

MA Series

CNC working centres and special machines designed for the manufacture of the tube bundle heat exchangers

Production



Leader in the industry since 1961

At the end of the 1950s, Franco Agostino seized the opportunity to learn the art of manufacturing tube expanders which Albert Otto, an experienced German manufacturer, passed on to him. Then, thanks to his indomitable spirit, his intuition and the help of his wife Luisa, Mr Agostino founded a small Italian factory which a few years later would become Maus Italia. In 1972 Maus Italia inaugurated its new headquarters and laid the foundations for its development. Mr Agostino entrusted the enterprise to his son Stefano, a mechanical engineer, who has been successfully devoting all his energy to bringing Maus Italia to the top of the European and world market in the industry since 1976.

Agostino has invested heavily in R&D, thus broadening his production from tube expanders to countless tools and complex machinery, introducing many new lines over time and collecting roughly thirty patents. In 1986 he added orbital welding machines, which in 2016 were entirely produced by Maus under the Giotto line. In 2015 Maus was further expanded on an area of 35,000 sq m - 7,000 of which are indoors. In 2017 the company passed from Sas to Spa.

2016 welcomed the third generation of Maus Italia Spa to ensure new managerial momentum: it was the turn of Anna Agostino, Stefano's daughter, who graduated from the Politecnico of Milan in both Mechanical and Management Engineering. As determined as her father and grandfather, she brought about the idea of Industry 4.0 whilst focusing on cost optimisation and technological innovation in general.



Experience, passion and technology

Maus Italia is a world-leading manufacturer of tools and machines required for the production and maintenance of tube bundle heat exchangers

Our core business is the design, manufacture and sale of tools and machines for the production and maintenance of heat exchangers, condensers, refrigerators and boilers in chemical plants, oil refineries and power plants.

Our aim is to accept the challenges stemming from the market to give impetus to in-house research and offer our customers increasingly specialised, high-tech machinery and tools.

Quality, Safety and Environment

Research, quality and safety are the watchwords of Maus Italia Spa.

Since 1995 Maus Italia Spa has been authorised to display the CE mark in line with UNI EN ISO 9001. Since then, the company has taken quality and safety standards to heart, achieving OHSAS 18001 Management System Certification in 2010.

The ISO 9001 Quality Management System is the internationally recognised reference standard for Quality management. This is particularly relevant for a company aiming to both meet the need to increase the effectiveness and efficiency of internal processes and to face the growing competitiveness on the market by improving its customer satisfaction and loyalty.

At present, Maus Italia Spa holds ISO 9001 (Quality System Certification), ISO 14001 (Management System Certification) and ISO 45001 (Safety System Certification).



Maus Italia in the world

In addition to the 63 people working at its headquarters, Maus Italia has a worldwide sales network with distributors and agents in more than 80 countries. We interact with them on a daily basis to best meet our end customers' needs and support them in any urgent matter they might have.

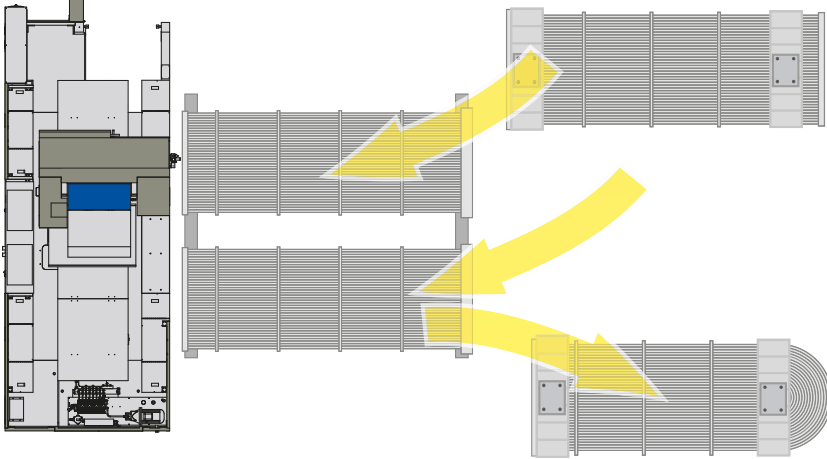


Layout of the assembly departments of the tube bundle including the MA series working centres

MA-2501

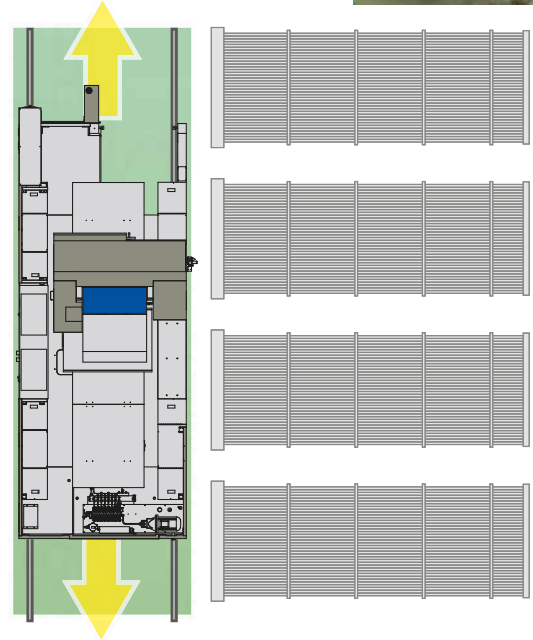
1 Fixed station automatic process

Fixed station layout where the medium-sized tube sheets are handled in order to position them in front of the machine which will only perform the precision positioning.



2 Mobile station automatic process

Mobile station layout for a better process planning with the MA-2501 placed on the medium-sized exchangers line in serial productions.

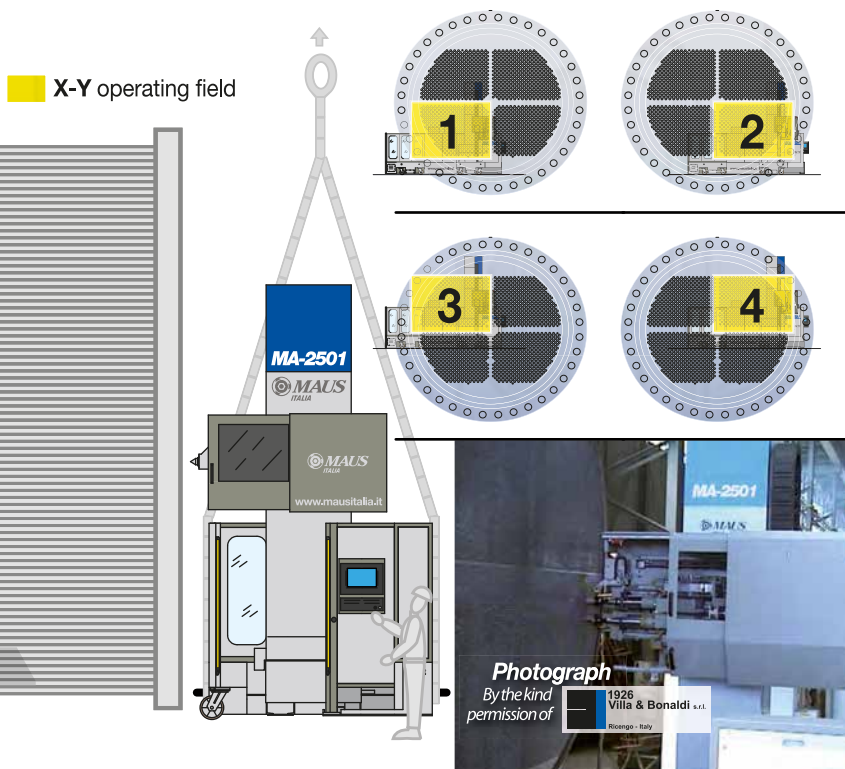


3 Multiple positioning automatic process with machine handling

Multiple positioning layout to work on large exchangers $\varnothing > 2500$ mm (100") difficult to handle.

In this case, the gantry crane positions the MA-2501 in front of the tube sheet for placement 1.

The following fast and simple placements 2 3 4 will allow to complete the process of the whole tube sheet.

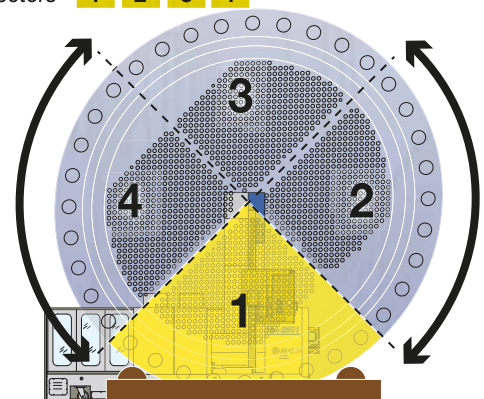


4 Multiple positioning automatic process with tube sheet rotation

Multiple positioning layout to work on large exchangers $\varnothing > 2500$ mm (100") difficult to handle.

In this case, the gantry crane positions the MA-2501 in front of the tube sheet.

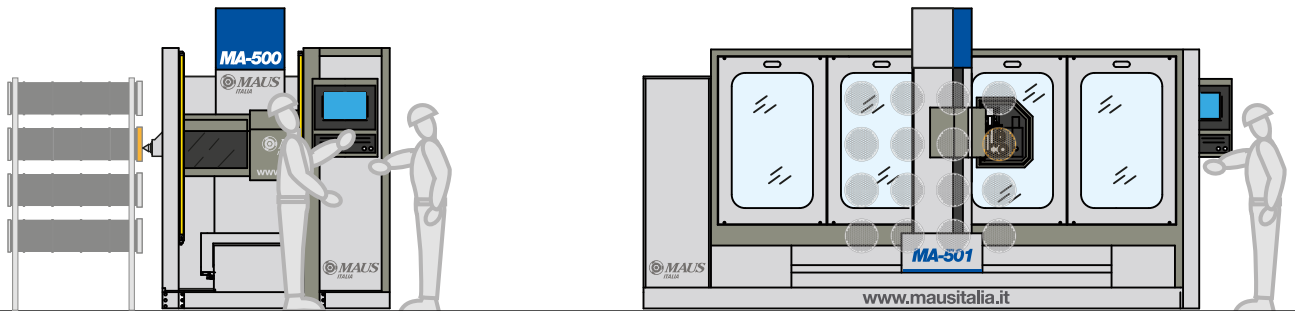
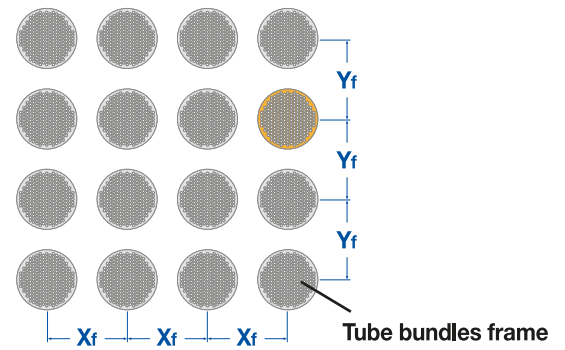
The positioning is achieved by rotating the tube sheet positioned on rollers and the processes are organized by sectors 1 2 3 4



MA-500

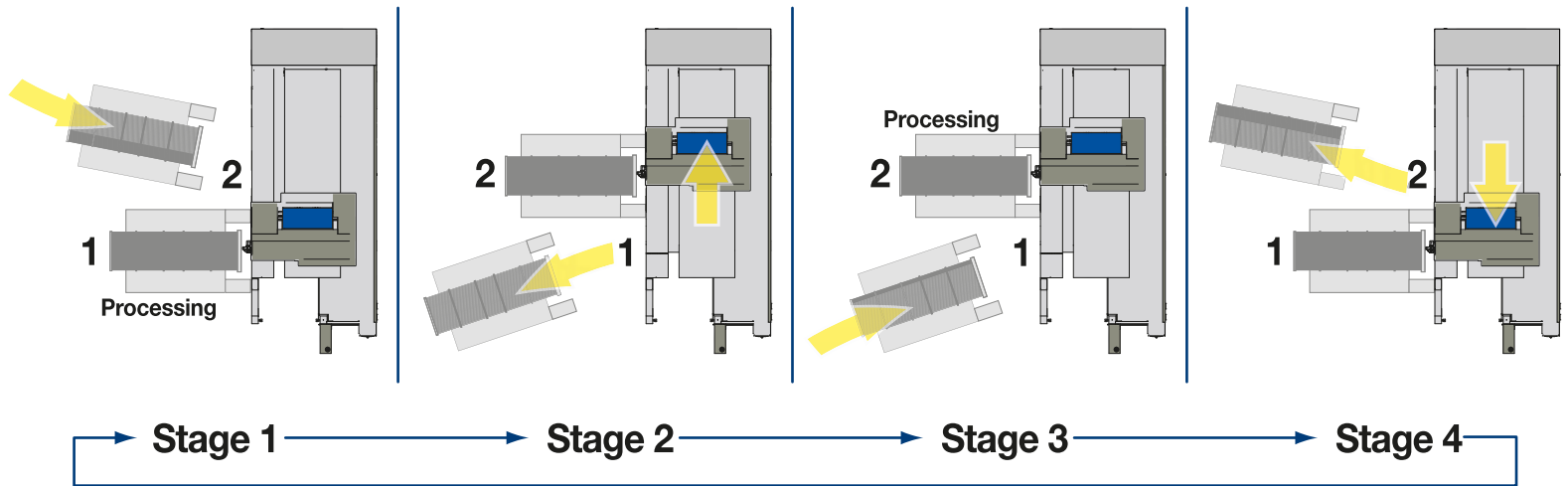
5 Automatic process with tube bundles multiple loader

Layout of process with **tube bundles multiple loader** to optimize the process in the serial production of **small tube sheet heat exchangers**.



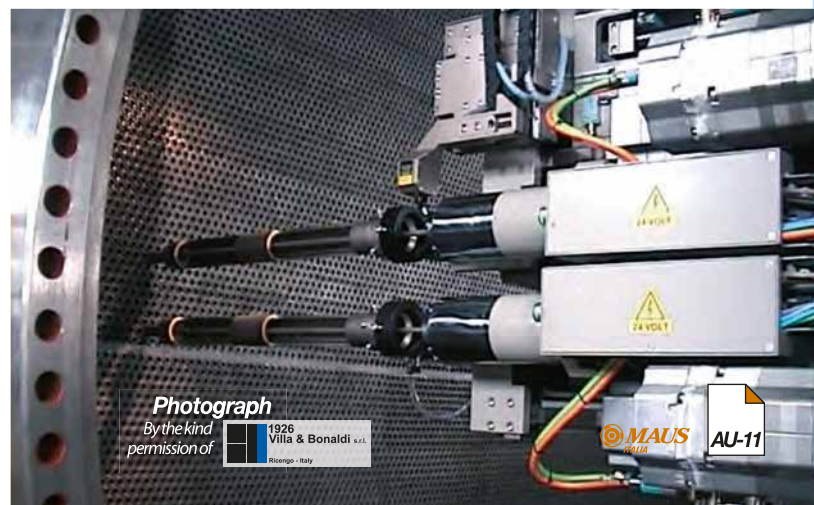
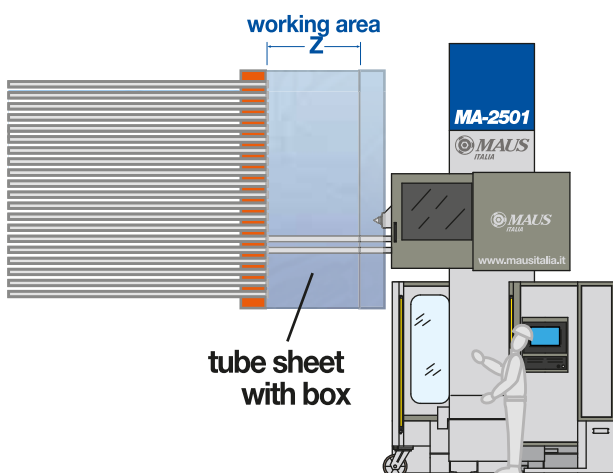
6 Pendulum process with trolleys

Pendulum process layout with trolleys for small exchangers in which the continuous positioning in front of the machine **eliminates the load/unload downtimes**, remarkably increasing the production.



7 In-depth process in the presence of tube sheet with box

MA-2501



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Riccione - Italy

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Automated processes overview



Rolling

The automated rolling cycle achieves **levels of productivity and quality incomparable** to those that might be reached with traditional systems.

Welding

The **TIG automatic orbital** welding is the high quality technological process for the tube-to-tubesheet jointing that our customers have been waiting for years.

This is an extraordinary match of software and technical solutions that guarantees a **precision result as well as unique quality and repeatability.**

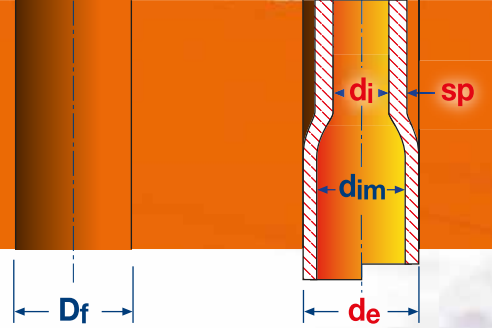
Facing

The automatic facing system enables to trim the tube ends in a **fast and precise** manner.

Grooving

Automatic execution of two small grooves in the holes of the tube sheets with **extraordinarily competitive production capacity.**





Rolling

The tube expansion is a **cold mechanical deformation process** which allows to obtain a **tight coupling** between **tube** and **tube sheet**.

This process is obtained by lengthening the **tube** and reducing the wall gauge against the surface of the hole in the tube sheet (*properly prepared*) using a special tool: the tube expander.

How does it happen

In brief, we can say that the **tube** material is cold deformed until it exceeds the yield point entering the field of **plastic deformation**, while the tube sheet material remains in the field of **elastic deformation**.

For this reason, it is *recommended* to use a material with a higher yield point for the tube sheet than the tube material.

How to calculate it

One formula to calculate the indicative theoretical value of the expanded tube inner diameter **dim** is as follows:

$$dim = di + (Df - de) + [2 \times (2\% \div 12\%) \times sp]$$

The rolling may be defined as **light** or **strong** according to the percentage of tube gauge reduction.

- **light** = 2% ÷ 6%
- **strong** = 7% ÷ 12%

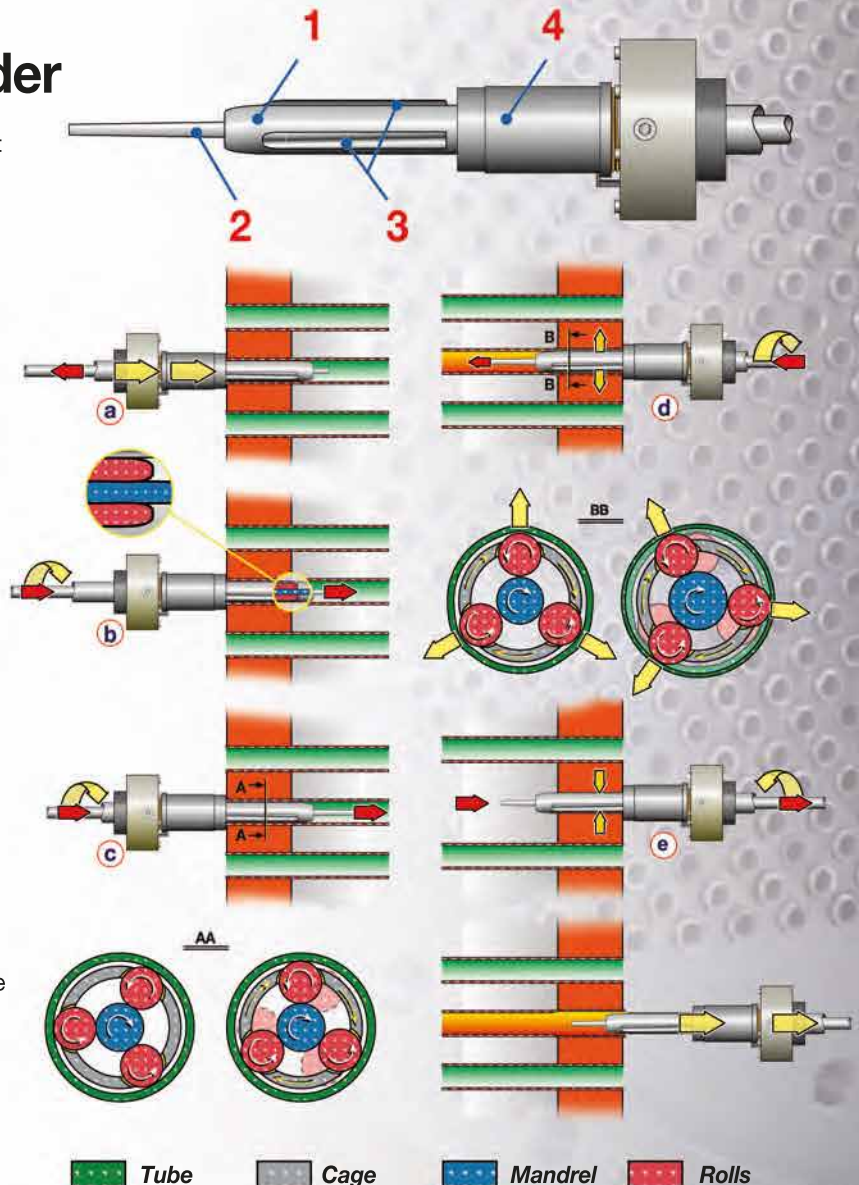
The technicians' experience and the preliminary tests performed on mock-ups are core elements for a reliable production.

The **theoretical value D_{im}** (internal expanded Ø) shall be compared to the maximum **value empirically measured** after the trial expansions until the desired reduction values of the tube wall gauge are reached.

