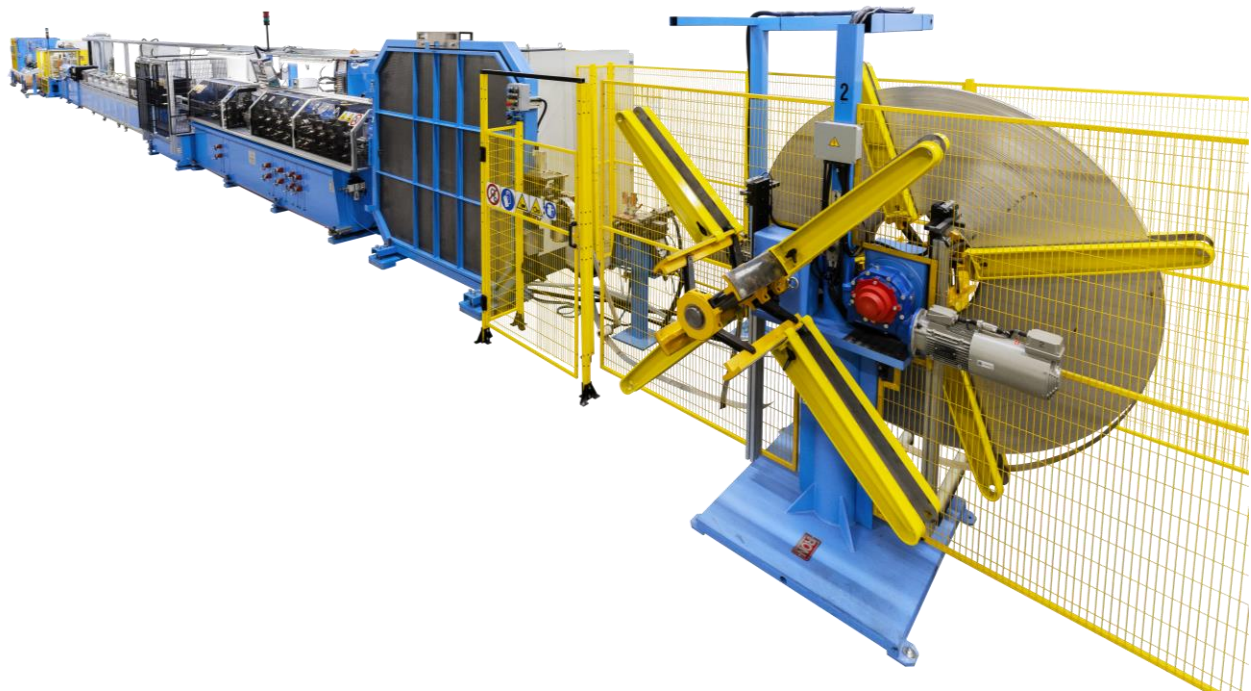




FORMING AND WELDING MACHINE FOR HEAT-TREATED TUBES



VIDEO – HEAT TREATED 6-16 MM



VIDEO – HEAT TREATED 10-28 MM

We propose, as a result of our long experience in the production of tube and construction of machines with the latest manufacturing technology, a generation of machines to forming, welding, cutting to length, straightening and sizing of the ends for stainless steel tube with innovative features and potential.

The possibility of obtaining, just by setting the required lengths and quantities, straightened tubes with sized ends, that is, ready to be used completes the advantages of these production lines.

The cutting occurs without deposit of metallic dust on the tube, so it guarantees a “clean” tube.

A special computer co-ordinate the running of the line with the possibility of setting working programs, in quantities and lengths. A diagnostic program which clearly displays eventual operation anomalies is also available.



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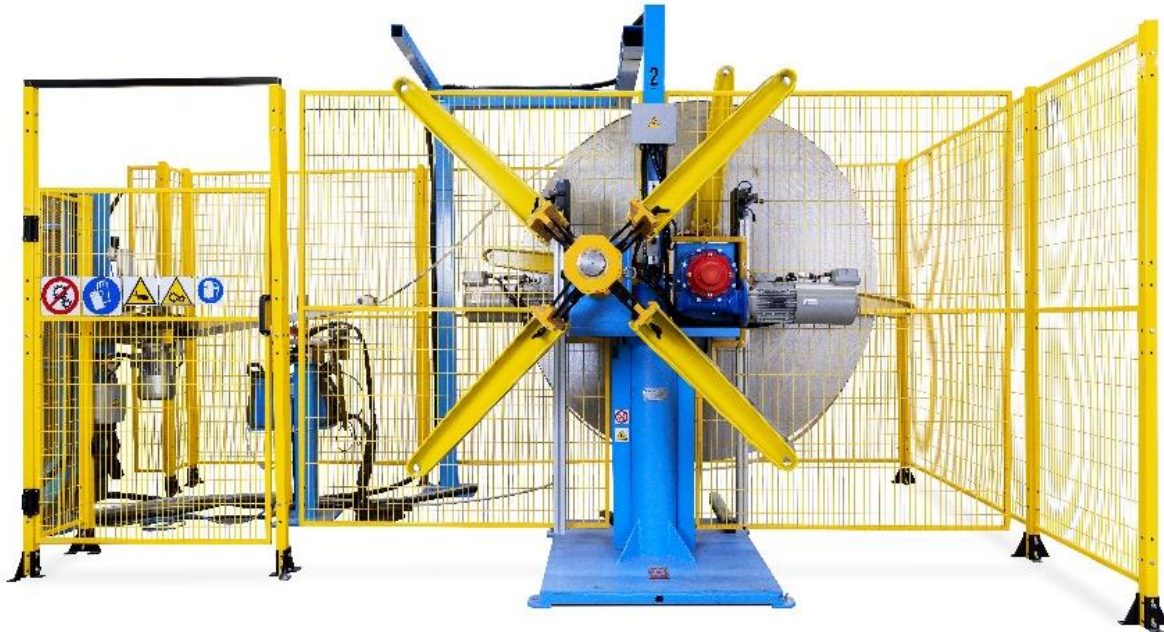


ADVANTAGES

- High production capacity.
- Double coil dereeler to minimize the downtime.
- Speed-torque setup for each motorized forming head for maximum flexibility.
- No contamination of lubricants.
- Quick setup and possibility to recall stored parameters.
- Process variables are stored in programs according to the type of product (code), such as:
 - Speed of each individual pair of rolls
 - Welding parameters
- Guarantee of good quality and control of the weld.
- Automatic management of the tube temperature during and after the heat treatment and when changing process parameters.
- Sealed TIG welding chamber with inert atmosphere.
- Inverter welder to guarantee the maximum speed and quality.
- No oxidation of the weld bead so no need for brushing or polishing.
- Weld monitoring camera installed to continuously monitor the position of the strip edges and the wear of the electrode (option available for automatic electrode positioning).
- Constancy of tube tension (pull) with automatic adjustment when changing working conditions
- Homogeneity and quality, meant as elongation and “brightness” of the tube after heat treatment.
- Possibility to produce tube either “as welded” or “heat-treated”, in straightened bars without the ends calibrated. When producing non-annealed tube (that is, “as welded”) the annealing sections are stopped.

