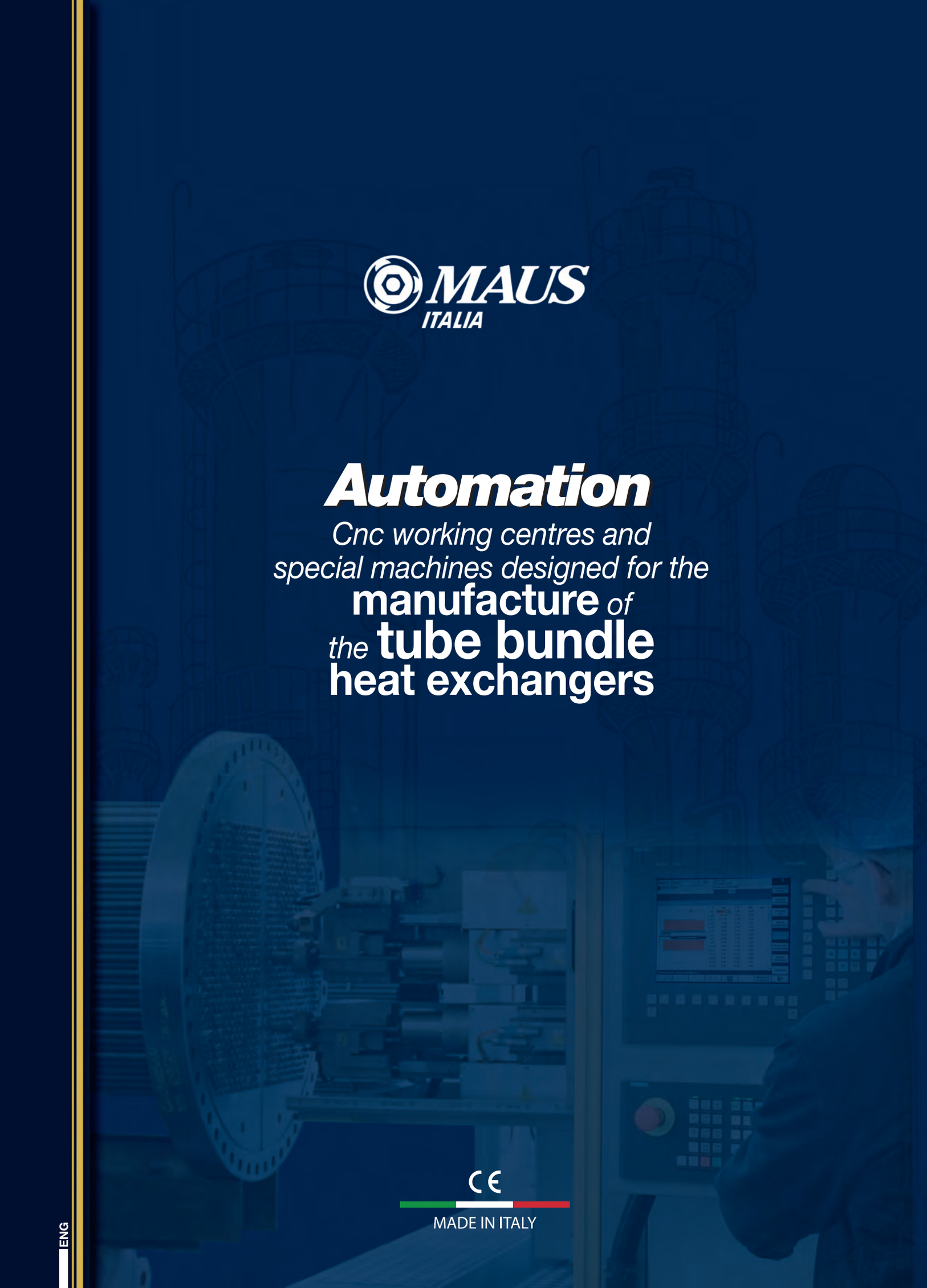
MAUS ITALIA

Automation

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



CE

MADE IN ITALY

ENG

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Maus Italia historical notes

Franco Agostino
The Founder

MAUS ITALIA 1961-2011 50

since 1961

At the end of the 50s, Franco Agostino seized the opportunity to grasp the art of manufacturing tube expanders which an elderly German manufacturer, Mr. Albert Otto, presented to him. Then, thanks to his indomitable courage and intuition, Mr. Agostino set up that small Italian factory that a few years later would become Maus Italia.

Early in the 80s, the company started the production of the first automatic expansion systems, meeting an increasing success by more and more demanding customers as for quality and productivity.

Nowadays Maus Italia has reached global leadership levels, thanks to a network of people who have been working very hard and to an Italian customer base with a strong export vocation.

Once again, at Maus Italia, the innovation arises from a long history of passion and enthusiasm, deeply rooted in the factory, which reflects in the proposed products.

This new and exclusive catalogue aims at helping the technician in choosing the
product.

Series MA cnc working centres historical notes

1980

The idea and the patent

In 1981, the idea of complete automation in the expansion process that Mr. Franco Agostino had been entertaining for years became reality through the launching on the Italian market of the first ***MA-1800****. The intuition of the self-learning centring system patented by the engineer Stefano Agostino would turn out to be successful.*

1990

Our expertise

During the 90s, the ***MA-1800*** *has been further developed and updated thanks to the close cooperation of the manufacturers.*
Among the main innovations, it is worth underlining the hydraulic machine base for alignment and the completely automated orbital welding.

2000

Productivity and reliability

2000 is the year of the launch of ***MA-2500****, whose main feature is the introduction of the double operating axis that consequently doubles productivity. The orbital welding becomes a completely integrated and reliable system.*

1993 - Photograph
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2010

Present and future

For the next decade, Maus Italia presents itself with an automation package which stands up to any comparison made up of:

- ***MA-500***
- ***MA-2501***
- ***MA-3501***
- ***MaTIG-500***

MAUS ITALIA

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DNV

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QUALITY MANAGEMENT SYSTEM CERTIFICATE

Certificato No. / Certificate No. CERT-00464-95-AQ-MIL-SINCERT

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Il sistema di gestione per la qualità di / the quality management system of

M.A.U.S. ITALIA di F. Agostino & C. Sas

S.S. Paullese Km 30 - 26010 Bagnolo Cremasco (CR) - Italy

È conforme ai requisiti della norma per i sistemi di gestione per la qualità
Conforms to the quality management systems standard
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Questa certificazione è valida per il seguente campo applicativo:
This certificate is valid for the following products or services:

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(Further clarifications regarding the scope and the applicability of the requirements of the standard(s) may be obtained by consulting the certified organization)

Progettazione e produzione di mandrini allargatubi, macchine per mandrinare e macchine per la manutenzione di scambiatori di calore
Design and production of tube expanders, rolling equipments and machines for maintenance of heat exchangers

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SINCERT
per l'Organismo di Certificazione / for the Accredited Unit: DET NORSKE VERITAS ITALIA S.R.L.
Renato Fratini, Lead Auditor
Vittore Marangon, Management Representative

La validità del presente certificato è subordinata a sorveglianza periodica (ogni 6, 9 o 12 mesi) e al riesame completo del sistema con periodicità triennale
The validity of this certificate is subject to periodical audits (every 6, 9 or 12 months) and the complete re-assessment of the system every three years

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Automation

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

Through this publication, Maus Italia aims at presenting a complete overview of unique **cnc working centres** and **special machines.** The ambition of our company is to provide an innovative method for companies manufacturing heat exchangers to achieve a definite solution of the issues related to:

- **productivity**
- **quality**
- **safety**

In the following pages you will find a detailed description of the **completely automatic manufacturing process** in the **cnc working centres**, as for:

- the **tube expansion**
- the **TIG** tube-tube sheet **orbital welding**
- the **facing** of the tubes after expansion
- the **grooving** of the holes of the tube sheet

At the end of this publication you will find a chapter dedicated to the **special machines** proposed for:

- the **insertion** of the tube bundle

Series MA cnc working centres overview

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”*)

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 **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 sheet 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-tube sheet.

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.**

Special machines overview

BundleIN

Tube bundles inserter for heat exchangers.

The ***BundleIN***, together with the gantry crane, enables to solve the problem of a **fast, accurate**, and **safe** insertion.
The original functioning based on two **synchronized hydraulic guns** stretching two steel wire ropes makes it possible to apply it to **tube sheets regardless of length limits** with the following main features:

- **Tube sheet max diameter limitless**
- **Tube bundle max length limitless**
- **Max load capacity limitless (according to the gantry crane)**
- **Max pulling force 60 T (*132200 Lb*)**
- **Max insertion speed 2 m/min (*6.5 Ft/min*)**

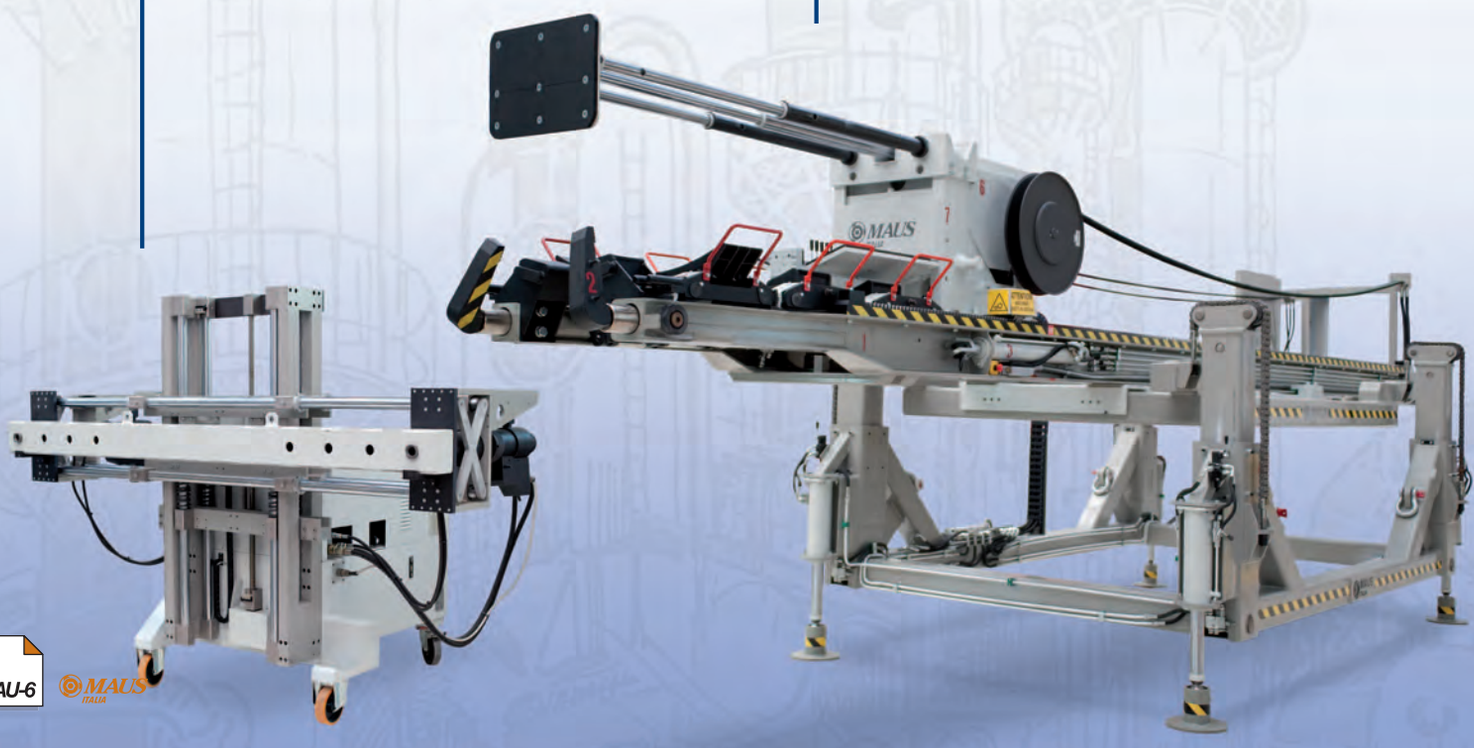
Mef shopIN

Fixed station tube bundle heat exchangers **inserter/extractor.**

The ***Mef shopIN*** is an **independent machine — no gantry crane required —** and it enables to solve the problem of **fast, accurate,** and **safe insertion and extraction**.
The Maus Italia expertise in **manufacturing extractors** *(aerial, self-positioning and off-shore extractors)* made it possible to create a machine dedicated to modern companies manufacturing heat exchangers with the following main features:

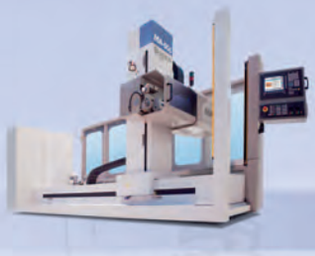
- **Tube sheet max diameter 2000 mm (*78”*)**
- **Tube bundle max length 7500 mm (*295”*)**
- **Max load capacity 22 T (*48500 Lb*)**
- **Max thrust/pulling force 35 T (*77100 Lb*)**
- **Max insertion/extraction speed 1,5 m/min (*4.9 Ft/min*)**

Maus Italia *(an **ISO 9001** certified company)* is able to provide **entirely customized *Mef shopIN*** according to the customers' requests.