The automatic tube expander

The tube expander is a tool made of alloy steels which underwent a heat treatment with wear and fatigue resistance features. It is made up of four main parts:

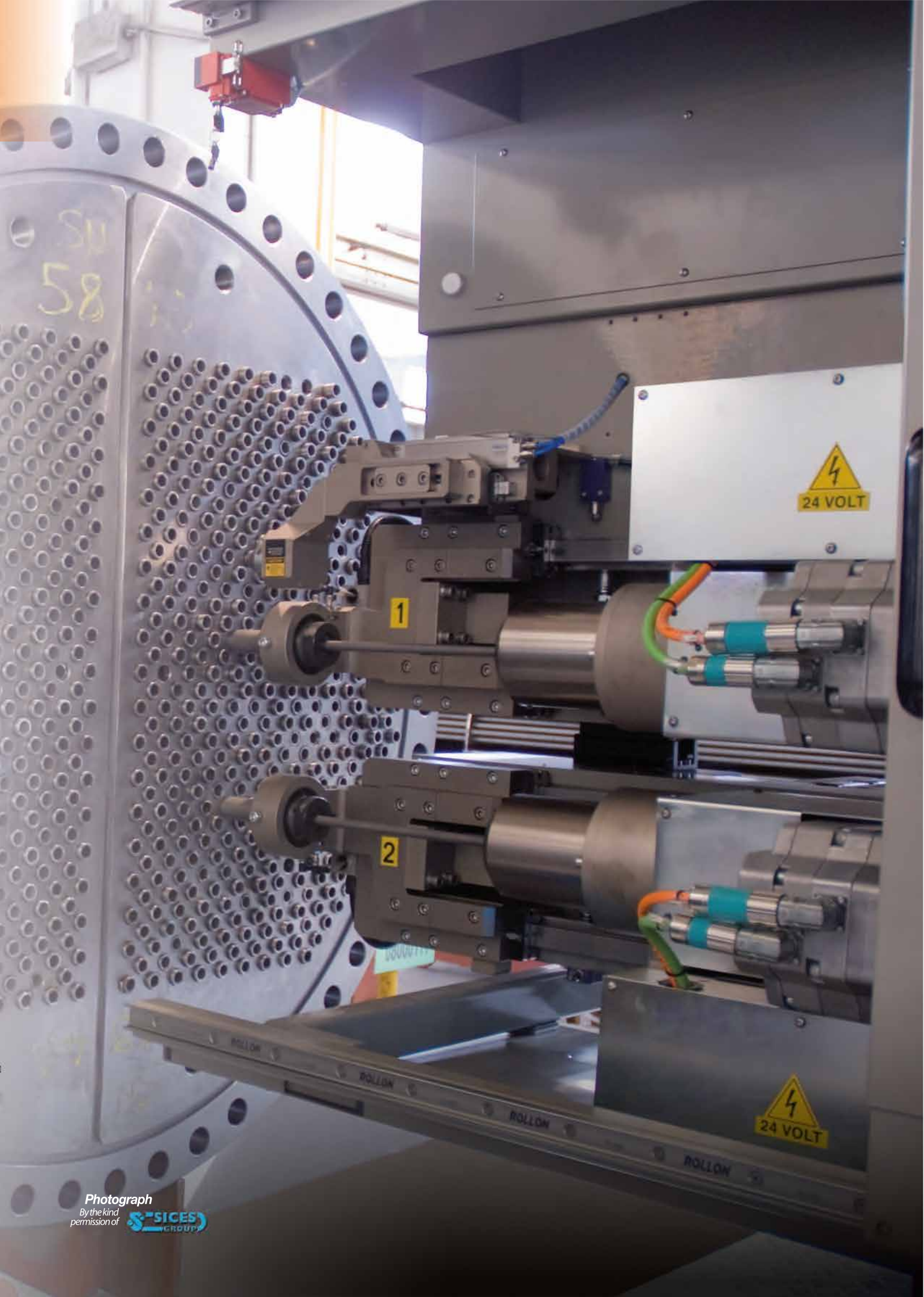
- **1 - cage** (main housing)
- **2 - mandrel** (rotating conical shaft)
- **3 - rolls** (conical cylinders)
- **4 - thrust collar** (spacer)



Process

- a** The tube expander, with the **mandrel** completely backed, is inserted into the tube until the fixed limit depth is reached.
- b** The **mandrel**, rotating and pushed forward, comes up to the **rolls**.
- c** Due to the friction, the **rolls** rotate in turn and when they come into contact with the tube, they give a rotatory movement to the **cage** enabling the **mandrel** to move forward. *The forward movement of the mandrel is achieved thanks to a mechanical thrust device.*
- d** The **rolls** expanded by the forward movement of the **mandrel** compress the tube until it sticks to the hole of the sheet and, through a process of subsequent rollings, the crushing of the tube gauge (**sp**) of the tube against the hole wall of the sheet is achieved.
- e** Once the desired expansion value is reached, the **mandrel** rotation inversion releases the tube expander from the tube.

- di** tube inner diameter (prior to rolling)
- Df** diameter of the tube sheet hole
- de** tube outside diameter (prior to rolling)
- sp** tube gauge



58

1

2

24 VOLT

24 VOLT

ROLLON

ROLLON

ROLLON

ROLLON

Rolling: common applications

A valid **additional help** is given by the analysis of the **most common cases** and **expansion issues** so that the right choices to be taken among the wide range of products that Maus Italia offers may be examined.

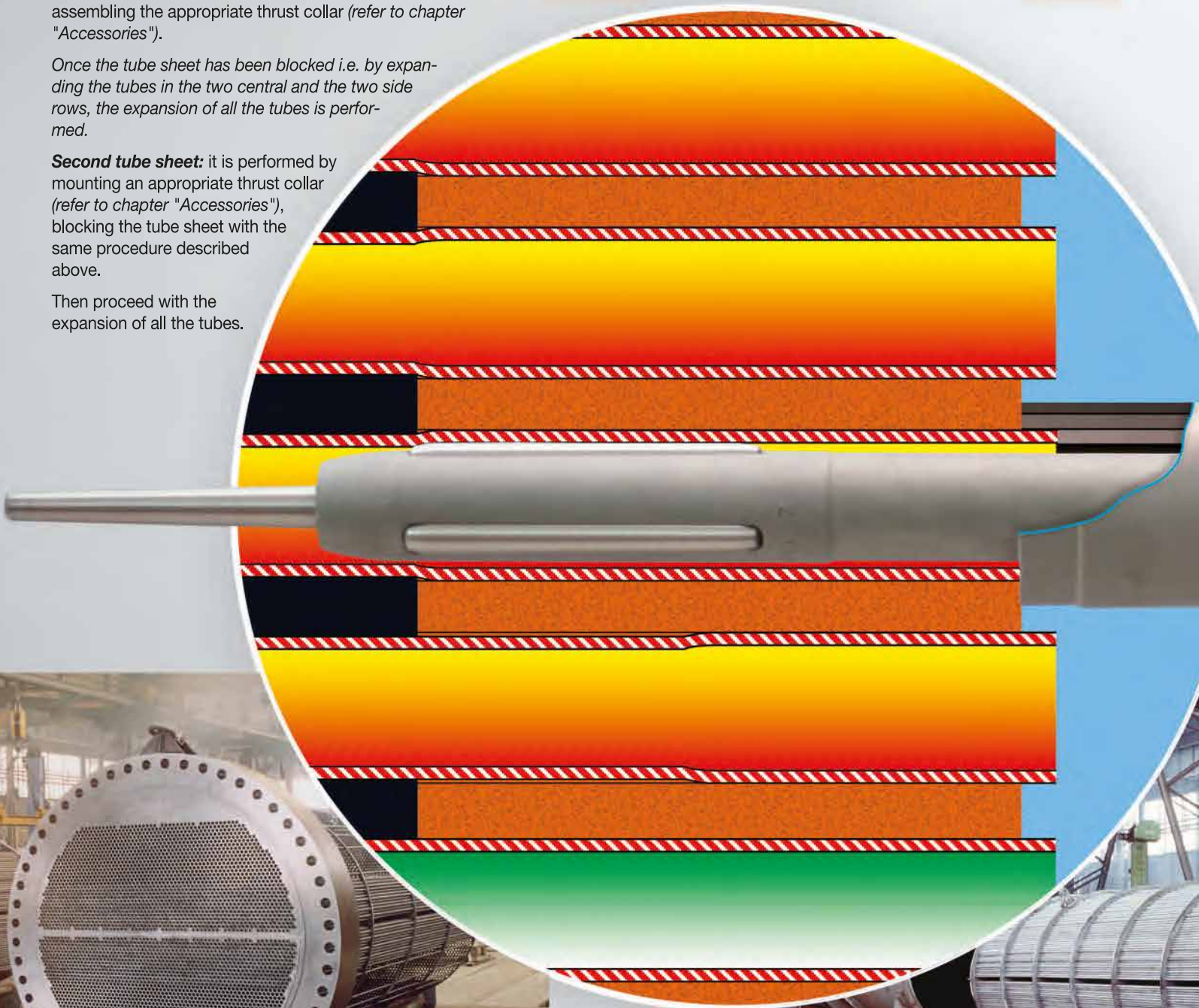
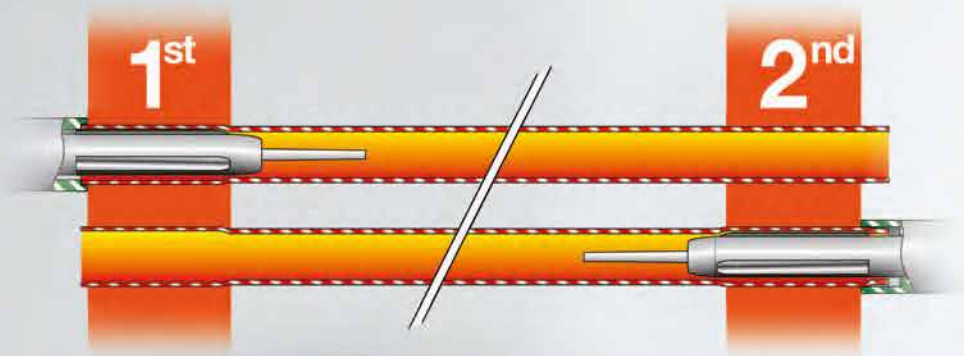
Heat exchangers with tubes only expanded : two tube sheet with straight tubes

First tube sheet: it is performed on **free tubes** by assembling the appropriate thrust collar (refer to chapter "Accessories").

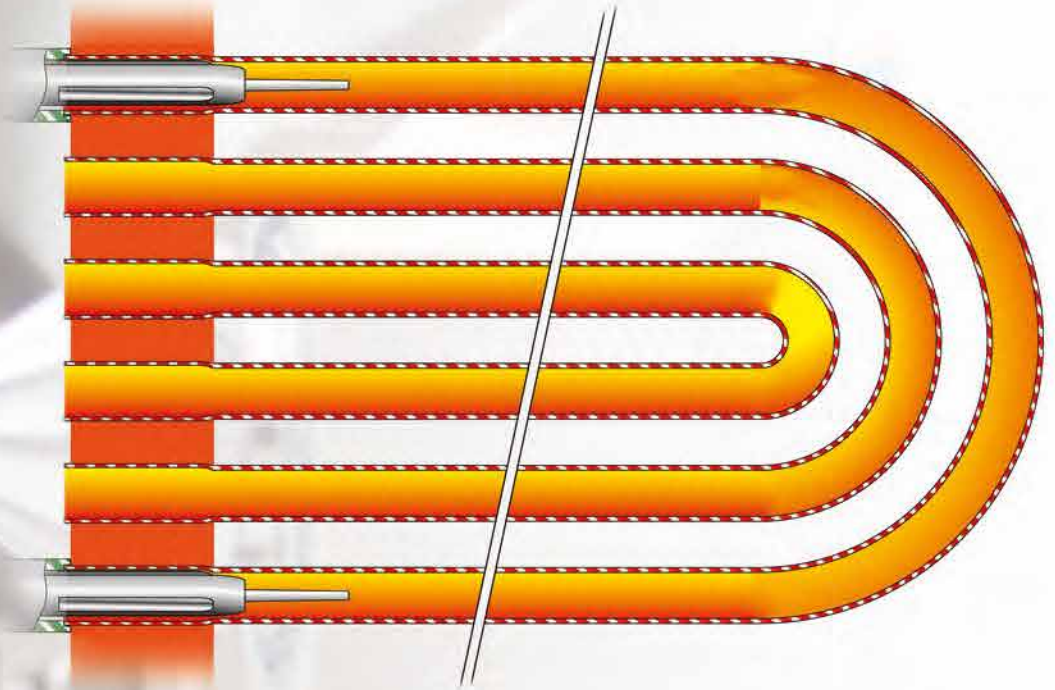
Once the tube sheet has been blocked i.e. by expanding the tubes in the two central and the two side rows, the expansion of all the tubes is performed.

Second tube sheet: it is performed by mounting an appropriate thrust collar (refer to chapter "Accessories"), blocking the tube sheet with the same procedure described above.

Then proceed with the expansion of all the tubes.



Heat exchangers with tubes only expanded: One tube sheet with U-tubes

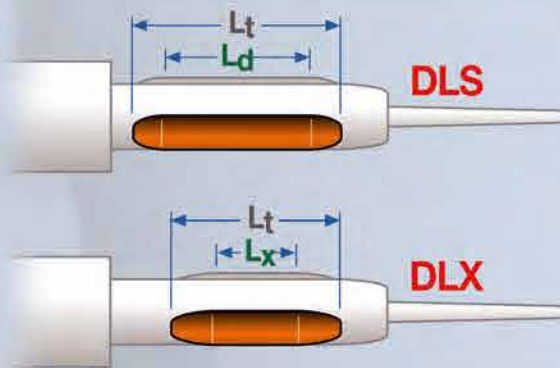


The rolls

One of the decisive parameter in defining the tube expander is the **useful length (L_u)** of the rolls.

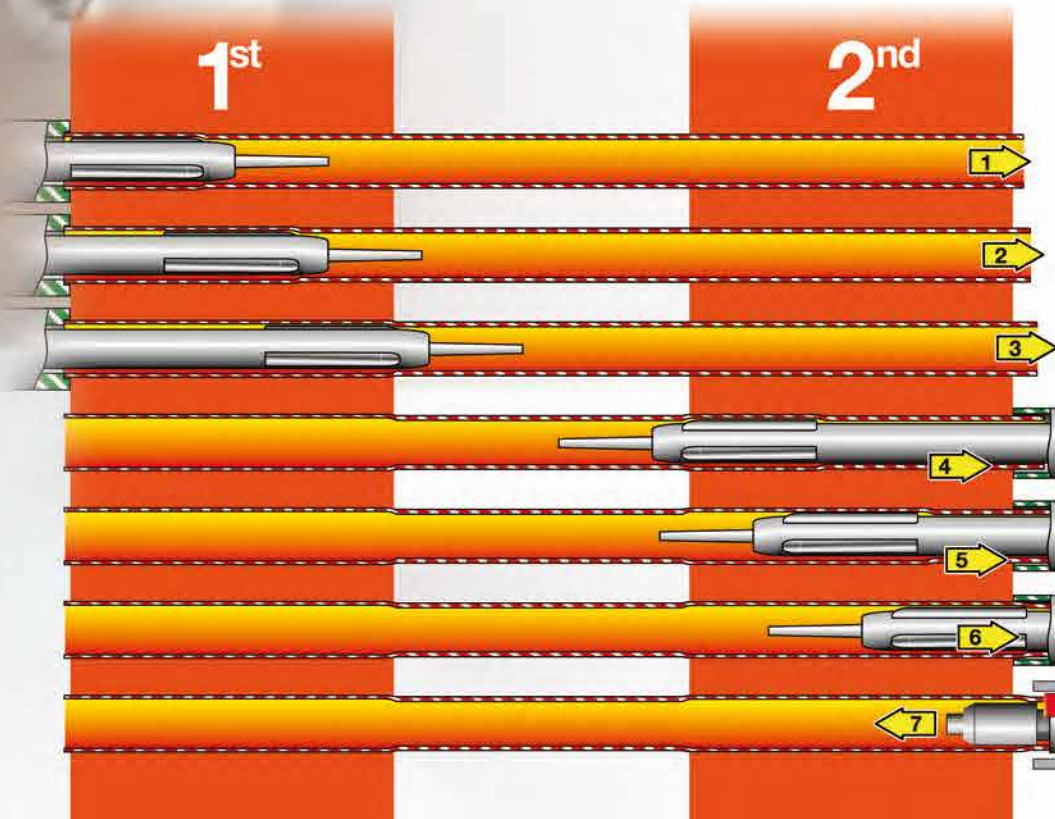
The rolls are provided in different versions according to the design of the coupling tube-tube sheet:

- DLS** Double bending point **L_d** = standard useful length
- DLX** Double bending point **L_x** = special useful length



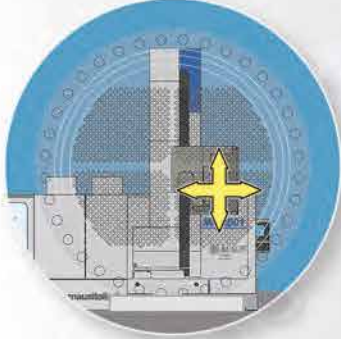
The double radius roll is essential in expanding tubes welded to the sheet and it is recommended in multiple step expansion.

Multiple step tube expansion



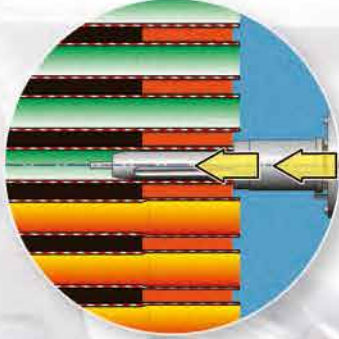
Automatic rolling: the process stages

After having analysed the theory of expansion and its fields of application, let's now expand on both the operating and the automated process stages.



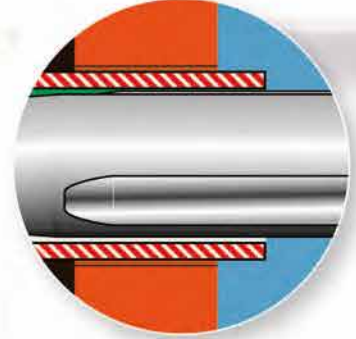
Stage 1

Positioning the tube expander at the centre of the tube to be worked



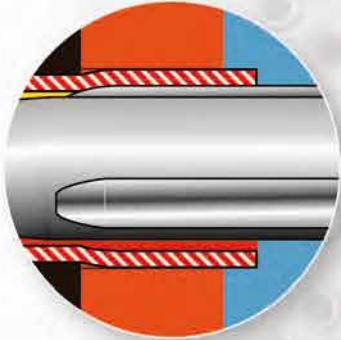
Stage 2

Positioning the tube expander at the operating limit depth required by the design



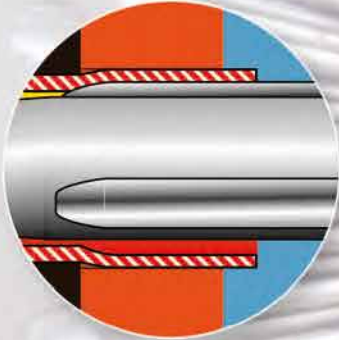
Stage 3

Automatic survey of the tube diameter



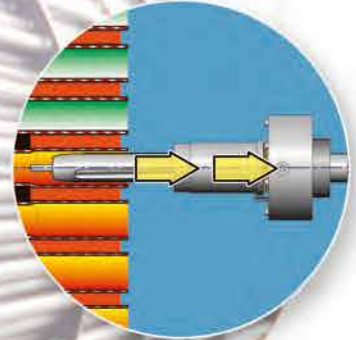
Stage 4

Approaching the tube to the hole



Stage 5

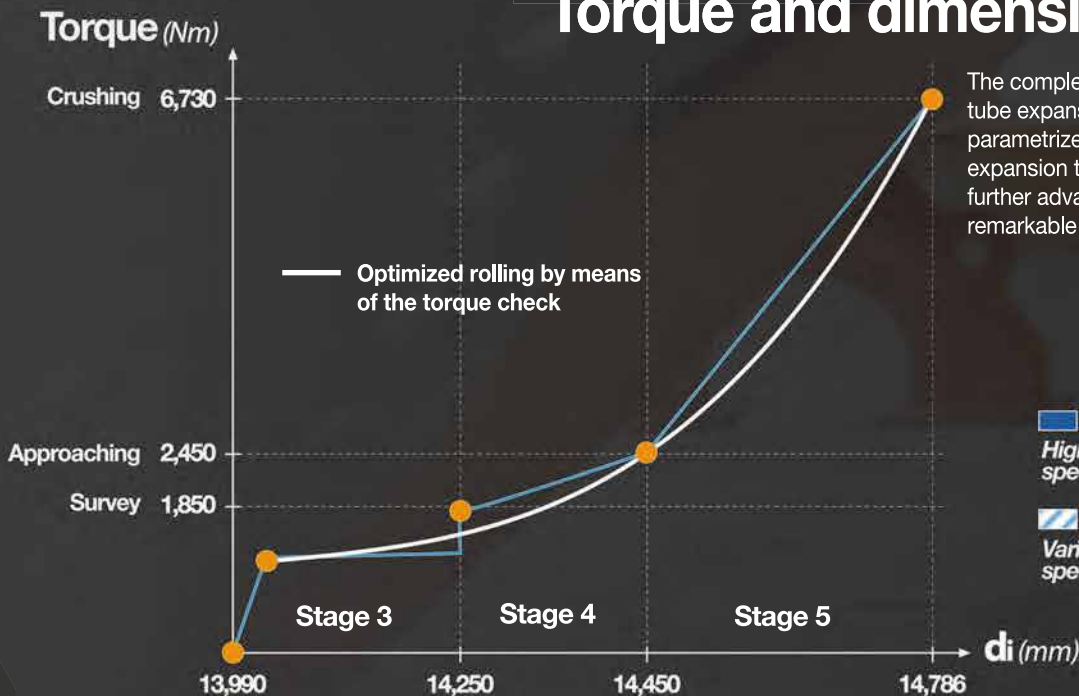
Crushing of the tube gauge



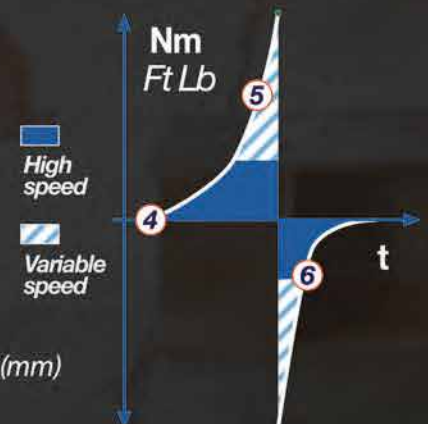
Stage 6

Releasing the tool and restarting by "Stage 1" (with exception of the possible re-positioning in the same tube by repeating the operation from "Stage 3")

Torque and dimension check



The complete torque and dimension check of the tube expansion enable to analyse and to parametrize the stages of the process during the expansion thus optimizing the expansion times. A further advantage of such a technology is the remarkable reduction in the tools wear.



Total quality

Automatic rolling: the report

Real time report on file - Total quality

The continuous and increasing demand for appropriate documentation to certify a company total quality is met by the complete and detailed data storage.