**MACHINE CONFIGURATION AND OPTIONS**

DESCRIPTION	CODE	6-16 mm	10-28 mm
Double strip dereeler 200+200 kg	100/00.EA1000	✓	✓
Double strip dereeler 600+600 kg	100/00.EB1000	OPT	OPT
Double motorized strip dereeler 1200+1200 kg	100/00.EC1000	OPT	OPT
Vertical strip accumulator unit	100/00.FA1000	✓	✓
Pneumatic heavy duty strip cutter	100/00.FD1000		OPT
Forming table for the production of heat treated tube - diam. 6 - 16 mm	100/00.GC1000	✓	
Forming table for the production of heat treated tube - diam. 10 - 28 mm	100/00.GD1000		✓
TIG welding chamber	100/00.HA1000	✓	✓
TIG welding chamber - heavy duty version	100/00.HB1000	OPT	✓
Induction heat treatment unit	100/00.JA1000	✓	✓
Calibration and pre-straightening unit	100/00.KA1000	✓	✓
Rotating straightening unit	100/00.LC1000	✓	✓
Flying cut-off unit with score and break cutting system	100/00.NA1000	✓	✓
Flying cut-off unit with circular saw cutting system	100/00.NB1000	✓	✓
Flying cut-off unit with interchangeable cutting system - score and break + circular saw	100/00.ND1000	✓	✓
Off-loading unit for tube in bars (u-shape) - max length 6000 mm	100/00.PC1000	✓	✓
Extension table for the off-loading unit - 3000 mm	100/00.PC2000	OPT	OPT
Transfer with deburring unit for tube in bars cutted by circular saw	100/00.QA1000	OPT	OPT
Double recoiler unit - max coil OD 1200mm	100/00.RA1000	OPT	OPT
Double recoiler unit - max coil OD 1500mm	100/00.RB1000	OPT	OPT
Kit for additional coil width	100/00.RC1000	OPT	OPT
Kit for additional coil internal diameter	100/00.RD1000	OPT	OPT
Inline diameter measuring device - rotating version	100/00.MB1000	OPT	OPT
External unit to test the weld quality of stainless-steel tubes	100/00.SA1000	OPT	OPT
Unit to test tube in coils by means of pressure (under water) - max coil OD 1200 mm	100/00.TA1000	OPT	OPT
Oversized unit to test tube in coils by means of pressure (under water) - max coil OD 1500 mm	100/00.TB1000	OPT	OPT
Tube burst testing unit by pressure	100/00.UA1000	OPT	OPT

**DESCRIPTION OF THE MACHINE COMPONENTS****DOUBLE STRIP DE-REELER****Figure 1** Double strip de-reeler

De-reeler unit with the possibility to hold no.2 stainless-steel strip coils, to avoid stopping the machine for changing the coil.

	100/00.EA1000	100/00.EB1000	100/00.EC1000
Max. weight of the coil	200 + 200 Kg	600 + 600 Kg	1200 + 1200 Kg motorized
Max. outside diameter of the coil	1200 mm	1400 mm	1500 mm
Inside coil diameter	250-700 mm	280-750 mm	450-550 mm



STRIP JOINING BENCH



Figure 2 Strip joining bench

Strip joining bench with manual welder to join the two ends of strip. The joining process involves manual welding to avoid machine downtime when changing the coil.

Notes: the strip joining bench and the manual welder are included in the line supply.



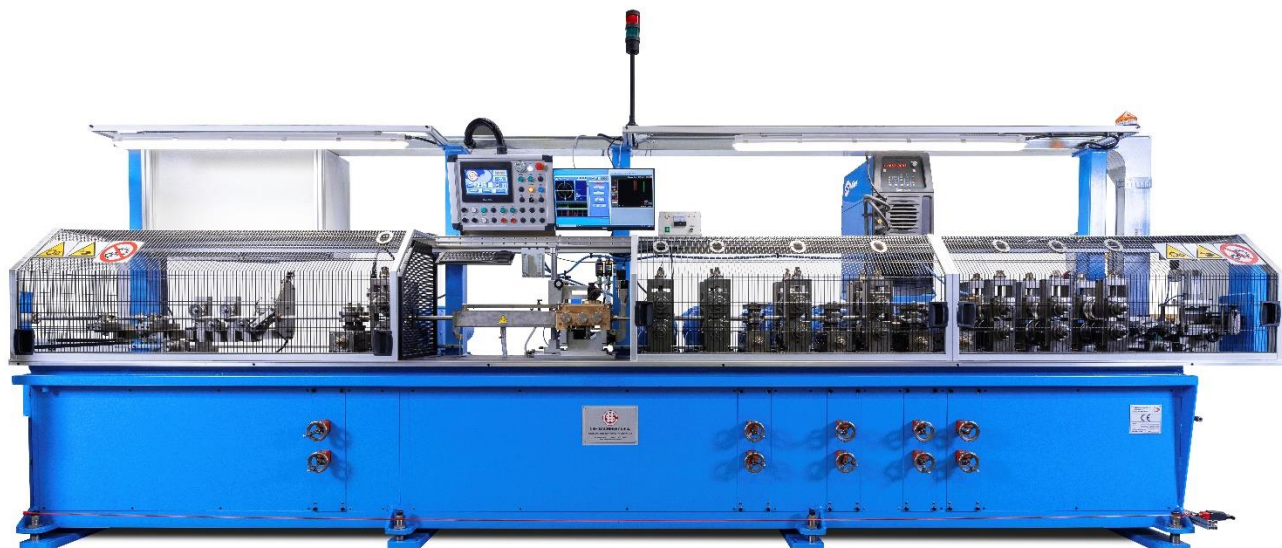
STRIP ACCUMULATOR



Figure 3 Vertical strip accumulator unit

Vertical strip accumulation system for seamless production.
This equipment allows to eliminate totally the line stops due to coil change.

Mod. 100/00.FA1000 - vertical strip accumulator unit

**TUBE FORMING AND WELDING UNIT****Figure 4** Tube forming and welding unit

Tube forming and welding unit complete with:

- Set of tool-steel rolls for one tube diameter
- Cooling water flow regulators, complete with flowmeters and safety devices for water flow regulation. Closed circuit refrigerating system for Cyclomatic coil and welding torch.
- Gas regulators with flowmeters for gas flow inside tubes (argon + 10% hydrogen) and outside tubes (argon).
- Cyclomatic system for the control of the position of the welding point.
- Video camera and monitor to display welding arc and profile in welding box.
- Eddy Current for the continuous test of the weld integrity.
- 500 Amp TIG-welder for continuous welding of tube, complete with welding torch.
- Closed welding chamber with 3 pair of rolls, complete with welding torch holder.
- Operator interface for programming, management, diagnostics and control of the production line

	Mod. 100/00.GC1000	Mod. 100/00.GD1000
Outer diameter range	Ø 6 - 16 mm	Ø 10 - 28 mm
Num. forming roller pairs	6 motorized rollers + 4 idle heads	7 motorized rollers + 4 idle heads
Tube max thickness	1 mm	1,5 mm