Cnc working centres

MA-500



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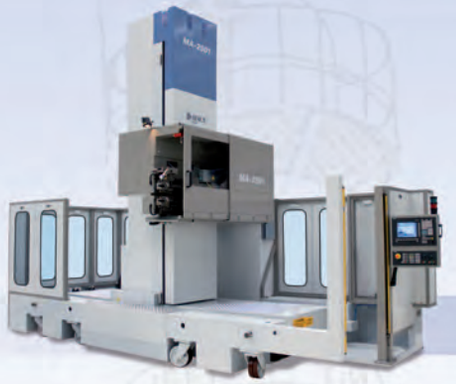
MA-2501



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MA-3501

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MaTIG-500

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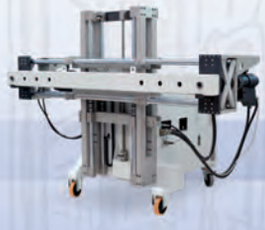
Special machines

BundleIN



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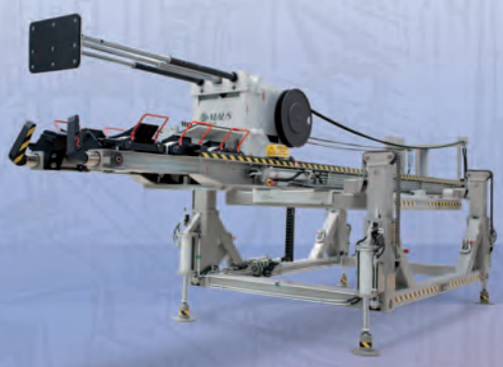
Mef shopIN



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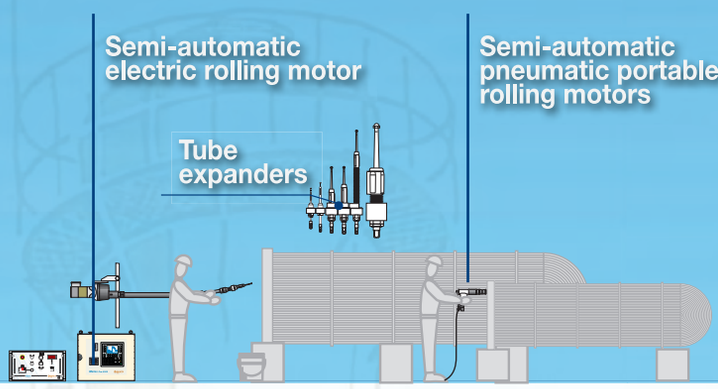
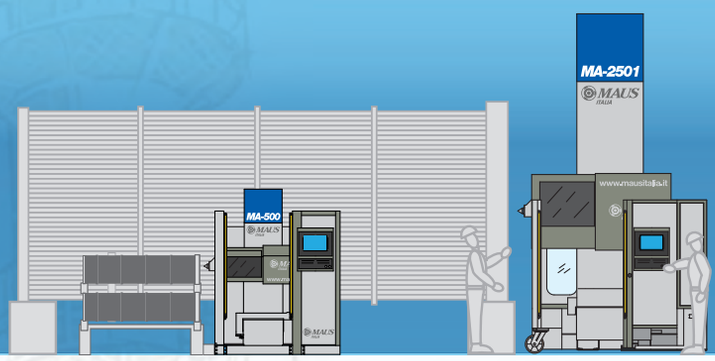
Traditional applications and automated solutions overview

Traditional rolling

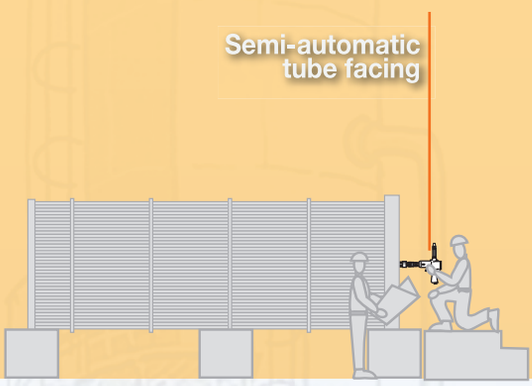


Automatic rolling

MA-500 / MA-2501 / MA-3501

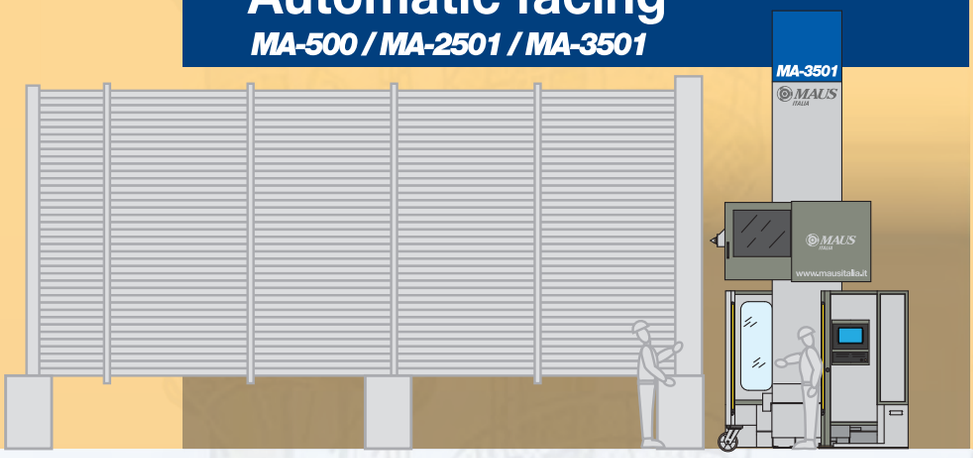


Traditional facing

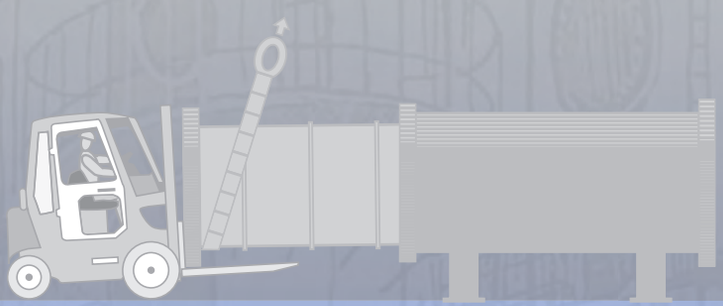


Automatic facing

MA-500 / MA-2501 / MA-3501

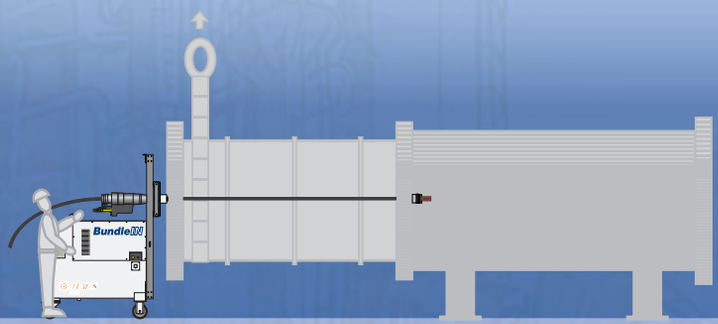


Traditional insertion



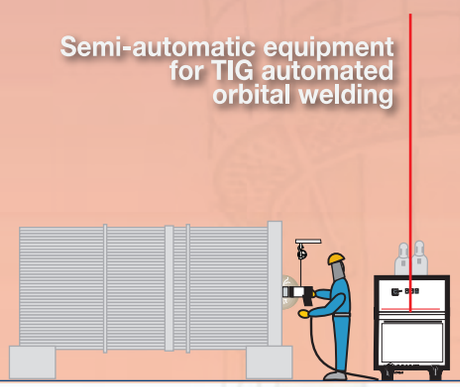
Servo assisted insertion

BundleIN *- With no weight nor length limits*



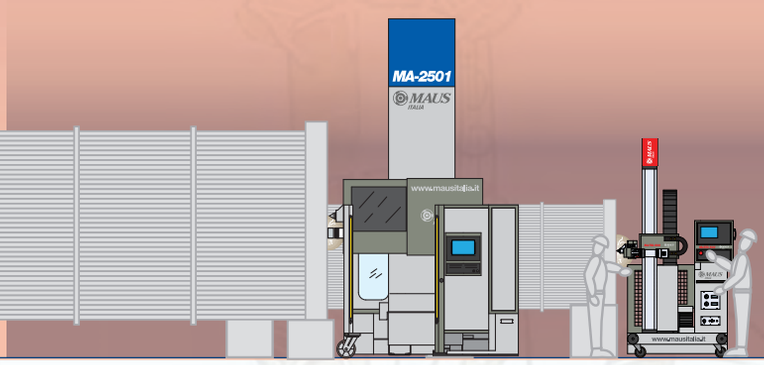
Traditional welding

Semi-automatic equipment
for TIG automated
orbital welding



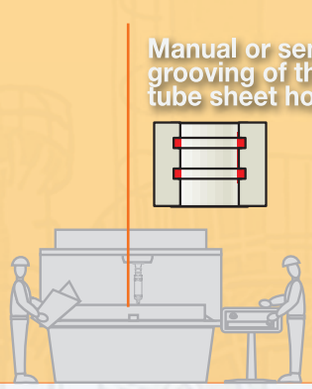
Automatic welding

MA-2501 / MA-3501 / MaTIG-500



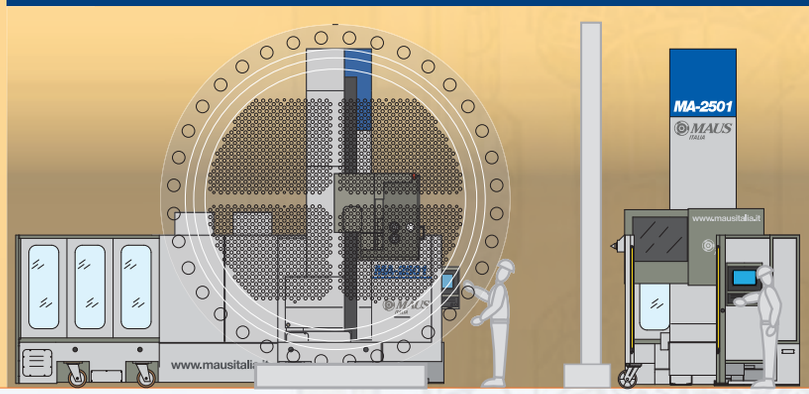
Traditional grooving

Manual or semi-automatic
grooving of the
tube sheet hole



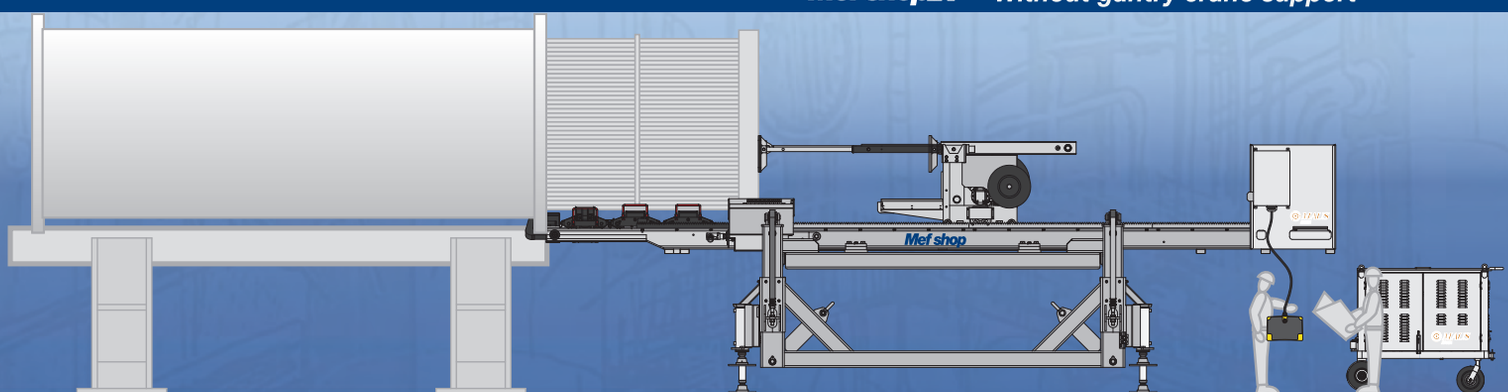
Automatic grooving

MA-2501 / MA-3501



Servo assisted insertion

Mef shopIN *- Without gantry crane support*



MA

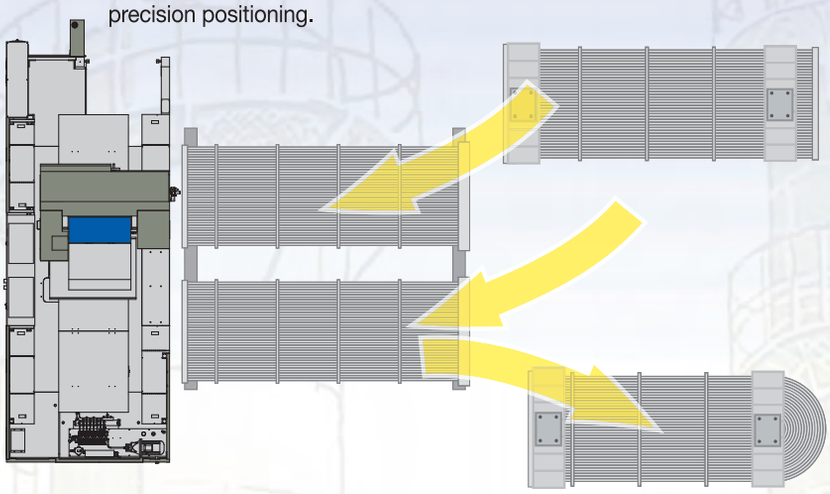
MAUS ITALIA

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

MA-2501

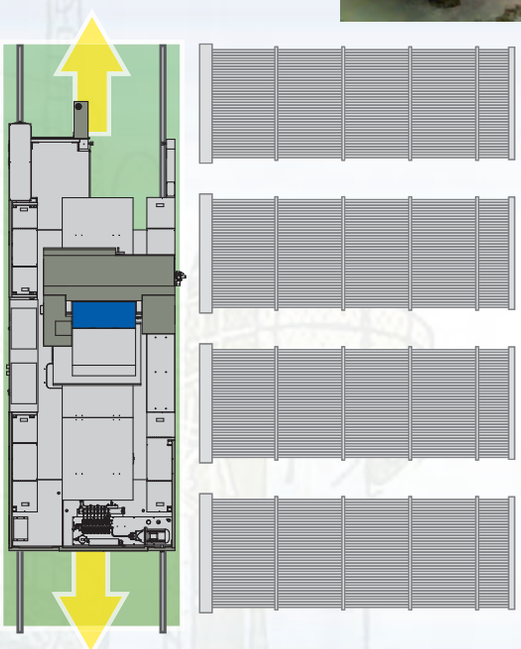
1 Fixed station automatic process

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.

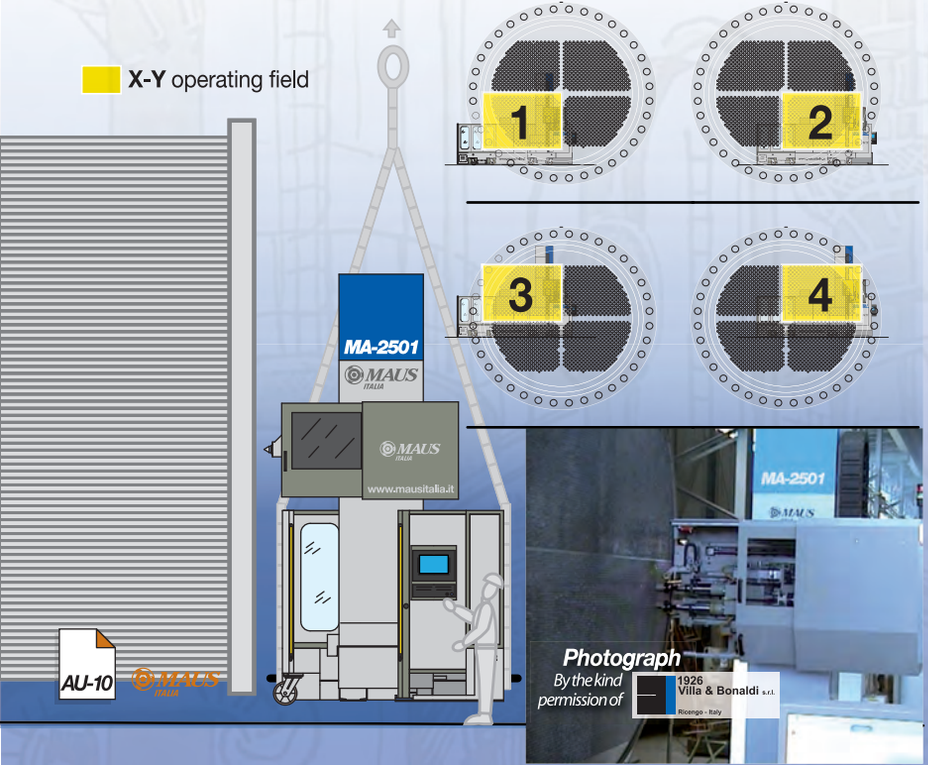


3 Multiple positioning automatic process with machine handling

Multiple positioning layout to work on **large exchangers**
Ø > 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.