The file report registers the dimensional measure of the expanded tube and saves the position on the hole sheet matrix as well as the position of the mandrel referred to the external edge of the sheet in case of multiple expansion, so as to guarantee the complete traceability of each operation without errors.

Expansion step

X,Y coordinates of the machine position

Hole number

Main or secondary tool (double axis)

Tube diameter prior to rolling

Diameter of the approached tube

Diameter of the expanded tube

Torque reached by motor

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Date/Date	13/4/6												
2	Ora/Time	8:30:43												
3	Commissa/Job n.													
4	Disegno/Drawing n.													
5	Nota/Notes													
6	P/S	N	X	Y	Z	D1	D2	D3	Nm					
7	P	5	1102.09	90.55	40	14.59	15.09	15.37	9.94					
8	S	4	1102.09	90.55	40	14.42	14.96	15.72	9.83					
9	P	5	1102.09	90.55	80	13.56	15.13	15.18	7.69					
10	S	4	1102.09	90.55	80	13.42	14.99	15.11	8.14					
11	P	6	1102.01	64.97	40	14.36	14.87	15.12	10.13					
12	P	6	1102.01	64.97	80	14.25	15	15.04	7.42					
13	S	5	1102.01	64.97	40	14.45	14.96	15.55	10.19					
14	S	5	1102.01	64.97	80	13.3	14.9	15.02	7.79					
15	S	6	1102.02	39.57	40	14.33	14.33	14.33	0.08					
16	S	6	1102.02	39.57	80	13.31	13.35	13.35	-0.25					
17	P	7	1102.02	39.57	40	14.65	15.05	15.27	9.9					
18	P	7	1102.02	39.57	80	13.3	15.07	15.15	7.36					
19	P	8	1102.63	268.61	40	14.53	14.95	15.3	10.24					
20	P	8	1102.63	268.61	80	14.46	14.99	15.1	7.46					
21	P	9	1102.51	294.19	40	14.52	14.97	15.41	9.95					
22	P	9	1102.51	294.19	80	14.47	15	15.16	7.63					
23	P	10	1102.35	192.46	40	14.64	15.09	15.29	10.03					
24	P	10	1102.35	192.46	80	13.3	15.13	15.17	7.36					
25	P	11	1102.39	217.78	40	14.64	15.05	15.31	10.54					
26	P	11	1102.39	217.78	80	13.3	15.1	15.13	7.35					
27	P	12	1102.39	243.22	40	14.63	15.06	15.29	10.08					
28	P	12	1102.39	243.22	80	14.48	15.1	15.16	7.41					
29	P	13	1102.55	268.74	40	15.08	15.35	15.45	9.97					
30	P	13	1102.55	268.74	80	15	15.15	15.2	7.24					
31	P	14	1101.95	14.22	40	14.52	14.94	15.18	9.86					
32	P	14	1101.95	14.22	80	14.49	14.97	15.05	7.49					

Traceability and documented report of every single operation!

Automatic rolling: operator interface

The parameter setting system in a **modern graphical platform** is based on the Maus Italia deep expertise. The numerical control combined with the convenience of a personal computer to reach an **optimal operating efficiency**.

Expansion data 1

- Definition of the theoretical geometry of the expansion to be performed.
- Diameter and gauge of the tubes to be expanded
- Mandrel size.
- Forward movements and rotation speed.



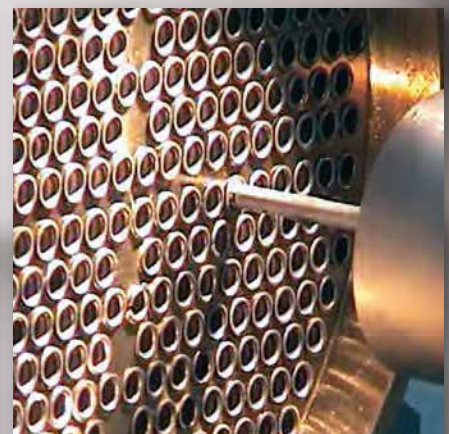
Expansion data 2

- Setting of the expansion control parameters
- Tool wear control and adjustable alarm threshold
- Dimensional control of the expanded diameter with adjustable alarm threshold
- Type of lubrication



Expansion steps

- Definition of the number of expansion steps to be performed on each tube to meet the project requirements.
- Final expansion to be reached.
- Execution methods.





Automatic welding

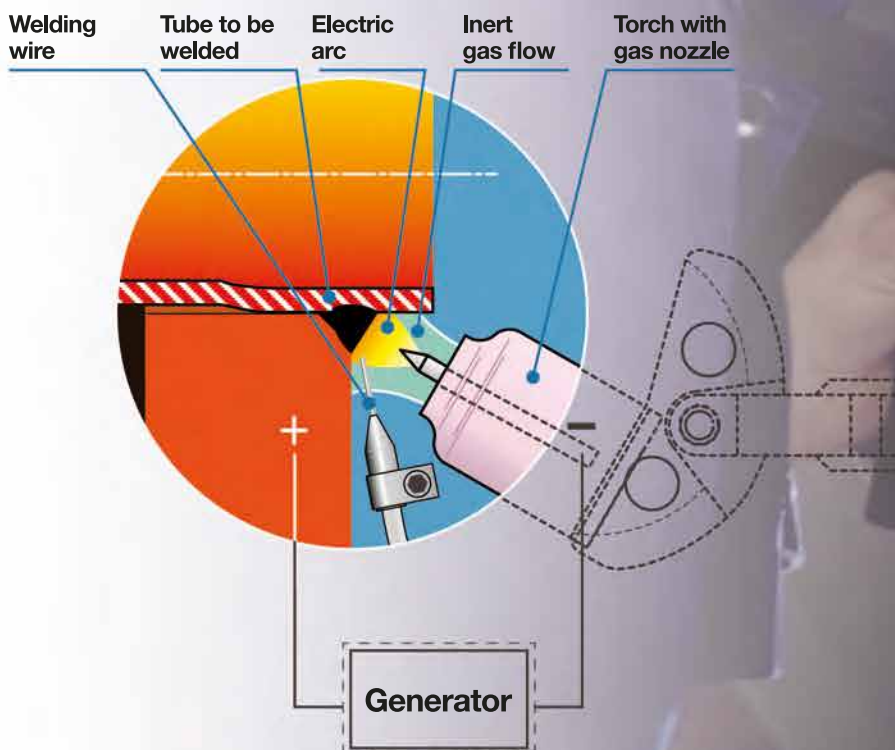
The **TIG orbital welding** is the most used and reliable technology as for the **tube-to-tubesheet joint**.

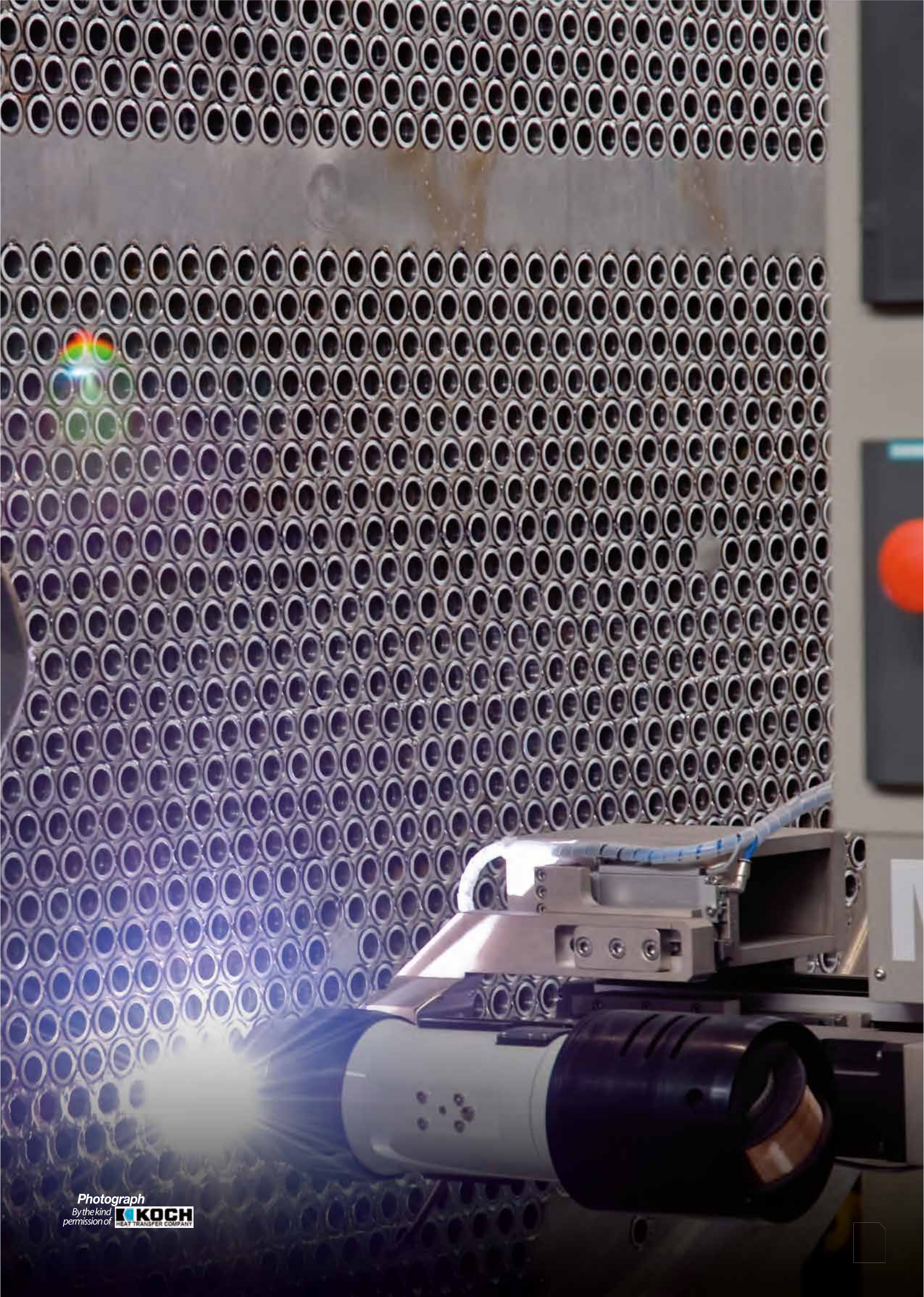
The **TIG (Tungsten Inert Gas) orbital welding process** is performed through an electric arc which shoots between a **non-consumable electrode** and the parts to be welded with or without weld material.

It all has to be performed in protective atmosphere by an inert gas (*generally argon*) flowing into the torch.
The protective atmosphere is necessary to guarantee the constant working of the electric arc avoiding the weld puddle to be contaminated by environmental elements.

In this particular case related to the process automation equipment, Maus Italia offers an **entirely automated** tube-to-tube sheet welding cycle, able to guarantee a **complete control of both quality and geometry of the weld puddle**.

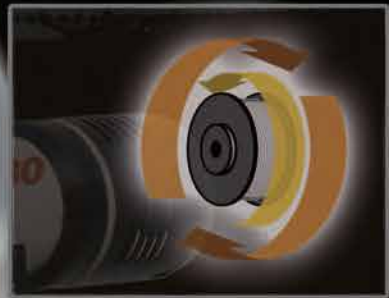
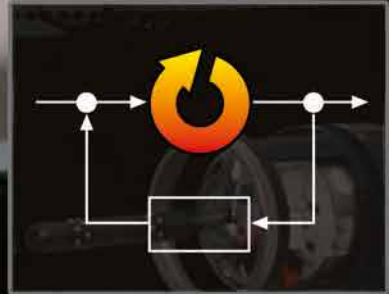
The **outstanding results** make this technology unique.





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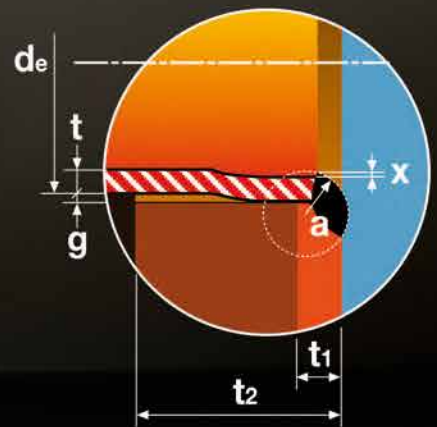
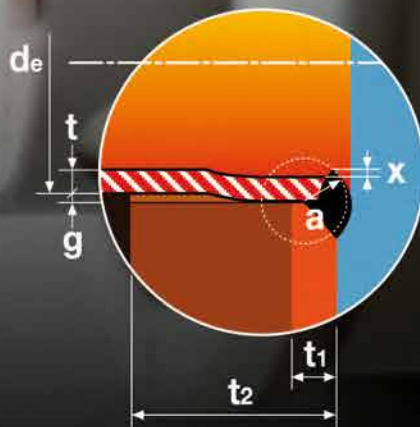
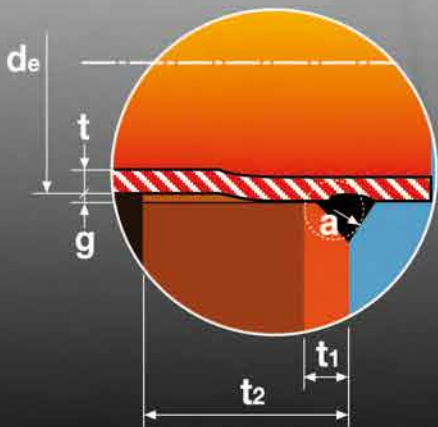




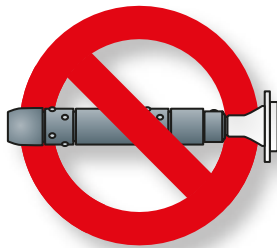
Protruding tube

Flush tube

Recessed tube



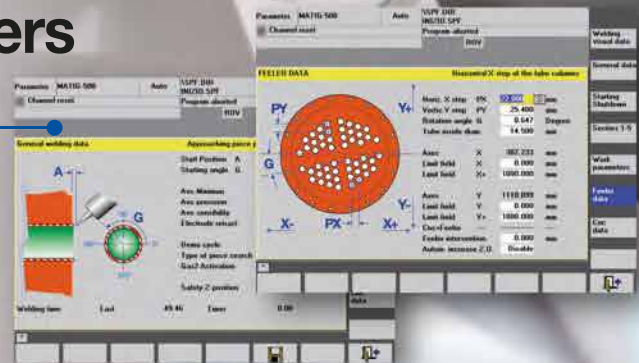
Automatic welding: parameters



Centring and positioning

High-precision definition of the alignment, with a deviation of only 0,05 mm (0.002") between the rotating orbital axis of the welding torch and the axis of the tube to be welded, and setting of the functions

- **AVC**
- Touch
- Retract electrode.



Controlled arc switch on

Page assigned to the upslope parameters, from the preGAS to the electric arc striking variables and the formation of the weld puddle.

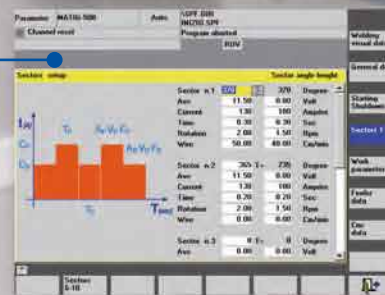
Proper preparation to **TIG orbital** welding.



Welding

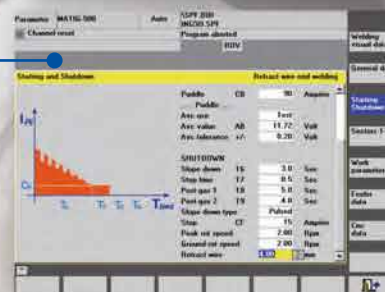
The number of sectors, current, pulse, the rotation speed and quantity of filler material are just some of the parameters that can be set in this display.

The heart of the weld pulsated here producing a union of the tube and tubesheet.



Controlled arc shut down

Page assigned to the downslope variables from extinguishing the electric arc to the correct control of the weld closure (such as the seam overlap) and postGAS protection.



First Ohm's law in relation to the **AVC** control of the voltaic arc in **TIG orbital** welding

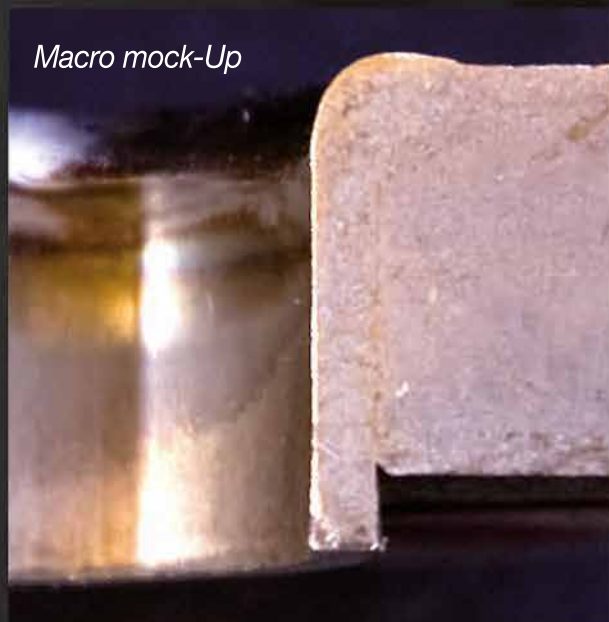
AVC (Arc Voltage Control) is the automatic control of the arc's height during welding.

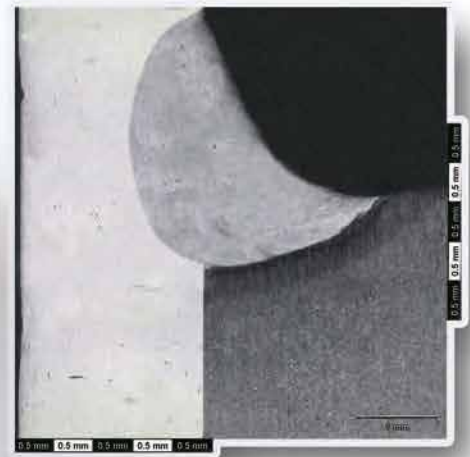
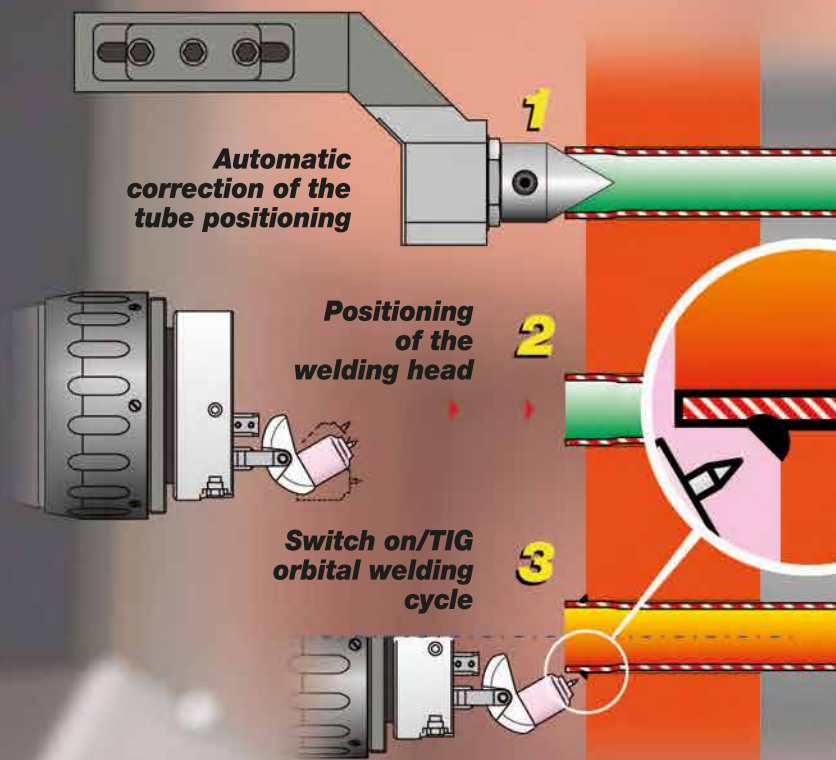
The principle on which the **AVC** operates is Ohm's law: $R = \frac{V}{I}$

At the same current intensity **I**, the distance of the electrode from the weld puddle **R** is proportional to the welding arc voltage **V**.

The continuous monitoring of the welding arc voltage **V**, allows to adjust the distance **R** of the electrode from the weld puddle in order to obtain a constant penetration over the entire weld in progress.

Macro mock-Up





Control radiograph

14 BWG 3/4" tube
 316L material
 Tube prominence 5 mm (0.197")
 Tube sheet thickness 125 mm (4.92")



Control radiograph

18 BWG 1" tube
 304L material
 Tube prominence 0 mm (0.0")
 Tube sheet thickness 72 mm (2.83")

AVC system to manage the distance between electrode and part

The **AVC** technology is applied to the welding systems proposed by Maus Italia in order to guarantee more and more qualified performances to the most demanding customers.

A **CNC** system control the electrode movement.

