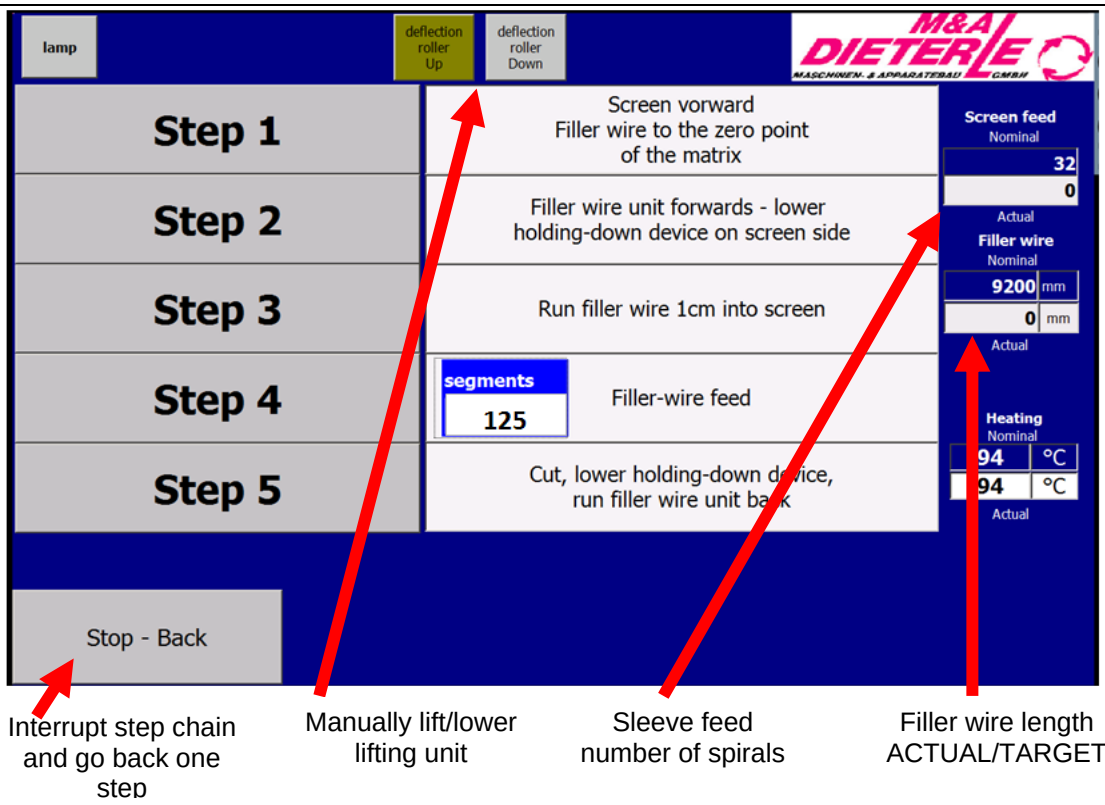
Change selection button in “manual” menu to “semiautomatic”



The process steps are essentially identical to those described under “manual”; however, the individual steps are activated sequentially using buttons. Several machine functions are sometimes summarised in one step (step 5).

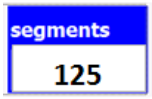
The STEP buttons are hidden after the step has been completed so that only the remaining steps are visible. After completing a filling cycle, all buttons are displayed again.

.



Menu screen for “semiautomatic” mode

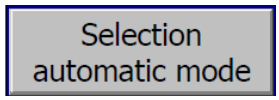
Process steps	Controls / buttons
Step 1: Initiate 0 point on the matrix sleeve feed. Feed direction and speed with left knob. forwards = counter-clockwise rotation backwards = clockwise rotation	Step 1
Step 2: Move filler wire unit forward	Step 2

Slowly insert filler wire approx. 1 cm into sleeve. Feed rate and direction with right knob forwards = counter-clockwise rotation backwards = clockwise rotation Attention! Move filler wire feed **back to a max. of 10mm! Only for making corrections while inserting filler wire**	
Step 4: Insert cored wire at higher speed into the sleeve until the pre-set cored wire length has been reached. Regulate feed rate with right knob. Display of filled sections.	 
Step 5: Cut filler wire Lower filler wire hold-down clamp. Reverse filler wire unit. Lift filler wire hold-down clamp. >>> Ready for the next filling cycle	
Go back one STEP	