X-Y operating field

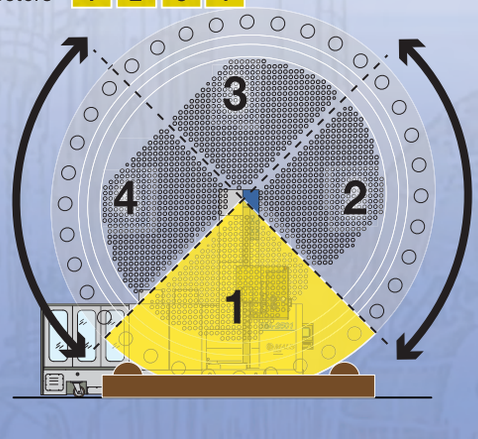


4 Multiple positioning automatic process with tube sheet rotation

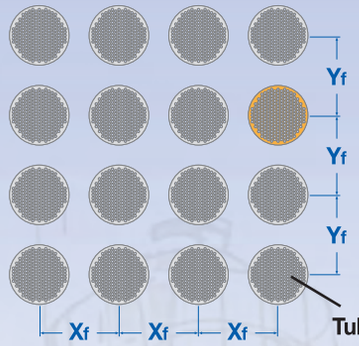
Multiple positioning layout to work on **large exchangers**
Ø > 2500 mm ***(100")*** difficult to handle.

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**

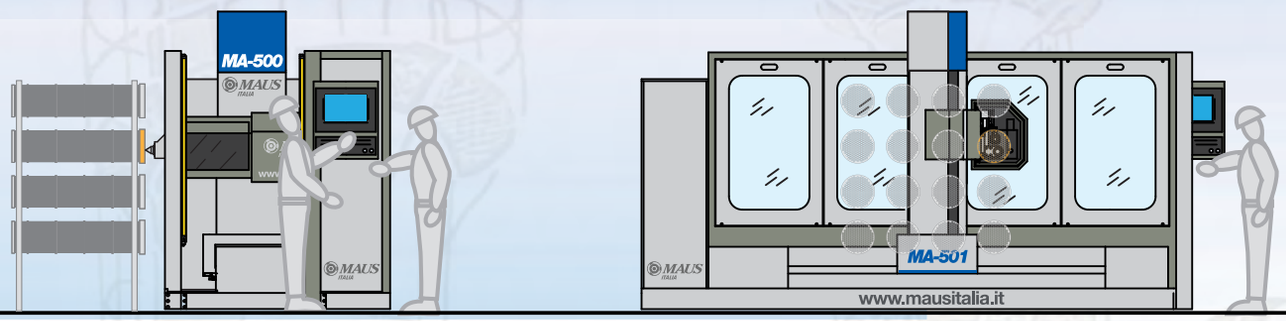


MA-500



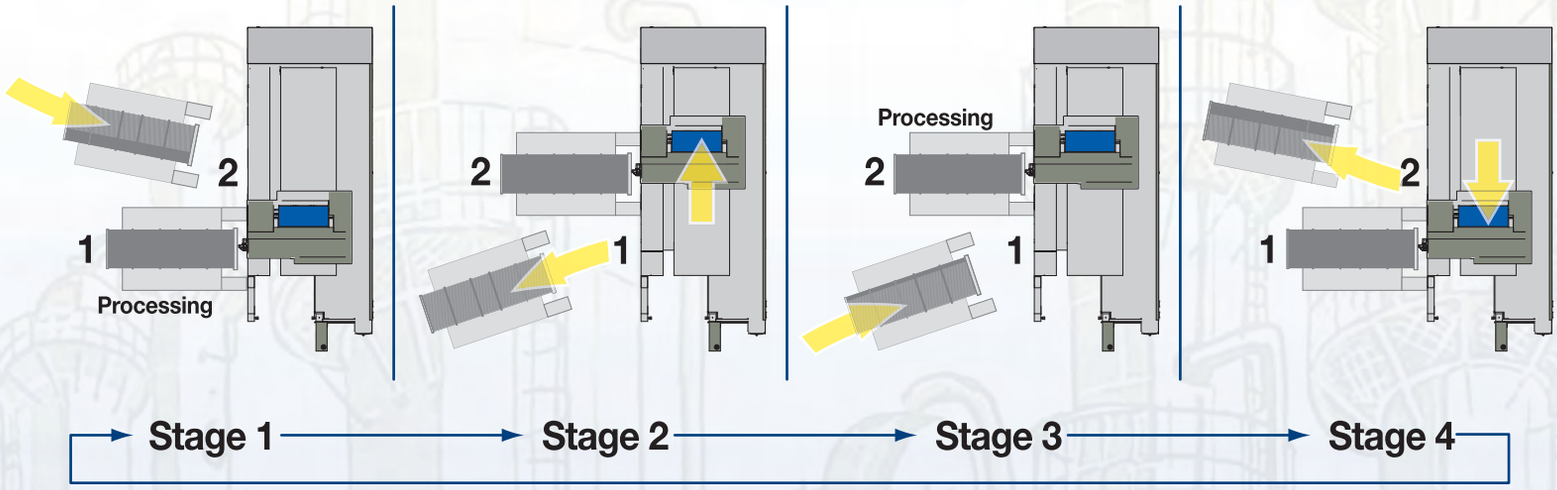
5 Automatic process with tube bundles multiple loader

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



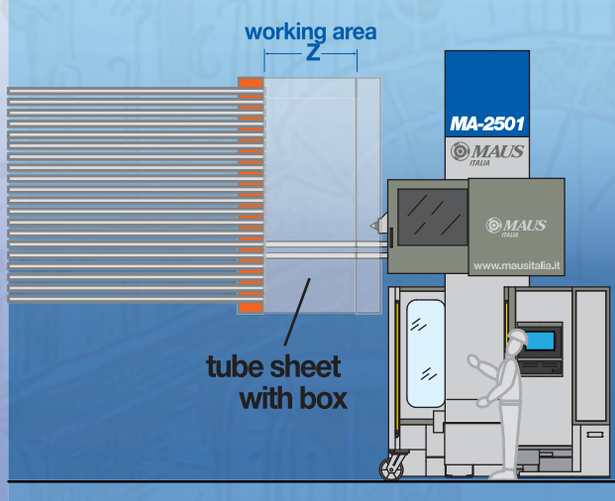
6 Pendulum process with trolleys

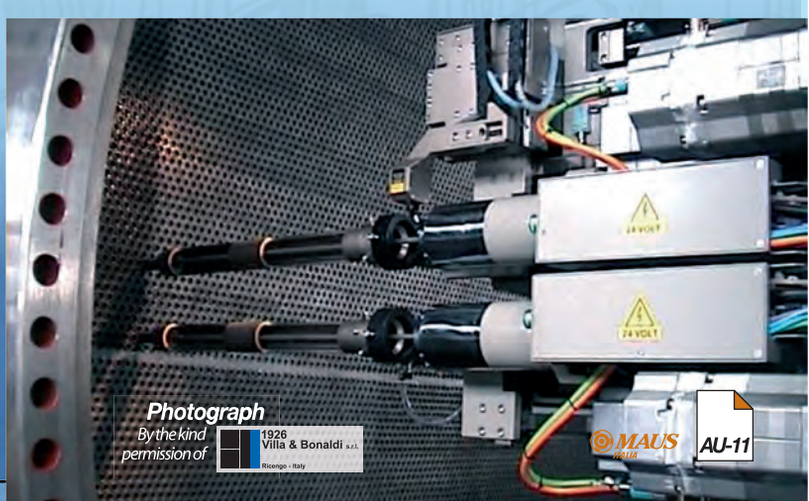
Pendulum process layout with trolleys for small exchangers in which the continuous positioning in front of the machine **eliminates the load/unload downtimes, remarkably increasing the production.**



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

MA-2501

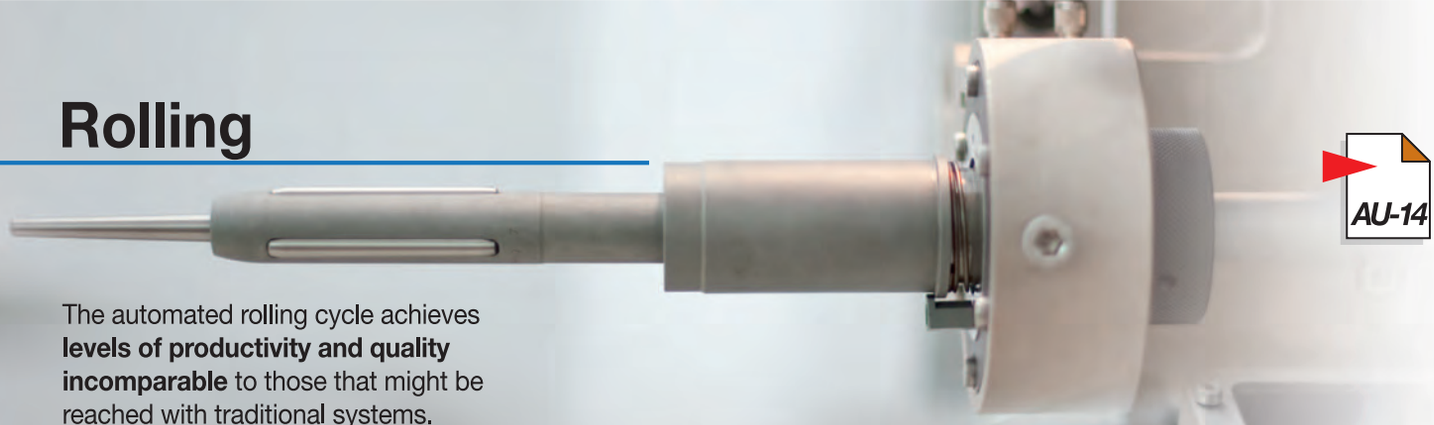




1 Automated processes overview

Rolling

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



AU-14

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.**

AU-22

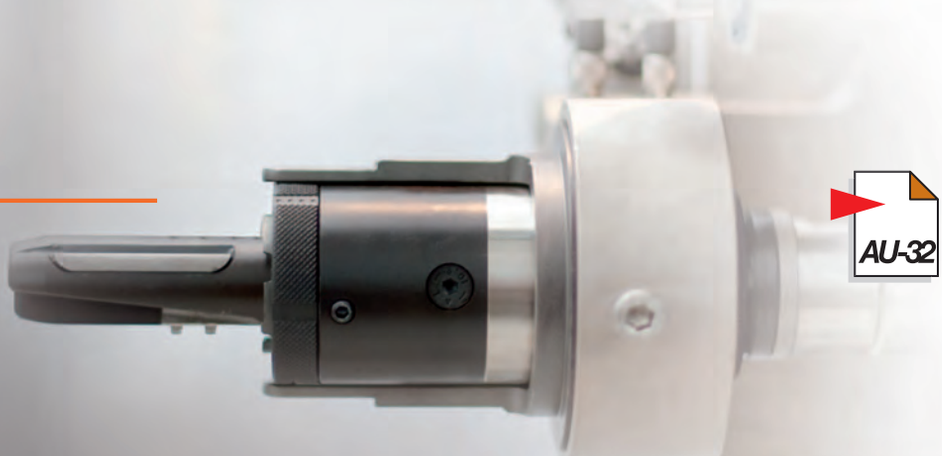
Facing

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

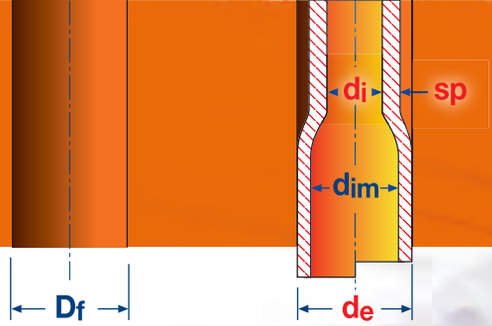
AU-28

Grooving

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



AU-32



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 d_{im} is as follows:

$$d_{im} = d_i + (D_f - d_e) + [\ 2 \times (2\% \div 12\%) \times sp\ ]$$

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

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

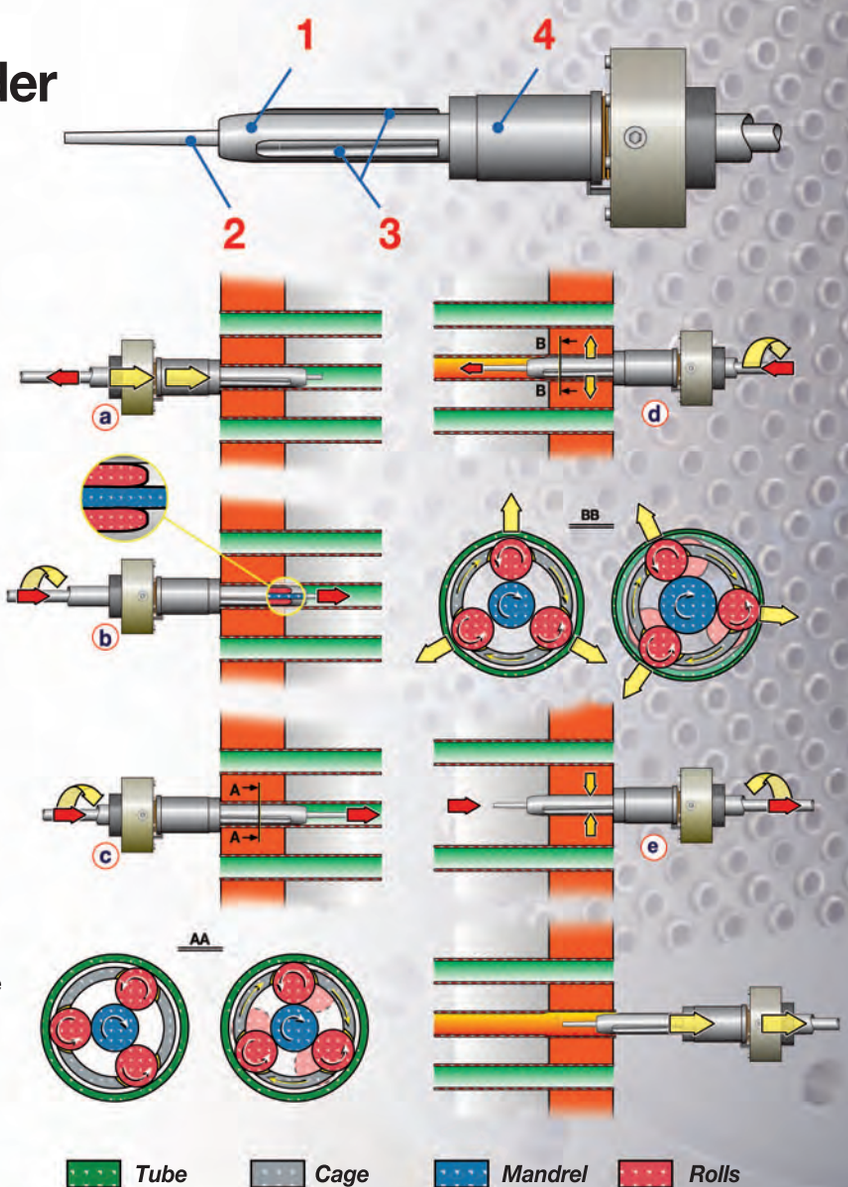
The technicians' experience and the preliminary tests performed on mock-ups are core elements for a reliable production.