In particular, the correlated functions that use the **AVC** systems are:

Touch

searching for the part and positioning of the electrode at the desired distance;

Retract

Preset retreat of both the electrode and the wire nozzle in case of multiple passing;

Sharpening control

During the puddle formation, measuring the arc enables to check for appropriate electrode sharpening;

Arc voltage

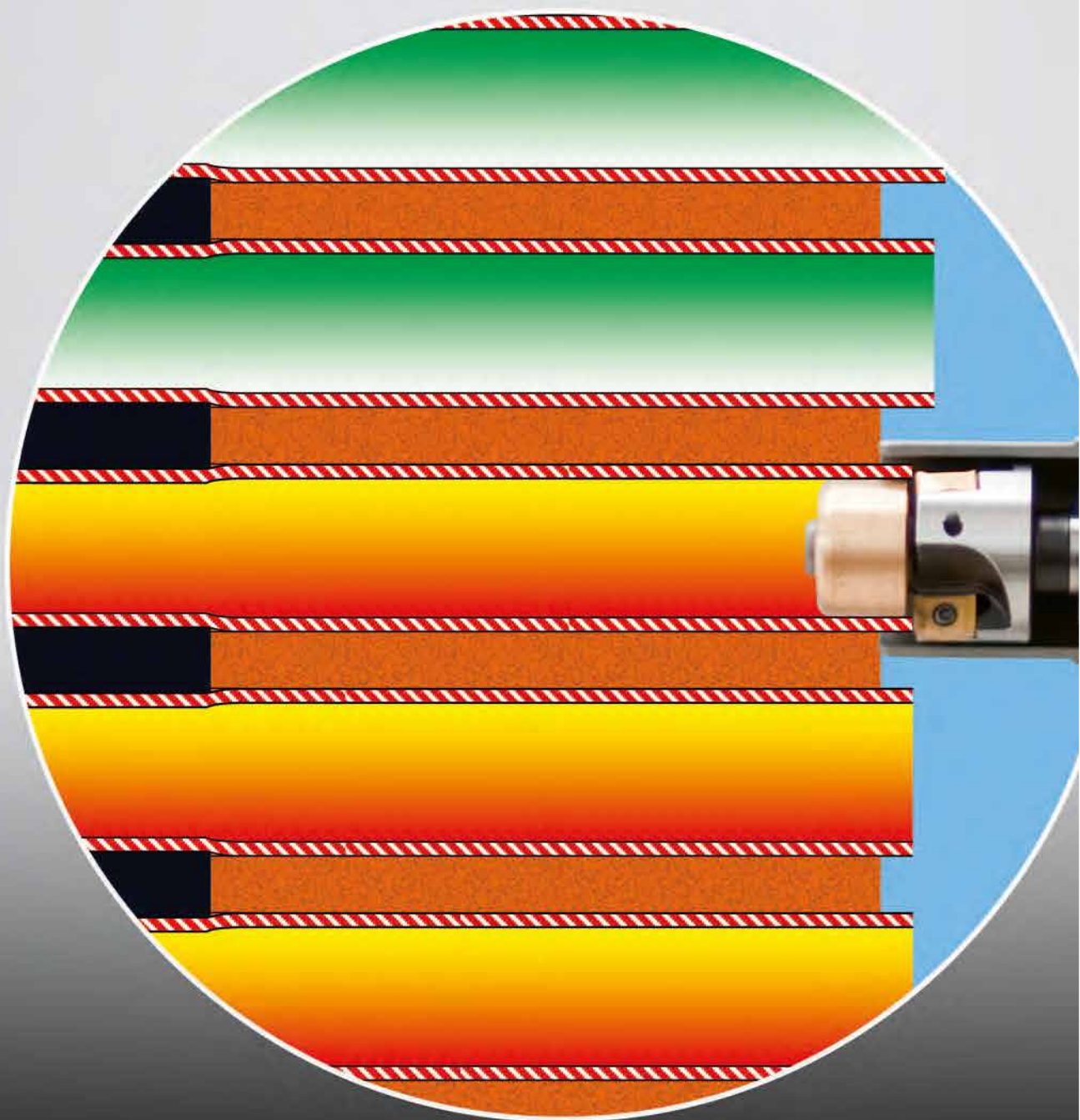
An alarm may be activated if the arc voltage falls below a preset value.

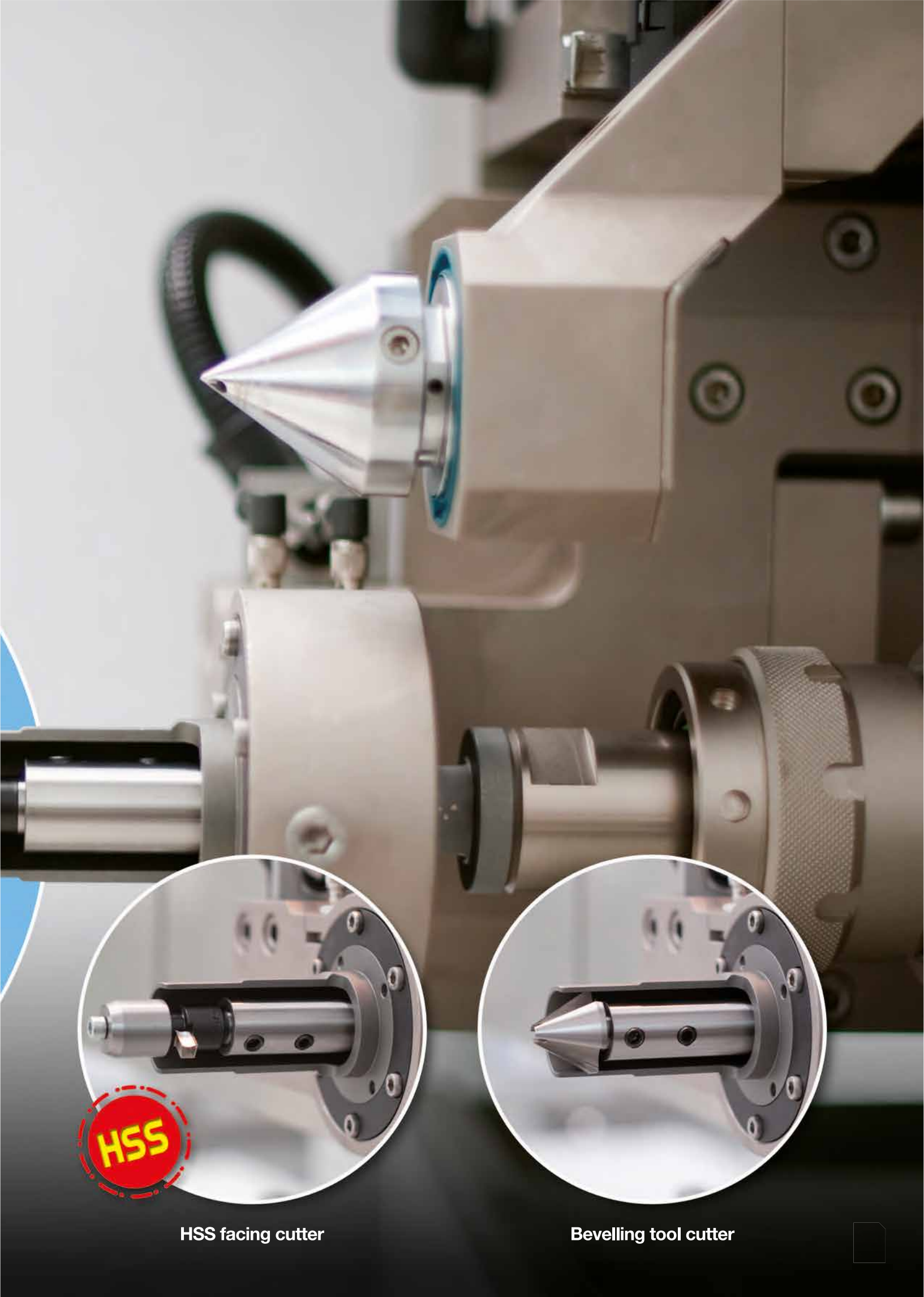


Automatic facing

The **entirely automatic** system proposed may be used both to **remove the excess of material** and to **prepare the welding**.

A complete range of tools chosen according to the material to work on enables to **optimize the process** from both a **qualitative and productive** point of view.





HSS facing cutter



Bevelling tool cutter



Automatic facing: compensation of the tube sheet deformation

The shaving removal process of the tube ends, in the heat exchangers, shall guarantee the **constant prominence of the tube itself with respect to the tube sheet.**

In fact, mainly in **large tubesheets**, it is common to have to deal with **noticeable deformations** which **modify its flatness** causing the variation of reference "zero".

The possible preparation to welding of the tube end will be **dimensionally constant and uniform.**

Before
After

The tube sheet deformation is merely representative and intentionally accentuated.



Automatic facing: parameters

Milling data

- Final tube protrusion
- Forward movements and rotation speed
- "Break-shaving" function
- Tool wear control



Parametri	CRANK	JOG	VSF DRL
# Reset comando			INC/20 SPS
			Programma attivato
			RDV
			Parametri di Lavoro
			Dati del Latidatore
			Dati del Cnc
			Dati di manutenzione
			Facci di manutenzione
			Visuali dati manutenzione
			Stato di lavoro
			Substrato
			Memoria: re dati v.2

Dati di Fresa Cima		Distanza di movimento (mm) di Lato	
Quota iniziale	A	12.000	mm
Quota finale	B	2.000	mm
Incremento	C	1.000	mm
Percezione pos.	Z1	6.000	mm
Percezione pos.	Z2	6.000	mm
Capota elevatore tubo		3.000	mm
Capota verso base		20.000	mm
Capota motore	SP1	8.000	mm
Capota motore	SP2	8.000	mm
Avanci. in percec.		500	mm/min
Avanci. in lavoro		200	mm/min
Avanci. in sbalzo		100	mm/min
Giri/min	RPM	1.000	rpm/min
Tipi di lubrificazione		Reverse	
Tubo di inizio		1	A.

Optional double axis
Up to 1200 faces/hr

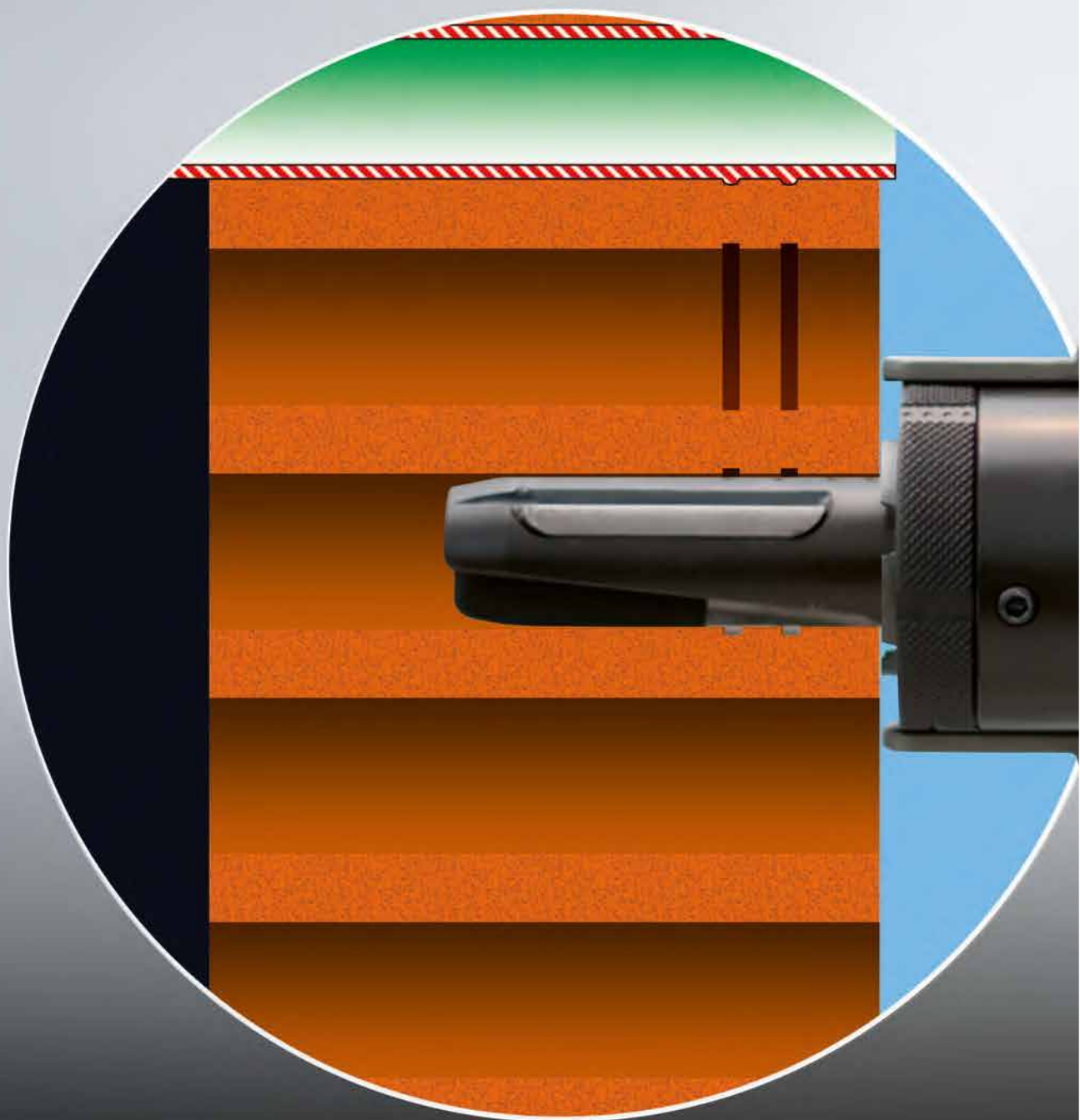
Automatic grooving

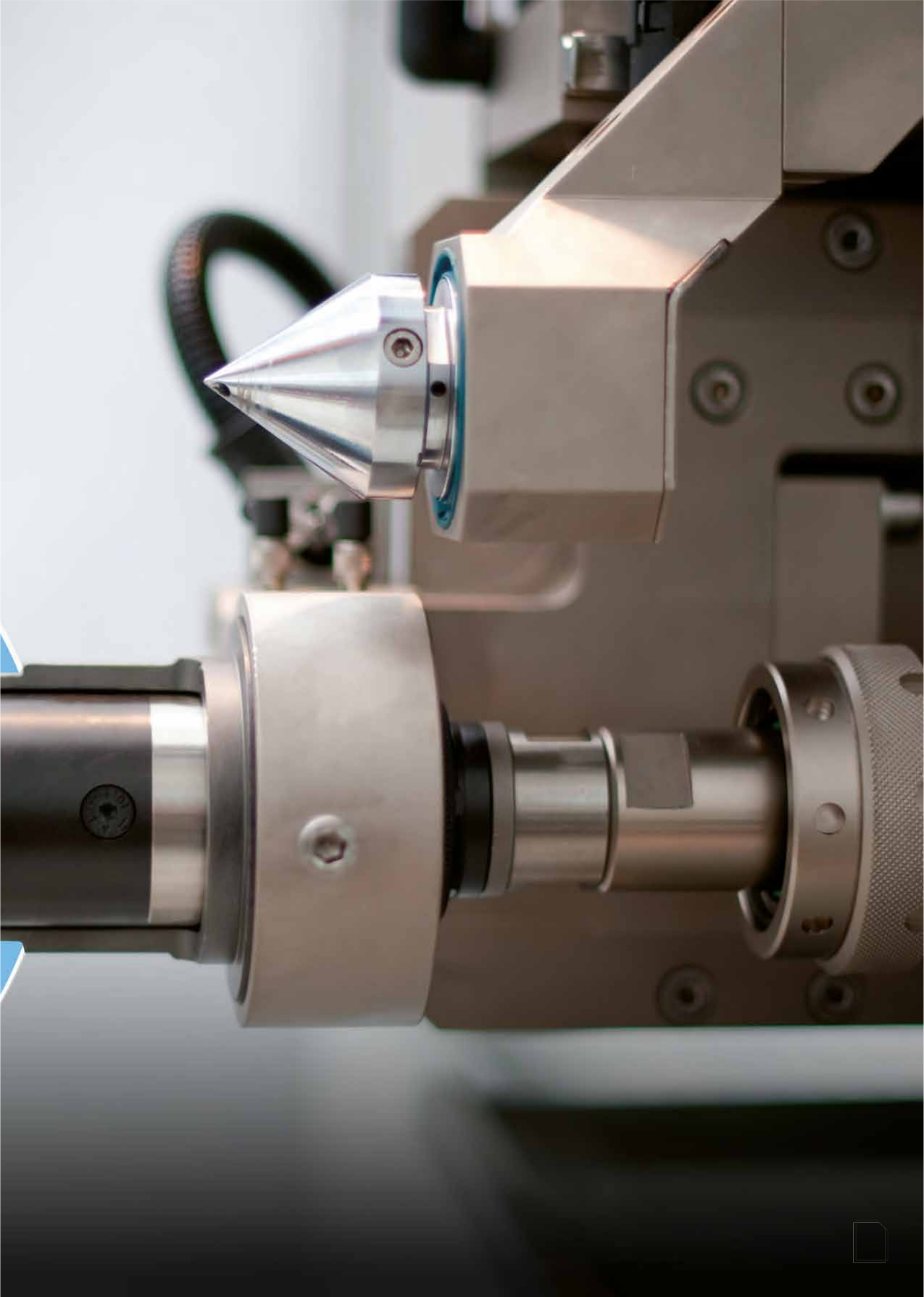
The **entirely automatic** system proposed may be used to realize grooves inside the holes of the tube sheets.

A complete range of tools and accessories chosen according to both the project geometry and the materials to work on enables to **optimize the process from both a qualitative and productive point of view**.

The automatic cycle is preset and equipped with a command and **control program of the tool wear level**.

The only parameters to be adjusted are the speed and feeding.



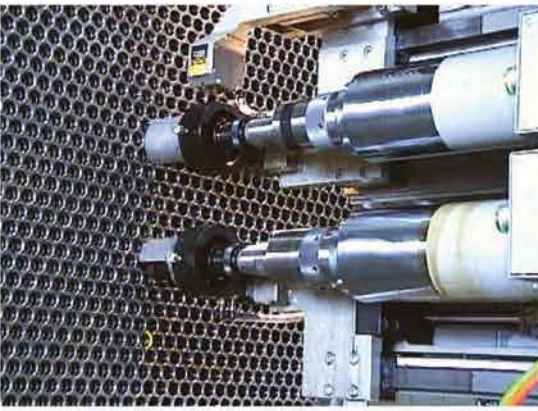


Automatic grooving: parameters

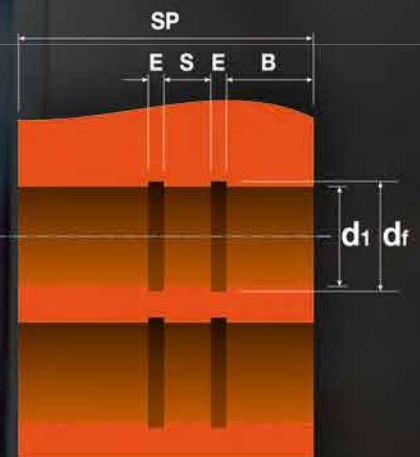
Grooving tool **F/26**

- Definition of the groove geometry to be performed.
- Tool wear control
- Forward movements and execution speed.

SUMMARY DATA	
Profondità	A 0.350 mm
Vis profondità A n.1	0.000 mm
Vis profondità A n.2	0.000 mm
Intorno	0.120 mm
Passoora calc. Z1	0.000 mm
Passoora calc. Z2	0.000 mm
Passoora calc. Z3	0.000 mm
Passoora ves. Z2	0.000 mm
Coppia torca linea	12.500 Nm
Coppia motore SP1	0.000 Nm
Coppia motore SP2	0.000 Nm
Avanz. max Z	16.000 Z
Avanz. in lavoro	210 mm/min
Vel. F/26	350 giri/min
Tipi di lubrificazione	Auto lubr.

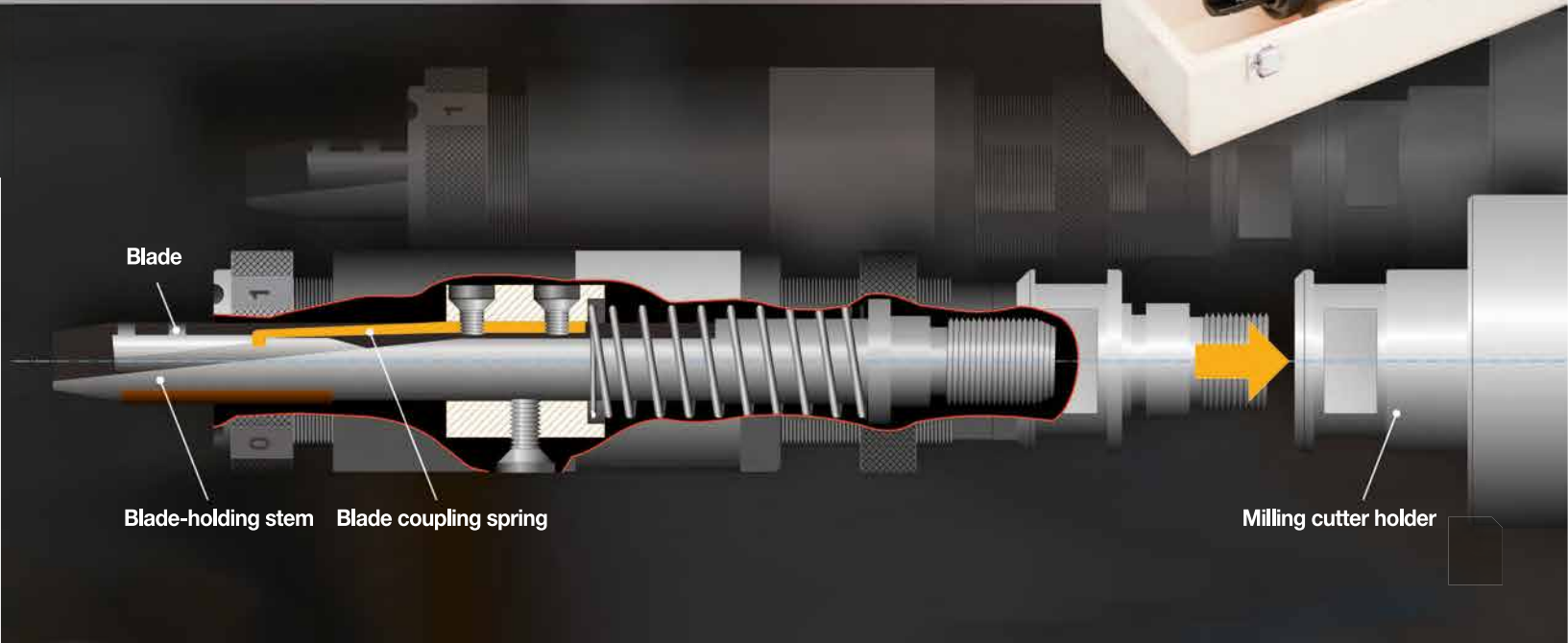


Optional double axis
900 holes/hr (2 holes in 8 sec.)