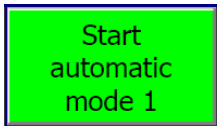
2.4.6 Filling “automatic” mode

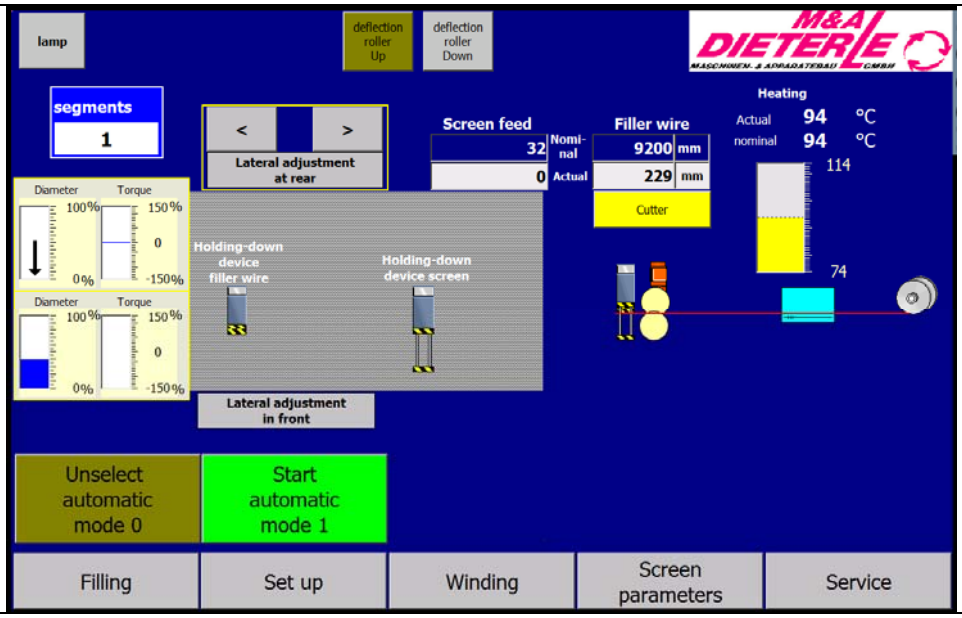
After process start in “manual” mode, “automatic” mode can be selected if the filling process is error-free.

Change selection button in “manual” menu to “automatic”



Process start in “automatic” menu



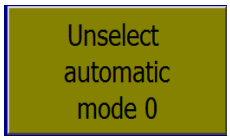


“Automatic menu”

The process steps are identical to those described under “manual”; in contrast, the individual steps are completely automatically processed in succession. The start of the next cycle is also carried out using the controls.

Shut-off occurs either in the event of a disruption, when the pre-set number of filling sections has been reached, or by manually pressing the button “unselect automatic mode”.

Manual process termination in the menu “automatic”

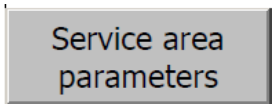


2.4.7 Service menu

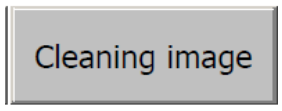
In addition to manufacturer contact information for the machine and the controls, the controls can be set to various different languages here (only with a password).

Service menu

Selection button in the service menu for switching to the menu “parameter settings and adjustments”
>>> 2.6.8

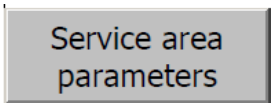


Before cleaning the touch screen, the screens switching functions are deactivated with the button “clean screen”. A white screen with a bar diagram will display the remaining cleaning time.