WELDING UNIT

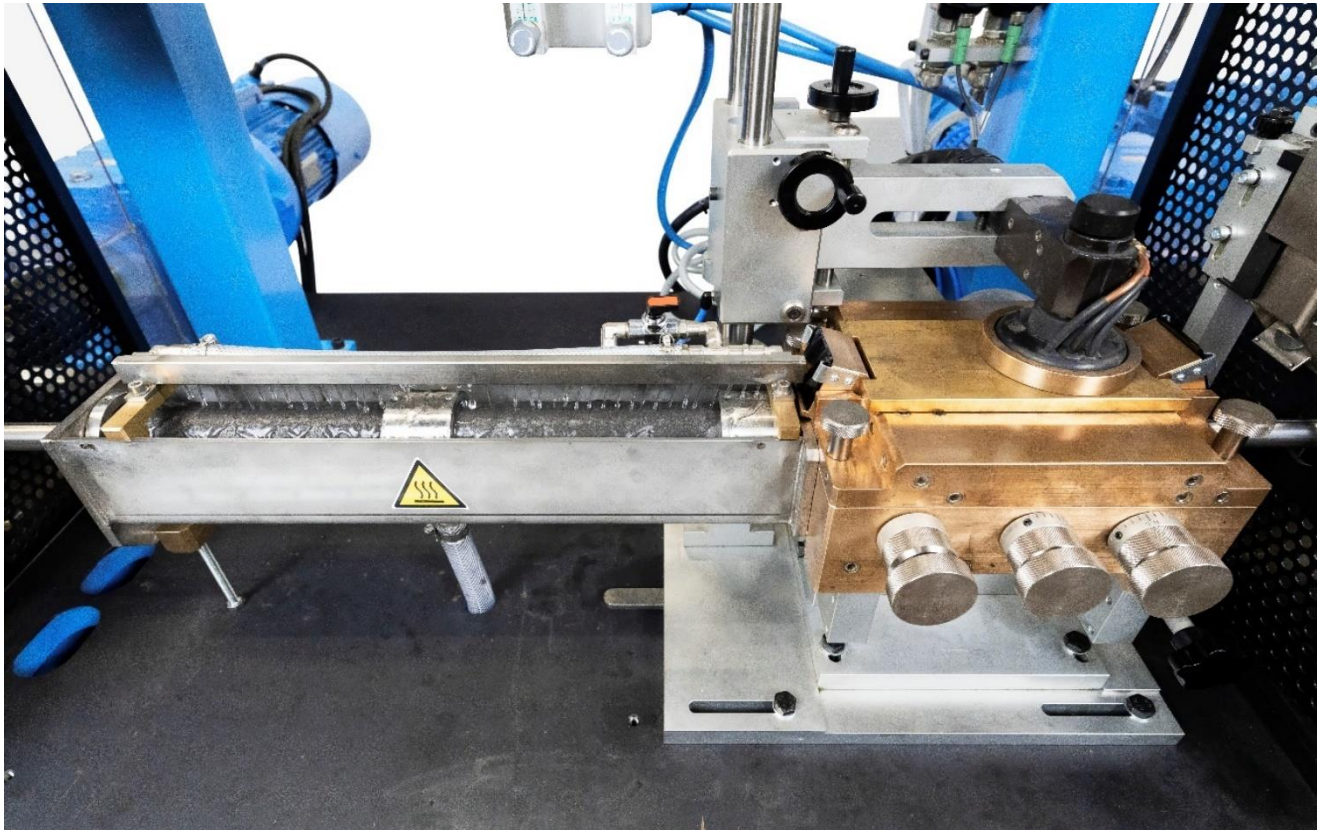


Figure 5 Welding unit

Standard	Heavy duty
Mod. 100/00.HA1000	Mod. 100/00.HB1000
• welding torch • welding box • camera and display for welding check	• welding torch • welding box (heavy duty) • camera and display for welding check

Note: The machine does not mix gases. You need to use premixed gases (for welding torch) which are then supplied to the relative gas flow regulator.



Figure 6 TIG welding monitor

The monitor displays the view from a special camera with adjustable optics to detect the welding arc (plasm). The camera is pointed inside our welding box which has an opening on the cover.

INDUCTION HEAT TREATMENT UNIT



Figure 7 Induction heat treatment unit complete with cooling tunnel

Mod. 100/00.JA1000

Induction furnace for heat treatment, complete with:

- heating area, complete with induction device;
- optical pyrometer to check tube temperature.
- tunnel for cooling the tube with water circulation, complete with valves for controlling gas regulation (nitrogen + hydrogen) and protections;
- HMI for the programming, diagnostics management and control of the heat treatment line.



Figure 8 Induction furnace for heat treatment



Figure 9 Optical pyrometer to check the tube temperature.

N.B.: Cooling of the induction furnace line

The induction furnace has a water recirculation cooling system.

The user needs to set up a system to process the high frequency water recirculation and the tube tunnel cooling heat exchanger.

It is recommended a closed recirculation refrigeration system.



CALIBRATION AND PRE-STRAIGHTENING UNIT

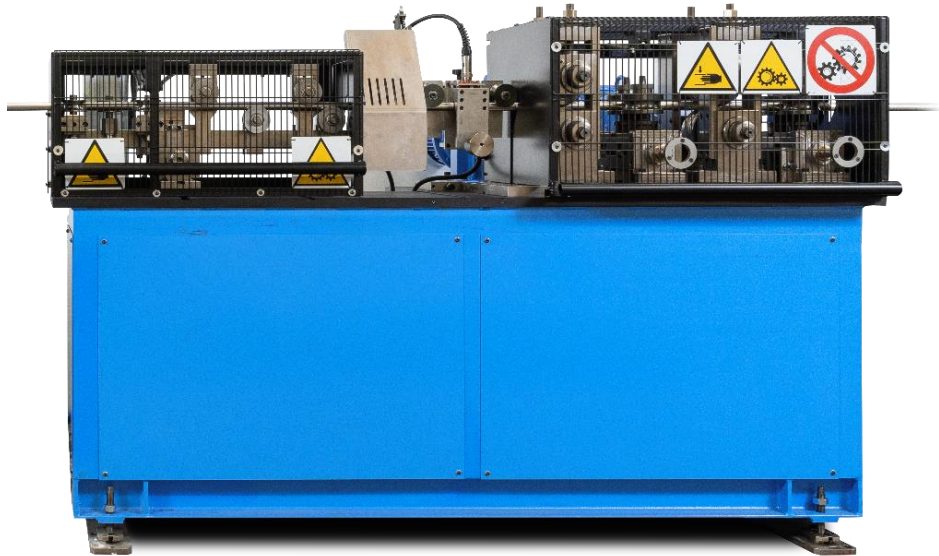


Figure 10 Calibration and pre straightening unit

Bench to collect tube at the exit of cooling section with:

- 2 pair of rolls, where the lower roll is driven by a motor with variable speed, managed by the PLC of the tube welding line
- 2 pairs of non-motorized rolls
- 1 Eddy-Current for the continuous test of the weld integrity
- 1 pre-straightening rollers

Mod. 100/00.KA1000 - calibration and pre-straightening unit



STRAIGHTENING UNIT

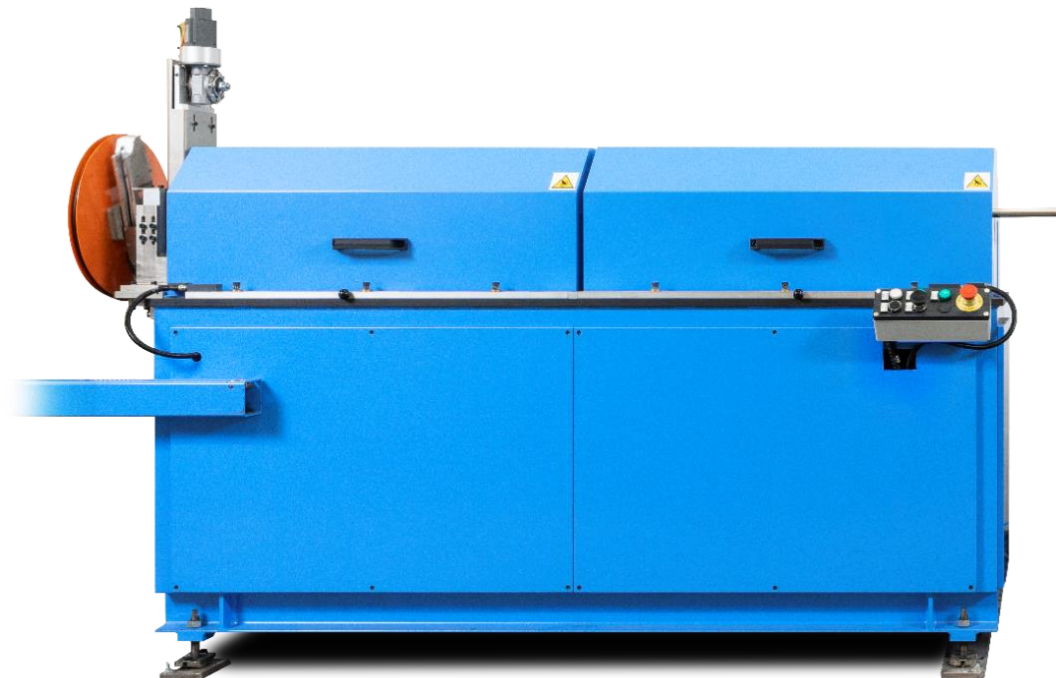


Figure 11 Straightening unit for heat treated line

After the calibration and the test of the weld integrity, the tube is guided inside the straightening unit.