Photograph
By the kind permission of
1926 Villa & Bonaldi s.r.l.
Bologna - Italy

Tube sheet of 18,000 holes for 3/4" tubes



FOCS self-learning centring feeler (optional)

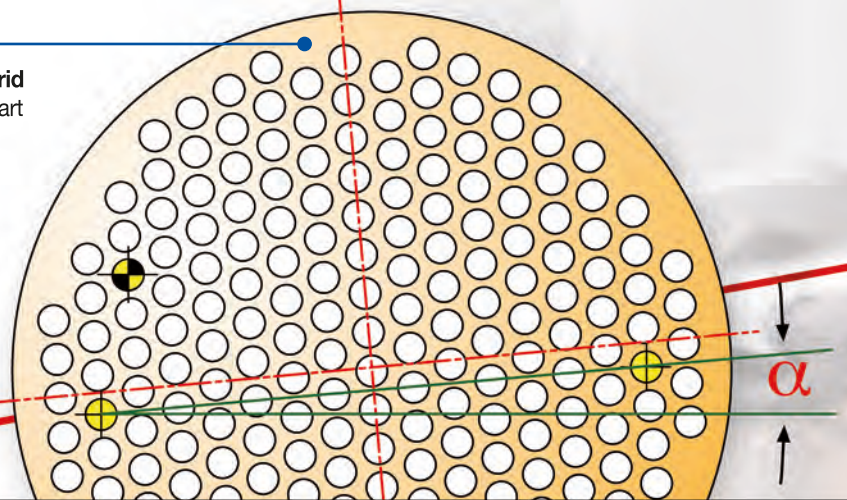
Feeler management software

To complete the cnc cycle, Maus Italia provides the use of the feeler thanks to a software designed and developed according to its experience



Part position zero

Measurement and storage of the **hole grid position on the tubesheet** and of the part zero with respect to the machine zero



Feeler system special functions

- Detection and display of the distance from the tube sheet by laser device (**FOCS-3** only).
- Fast localization of the zero point and rotation of the cnc program hole plan up to the collimation to the actual hole plan.
- Detection and automatic correction of hole positioning errors.
- Possibility to work on the tube sheets without the cnc program in an entirely automatic cycle.
- Adjustable intervention at each tube or at regular intervals

Technical specifications

- Centring precision ± 0.05 mm (± 0.002 ").
- Automatic correction capacity according to the tube inner \varnothing .
- Min/max capacity of the centring diameter from 4 to 50 mm (from 0.157" to 1.968").
- Distance detection from 80 mm to 330 mm (from 3.150" to 12.992"). Precision ± 0.05 mm (± 0.002 " (**FOCS-3** only).



Laser
measure of the
distance from
the tubesheet



Class 1 laser

Laser
hole presence
confirmation



Feeler protection



MausCAM X-Y programming software based on CAD data of the tubesheet drilling

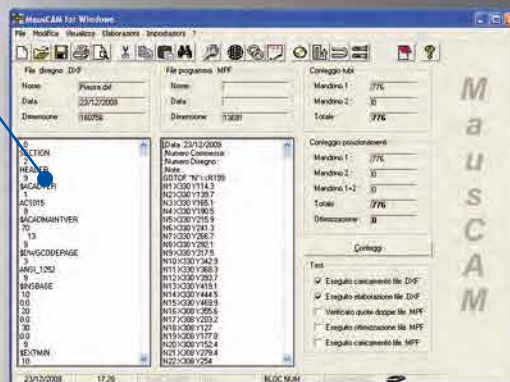
DXF from standard CAD

This system is based on the reading of the **DXF (drawing interchange format)** and it is able to elaborate the tube sheet CAD files in a few passages and to automatically obtain the **matrix of the tubesheet hole coordinates**.



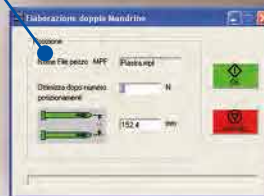
Interactive processing

During the processing, it is possible to control and optimize the path according to the position or the geometry. If the tube sheet is bigger than the available run, **it is possible to break up the program in subsequent parts**.



Management of the double mandrel

Everything is performed automatically: according to the set distance between the two axes of the machine (**MA-2501 version and MA-3501 with second optional axis**), the MausCAM software optimizes the tool run thus reducing remarkably the number of positionings (**multiple simultaneous processes**), and subsequently increasing productivity. Moreover the **MausCAM** software is able to verify and indicate any possible **coordinate overlap**.

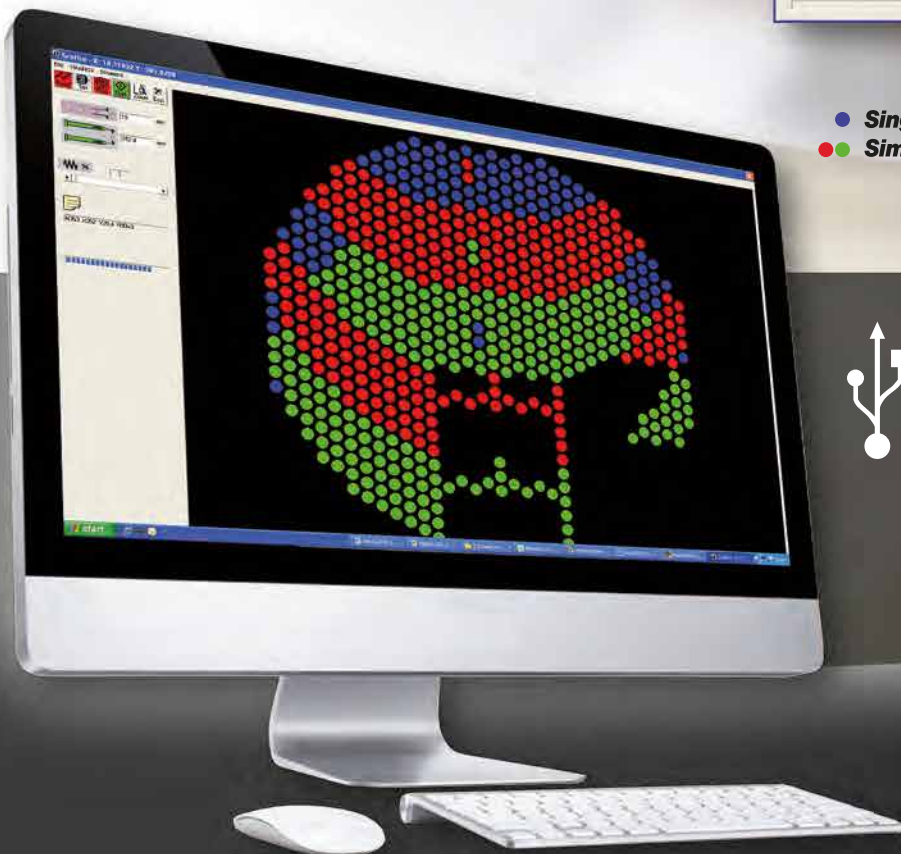


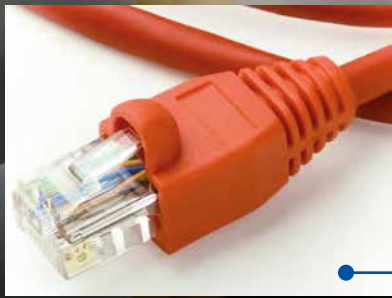
- **Single process**
- **Simultaneous process:**
 - First axis
 - Second axis



Program transfer to the cnc

The program files can be easily stored or loaded in the machine numerical control by a common **USB pen drive**.





USB communication port

For a fast and reliable exchange of information between machine and office.

Network connection

An Ethernet connection (a serial RS232 is also available) is ordinarily installed in order to enable the network connection. An optional Web diagnostic program is also available.



MA series cnc working centres designed for the manufacture of the tube bundle heat exchangers



Maus Italia here proposes a **complete range** of cnc working centres designed to solve the most complicated problems related to the **automation of processes in the manufacture of tube sheet heat exchangers.**

The **technical staff** of the Maus Italia "Automation and Welding Division" is at customers' complete disposal to suggest the ideal solution to any kind of application.



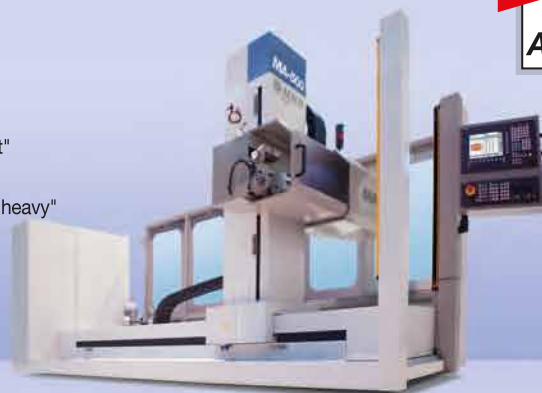
MA-500

Cnc working centre with **single axis** fixed machine to **expand** and **face** the tube bundle tubes.

Automatic solution ideal for the **serial production** of **tube bundle exchangers** with the following features:

- **Tube sheet max diameter**
1000 mm (40")

- **Tube sheet max thickness**
200 mm (8")
- **Tube diameter**
First **line of tube expanders** called "light"
6 ÷ 16 mm (1/4"÷5/8")
Second **line of tube expanders** called "heavy"
9,5 ÷ 51 mm (3/8"÷ 2")



AU-42

MA-2501

Cnc working centre with **single or double axis** movable machine for **expansion**, **TIG orbital welding**, and **facing** of the **tube bundle tubes** and for the **grooving** of **medium-large diameter tube sheet holes**.

The **MA-2501** is the most innovative and effective solution ever proposed by Maus Italia as for automating the process cycles of assembling of the **tube bundle exchangers** with the following main features:

- **Tube sheet diameter**
2500 mm (100")
- **Tube sheet max thickness**
700 mm (27.5")
- **Tube diameter**
9,5 ÷ 51 mm (3/8"÷ 2")

The **specified diameter of the tube sheet** refers to the **single positioning**.

Processing on **greater diameters** is possible with fast and simple **multiple positioning**.



MA-3501

Cnc working centre with **single or double axis** movable machine for **expansion**, **TIG orbital welding**, and **facing** of the **tube bundle tubes** and for the **grooving** of the **large diameter tube sheet holes**.

The **MA-3501** is the most innovative and effective solution ever proposed by Maus Italia as for automating the process cycles of assembling of the **tube bundle exchangers** with the following main features:

- **Tube sheet diameter**
3500 mm (140")
- **Tube sheet max thickness**
700 mm (27.5")
- **Tube diameter**
9,5 ÷ 51 mm (3/8"÷ 2")

The **specified diameter of the tube sheet** refers to the **single positioning**.

Processing on **greater diameters** is possible with fast and simple **multiple positioning**.



MaTIG-500

Single axis cnc working centre for the **TIG orbital welding** of the tube-to-tubesheet.

Light, handy and flexible, it is proposed to meet the constantly increasing demand for **quality and repeatability** to automate the assembling process cycles of the **tube bundle exchangers** with the following main features:

- **Tube sheet diameter**
1500 mm (59")
- **Tube diameter**
4 ÷ 51 mm (5/32"÷ 2")

The **specified diameter** of the tube sheet refers to the **single positioning**. Processing on **greater diameters** is possible with fast and simple **multiple positioning**.



MAUS
ITALIA

MA-500



Tube sheet
max diameter
1000 mm (40")

Tube sheet
max thickness
200 mm (8")

Tube diameter
"light" line
6 ÷ 16 mm (1/4" ÷ 5/8")
"heavy" line
9,5 ÷ 51 mm (3/8" ÷ 2")

MA-500

Single axis cnc working centre for rolling and facing serial production.

The **MA-500** is the most innovative and effective solution ever proposed by Maus Italia as for **automating the process cycles** of assembling of the **small heat exchangers in the serial production**.

● High technology

The **exclusive FOCS2 centring system** together with the cnc **without the traditional mechanic contact accessories** — which has been widely tested in our 30-year experience in the automation field — guarantee an extremely high geometry precision in the operations with a **deviation of only 0,05 mm (0.002")**.

The setting of all the working and positioning parameters is operated by **Windows XP®** operating system with cutting edge graphical and multitasking features.

● Maximum productivity

The **MA-500** cnc working centre enables the **single axis expansion and facing** of the tube bundle tubes as well as the **optional grooving** of the tube sheet holes: entirely automated and cost efficient processes and a remarkably reduced production time.

The **MA-500** working centre is the most advanced solution available on the market in this field: **the choice preferred by those looking for quality and performance**.



Photograph
By the kind
permission of

BLOKSMA

600 tubes/h
1 cycle every 6 sec.

Column

Extremely tough and solid normalized steel electrowelded structure, positioned on the X axis crane.

Centring tracer point

Optional self-learning laser centring system which is able to work both in synchrony with the CNC and autonomously.

Y axis

Vertical run trolley and Z axis support with the operating axis

Z axis

Transverse run trolley tubesheet approach

Tool holder head

Tool holder head to be tooled up with semi-automatic tool change for rolling, facing and grooving (optional)

Electric cabinet

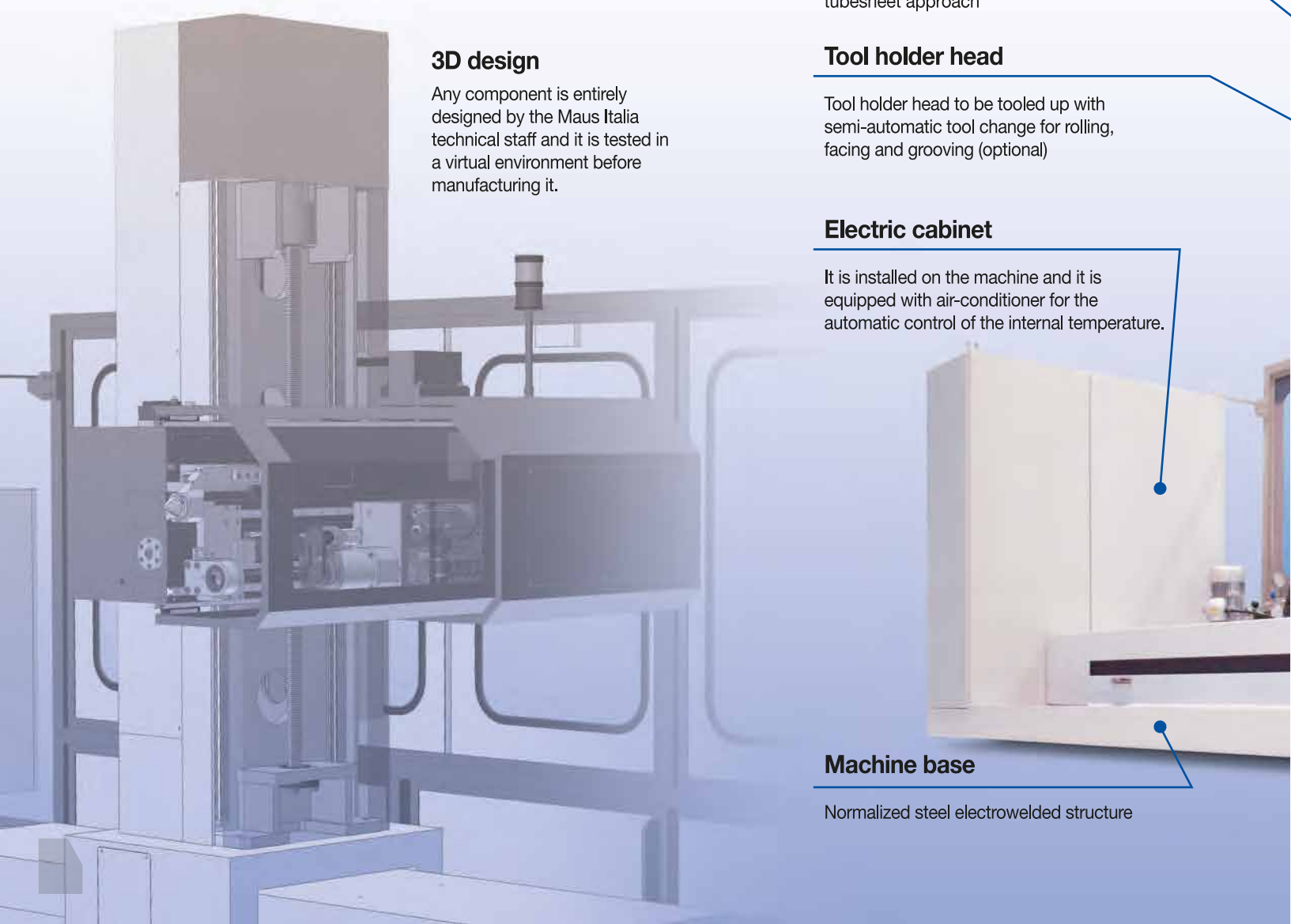
It is installed on the machine and it is equipped with air-conditioner for the automatic control of the internal temperature.

3D design

Any component is entirely designed by the Maus Italia technical staff and it is tested in a virtual environment before manufacturing it.

Machine base

Normalized steel electrowelded structure



MA-500

Single axis cnc working centre for rolling and facing serial production.

Machine status signalling

A complete range of signals and alarms informs about the machine status and helps the operator both in the operative stages and while setting a new work.

Control console

The control console is located in such a way that maximum visibility of the working area is guaranteed. The CNC display guarantees maximum working easiness.

X axis

Column support trolley for horizontal positioning.

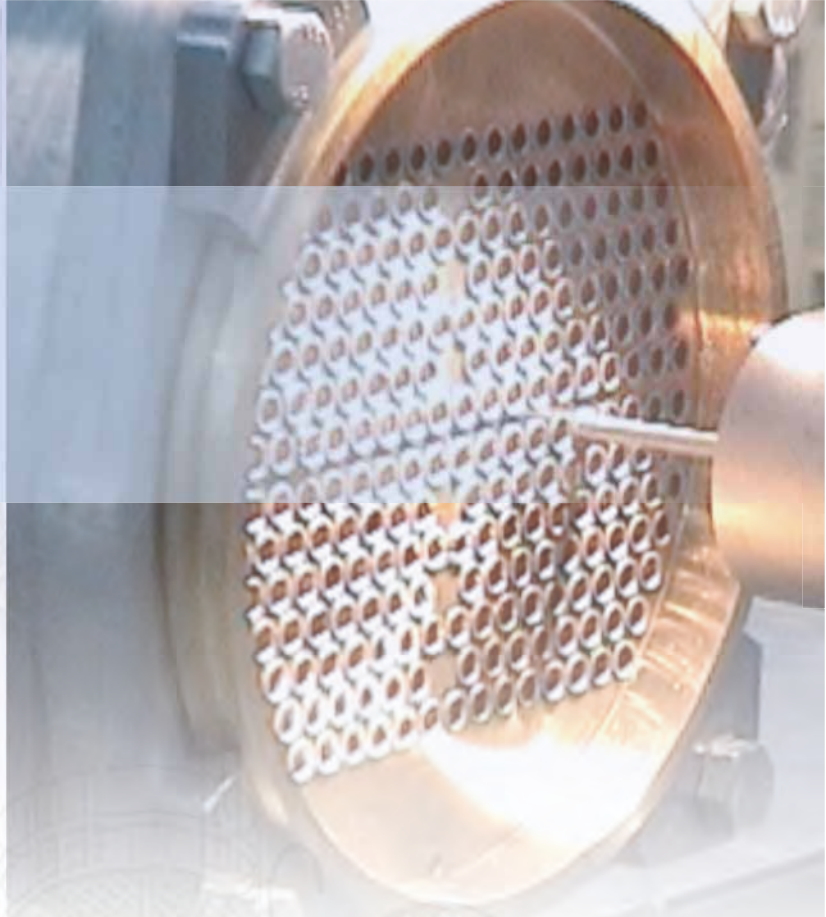
Remote control

It enables the operator to handle the main positioning in manual mode, remaining near the working area in total safety.



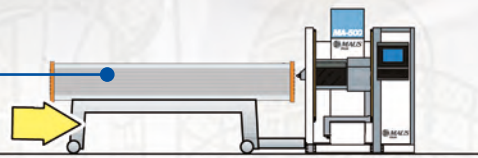
MA-500

Positioning



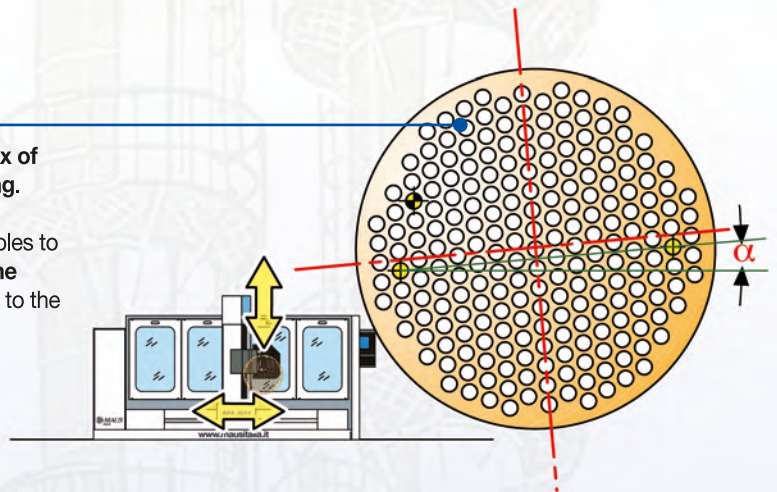
1 Positioning

The manufacturer will provide for **mechanical strikers** which will make the positioning of the tubesheet (by gantry crane or trolley) **simple and precise**.



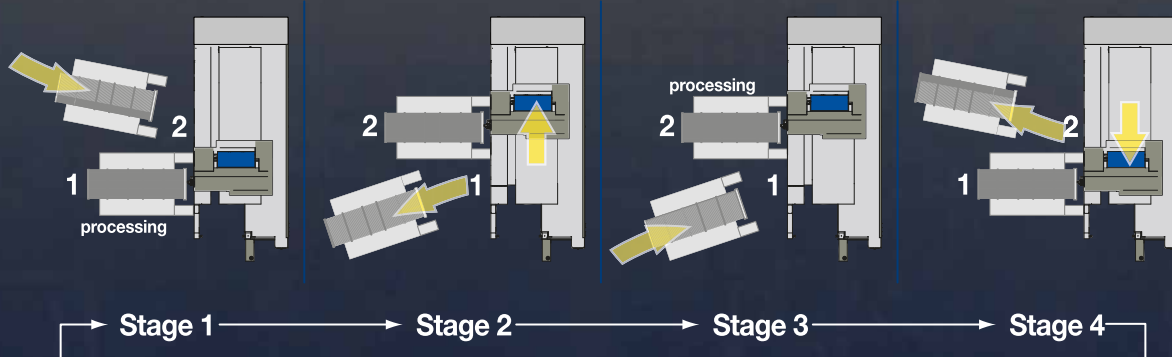
2 Zero setting

Collimation of the tubesheet hole centre **matrix of the cnc program to the machine zero setting**. A semi-automatic procedure combined to the **FOCS-2** laser self-learning centring feeler enables to **calculate and store both the position and the actual rotation of the tube sheet** with regard to the machine.



Pendulum process with trolleys

So-called **pendulum process** layout with trolleys for processing **small exchangers** in which the continuous positioning in front of the machine **eliminates the load/unload downtimes**, remarkably increasing the production.



MA-500

Applied technologies

Total quality



TL Free tubes

Rolling on a tube simply inserted into the tube sheet — without being blocked and consequently free to move longitudinally — has been one of the **first issues successfully solved** by the Maus Italia **MA** series machines.