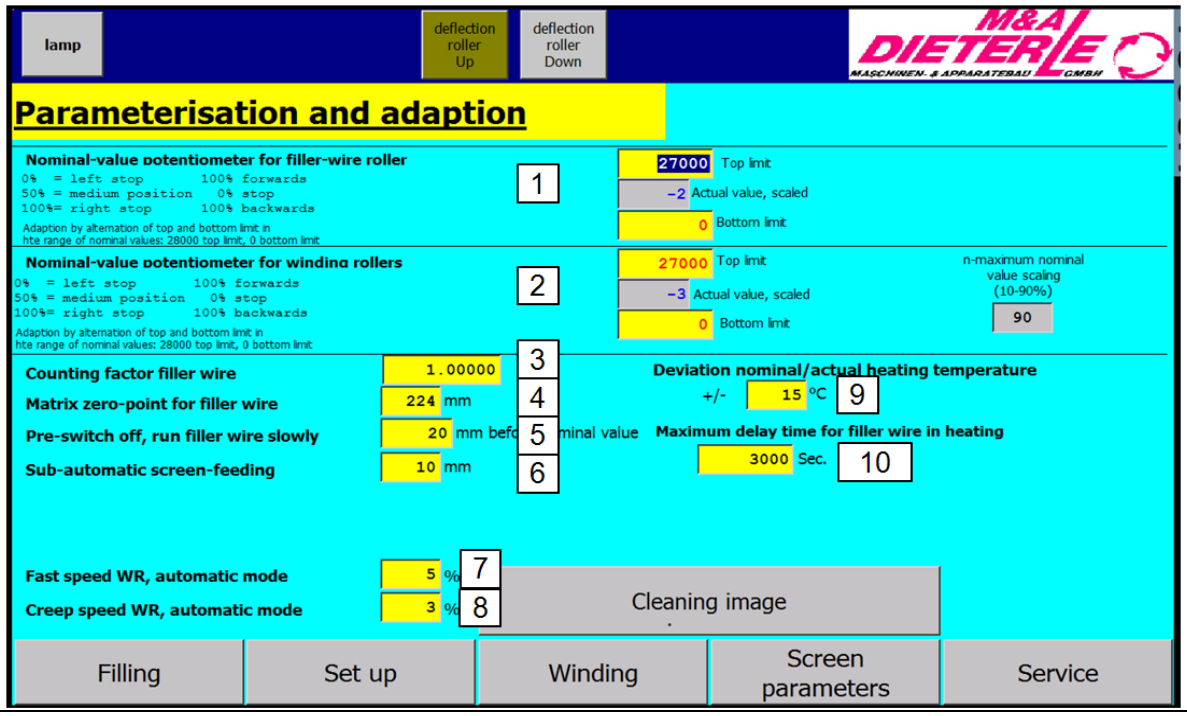


2.4.8 Parameter settings and adjustments

Selection button in service menu for switching to the menu “parameter settings and adjustments”. Password protection!



The basic password protected parameters of the controls can be changed if needed in the menu “parameter settings and adjustment”.



Parameter menu

1. Target value potentiometer filler wire roller
Fixed internal value. Only necessary, in case of change of the potentiometers, or if changing manufacturer's specifications.

2. Target value potentiometer winding rollers
Fixed internal value. Only necessary, in case of change of the potentiometers, or if changing manufacturer's specifications.

3. Filler wire counter factor
Fixed value

4. Zero point filler wire matrix
Distance filler wire cutting edge/front edge matrix. No changes necessary.

5. Pre-switching filler wire start slowly
Slower feed before reaching pre-set filler wire length.
Recommended value: 50mm

6. Retract sleeve semiautomatic
Slow movement of filler wire into sleeve after insertion.
Recommended value: 10mm

7. Fast speed WR automatic
Speed value for *pre-selection V1 "slow"*. Also see sleeve parameters (2.6.3)
Recommended value: 8%

8. Slow speed WR automatic
Speed value for *pre-selection V2 "fast"*. Also see sleeve parameters (2.6.3)
Recommended value: 3%

9. Difference deviation target/actual temperature heater
Determine the tolerance range for actual temperature deviations relative to pre-set target temperature, **target value: 7°C**

10. Max. holding time for filler wire in heater
To avoid a reduction in quality of the filler wire in the running heater during idle time, a maximum time of **900 seconds** is set, after which an error message is displayed indicating that the filler wire may no longer be used.

2.5 Rewinding and removing the filled sleeve

Use the “winding” menu to rewind.

After filling the last section, the precursor/end section is separated from the sleeve by removing the corresponding pintle wire and wound onto the front winding tube. The precursor is then secured with Velcro straps or tape. The sleeve ends are secured on both sides before removing with hold-down clamps.

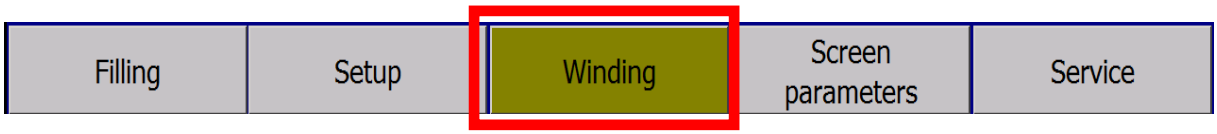
Analogous to the description of the setup process (2.2.1), the front winding tube is now removed (with its accompanying precursor) from the machine.

The empty winding tube for shipping, described under 2.2.1, can now be inserted into the filling table and clamped with the jaw chucks.

After lifting the hold-down clamp, the filled sleeve is wound forward until it can be attached to the front winding tube with tape. The sleeve can then completely – after the first rotations on the tube under tension – be wound to the front tube.

Before the finished sleeve is removed from the machine, it must be wrapped with foil or secured with Velcro.
The sleeve roller can be removed again using a crane and traverse, as described under 2.2.1.