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.

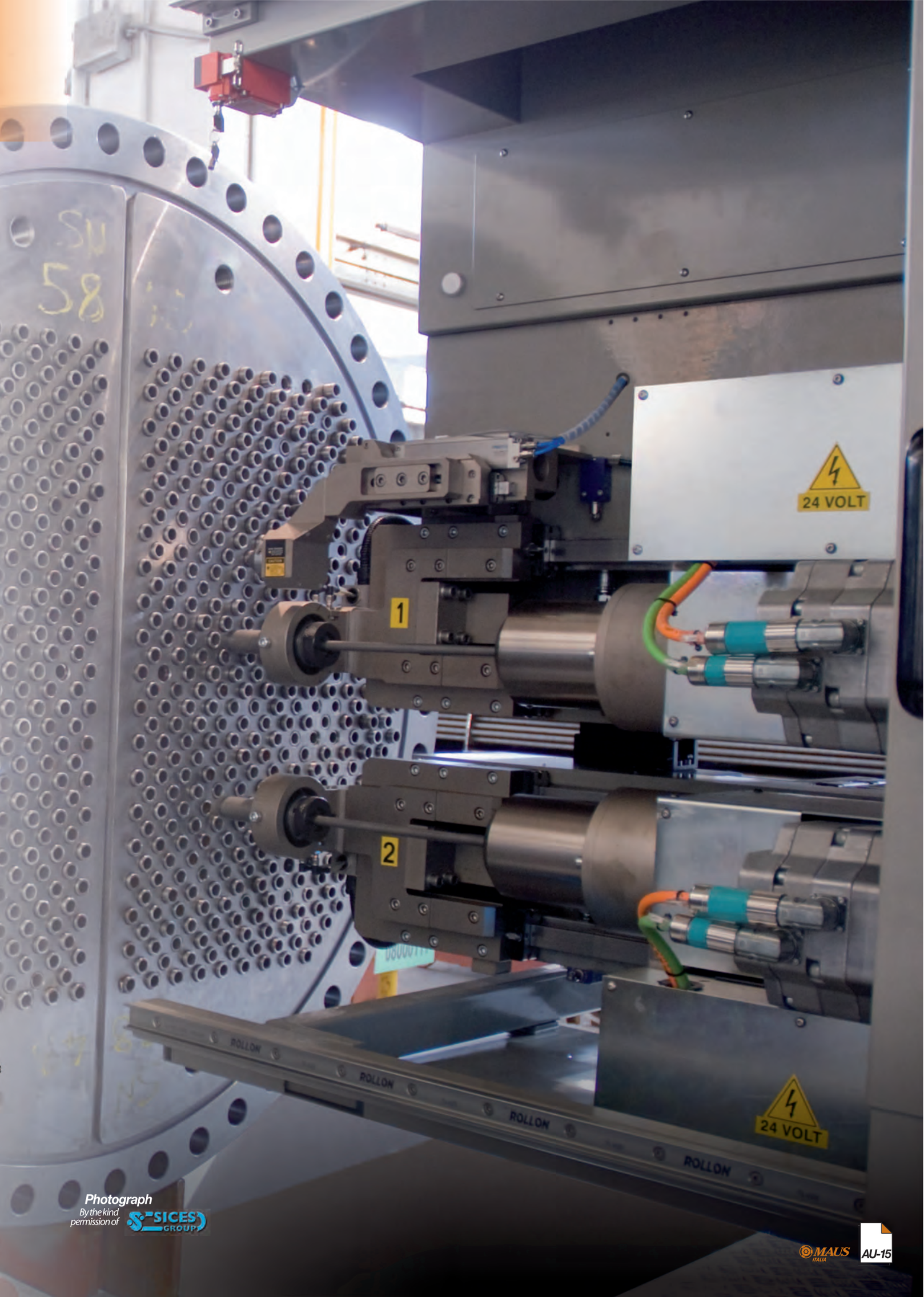
(b) The **mandrel**, rotating and pushed forward, comes up to the **rolls**.

(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.

d_i tube inner diameter *(prior to rolling)*
D_f diameter of the tube sheet hole
d_e tube outside diameter *(prior to rolling)*
sp tube gauge



Photograph
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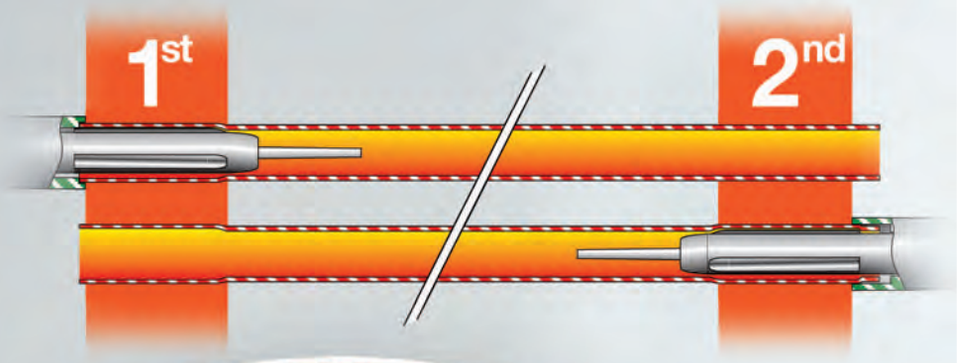
Rolling: common applications

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

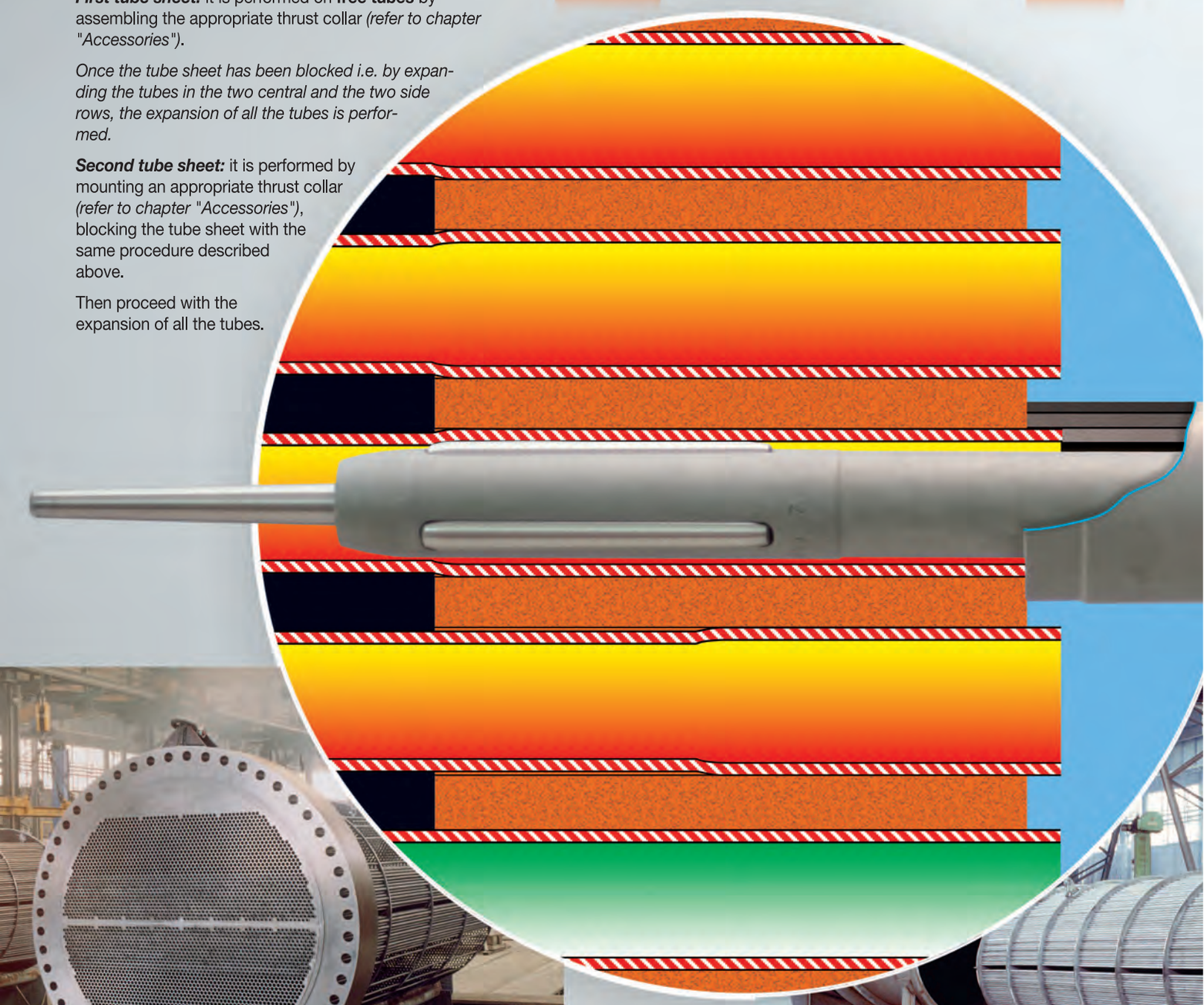


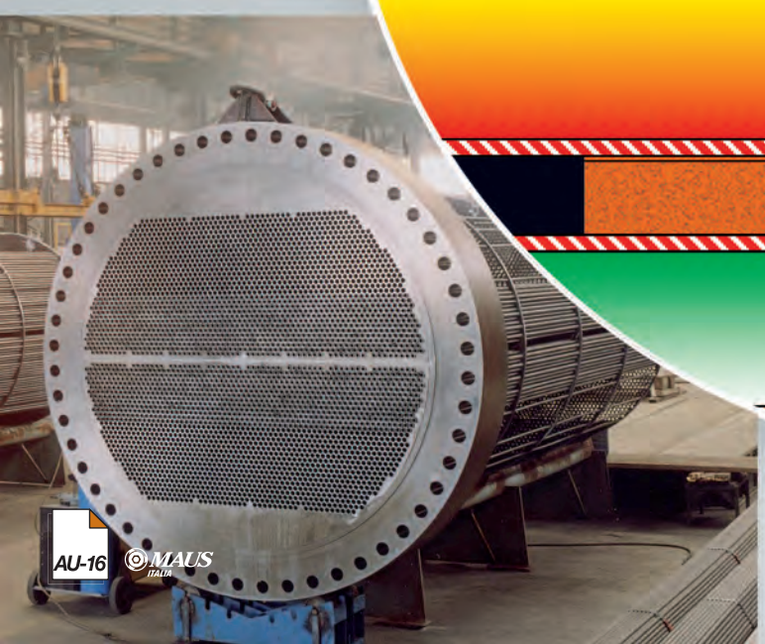
First tube sheet: it is performed on **free tubes** by assembling the appropriate thrust collar *(refer to chapter "Accessories")*.

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.

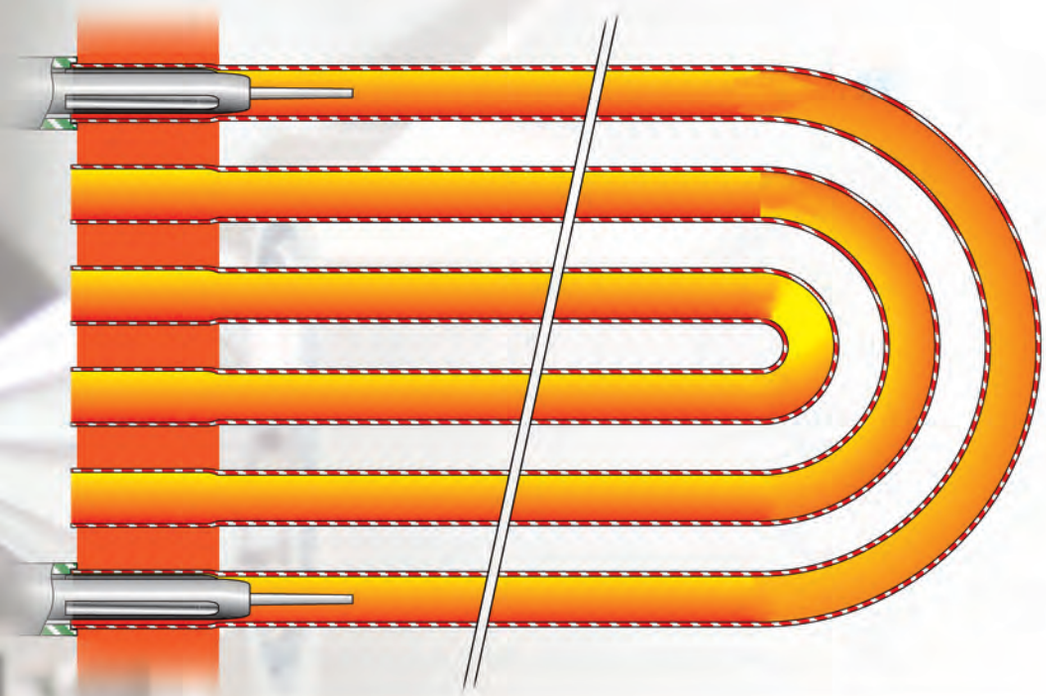
Second tube sheet: it is performed by mounting an appropriate thrust collar *(refer to chapter "Accessories")*, blocking the tube sheet with the same procedure described above.

Then proceed with the expansion of all the tubes.