The straightening process is necessary in order to correct any deformations produced during the heat treatment.

At the exit of the straightening unit is possible to control the outer diameter of the tube through a beam sensor (optional).

MOD. 100/00.LC1000

Rotating tube straightener unit for heat-treated lines.

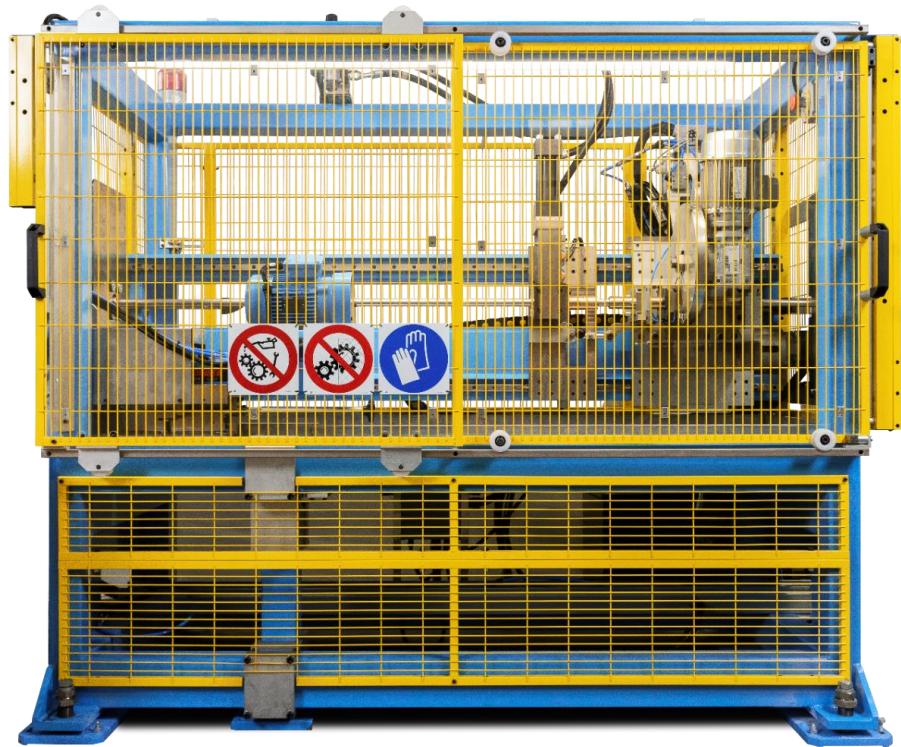
**FLYING CUT-OFF UNIT**

Figure 22 Flying cut off unit

Mod 100/00.NA1000**Flying cut-off unit with score and break cutting system**

It has been developed to eliminate all the problems which exist with the orbital cutting systems, which are conceptually similar but realized with scoring wheels. The cut, in fact, is not carried out by blades, which insist orthogonally on the wall of the tube, but is carried out through the combined action of:

- a scoring tooth (realized with three keen tooling) which removes progressively materials along a circular section of the cylindrical wall, reducing only the wall thickness, and of
- a clamp which breaks the segment of the tube.

The result is a cut that does not cause deformation of the tube itself at the cut edge. The cut operation will take place once the carriage has reached the speed of the tube. At that moment the pincer collet grubs onto the tube and the cutting knife starts moving into the tube while the cutting head is rotating. The cutting bit will penetrate the tube and when the set depth is reached the knife moves back while the "break" collet starts pulling the tube away from the cutter until the tube breaks (completing the action score and break). The tube is then discharged on the offload tray.

- Tube OD range: 6 – 22 mm (to be defined)
- Wall thickness range: 0,3 – 1,0 mm

**Mod 100/00.NB1000****Flying cut-off unit with circular saw cutting system**

The movement of the blade is done by a numerical axis with encoder, servo controller and brushless motor allowing full control of the cutting with reference to the tube speed. The cutting blade rotation is achieved with an asynchronous motor and the cutting movement is done pneumatically.

- Tube OD range: 6 – 28 mm
- Wall thickness range: 0,8 – 1,5 mm

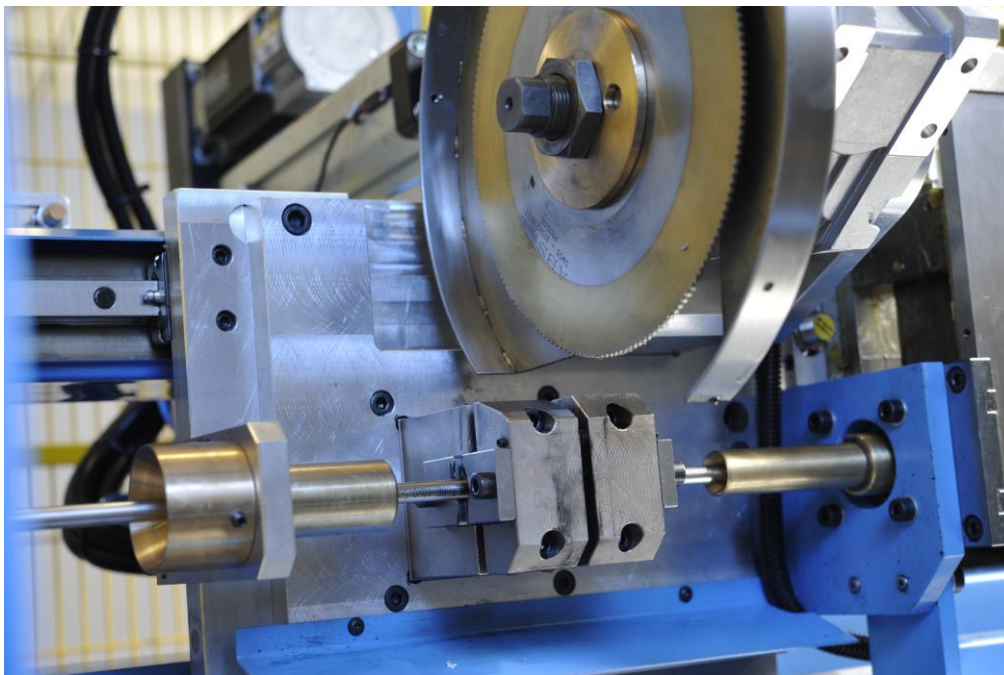


Figure 3 Flying cut-off unit with circular saw cutting system

Mod. 100/00.ND1000**Flying cut-off unit with interchangeable cutting system: score and break + circular saw**

This option includes both the score & break cutting system + circular saw cutting system. This means that the cutting unit can be interchanged between the two, depending on the maximum diameter and thickness of the tube that needs to be produced.

Score & break cutting system:

- Tube OD range: 6 – 22 mm
- Wall thickness range: 0,4 – 0,8 mm

Circular saw cutting system:

- Tube OD range: 6 – 28 mm
- Wall thickness range: 0,8 – 1,5 mm

It is possible to mount on the same machine different cutting systems or a combination of them as options.