2.6 Weld edge on filled sleeve



The sleeve edge is welded/melted during the rewinding of the front winding tube in the “winding” menu.

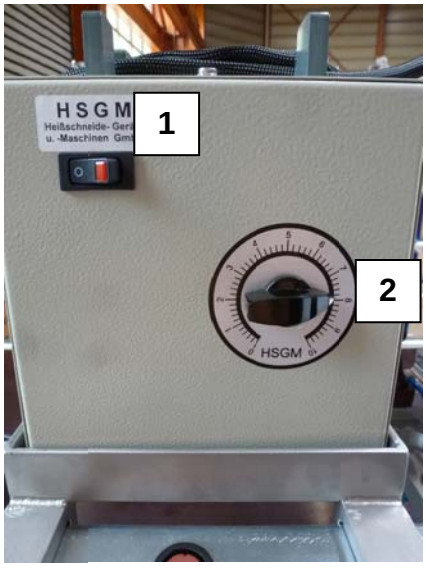
An electrical heater bar arranged parallel to the sleeve edge is lowered to the sleeve via a pneumatic cylinder; the sleeve feed starts simultaneously.

First, the cored wire hold-down clamp is positioned such that the heat bar is approx. 20 – 30mm inside the sleeve edge.

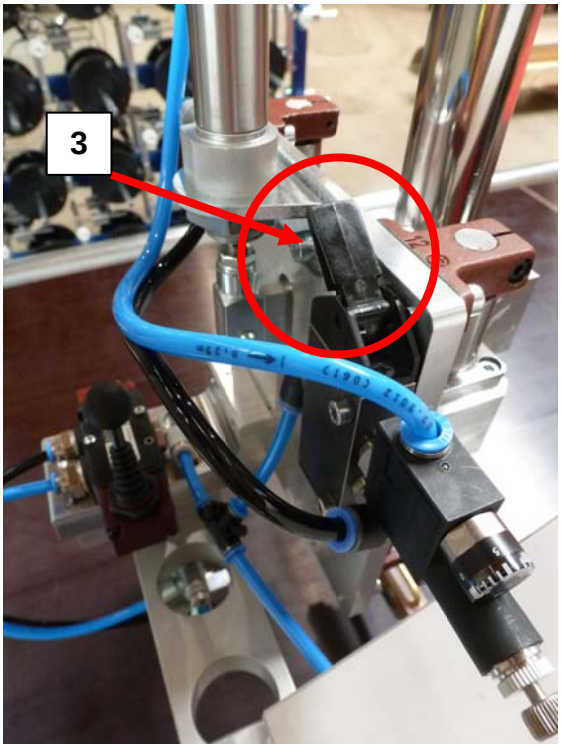
The welding device mounted onto the filler wire hold-down clamp is switched on shortly before at the control device (1) and the knob (2) is set to value 8 (example for PET).

Recommended reference values for the settings in the sleeve parameters menu (2.4.3):

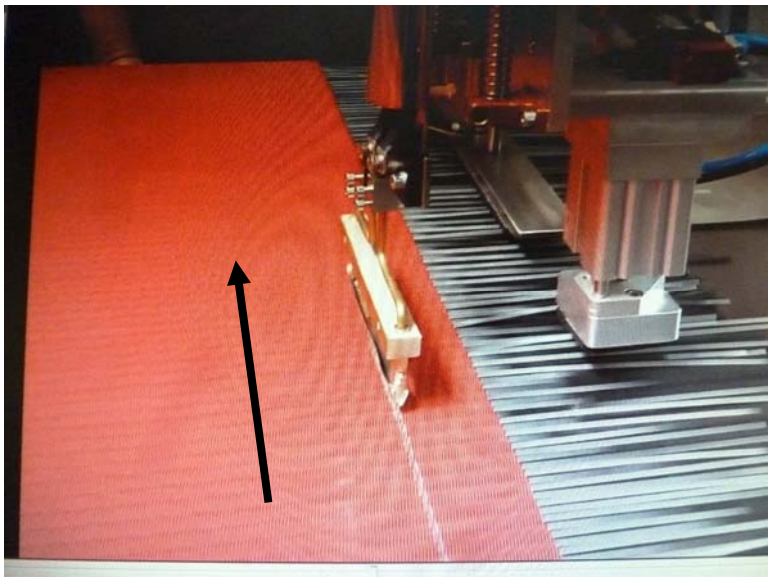
Pull target value: 16%
Filler wire feed: 19m/min



As soon as the sleeve feed starts, the pneumatic valve (3) …



… is manually lowered to the sleeve passing through.



As soon as the inference of the precursor and sleeve is reached, the heat bar is lifted. The device can then be switched off again.