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



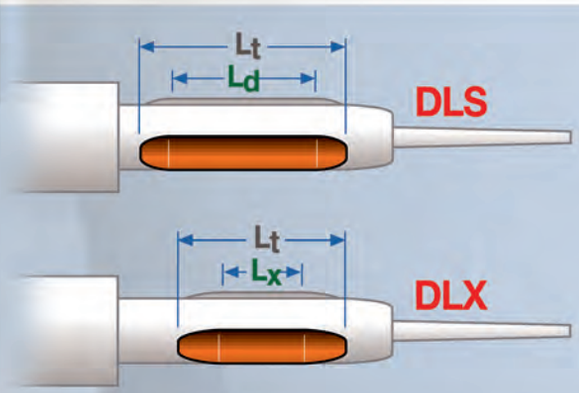
The rolls

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:

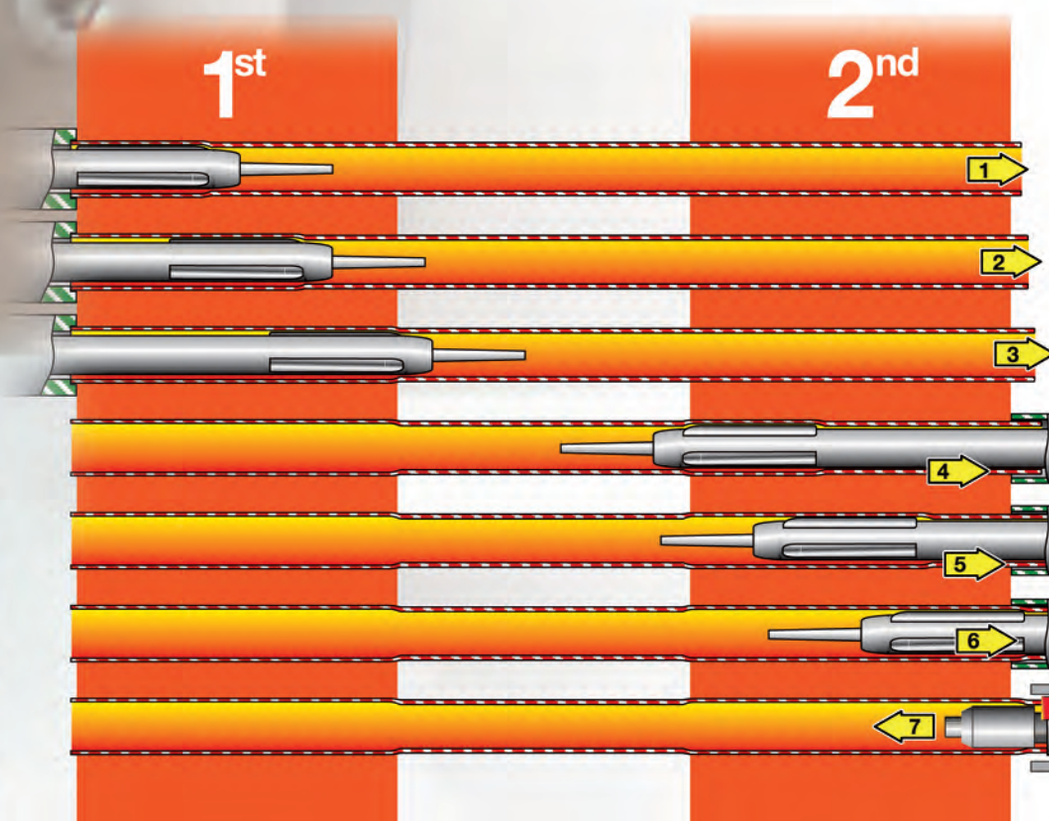
DLS Double bending point L_d = standard useful length

DLX Double bending point L_x = special useful length



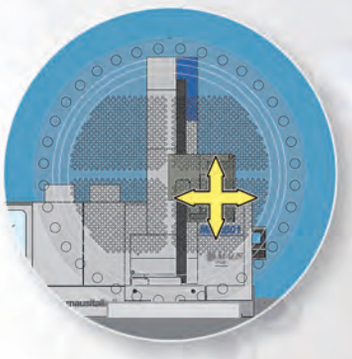
The double radius roll is essential in expanding tubes welded to the sheet and it is recommended in multiple step expansion.

Multiple step tube expansion



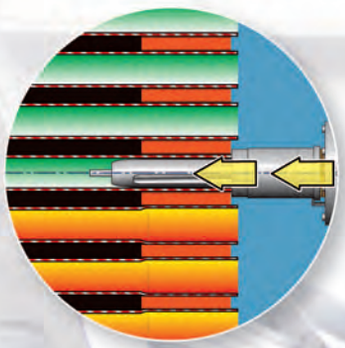
Automatic rolling: the process stages

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.



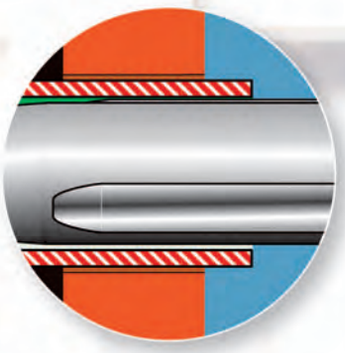
Stage 1

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



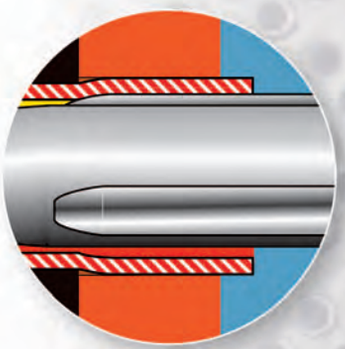
Stage 2

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



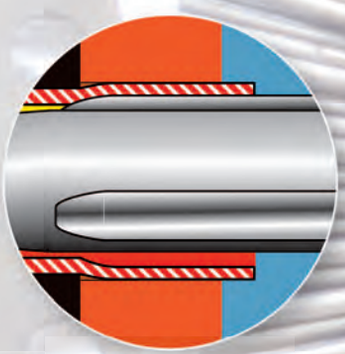
Stage 3

Automatic survey of the tube diameter



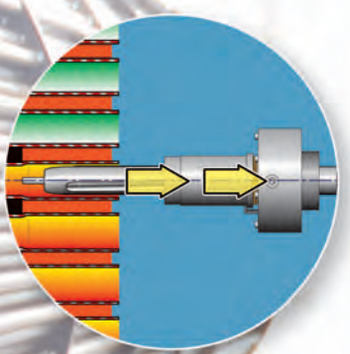
Stage 4

Approaching the tube to the hole



Stage 5

Crushing of the tube gauge

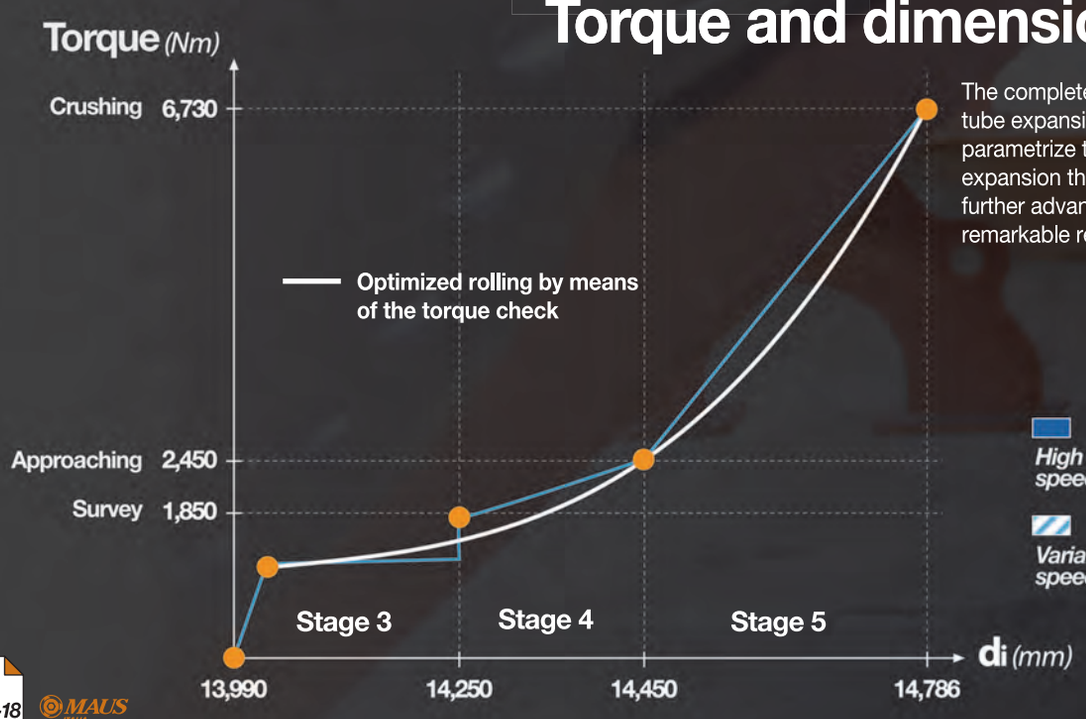


Stage 6

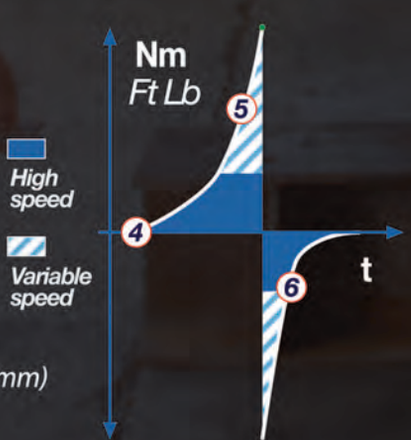
Releasing the tool and restarting by **"Stage 1"**

(with exeption 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

Microsoft Excel - REP111.MPF

File Modifica Visualizza Inserisci Formato Strumenti Dati Finestra ?

Digitare una domanda.

Arial 10

B3

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Data/Date	13/4/6												
2	Ora/Time	8:30:43												
3	Commessa/Job n.													
4	Disegno/Draw n.													
5	Note/Notes													
6	P/S	N	X	Y	Z	D1	D2	D3	NM3					
7	P	5	1102.09	90.55	40	14.59	15.06	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					
33														
34														

REP111

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

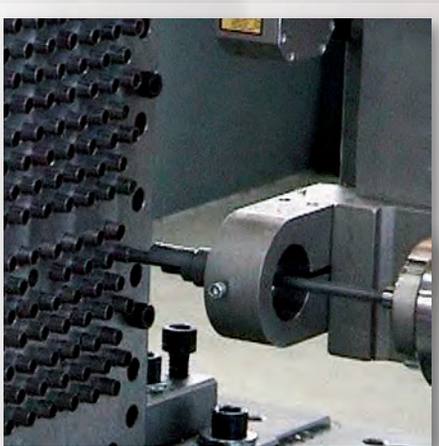
- Definition of the theoretical geometry of the expansion to be performed.
- Diameter and gauge of the tubes to be expanded
- Mandrel size.
- Forward movements and rotation speed.

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

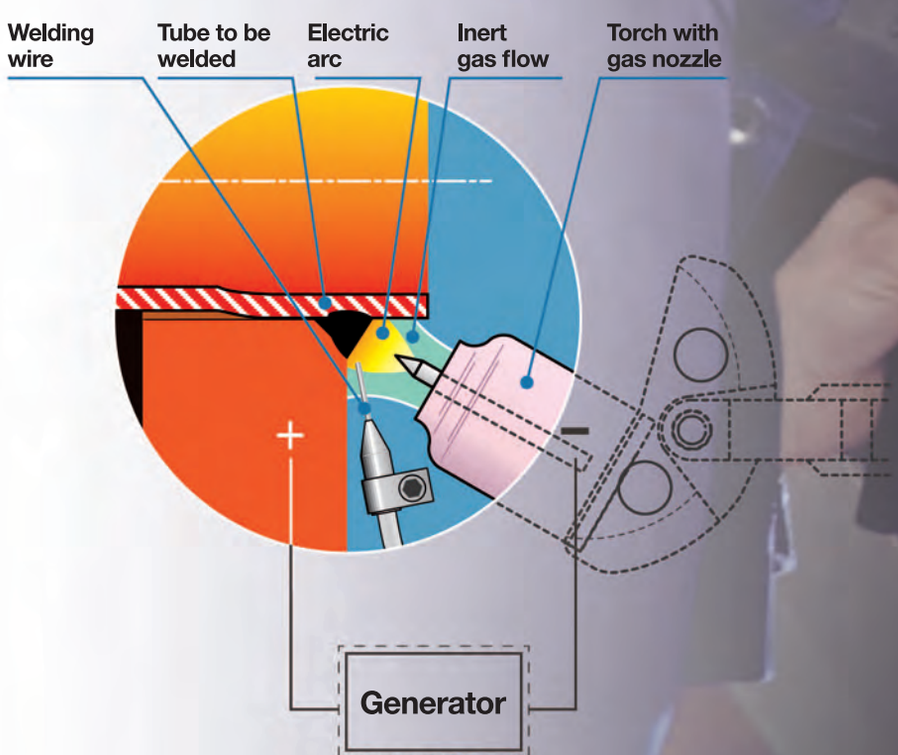
The **TIG *orbital* welding** is the most used and reliable technology as for the **tube-to-tubesheet joint.**

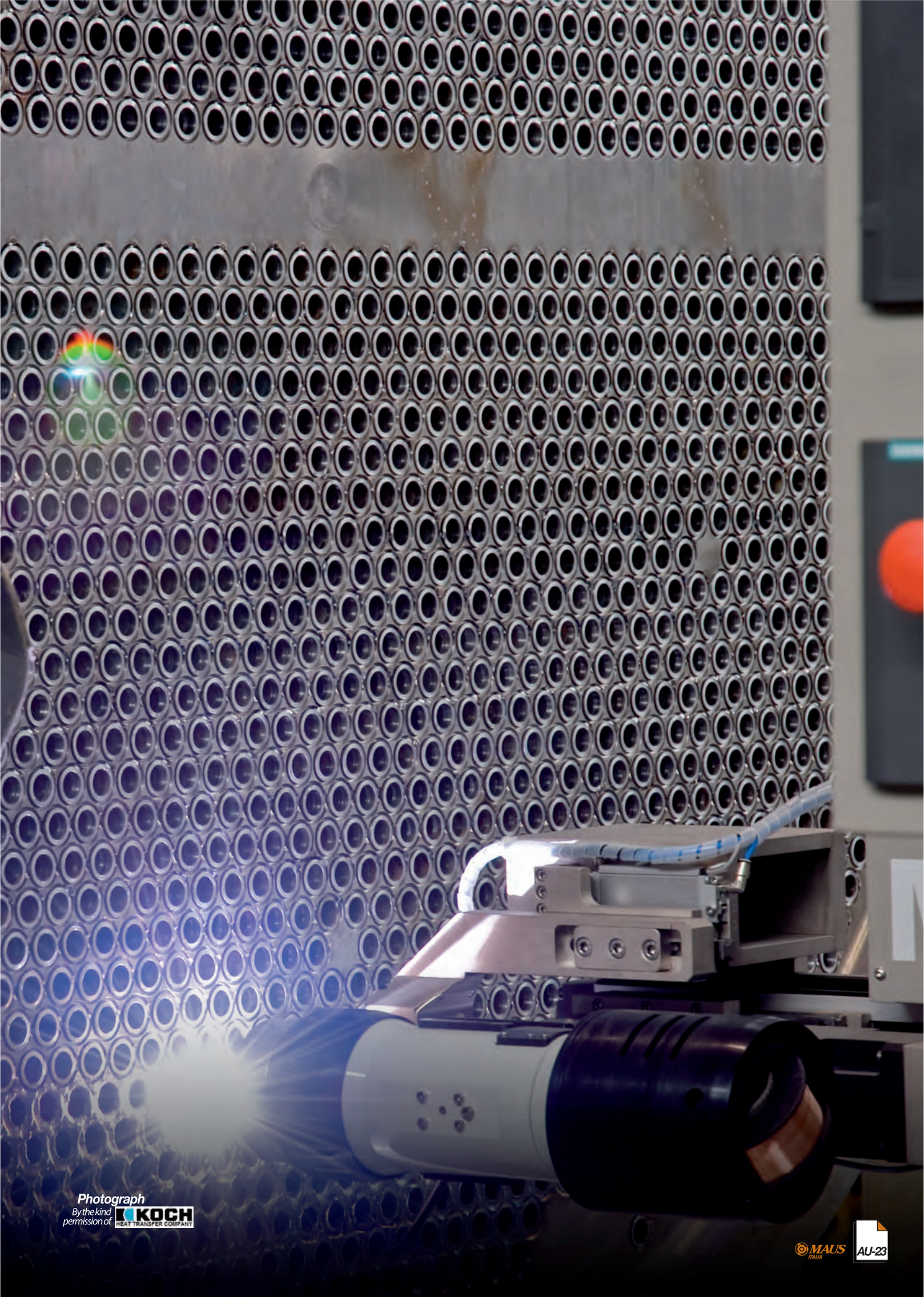
The **TIG** *(Tungsten Inert Gas)* ***orbital*** **welding process is performed through an electric arc which shoots between a non-consumable electrode and the parts to be welded with or without weld material.**