OFF-LOADING UNIT FOR TUBE IN BARS



Figure 44 Off-loading unit for tube in bars (the off-loading in the image includes the deburring units)

Sorting/unloading tray to be used when producing straight bars. This tray is placed after the cutting device and can rotate to one side to off-load the good pieces, or to the opposite side to offload eventual rejects.

Mod. 100/00.PC1000

Off-loading unit for tube in bars for heat-treated tube.
Max. length: 6000 mm

Mod. 100/00.PC2000

Extension table for the off-loading unit.
Length: 3000 mm



OPTIONS

PNEUMATIC HEAVY-DUTY STRIP CUTTER

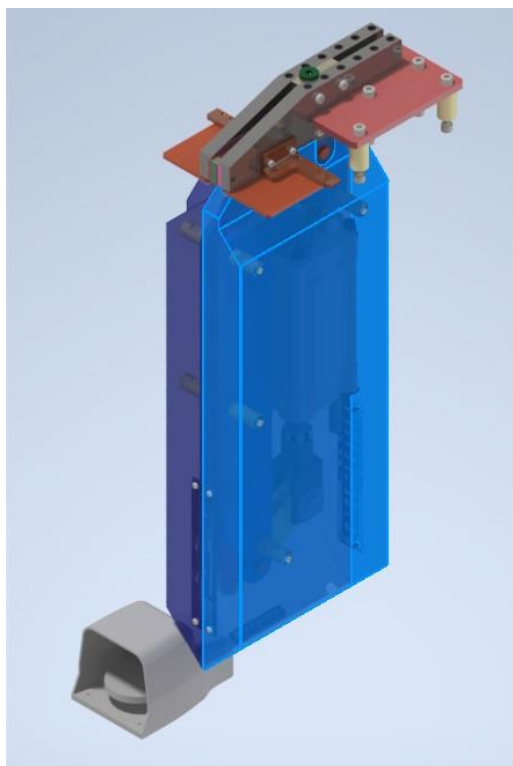


Figure 55 Pneumatic heavy duty strip cutter

The pneumatic heavy duty strip cutter is a pneumatic device that can be integrated in line and is recommended for the production of large diameter and thickness tube.

Mod. 100/00.FD1000 – Pneumatic heavy duty strip cutter

Strip max. width: 100 mm

Strip max. thickness: 2 mm



INLINE DIAMETER MEASURING DEVICE

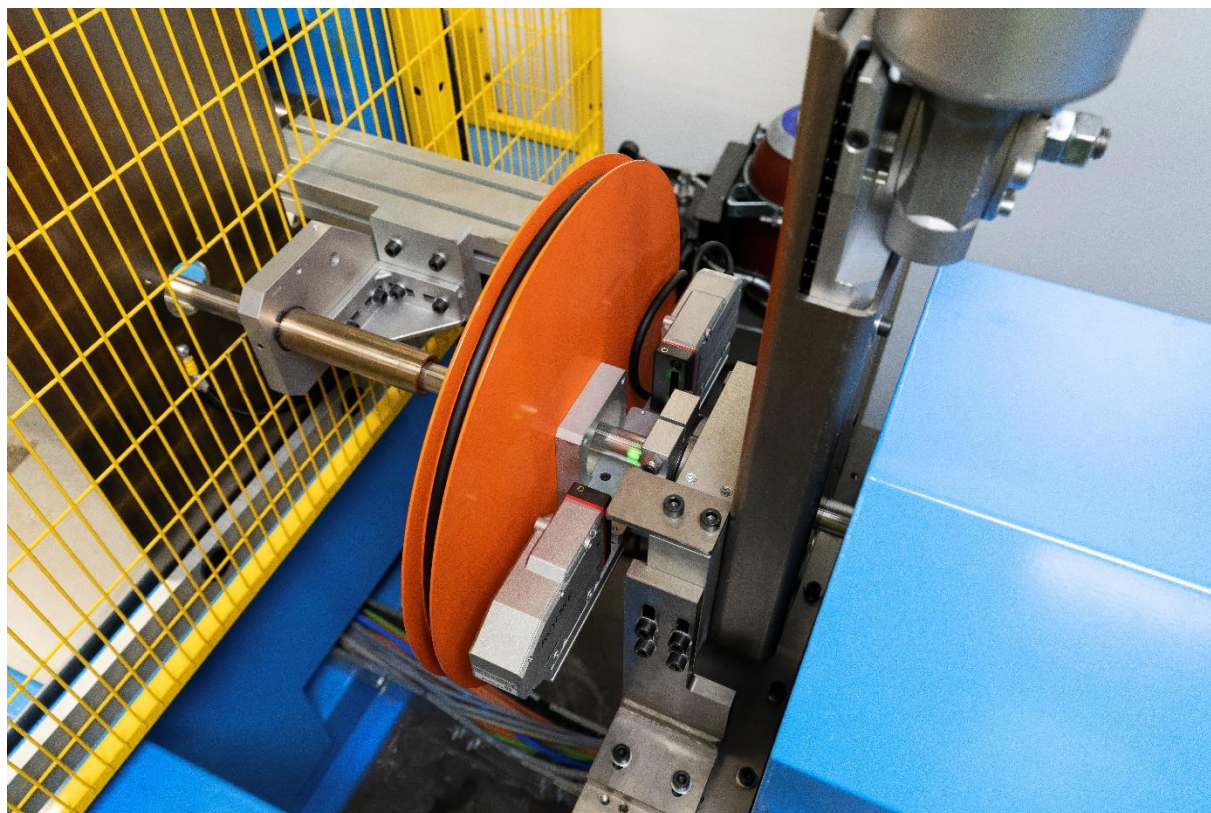


Figure 66 Inline diameter measuring device

Device for the inline tube diameter measuring, complete with:

- ccd beam sensor
- link interface (dp)
- fixing flange
- device to rotate measuring
- adjustment parts

Mod. 100/00.MB1000

Inline diameter measuring device (rotating version).



DEBURRING UNIT

Unit to deburr the ends of the cut tube by brushing. A set of rotating brushes removes the small burrs created during the cutting with a rotating blade, leaving a square cut at the ends without burrs.

Air is blasted inside the tube to remove any pieces of metal due to the cutting action of the blade. This air blast cannot remove very small particles that are clinged to the inner diameter of the tube by electrostatic force or by any residuals left by the lubricant, when used.

Mod. 100/00.QA1000

Transfer with deburring units for tubes in bars cut by circular saw.