Whether a forced rolling or a pre-welding approach has to be performed, the proposed working centres — duly equipped — are able to **block and expand** a free tube at the desired protrusion, in a **completely autonomous and automatic** manner.



RP Parallel roller

The **RP** technology — better known as parallel roller — was introduced on the **MA** series working centres in 1991 by Maus Italia.

It enables to **minimize the tube elongations and its relative residual tensions after rolling in order to reach a uniform tube-to-tubesheet contact all along the expansion.**

It provides for the use of **tube expanders with the roll housing site axis parallel to the cage axis.**

The main **advantages** are:

- **tube cylindricity** after rolling;
- **reduced tube elongation**;
- **mandrel rotation speed independent from the rolling speed (reduced tool wear)**;
- **reduction of the residual internal tensions** between tube and tube sheet.



CPZ Automatic compensation of the expansion limit depth

Z axis zero setting automatic system:

the external **edge of the tube sheet** becomes the **reference mark** for each single tube, regardless of the **tubesheet deformation** or the machine alignment to the tube sheet.



CDAS Mandrel forward movement digital control

The pin forward movement digital control enables to **verify the real-time actual tube expansion dimension.**

This technology enables to **record the value of any performed expansion.**



CVSC Speed continuous variation

The latest innovation in rolling.

The tube expander mandrel **rotation speed varies continuously** according to the **instantaneous torque**

Advantages:

- **Optimized expansion cycle** according to the toughness of the expanding tube material
- **Reduced tool wear**
- **Higher processing speed**

Long-lasting reliability

Tool lubrication

An internal tool lubrication automatic system, equipped with a properly set minimum level control, automatically manages the appropriate lubrication of the tube expander.



Guide lubrication

Grease lubrication gearcase for recirculating ball screws activated according to the number of meters covered by each machine axis.

The linear guides are instead equipped with a device directly applied to the runners which enables more than 10000 km (*approx 6200 mi*) covered without any maintenance intervention.



Climate-controlled electric cabinet

A double air-conditioner controls and automatically manages the temperature in order to protect the electronic equipment on the machine.



Lamp

Perfect visibility of the working area thanks to the low voltage spot halogen lamp located directly over the working area.



MA-500

Main components

Ergonomic console and remote control

Hinged to the protection structure, the console enables to control the whole working area especially during the setting stages. As a further complement, a remote control allows to perform the main manual movement and it enables the operator to verify the alignment on the machine in total safety.



Sinumerik 840 D

The **MA-2501** CNC group adopts the **Totally Integrated Automation SIEMENS®** solution that implies a uniform system of products in which every component is designed to work in synergy with the others.



Alarm signalling lamp

Immediate signalling of the machine status

- Green light: automatic cycle in progress
- Red light: alarm status
- Light off: machine in standby



Safety systems

A fixed safety structure bounds the machine preventing the access to the axes operating areas.

This system is integrated with a set of fixed as well as mobile safety photoelectric barriers.

The sliding cover with electromechanical interlock completes the protection of the tube expanders rotation area.



USB communication port

For a fast and reliable exchange of information between machine and office.





Tube sheet
diameter
2500 mm (100")

Tube sheet max
thickness
700 mm (27.5")

tubes
diameter
9,5 ÷ 51 mm (3/8" ÷ 2")

Photograph
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ATTENZIONE
E SEVERAMENTE VIETATO SALIRE
SUL BASAMENTO DURANTE
IL CICLO AUTOMATICO

MA-2501

Single or double axis cnc working centre with movable machine for rolling, facing and grooving of the tube bundle tubes.

The **MA-2501** is the most innovative and effective solution ever proposed by Maus Italia as for automating the process cycles of assembling of the medium-sized and large heat exchangers.

● High technology

The **exclusive FOCS3 centring system** together with the cnc, **without the traditional mechanic contact accessories**, which has been widely tested in our 30-year experience in the automation field, guarantee an extremely high geometry precision in the operations **with a deviation of only 0,05 mm (0.002")**.

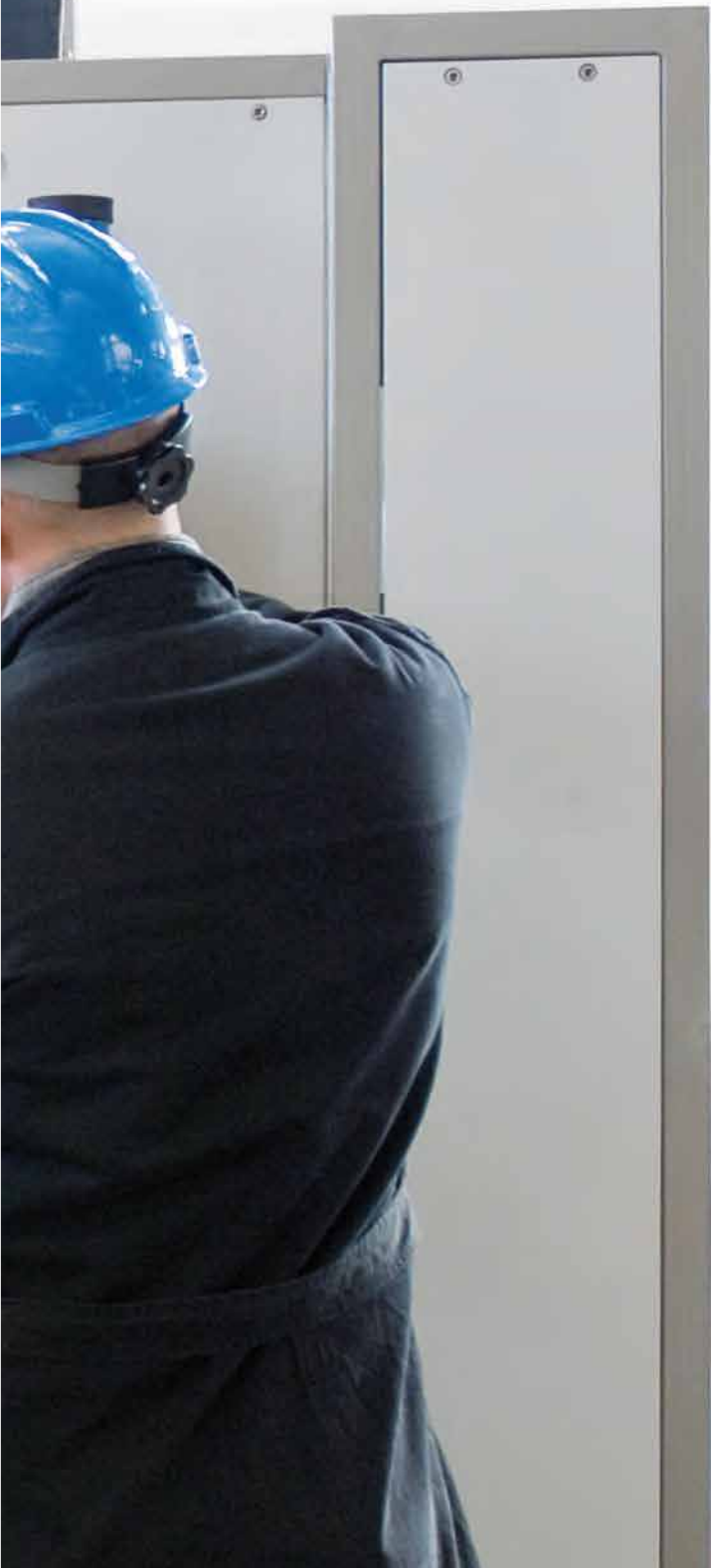
The setting of all the working and positioning parameters is operated by **Windows XP®** operating system with cutting edge graphical and multitasking features.

● Maximum productivity

The **MA-2501** cnc working centre enables the **single or double axis expansion, TIG orbital welding, and facing** of the tube sheet tubes as well as the **optional grooving** of the tube sheet holes: entirely automated and cost efficient processes and a remarkably reduced production time.

● Maximum manoeuvrability

Thanks to the **servo hydraulic machine base (optional)** and the 8 pivoting wheels provided, the **MA-2501** enables the **correct alignment** of the machine to the tube sheet which is fundamental as for quality.



Column

The vertical dimensions are halved for transport thanks to the hinged column folding at its base on the horizontal crane.

Centring feeler

Optional self-learning laser centring system which is able to work both in synchrony with the cnc and autonomously.

Tool holder head

Tool holder head equipable with semi-automatic tool change for rolling, facing and grooving.

Y axis

Vertical run trolley and Z axis support with the operating axis

Electric cabinet

It is installed on the machine and it is equipped with air-conditioner for the automatic control of the internal temperature.

Mobile machine base

Thanks to the mobile machine base servo hydraulic movements, a fast and precise alignment to the tube sheet is guaranteed. In fact this operation takes just a few minutes and it does not require any other special devices.



MA-2501

Single or double axis cnc working centre with movable machine for rolling, facing and grooving of the tube bundle tubes.

Machine status signalling

A complete range of signals and alarms about the machine status helps the operator both in the operative stages and while setting a new work.

Z axis

Transverse run trolley sheet approach for both first and second axis (optional)

Third axis: TIG orbital welding

Welding generator holder compartment

Installed on the machine and isolated from the other electronic components to prevent issues due to the high-frequency starting.

Control console

The control console is located in such a way that maximum visibility of the working area is guaranteed. The cnc display guarantees the maximum working easiness.

X axis

Column support trolley for horizontal positioning.

Remote control

It enables the operator to handle the main positioning in manual mode, remaining near the working area in total safety.

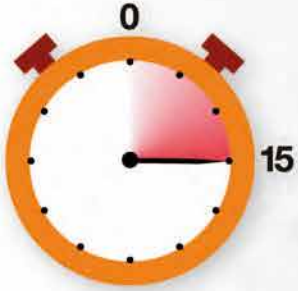


As for **quality**, a **precise alignment of the machine to the tube sheet** is essential. Having to deal with large heat exchange instruments, the thing that mainly concerns the technician is **how to manage such a tricky operation in a correct and safe way**.

Thanks to the **optional servo hydraulic machine** — optionally proposed for **MA-2501** — the **zero setting concept, typical of the traditional machine tools**, is completely revolutionized leading the machine to line up with the tube sheet.

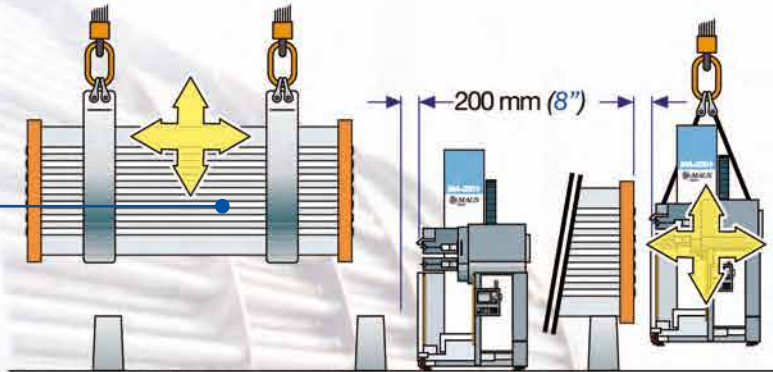
Thanks to the **servo hydraulic system installed**, it is possible to move the machine in the **three dimensions** in a **few minutes** and, in combination with the **FOCS-3** feeler, to perform the **correct alignment of the sheet zero to the cnc program**.

Moreover, it provides a **total flexibility**: if the tube sheet dimensions exceed the available run of the machine, it is possible to **break up the program in parts or quadrants** — not necessarily equal — and proceed to the **exchanger rotation or to the displacement of the machine to the different sectors to be worked**. This operation is made easier by the **8 pivoting wheels provided**.



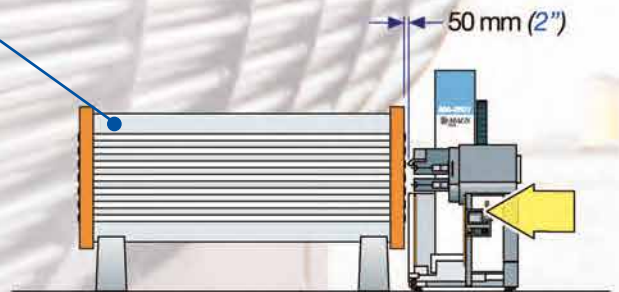
1 Approximate positioning

Using the regular hoisting devices available in the workshop (**gantry crane**), the operator **positions the tube bundle at a safety distance** of approx 200 mm (8") in a **non definitive manner**.



2 Precision positioning

Using the "**Translation**" command, max run 150 mm (6"), the operator **moves the machine near to the tube sheet positioning it at the desired working distance**. Whenever necessary, **this command may be repeated** to cover longer distances.



MA-2501

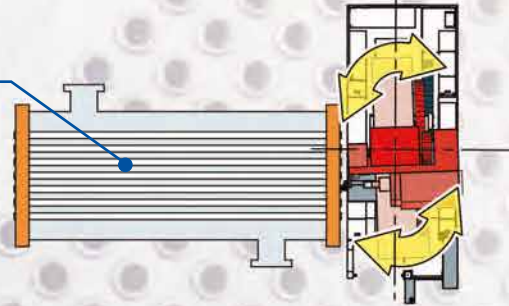
Servo hydraulic machine base: fast positioning

Optional

3

Horizontal alignment

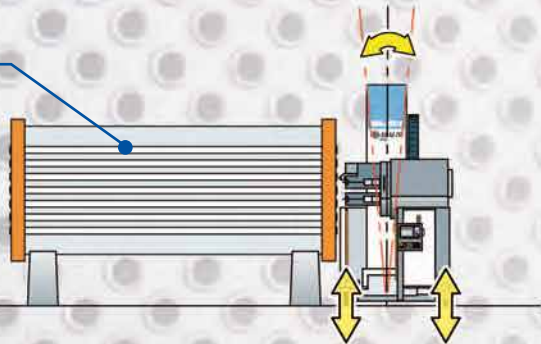
Using the "Rotation" command, it is possible to rotate by $\pm 8^\circ$ the X axis horizontal runway. The **FOCS-3** feeler displays in real time the distance rate of the tube sheet with a precision of $\pm 0,05$ mm (0.002").



4

Vertical alignment

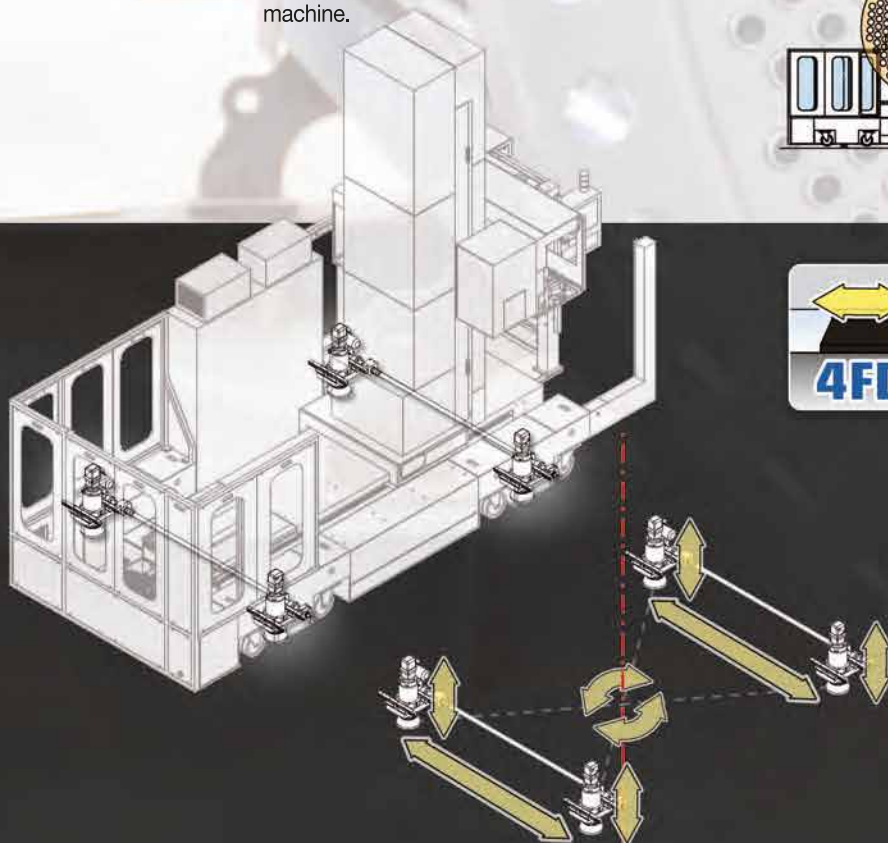
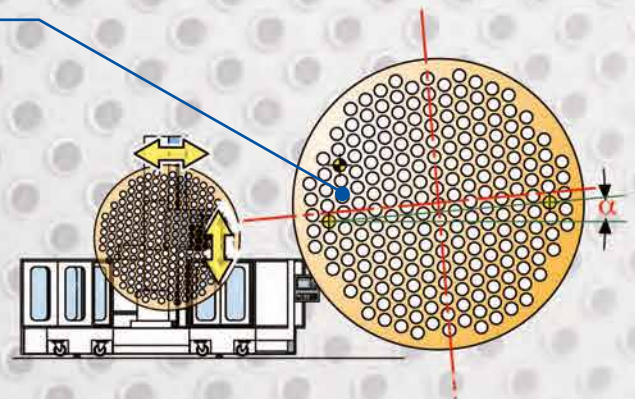
Thanks to the 4 independent servo hydraulic legs, the operator can easily verify and correct the vertical rod (Y axis) alignment to the tube sheet.



5

Zero setting

Collimation of the tubesheet hole centre matrix of the cnc program to the machine zero setting. A semi-automatic procedure combined to the **FOCS-3** laser self-learning centring feeler enables to calculate and store both the position and the actual rotation of the tube sheet with regard to the machine.



4FD Four Feet Drive

The new **MA-2501** and **MA-3501** servo hydraulic machine base guarantees toughness and precision.

In particular, the 4 positioning legs contribute to compensate the horizontal thrusts.

The transmission system on each leg guarantees continuity and precision in translation.

Up to 850 expansions/hr
1200 faces/hr
800 grooves/hr

MA-2501

Second axis:
rolling, facing and grooving

Optional

Proposed as an optional, it enables to **significantly increment productivity** in rolling, facing, and grooving.

The system enables to **work simultaneously on two tubes or tubesheet holes in a completely autonomous and independent way.**

High productivity

The **second working axis** is the result of a project designed for a specific purpose: **productivity and quality.**

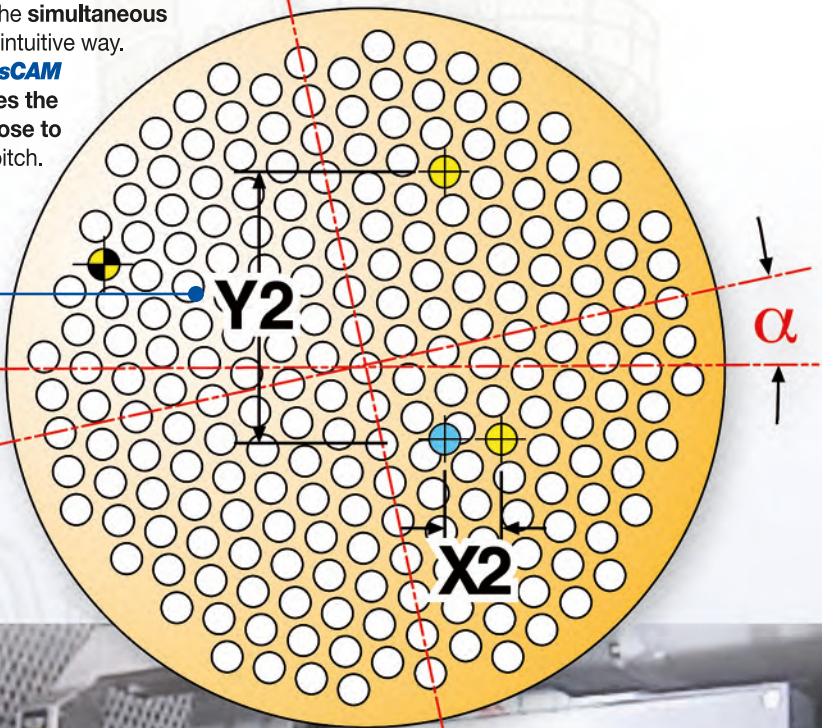
The complete independence of the two axes is guaranteed by the working channels **cnc technology** and it enables to manage the **simultaneous operation of the two installed tools** in a simple and intuitive way.

Thanks to the **cnc programming** assisted by the **MausCAM** software provided, **MA-2501**, automatically separates the sheet areas to be worked by a double tool from those to be worked by a single tool, according to the drilling pitch.

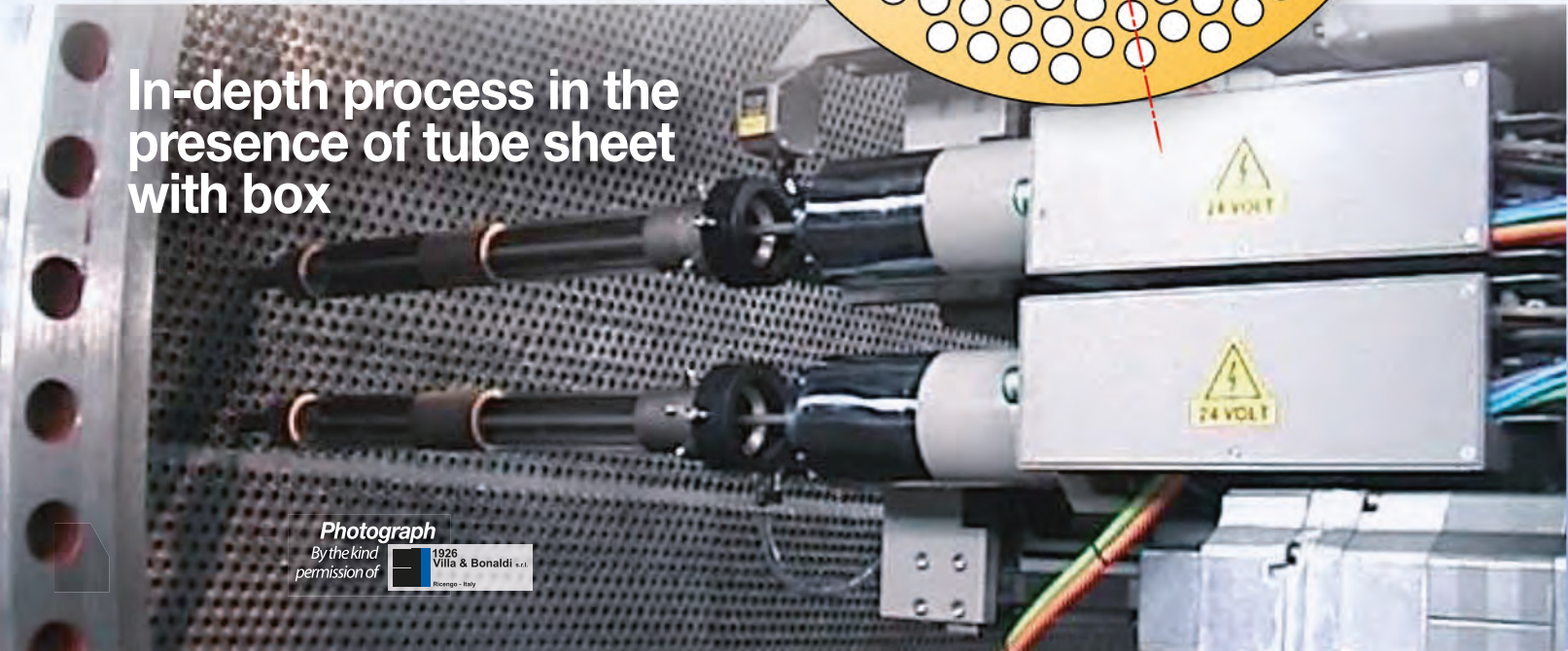
Automatic compensation

The operating wheelbase between the two tool axes is not a mere direct function of the tube sheet drilling pitch, but it shall **also take into account the actual tube sheet positioning with regard to the machine.**

Thanks to a complete and revolutionary handling device of the second axis — numerically controlled both **horizontally** and **vertically** — it is possible to automatically compensate the **X2** and **Y2** wheelbase.