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.**





Photograph
By the kind permission of KOCH HEAT TRANSFER COMPANY

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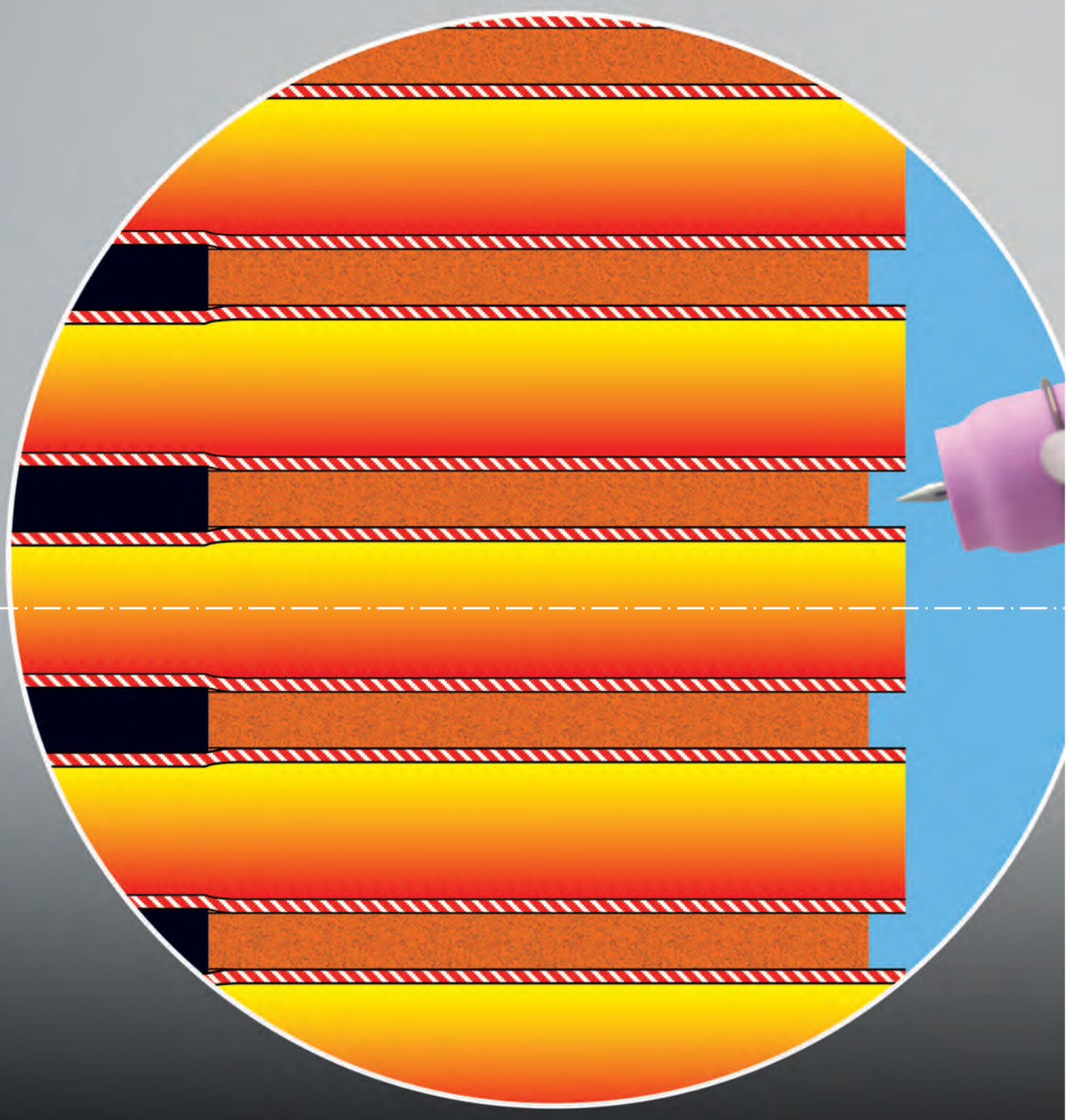
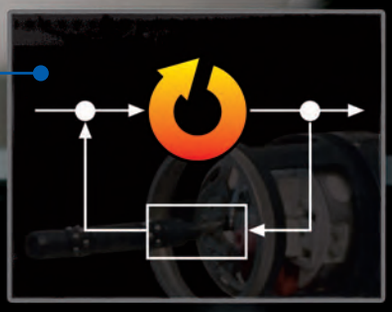
Automatic welding: special features



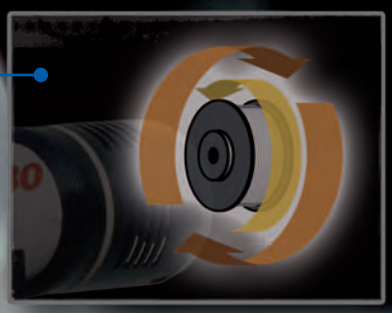
Torch rotation control

Continuous feedback control of the **orbital torch rotation speed** by a **tachometric dynamo** (angular-speed transducer which provides a voltage proportional to the rotation speed of the motor).



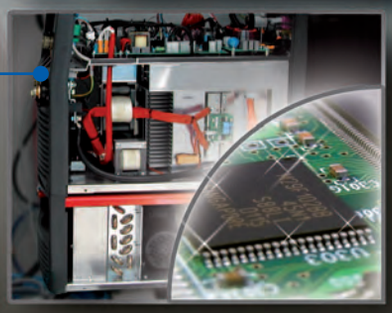
Weld material control

Unique system, which endlessly pulls the rotating wire along the orbital axis (to infinite), to achieve a **regular flow of the welding wire** to the puddle during the welding process.

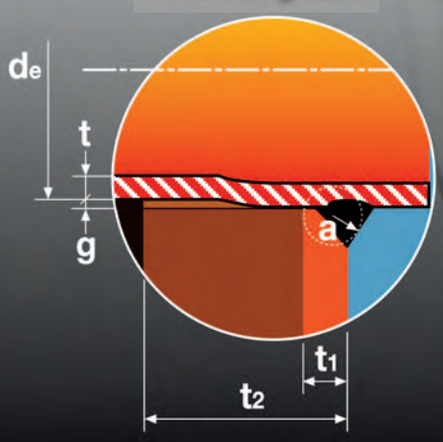


Inverter generator

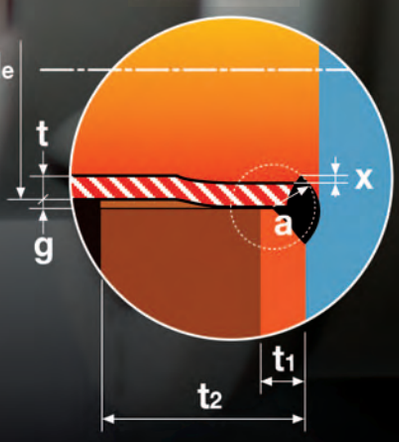
The inverter technology guarantees a **perfectly linear** current thus obtaining a **particularly stable and precise welding arc** as well as **high quality welding and an overall improvement in performance.**



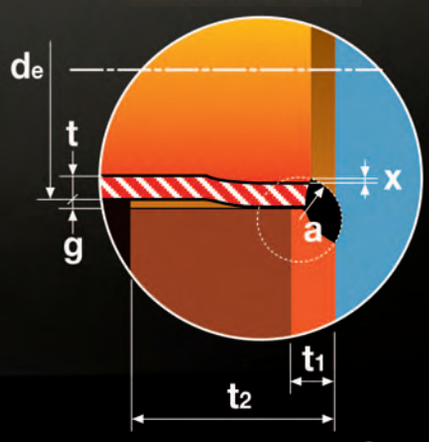
Protruding tube



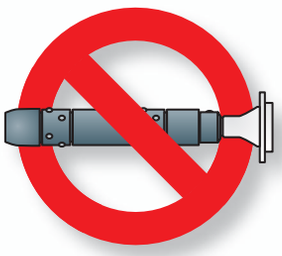
Flush tube



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

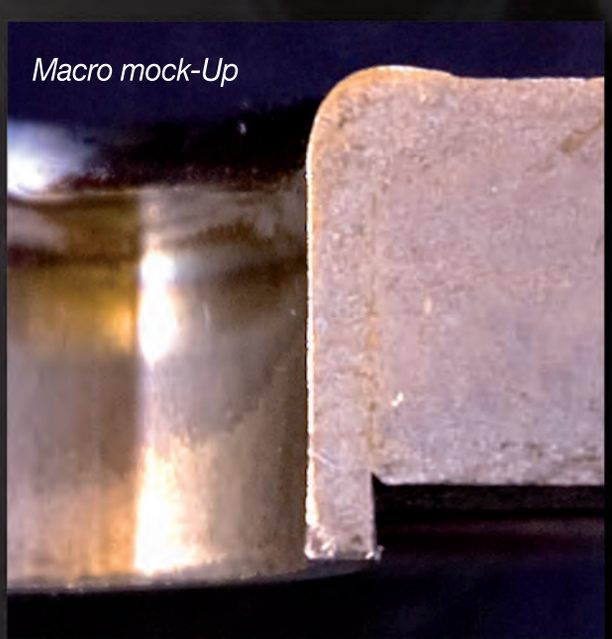
Page assigned to the downslope variables from extinguishing the electric arc to the correct control of the weld closure *(such as the seam overlap) and post*GAS protection.

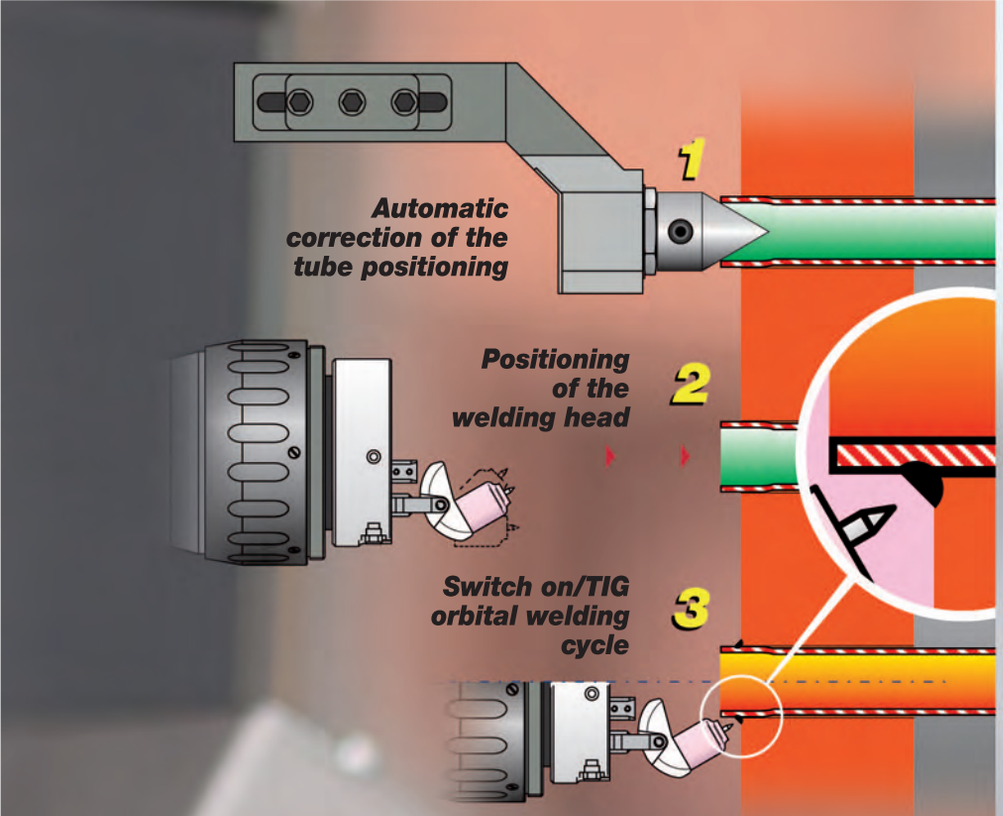
First Ohm's law in relation to the ***AVC*** control of the voltaic arc in **TIG** *orbital* welding

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 form 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.