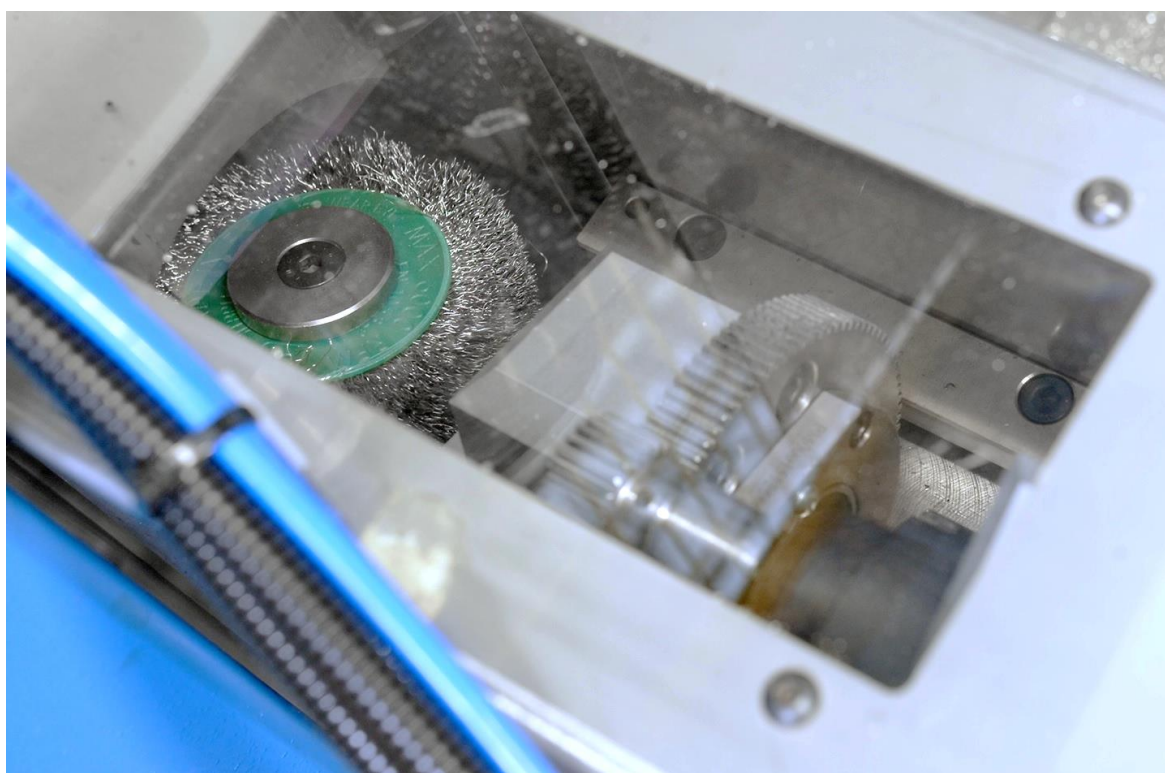


Figure 77: Deburring unit for tube ends



DOUBLE RECOILER UNIT



Figure 88 Double recoiler unit

Device made to recoil annealed stainless steel tube. This device is designed to be put in line with the tube mills with annealing, so that the tube being welded can be recoiled in ordered layers.

The tube is laid from right to left by a controlled arm. The tightness and ordered layering is ensured by setting the appropriate torque and speed for a particular tube being produced on the machine.

The recoilers have two coiling drums so that the machine does not have to stop each time a coil is finished.

Once a coil is complete the operator moves the tube end onto the other coiling drum and, once the recoiling starts, he can focus attention to the other to tighten it with cable ties and remove it from the drum.

OPERATION

Capability

The recoiling operation is related to the tube being able to be “laid” on the drum without crinkling, which is a function of the stiffness of the tube for any particular wall thickness. For a particular wall thickness the smaller the tube, the stiffer it is and the easier to wind around the drum.

**Ovality**

The thinner the tube the more accentuated will be ovality when you decoil. This is also more noticeable on the inner layers.

Hardness

Stainless steel harden with cold work and therefore it is normal that the inner layers will be slightly harder than the outer layers. It should be noted that machines with drums of 600mm will decoil harder tube and more oval than those with drums of 850mm. If hardness is a problem, then 850mm drums should be used, with the difference that less tube can be recoiled.

THE DEVICE IS FORMED BY:

- 2 recoiling drums complete with coil release system
- 2 N.C arms which lay the side by side from left to right.
- 2 devices to block the ends of the tube at start of the recoiling process.
- Integrated control system.

TECHNICAL CHARACTERISTICS

		Mod. 100/00.RA1000	Mod. 100/00.RB1000
max coil width	mm	330	400
min coil internal diameter	mm	600	600
max coil external diameter	mm	1200	1500

OPTIONAL**Mod. 100/00.RC1000**

Kit for additional coil width

Mod. 100/00.RD1000

Kit for additional coil internal diameter

**TUBE TESTING UNITS****EXTERNAL UNIT TO TEST THE WELD QUALITY OF TUBES**

Figure 199 External unit to test the weld quality of stainless-steel tubes

Unit to test the weld quality of stainless-steel tubes, complete for one tube diameter, with:

- support bench, complete with drawers
- oil-air hydraulic press, complete with punch to enlarge the tube section (60°), clamp to hold the tube sample and pressure regulator.
- circular saw for the cutting to length of the sample to be tested
- unit for the tube inside/outside deburring

TECHNICAL CHARACTERISTICS

Pneumatic supply	: bar	6
Power supply	: V	to be defined
Power installed	: KW	1,3

Mod. 100/00.SA1000

For tube diameter range: Ø 6 to 25 mm.



UNIT TO TEST (UNDER WATER) TUBE IN COILS BY MEANS OF PRESSURE

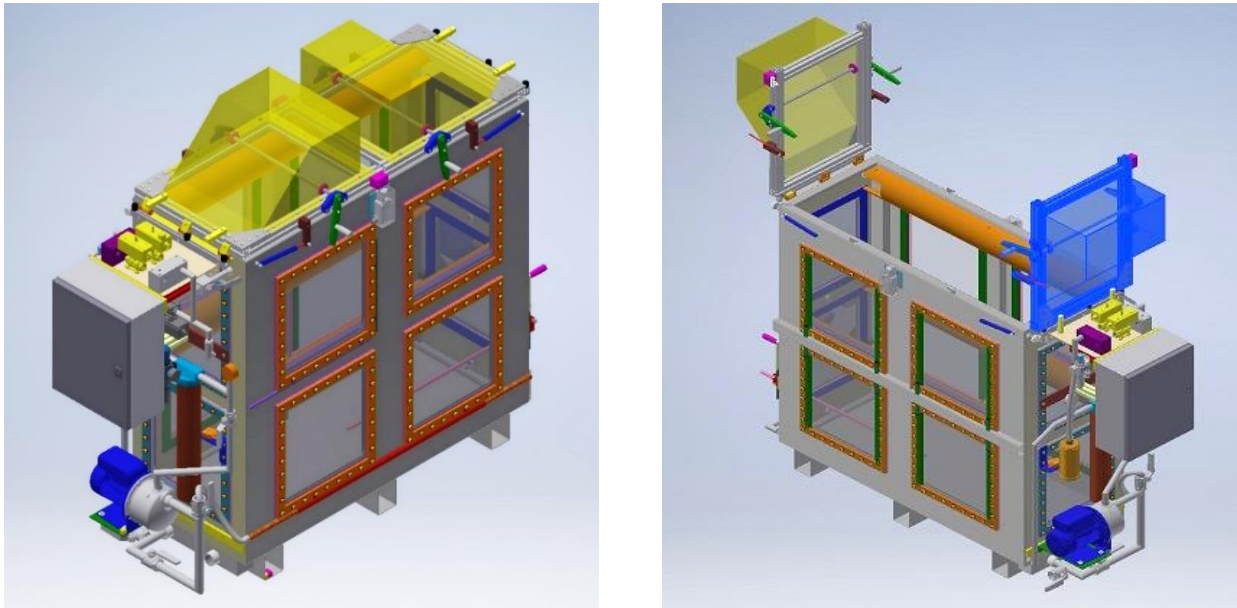


Figure 20 Testing unit

Unit to test tube in coils under water by means of pressure up to 60 bar, complete with:

- hydraulic and pneumatic circuitry for feeding, discharging and filtering of water
- vertical test tank
- electropneumatic safety system to manage load and unload pressure

Devices not included with the machine:

- loading/unloading crane
- compressor

Mod. 100/00.TA1000

Max. tube coil outer diameter: 1200 mm

Mod. 100/00.TB1000

Max. tube coil outer diameter: 1500 mm

TUBE BURST TESTING UNIT BY PRESSURE



Figure 21 Tube burst testing unit by pressure

Tube section testing unit through deformation by hydraulic means, complete with:

- support bench
- cutting die holding unit
- tube deformation holding matrix
- connection units between matrix and tube section
- hydraulic power unit with high pressure group (1000 bar) with proportional regulation

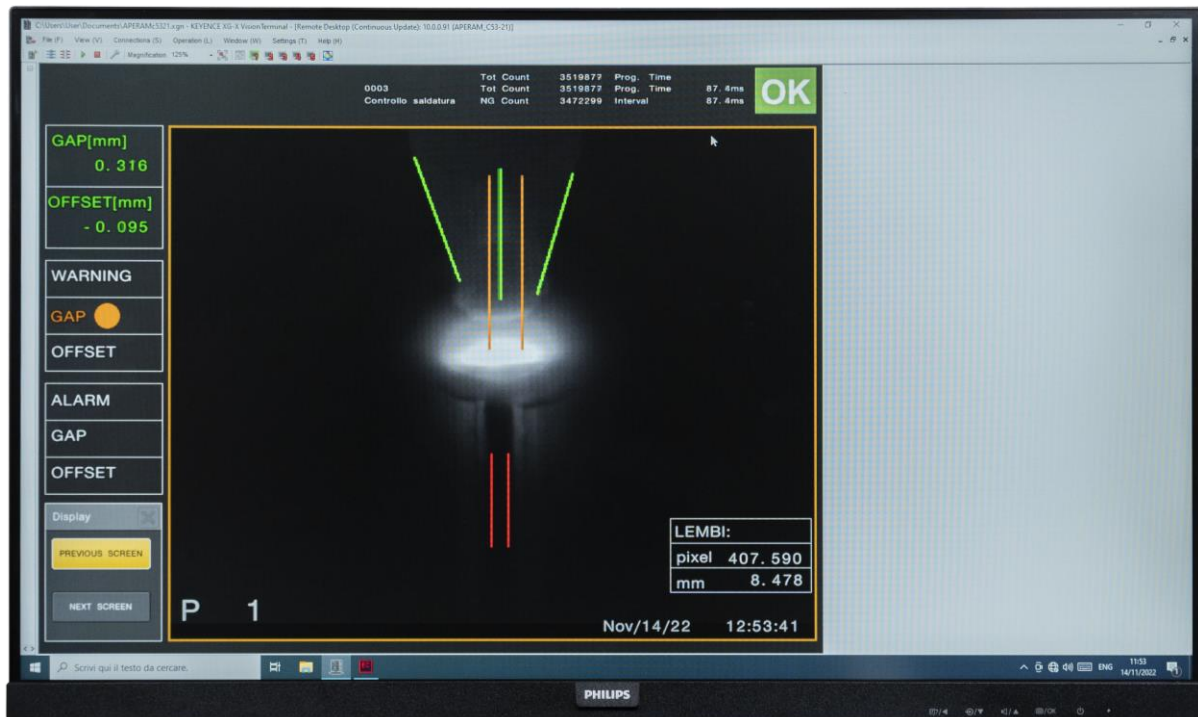
Machine ready for one diameter/thickness.

Mod. 100/00.UA1000

Tube burst testing unit by pressure.



SMART CAMERA



The device uses a special camera with adjustable optics to detect the welding arc (plasm). The camera is pointed inside our welding box which has an opening on the cover.

The camera is capable to detect also the edge of the strip to be welded. An electronic device processes images from the camera and calculates the theoretical axis.

This axis should be in the middle of the edges. The electronic device compares strip edge position and two threshold values related to electrode axis. The system generates two digital alarm signals.

It is possible to adjust all the settings and to visualize the images through a normal web browser. The system is provided complete with:

- Camera
- Optics for camera (75mm)
- Camera micro-controller unit
- Micro-controller unit power pack
- Mechanical support frame for camera
- LCD 17" monitor
- Monitor support
- Connection cables

**TECHNICAL FEATURES**

		STANDARD	HEAVY DUTY
OD tube range	mm	6 - 16	10 - 28
Max. tube length	mm	to be defined	
Tube thickness range	mm	0,4 - 1,5	

ALLOYS

- AISI 304 (EN 1.4301)
- AISI 304L (EN 1.4307)
- AISI 321 (EN 1.4541)
- AISI 316L (EN 1.4404)
- AISI 444 (EN 1.4521)
- AISI 316S (EN 1.4435)
- AISI 316Ti (EN 1.4571)
- AISI 310S (EN 1.4845)
- AISI 309 (EN 1.4828)
- ALLOY 800 (EN 1.4876)
- ALLOY 840 (EN 1.4847)
- ALLOY 825 (EN 2.4858)
- ALLOY 600 (EN 2.4816)
- ALLOY 601 (EN 2.4851)

TYPE OF PRODUCTION

PRODUCTION OF TUBE IN BARS			STANDARD	HEAVY DUTY
min-max tube OD		mm	6 - 16	10 - 28
min-max tube wall thickness		mm	0,4 - 1	0,4 - 1,5
max tube length		mm	to be defined	
tolerance on length	from 300 to 3000 mm	mm	± 1	
	from 30001 to 4300 mm	mm	± 1,5	
	from 4301 to 6000 mm	mm	± 5	
	from 6001 to 10000 mm	mm	± 10	
	from 10001 to 14000 mm	mm	± 15	
OD tube tolerance UNI EN 10217-7	OD 6 - 10 mm	mm	± 0,075 mm	
	OD 10,1 - 15 mm	mm	± 0,080 mm	
	OD 15,1 - 25 mm	mm	± 0,100 mm	

PRODUCTION OF TUBE IN COILS		STANDARD	HEAVY DUTY
OD x Wall Thickness feasibility	mm	see tables p.27	
max length	m	from 100 to 400	
max coil width	mm	330	400
min coil internal diameter	mm	600	600
max coil external diameter	mm	1200	1500



Range Outer Diameter x Wall Thickness for heavy duty model (austenitic alloy)

	thickness mm	0,4	0,5	0,6	0,7	0,8	0,9	1	1,1	1,2	1,3	1,4	1,5
diameter mm													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													

	feasibility with normal difficult
	feasibility with important difficult
	NO feasibility

Tube recoiler feasibility for heavy duty

	thickness mm	0,4	0,5	0,6	0,7	0,8	0,9	1	1,1	1,2	1,3	1,4	1,5
diameter mm													
10		620	620	620	620	620	620	620	620	620			
11		620	620	620	620	620	620	620	620	620			
12		620	620	620	620	620	620	640	640	640			
13			620	620	620	620	620	640	640	640			
14			620	620	620	620	620	640	640	640	640		
15			640	640	640	640	640	640	640	640	640		
16			640	640	640	640	640	640	640	640	640	640	
17			850	850	640	640	640	640	640	640	640	640	
18			850	850	640	640	640	640	640	640	640	640	640
19			850	850	850	850	850	850	850	850	850	850	850
20			850	850	850	850	850	850	850	850	850	850	850
21				850	850	850	850	850	850	850	850	850	850
22				850	850	850	850	850	850	850	850	850	850
23					850	850	850	850	850	850	850	850	850
24					850	850	850	850	850	850	850	850	850
25					850	850	850	850	850	850	850	850	850

xxx	feasibility with normal difficult on xxx internal coil diameter
xxx	feasibility with important difficult on xxx internal coil diameter
	NO feasibility

**UTILITIES****WELDING UNIT**

Consumption of cooling water	l/min	5
Gas mixture on the outside of the tube during welding (torch) Argon + 10% Hydrogen	Nm ³ /h	0,9
Gas inside the tube during welding Argon	Nm ³ /h	0,5

Note: chiller, materials and equipment for the gas supply Ar/H₂ are not included and must be installed by the customer.