In-depth process in the presence of tube sheet with box



MA-2501

Applied technologies

Total quality



TL Free tubes

Rolling on a tube simply inserted into the tube sheet — without being blocked and consequently free to move longitudinally — has been one of the **first issues successfully solved** by the Maus Italia **MA** series machines.

Whether a forced rolling or a pre-welding approach has to be performed, the proposed working centres — duly equipped — are able to **block and expand** a free tube at the desired protrusion, in a **completely autonomous and automatic** manner.



RP Parallel roller

The **RP** technology — better known as parallel roller — was introduced on the **MA** series working centres in 1991 by Maus Italia.

It enables to **minimize the tube elongations and its relative residual tensions after rolling in order to reach a uniform tube-to-tubesheet contact all along the expansion.**

It provides for the use of **tube expanders with the roll housing site axis parallel to the cage axis.**

The main **advantages** are:

- **tube cylindricity** after rolling;
- **reduced tube elongation**;
- **mandrel rotation speed independent from the rolling speed (reduced tool wear)**;
- **reduction of the residual internal tensions** between tube and tube sheet.



CPZ Automatic compensation of the expansion limit depth

Z axis zero setting automatic system:

the external **edge of the tube sheet** becomes the **reference mark** for each single tube, regardless of the **tubesheet deformation** or the machine alignment to the tube sheet.



CDAS Mandrel forward movement digital control

The pin forward movement digital control enables to **verify the real-time actual tube expansion dimension.**

This technology enables to **record the value of any performed expansion.**



CVSC Speed continuous variation

The latest innovation in rolling.

The tube expander mandrel **rotation speed varies continuously** according to the **instantaneous torque**

Advantages:

- **Optimized expansion cycle** according to the toughness of the expanding tube material
- **Reduced tool wear**
- **Higher processing speed**

MA

MAUS
ITALIA



Optional

MA-2501

Third optional axis:
TIG orbital welding

The option of the third **TIG orbital** welding axis completes the working centre.
By a single machine positioning and a single "part program", the operator is able to perform rolling and milling operations as well as to weld the tubes to the tube sheet.

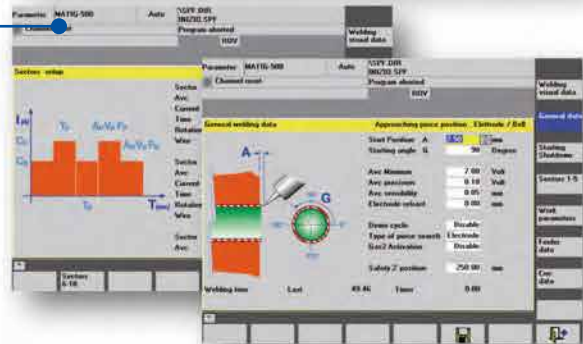
Welding torch lock

The cnc positioning of the welding head combined to the **FOCS-3** feeler control and correction guarantees the proper centring of the welding orbit to the tube, leading to quality and uniformity of the welded joint.



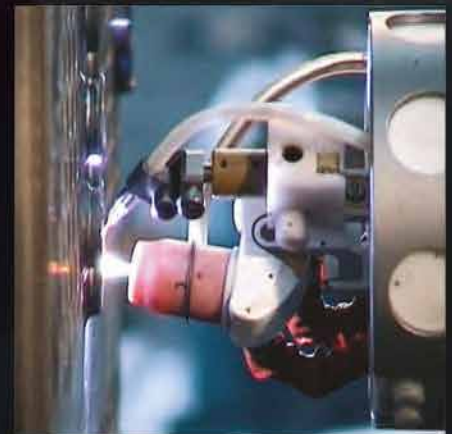
Total integration

The excellent result achieved is due to the perfect combination and integration of all the components of the system which have been designed, manufactured, and tested to work in an automation environment.



For further details
refer to **MaTIG-500**

AU-62



Long-lasting reliability

Tool lubrication

An internal tool lubrication automatic system, equipped with a properly set minimum level control, automatically manages the appropriate lubrication of the mandrel.



Guide lubrication

Grease lubrication gearcase for recirculating ball screws activated according to the number of meters covered by each machine axis. The linear guides are instead equipped with a device directly applied to the runners which enables more than 10000 km (approx 6200 mi) covered without any maintenance intervention.



Climate-controlled electric cabinet

A double air-conditioner controls and automatically manages the temperature in order to protect the electronic equipment on the machine.



Lamp

Perfect visibility of the working area thanks to the low voltage spot halogen lamp located directly over the working area.



Ergonomic console and remote control

Hinged to the protection structure, the console enables to control the whole working area especially during the setting stages. As a further complement, a remote control allows to perform the main manual movements and it enables the operator to verify the alignment on the machine in total safety.



MA-2501

Main components

Hydraulic power unit

Integrated in the hydraulic machine base, the power unit operates the hydraulic actuators in order to perform the auxiliary handlings on board.



Sinumerik 840 D

The **MA-2501** cnc group adopts the “**Totally Integrated Automation**” **SIEMENS®** solution that implies a uniform system of products in which every component is designed to work in synergy with the others.



Alarm signalling lamp

Immediate signalling of the machine status

- Green light: automatic cycle in progress
- Red light: alarm status
- Light off: machine in standby



Safety systems

A fixed safety structure bounds the machine preventing the access to the axes operating areas.

This system is integrated with a set of fixed as well as mobile safety photoelectric barriers.

The sliding cover with electromechanical interlock completes the protection of the mandrel rotation area.



USB communication port

For a fast and reliable exchange of information between machine and office.





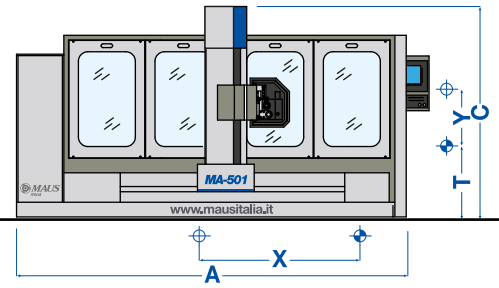
Supply			MA-500	MA-2501	MA-3501
Voltage	Volt - Ph		400 - 3	400 - 3	400 - 3
Frequency	Hz		50	50	50
Installed power	Kw		17	50	50
Dimensions			MA-500	MA-2501	MA-3501
Length	A	mm (Ft)	4200 (13.78)	6500 (21.32)	7600 (24.93)
Width	B	mm (Ft)	1700 (5.58)	2350 (7.71)	2350 (7.71)
Height	C	mm (Ft)	2160 (7.10)	4950 (16.24)	5155 (16.91)
Height for transport		mm (Ft)	1850 (6.10)	2730 (8.10)	2730 (8.10)
Weight		Kg (Lb)	7500 (16540)	13500 (29770)	16000 (35300)
Colours		RAL	7030 - 7035	7030 - 7035	7030 - 7035
Additional packing			---	1	1
Additional packing dim.		(Ft)	---	1800x1400x1200	1800x1400x1200
		Kg	---	(6.00x4.60x4.00)	(6.00x4.60x4.00)
Additional weight		Kg (Lb)	---	280 (620)	310 (690)
Dimensional capacities			MA-500	MA-2501	MA-3501
Stroke	X	mm (inches)	* 1700 (66.929)	2500 (98.425)	3500 (137.795)
Stroke	Y	mm (inches)	* 600 (23.622)	2500 (98.425)	3500 (137.795)
Stroke	Z	mm (inches)	400 (15.748)	800 (31.496)	800 (31.496)
Minimum height	T	mm (inches)	780 (30.709)	920 (36.220)	950 (33.465)
Fast forward movement			MA-500	MA-2501	MA-3501
X axis		m/min (Ft/min)	(98.4)	(65.6)	(32.8)
Y axis		m/min (Ft/min)	(98.4)	(65.6)	(32.8)
Z axis		m/min (Ft/min)	(98.4)	(82.0)	(82.0)
U axis		m/min (Ft/min)	(49.2)	(49.2)	(49.2)
Working capacity			MA-500	MA-2501	MA-3501
Tube sheet diameter		mm (inches)	1000 (39") max.	2500 (100")	3500 (140")
Tube sheet max thickness		mm (inches)	200 (8")	700 (27.5")	700 (27.5")
Tube max diameter		mm (inches)	6÷16 (1/4"÷5/8")	9,5÷51 (3/8"÷2")	9,5÷51 (3/8"÷2")
Tube expander torque		Nm (Ft Lb)	4 (2.950)	100 (73.756)	100 (73.756)
Tube expander max speed		rounds/min (R.P.M)	3000	1500	1500
Tube expander motor max power		Kw	1,25	5	5
Max tube pulling force		KN (Lb)	3,4 (2.508)	6,0 (4.425)	6,0 (4.425)
Max tube thrust force		KN (Lb)	3,0 (2.213)	5,0 (3.688)	5,0 (3.688)
Min wheelbase two tube expanders		mm (inches)	---	160 (6.299)	165 (6.496)
Max wheelbase two tube expanders		mm (inches)	---	305 (12.008)	305 (12.008)
Tool lubrication		Lt (GalUS)	3 (0.793)	3 x2 (0.793 x2)	3 x2 (0.793 x2)
Welding			MA-500	MA-2501	MA-3501
Max welding current		Amp	---	6÷200	6÷200
No-load voltage		Volt	---	81	81
Orbital speed		gir/min (R.P.M)	---	0÷6	0÷6
Welding wire speed		gir/min (R.P.M)	---	0÷150	0÷150
Welding wire spool		Kg/Ømm (Lb/Øinches)	---	1-100 (2.2/3,937)	1-100 (2.2/3,937)
Cooling unit		Lt (GalUS)	---	6 (1,585)	6 (1,585)
Cooling capacity		Kw	---	2	2
Electrode diameter		mm (inches)	---	1÷3,2 (0,039÷0,126)	1÷3,2 (0,039÷0,126)
Welding wire diameter		mm (inches)	---	0,8÷1,2 (0,031÷0,047)	0,8÷1,2 (0,031÷0,047)

MA-500 * Extensible stroke upon request: **X** up to 2500 mm (98,425"); **Y** up to 1200 mm (59,055").

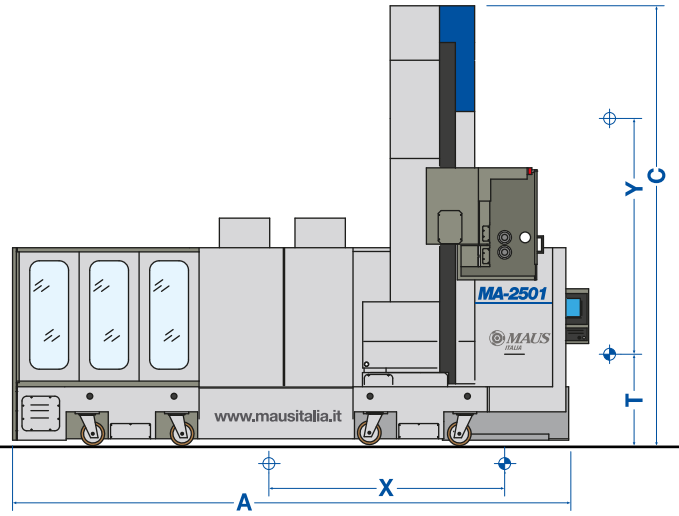
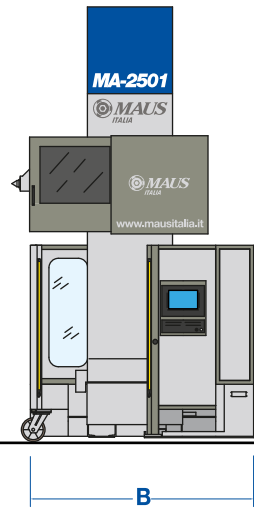
MA-500 * "Heavy" tube expanders line upon request: workable tube max diameter: 9,5÷51 mm (3/8"÷2")

Optional

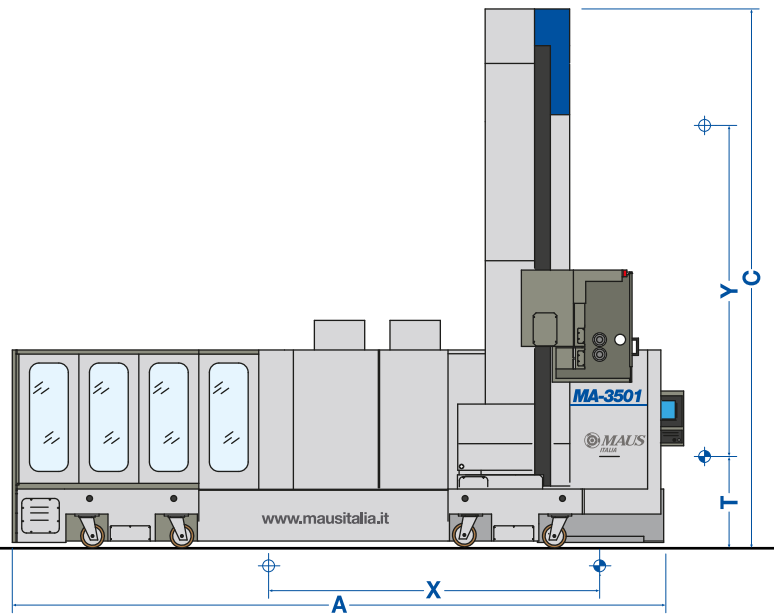
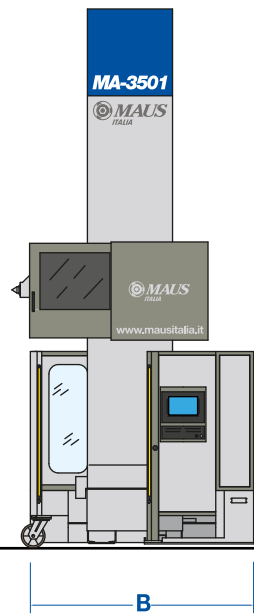
MA-500



MA-2501



MA-3501





Processes	MA-500	MA-2501	MA-3501
Rolling	●	●	●
Welding	—	+	+
Facing	+	+	+
Grooving	+	+	+
Servo assisted positioning	MA-500	MA-2501	MA-3501
Servo hydraulic machine base	—	+	+
Z working axis	MA-500	MA-2501	MA-3501
Z1	●	●	●
Z2	+	+	+
Z3 (Welding)	—	+	+
Centring and distance	MA-500	MA-2501	MA-3501
FOCS-2 (centring only)	+	—	—
FOCS-3 (centring + tube sheet distance)	—	+	+
High quality	MA-500	MA-2501	MA-3501
Real time report (Rolling)	●	●	●
AVC (Welding)	—	+	+
Software	MA-500	MA-2501	MA-3501
MausCAM	+	+	+
Data exchange	MA-500	MA-2501	MA-3501
USB	●	●	●
RS232	●	●	●
Ethernet	●	●	●

Provided ●

Optional +

Not available —



Main components	MA-500	MA-2501	MA-3501
Sinumerik	● 840 D	● 840 D	● 840 D
Quick tube expander change	●	●	●
Automatic tool lubrication	●	●	●
Guide lubrication	●	●	●
Air conditioned electric cabinet	●	●	●
Lamp	●	●	●
Ergonomic console	●	●	●
Hydraulic power unit	+	+	+
Alarm signalling lamp	●	●	●
Safety	MA-500	MA-2501	MA-3501
Fixed mechanical protection	●	●	●
Fixed photoelectric barrier	●	●	●
Mobile photoelectric barriers	●	●	●
Cover with interlock	●	●	●
Applied technologies	MA-500	MA-2501	MA-3501
TL Free tubes (with hydraulic head)	+	+	+
RP Parallel (and inclined) rolls	●	●	●
CPZ Z automatic compensation	+	+	+
CDAS Mandrel forward movement digital control	●	●	●
CVSC Speed continuous variation	●	●	●
Accessories	MA-500	MA-2501	MA-3501
Remote control	+	●	●

Provided ●

Optional +

Not available —

3

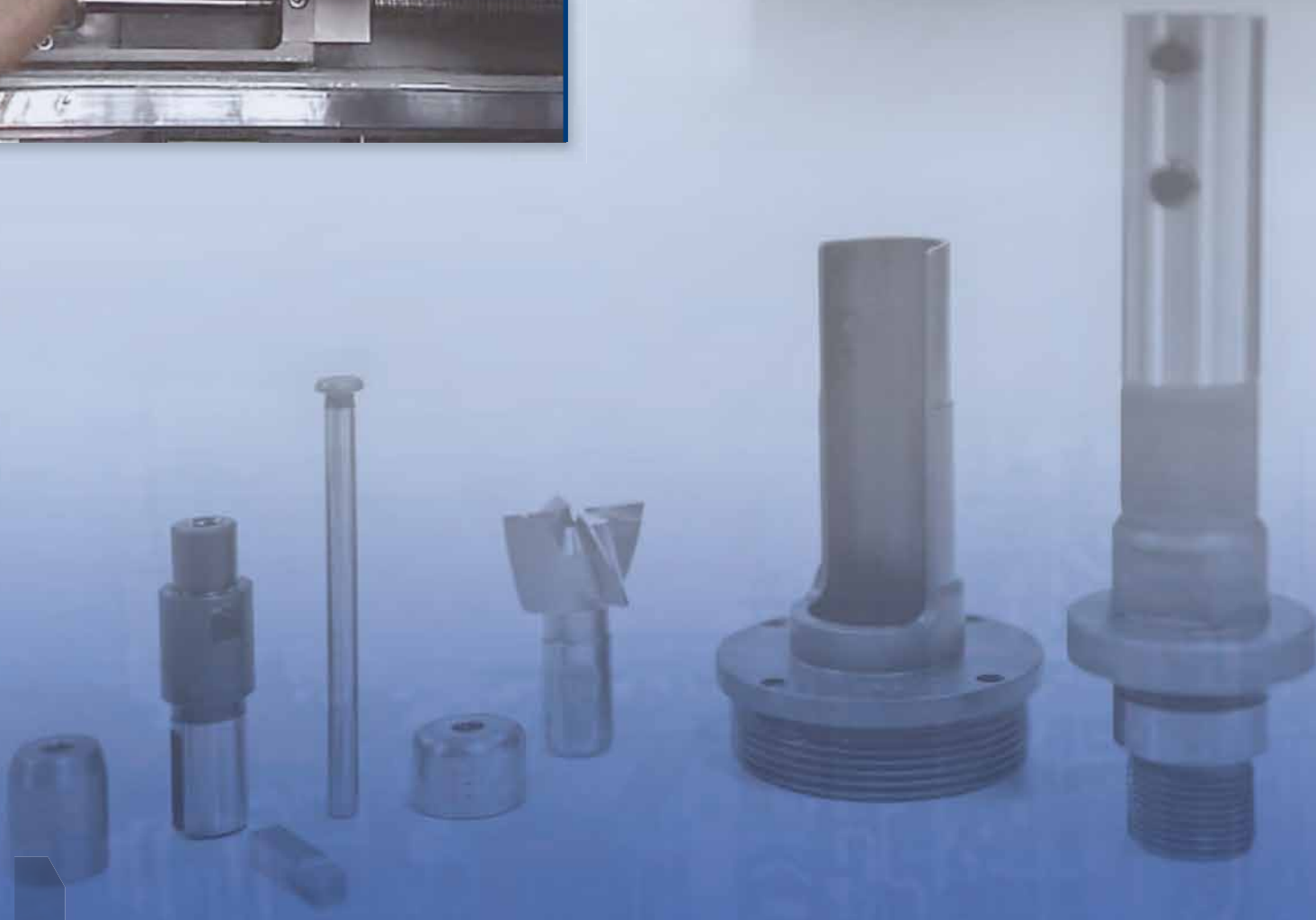
Accessories and tools for the MA series cnc working centres

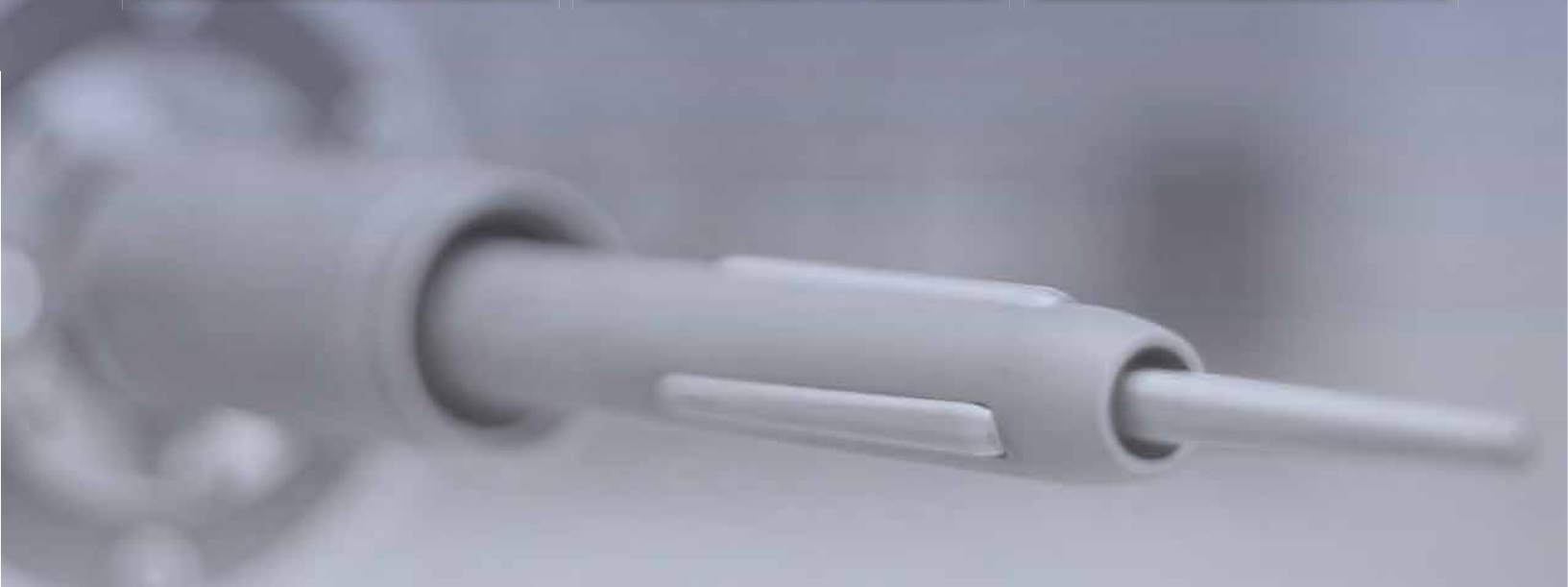


Maus Italia here presents a brief overview of the tools and the accessories designed for the **MA-500**, **MA-2501**, and **MA-3501** working centres.