Control radiograph

14 BWG 3/4" tube
316L material
Tube prominence 5 mm (0.197")
Tube sheet thickness125 mm (4.92")

Control radiograph

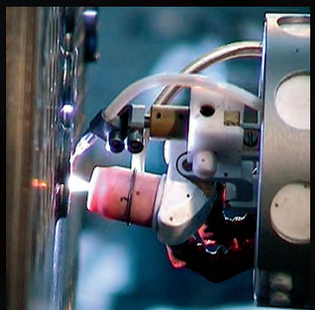
18 BWG 1" tube
304L material
Tube prominence 0 mm (0.0")
Tube sheet thickness 72 mm (2.83")

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;

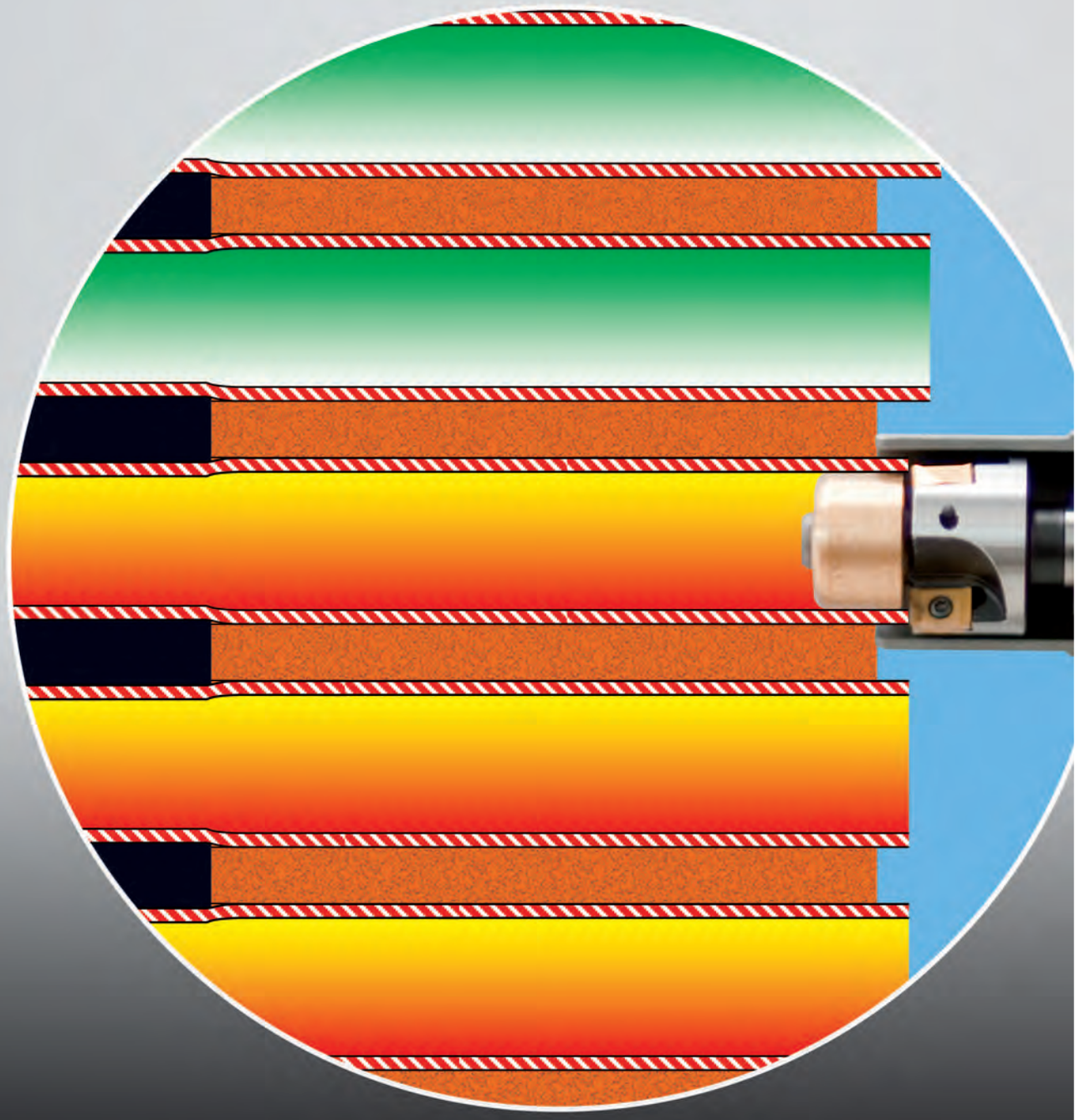
Sharpening control
During the puddle formation, measuring the arc enables to check for appropriate electrode sharpening;

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.**

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

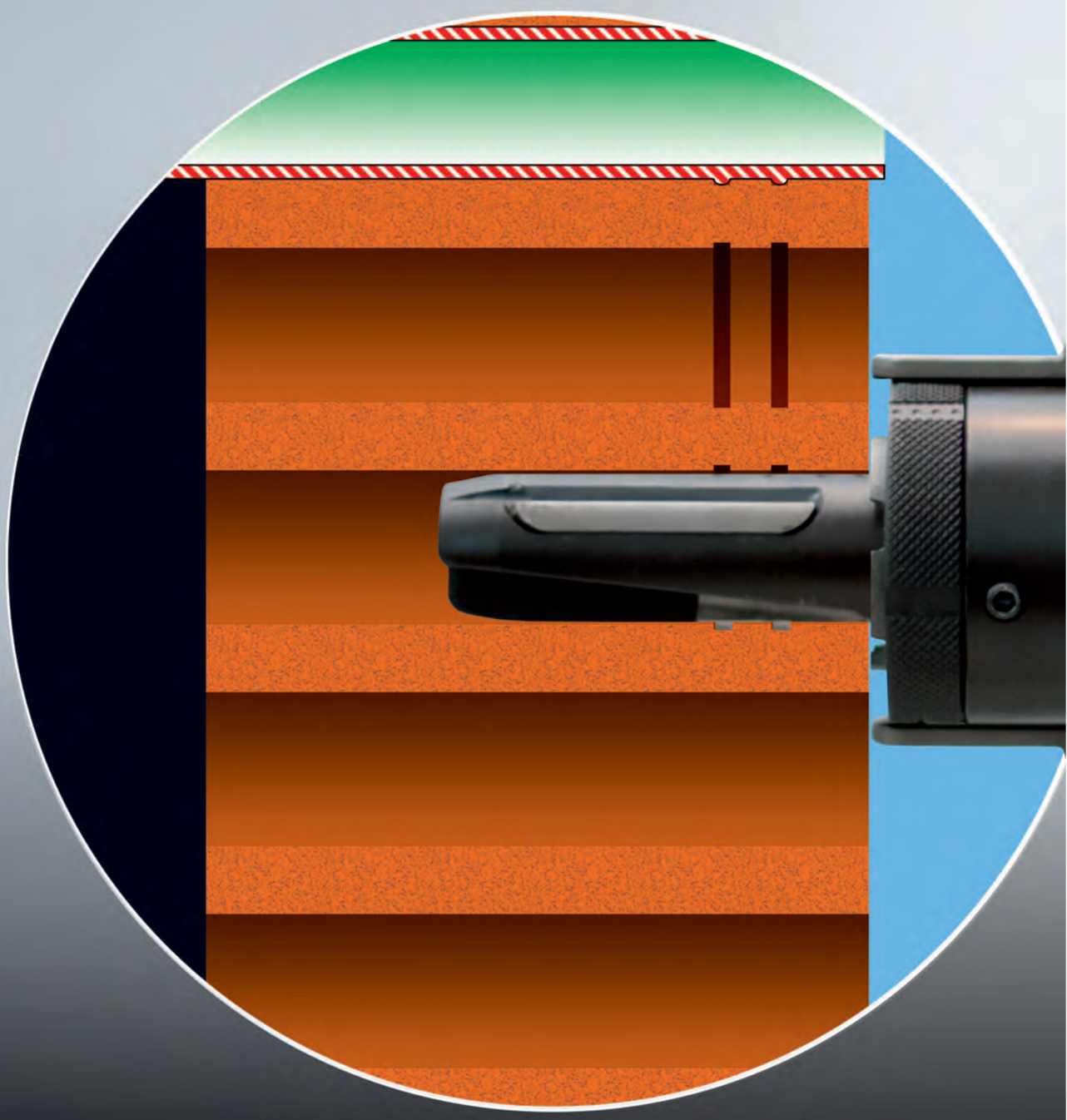
Optional double axis
Up to 1200 faces/hr

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.**

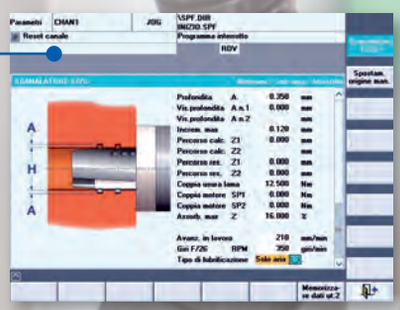
The automatic cycle is preset and equipped with a command and **control program of the tool wear level.**
The only parameters to be adjusted are the speed and feeding.



Automatic grooving: parameters

Grooving tool *F/26*

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



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

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

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


Blade
Blade-holding stem
Blade coupling spring
Milling cutter holder

MA

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Optional

FOCS self-learning centring feeler *(optional)*

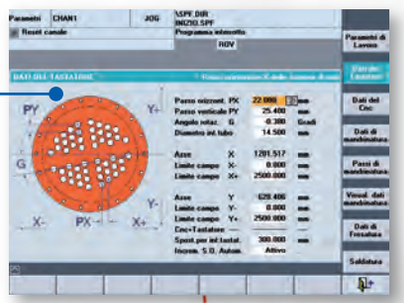
It is an *optional* **electropneumatic** device for the tube self-learning automatic centring.

Two versions are available, ***FOCS-3*** and ***FOCS-2***:

- The ***FOCS-2*** is designed for the ***MA-500*** and the ***MaTIG-500*** and it provides **all the centring and correction functions.**
- The ***FOCS-3*** is designed for the ***MA-2501*** and the ***MA-3501*** and it provides **all the centring and correction functions** as well as a **system to measure the distance from the tube sheet by a laser** beam.

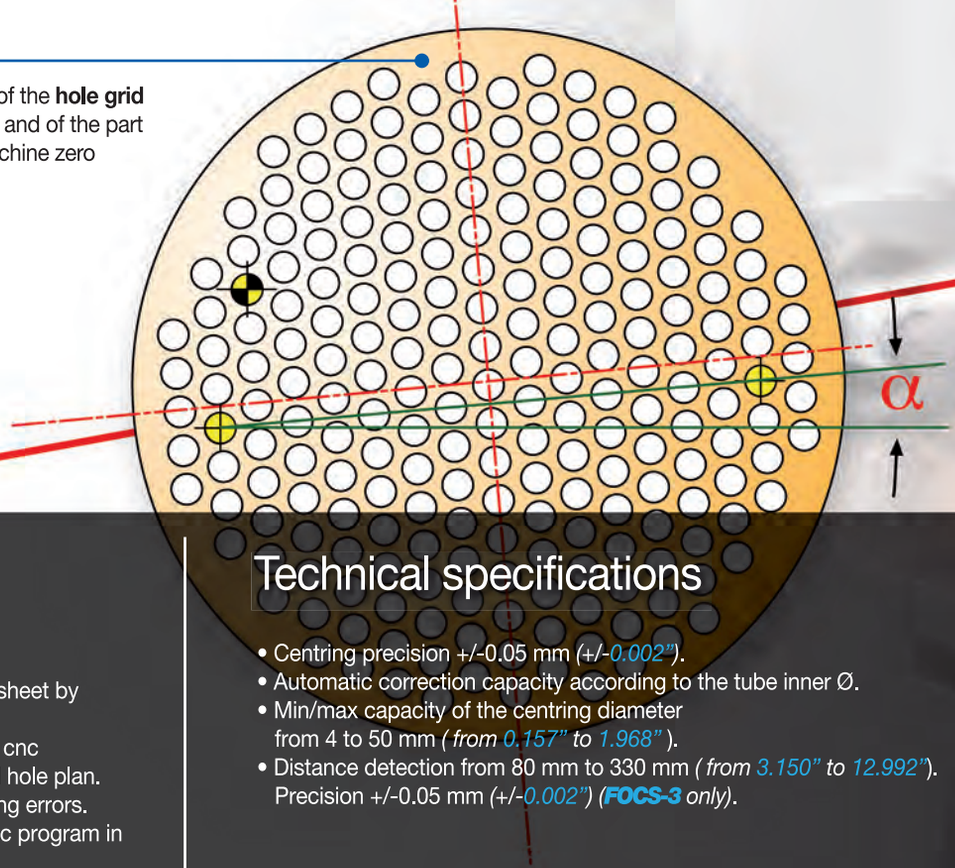
Feeler management software

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

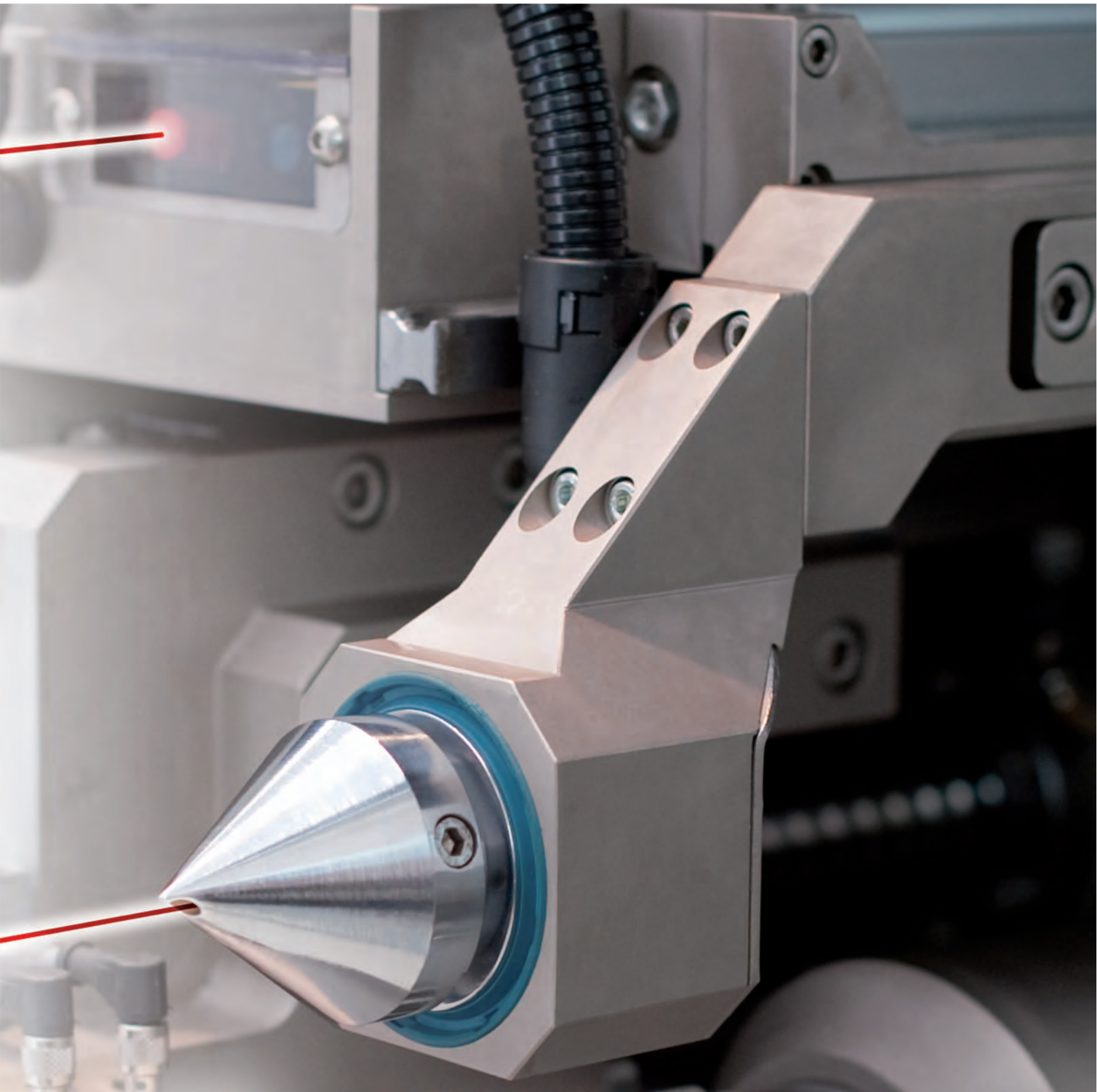


Feeler system special functions

- 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

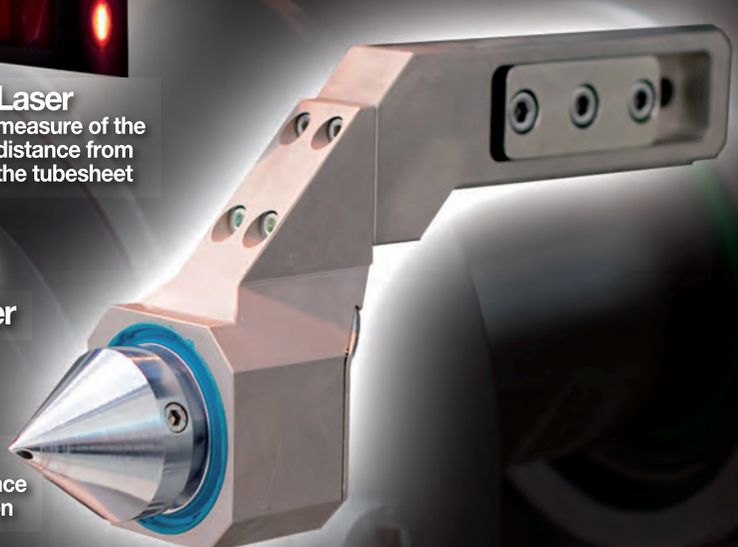
Technical specifications

- Centring precision +/-0.05 mm *(+/-0.002")*.
- Automatic correction capacity according to the tube inner Ø.
- 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