ANNEALING UNIT

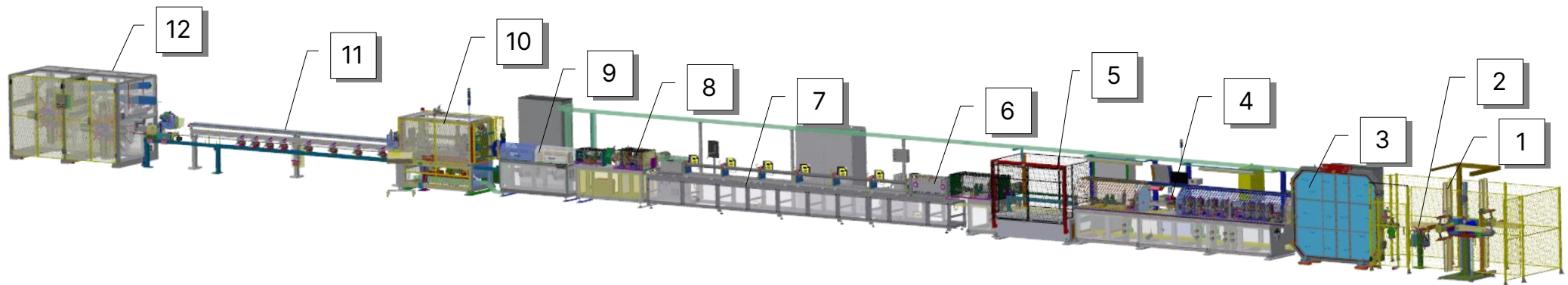
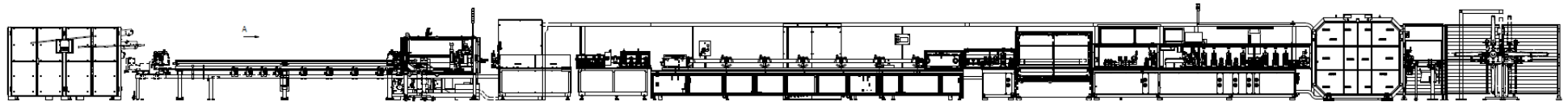
Consumption of water (cooling)	l/min	130
Gas mixture inside the induction furnace Nitrogen + 2% Hydrogen	Nm ³ /h	10-12
Power generator	KW	100

Note: the units for the gas supply, the cooling water and their installation are not included with the machine and should be installed separately by the customer.

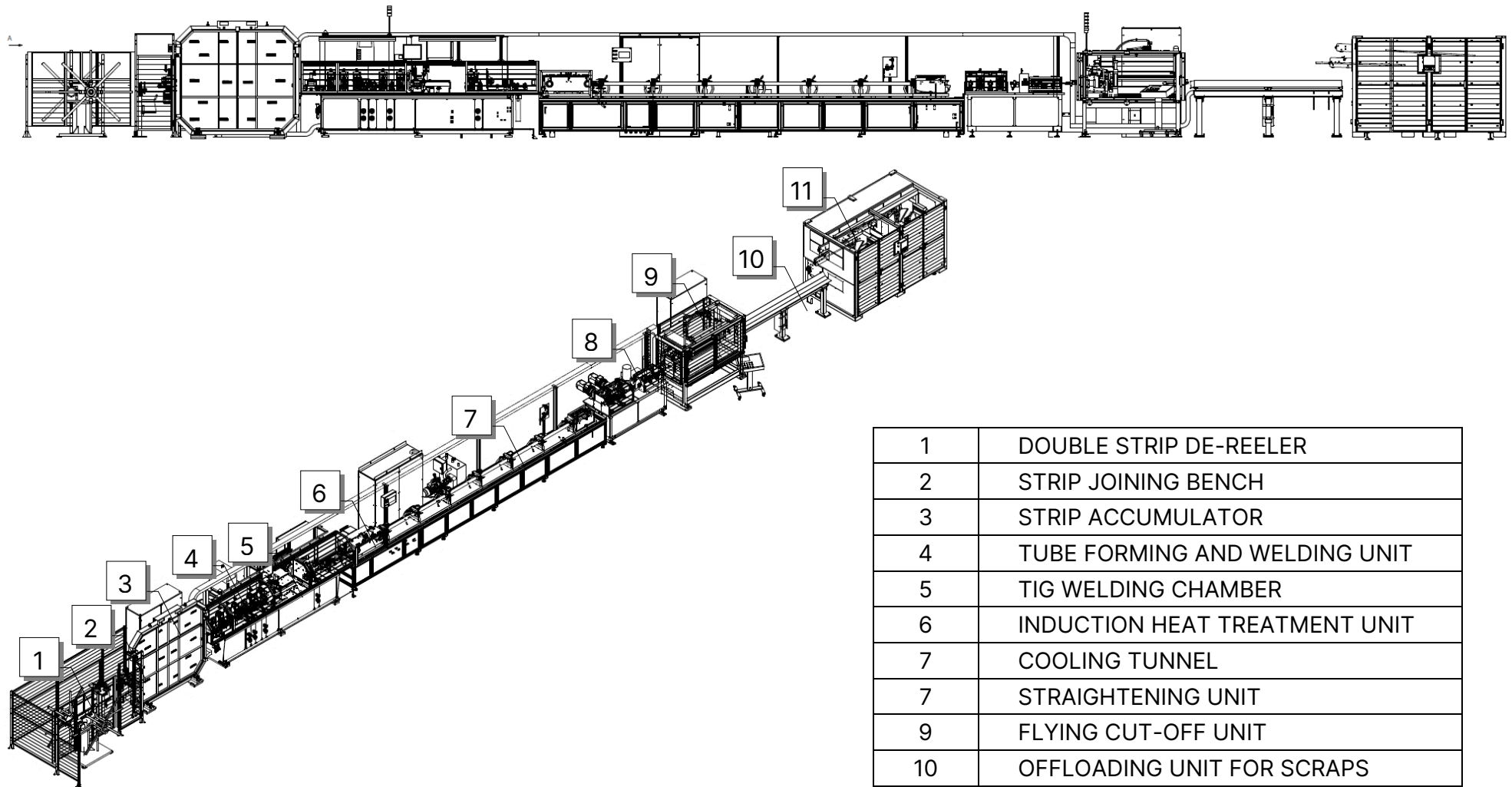


LAYOUT

HEAT-TREATED LINE FOR THE PRODUCTION OF TUBE IN BARS AND COILS



1	DOUBLE STRIP DE-REELER	7	COOLING TUNNEL
2	STRIP JOINING BENCH	8	CALIBRATION AND PRE-STRAIGHTENING UNIT
3	STRIP ACCUMULATOR	9	STRAIGHTENING UNIT
4	TUBE FORMING AND WELDING UNIT	10	FLYING CUT-OFF UNIT
5	TIG WELDING CHAMBER	11	OFFLOADING WITH DEBURRING UNIT
6	INDUCTION HEAT-TREATMENT UNIT	12	DOUBLE RECOILER UNIT

HEAT-TREATED LINE FOR THE PRODUCTION OF TUBE IN COILS


1	DOUBLE STRIP DE-REELER
2	STRIP JOINING BENCH
3	STRIP ACCUMULATOR
4	TUBE FORMING AND WELDING UNIT
5	TIG WELDING CHAMBER
6	INDUCTION HEAT TREATMENT UNIT
7	COOLING TUNNEL
7	STRAIGHTENING UNIT
9	FLYING CUT-OFF UNIT
10	OFFLOADING UNIT FOR SCRAPS
11	DOUBLE RECOILER UNIT