For **further technical** information, refer to the relevant catalogue.

The **technical staff** of the Maus Italia "Automation and Welding Division" is at customers' complete disposal to suggest the ideal solution to any kind of application.





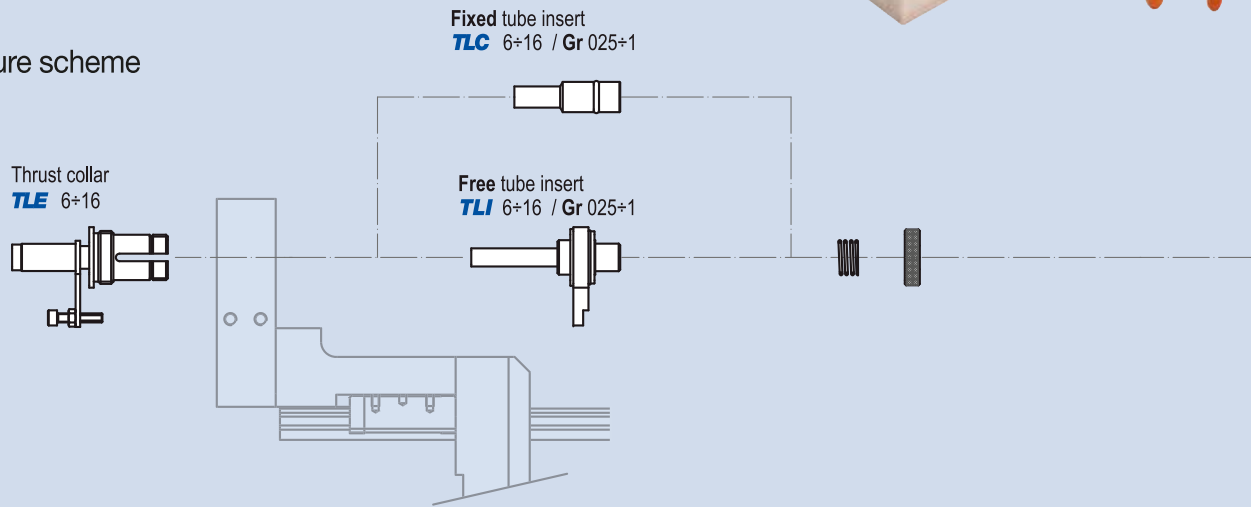
MA-500

Accessories and tools
for tube expansion
and facing



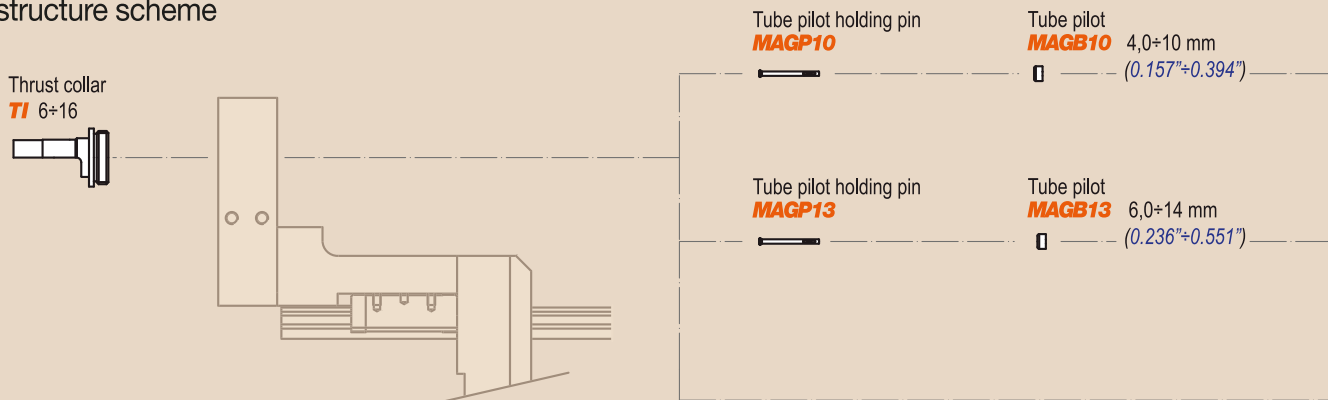
Rolling

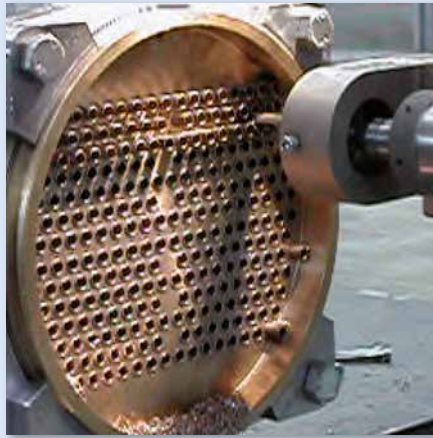
Tooling system structure scheme



Facing

Tooling system structure scheme





- Series **S** rolls
- Lu 14+17 mm (0.551"±0.669")
- Series **L** rolls
- Lu 26 mm (1.023")
- Series **C** rolls
- Lu 26 mm (1.023")

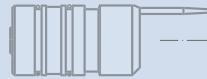
Gr 025±1



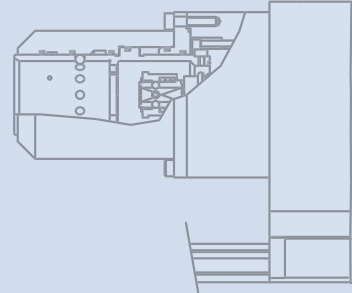
Mandrel **MA-500**
Gr 025±1



Quick connect cage holder
complete with
rotating distributor
for lubrication
Gr 025±1
MA-500



MA-500



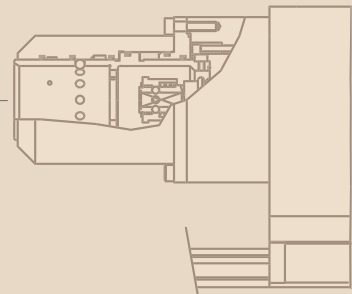
Cage
Gr 025±1
di 6,2±15,5 mm (0.244"±0.610")
RE 0±190 mm (0.000"±7.480")



Quick connect
tube end facer-holder
complete with
rotating distributor for lubrication
MA-500



MA-500



HSS facing tool
MAFHSS10 6+11



Holding shank
MAC500-10 de 5/16"±3/8"



HSS facing tool
MAFHSS-13 8+18



Holding shank
MAC500-13 de 3/8"±1/2"



Bevelling/milling cutter 60°- 90°
MAS-13 8+18



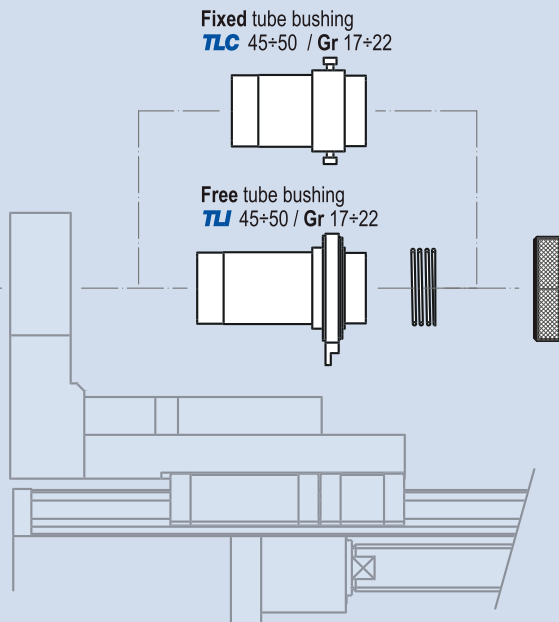
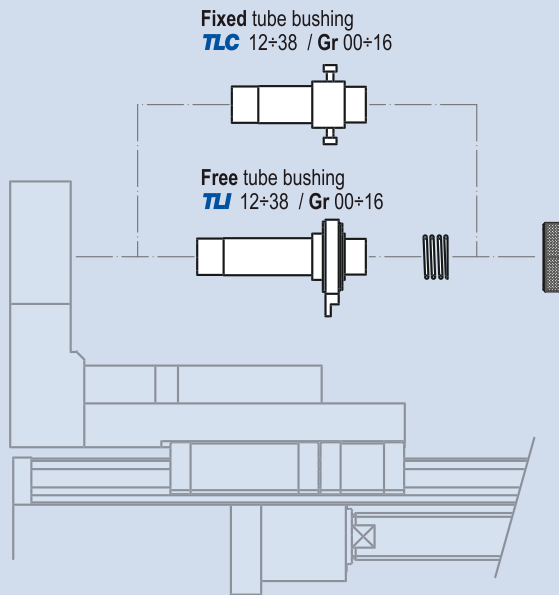
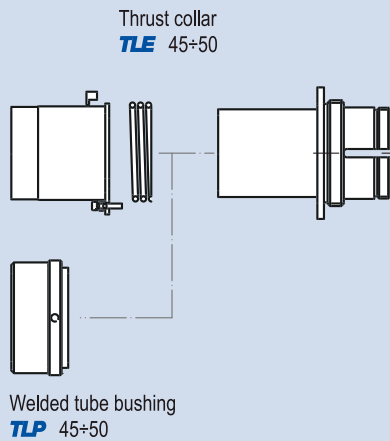
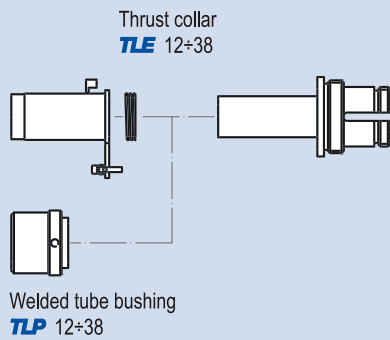
Gr size
de tube outside diameter
di tube inside diameter
Lu roll usefull length
RE expansion depth

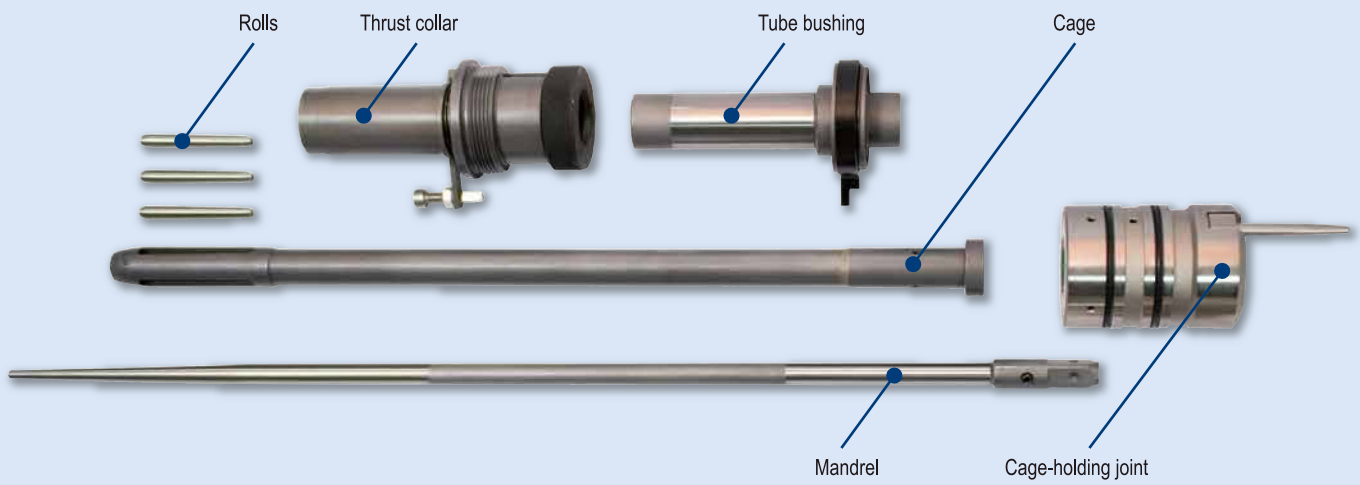
MA-2501

Accessories and tools
for tube expansion

Rolling

Tooling system structure scheme





Series **V** rolls
Lu 50 mm (1.968")
Gr 1+8

Series **T** rolls
Lu 30 mm (1.181")
Gr 00+8

Cage
Gr 00+8
di 9,6÷23,0 mm (0.378"±0.906")
RE 0÷400 mm (0.000"±15.748")

MA-2500 mandrels
Gr 00+8

Quick connect
 cage holder joint complete with
 rotating distributor for lubrication
Gr 00+8

MA-2501
MA-3501

Series **V** rolls
Lu 50 mm (1.968")
Gr 9+14

Series **T** rolls
Lu 30 mm (1.181")
Gr 9+14

Cage
Gr 9+14
di 21,0÷32,0 mm (0.827"±1.260")
RE 0÷400 mm (0.000"±15.748")

MA-2500 mandrels
Gr 9+14

Quick connect
 cage holder joint complete with
 rotating distributor for lubrication
Gr 9+14

Series **T** rolls
Lu 30 mm (1.181")
Gr 15+22

Cage
Gr 15+22
di 30,0÷49,0 mm (1.181"±1.929")
RE 0÷400 mm (0.000"±15.748")

MA-2500 mandrels
Gr 15+22

Quick connect
 cage holder joint complete with
 rotating distributor for lubrication
Gr 15+22



Gr size
de tube outside diameter
di tube inside diameter
Lu roll usefull length
RE expansion depth

MA-2501

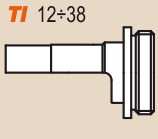
Accessories and tools
for tube facing

Facing

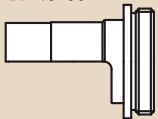
Tooling system structure scheme



Thrust collar
TI 12÷38



Thrust collar
TI 45÷50



Grooving

Tooling system structure scheme

Thrust collar
TFC 2÷4



Tube pilot holding pin
MAGP10

Tube pilot
MAGB10 7,0÷10,5 mm
(0.276"÷0.413")



F751 Tube pilot
MAG751 10,4÷13,4 mm
(0.409"÷0.528")



F751 cutter
F751 Gr 2



Tube pilot holding pin
MAGP13

Tube pilot
MAGB13 7,0÷15,0 mm
(0.276"÷0.591")



Widia bits
MACU 5/8"



F751 Tube pilot
MAG751 12,3÷23,7 mm
(0.484"÷0.933")



F751 cutter
F751 Gr 3÷5



Tube pilot holding pin
MAGP19

Tube pilot
MAGB19 12,0÷24,5 mm
(0.472"÷0.965")



Widia bits
MACU 3/4"÷1"



F751 Tube pilot
MAG751 23,4÷48,0 mm
(0.921"÷1.890")



F751 cutter
F751 Gr 6÷7

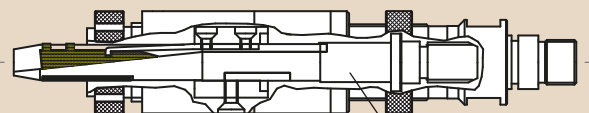


Tube pilot holding pin
MAGP32

Tube pilot
MAGB32 24,0÷49,0 mm
(0.945"÷1.929")

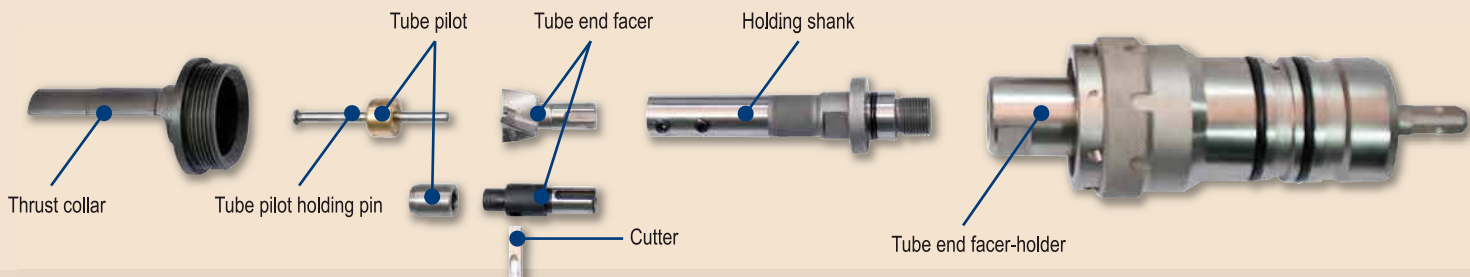


Widia bits
MACU 1.1/4"÷2"



F/26 cutter
LM2

Cutter-holding mandrel
RE 1÷47 mm (0.039"÷1.850")



HSS tube end facer
MAFHSS10 11÷15

Bevelling tool 60°- 90°
MAS13 10÷15

F751 tube end facer
MAF751 5/8"

Insert tube end facer
MAFAST13 5/8"

HSS tube end facer
MAFHSS13 15÷18

Bevelling tool 60°- 90°
MAS13 10÷18

F751 tube end facer
MAF751 3/4"±1"

Insert tube end facer
MAFAST19 3/4"±1"

HSS tube end facer
MAFHSS-9 22÷28

Bevelling tool 60°- 90°
MAS19 22÷28

F751 tube end facer
MAF751 1.1/4"±2"

Insert tube end facer
MAFAST32 1.1/4"± 2"

HSS tube end facer
MAFHSS32 34÷53

Bevelling tool 60°- 90°
MAS32 34÷50

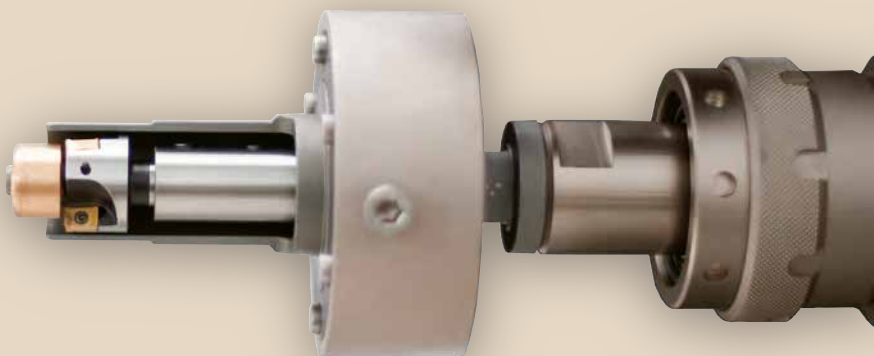
F/26 grooving tool
de 5/8"±1.1/4"

Holding shank
MAC-10 de 3/8"±1/2"

Holding shank
MAC-13 de 1/2"±5/8"

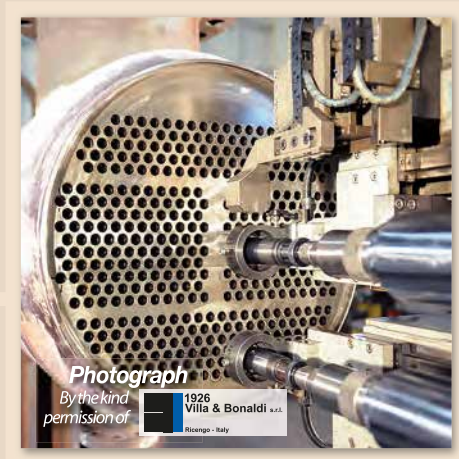
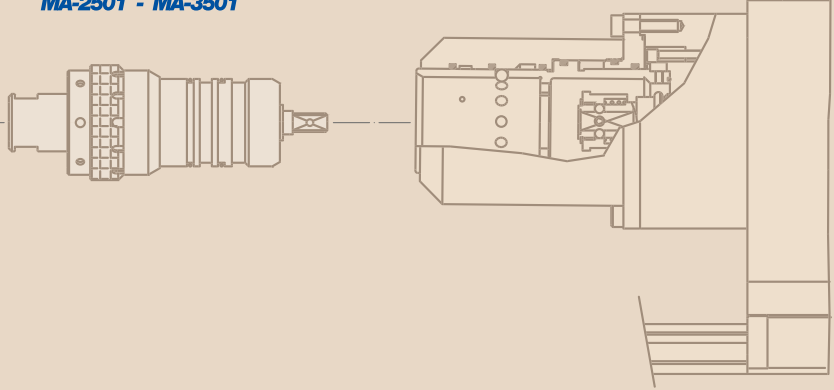
Holding shank
MAC-19 de 3/4"±1"

Holding shank
MAC-32 de 1.1/4"±2"



Quick connect tube end facer-holder complete with rotating distributor for lubrication
MA-2501 - MA-3501

MA-2501
MA-3501



Photograph
By the kind permission of
1926 Villa & Bonaldi s.r.l.
Riccione - Italy

Gr size
de tube outside diameter
di tube inside diameter
Lu roll usefull length
RE expansion depth

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