MA

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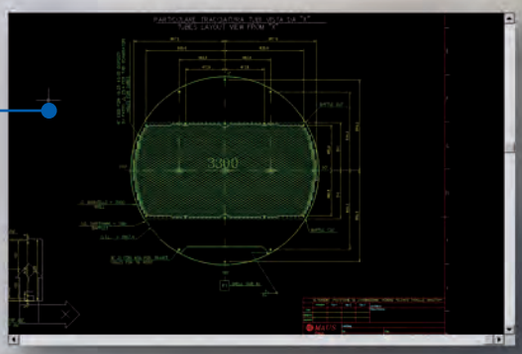
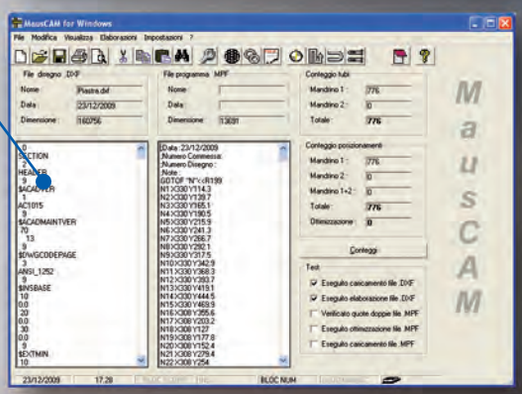
MausCAM X-Y programming software based on CAD data of the tubesheet drilling



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.**

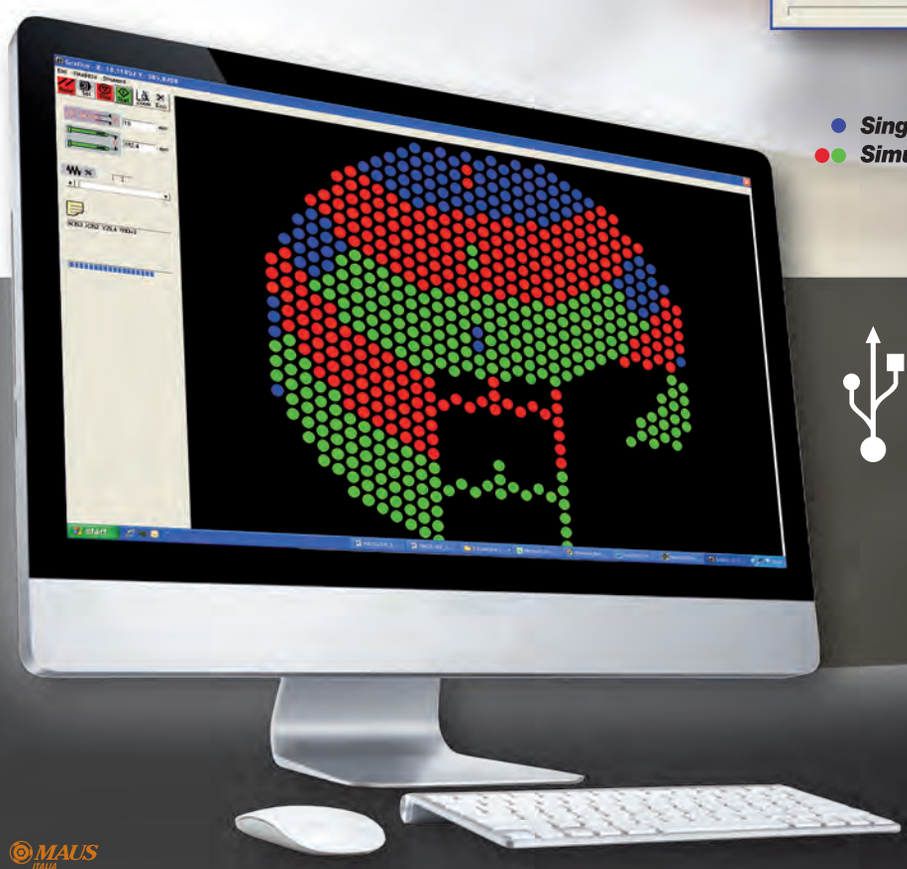
Interactive processing



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.

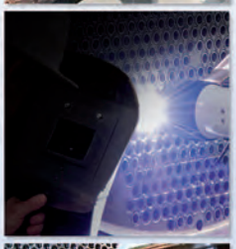
Network connection

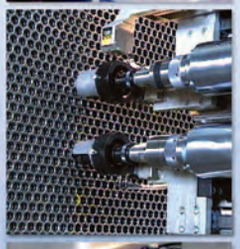
An Ethernet connection *(a serial RS232 is also available)* is ordinarily installed in order to enable the network connection.
An *optiona*l Web diagnostic program is also available.

2 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

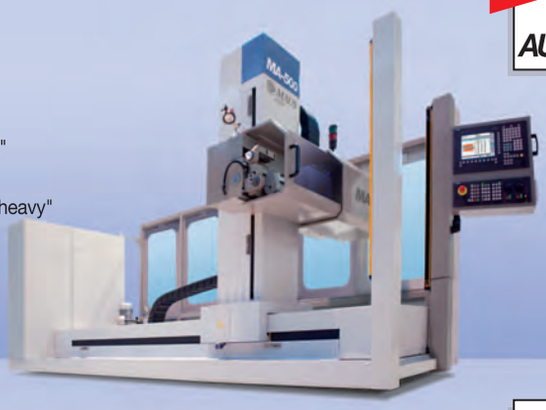
Cnc working centre with **single axis** fixed machine to **expand** and **face** the tube bundle tubes.

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

AU-50

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

AU-50

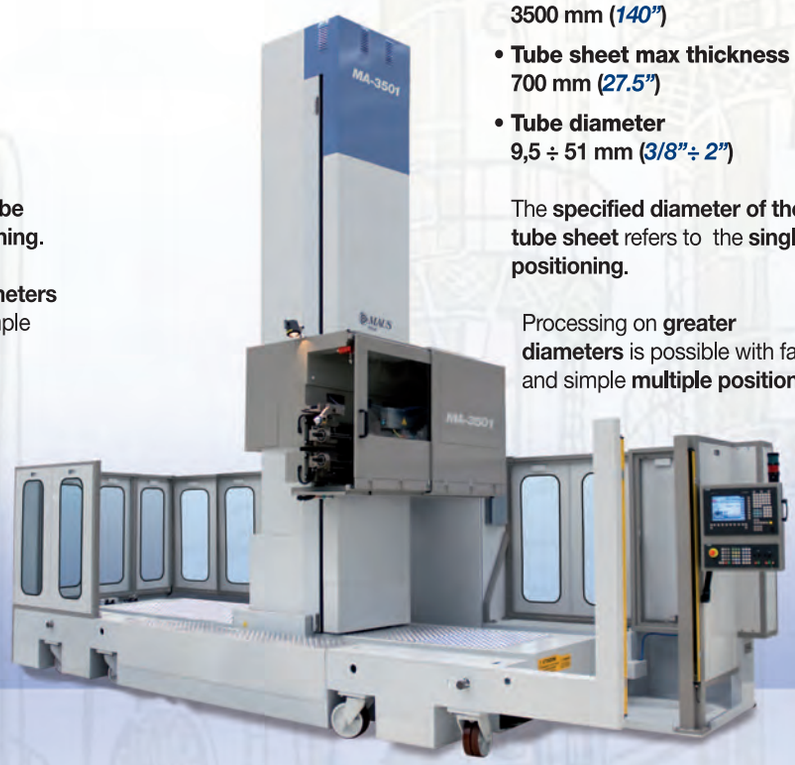
Cnc working centre with **single** or **double axis** movable machine for **expansion**, **TIG orbital welding**, and **facing of the tube bundle tubes** and for the **grooving** of the **large diameter tube sheet holes.**

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

AU-62

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

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”)

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MA

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 *optiona*l **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.***

MA

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Photograph
By the kind permission of BLOKSMA HEAT EXCHANGERS

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

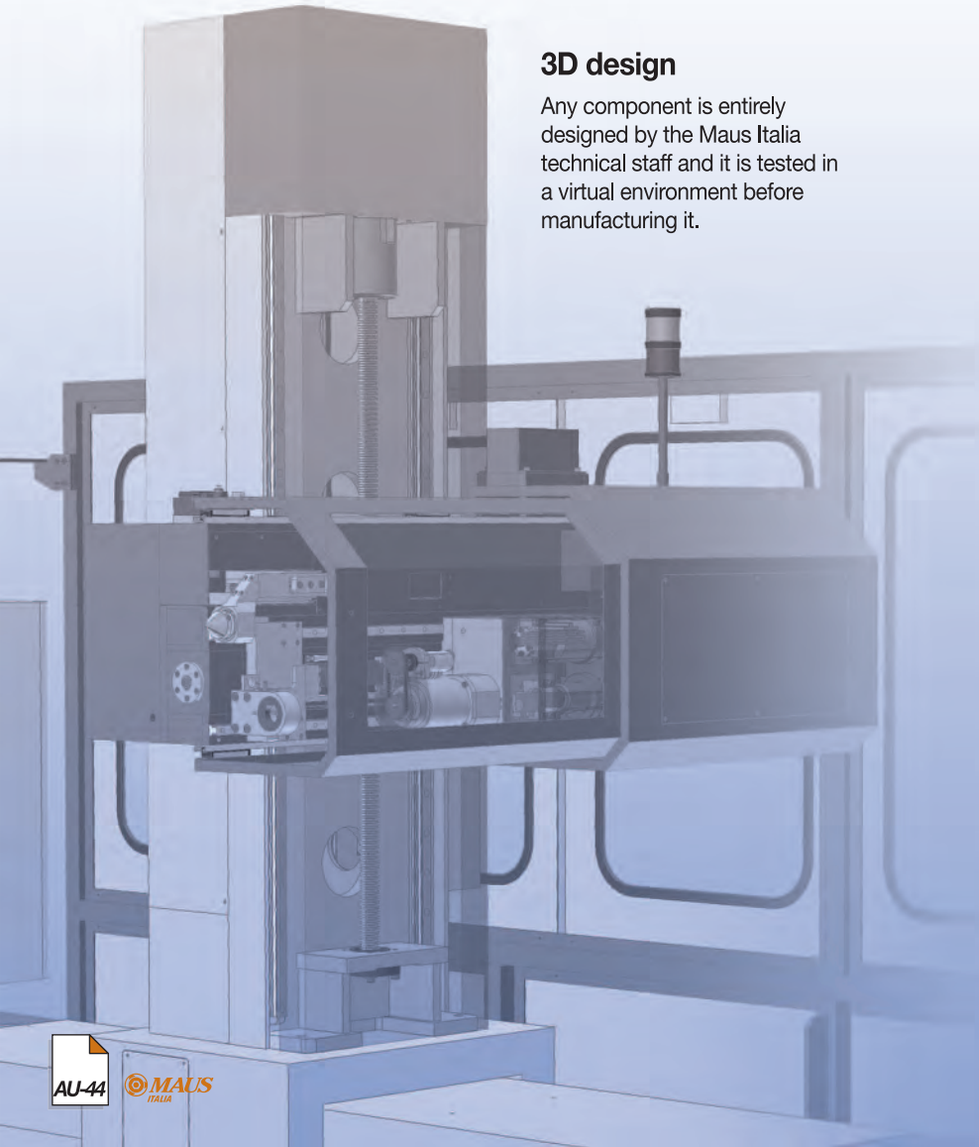
Transverse run trolley
tubesheet approach

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

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MA

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.

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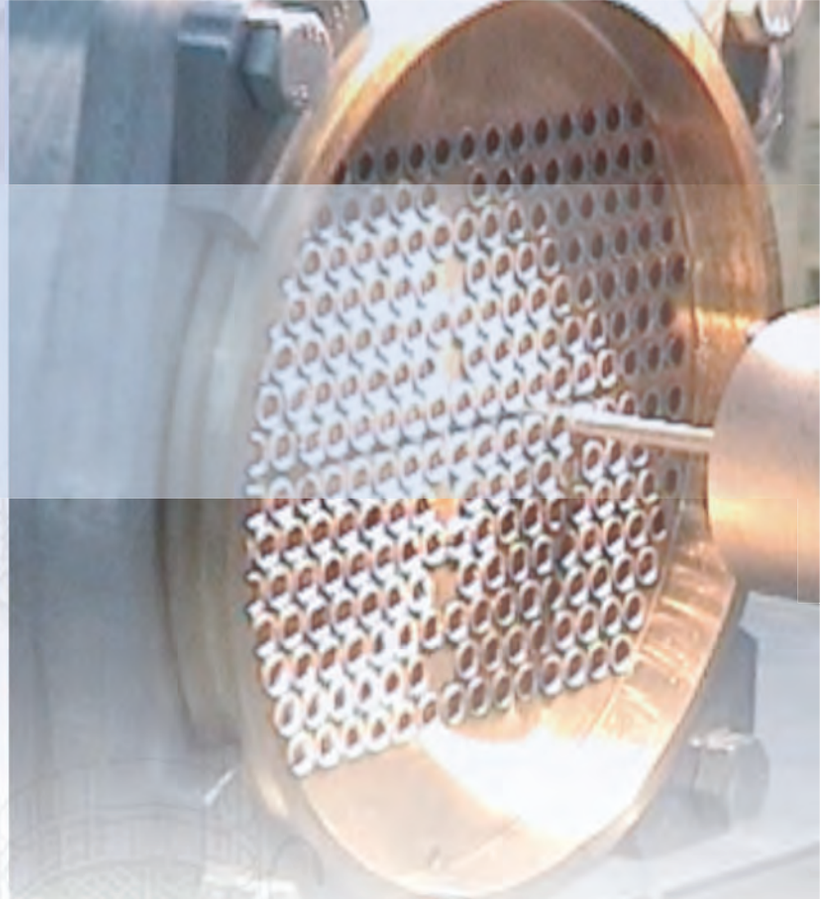
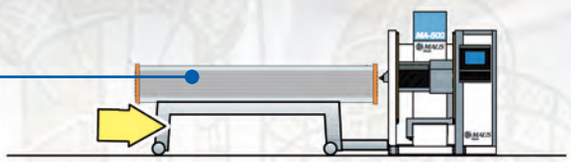
MA-500

Positioning



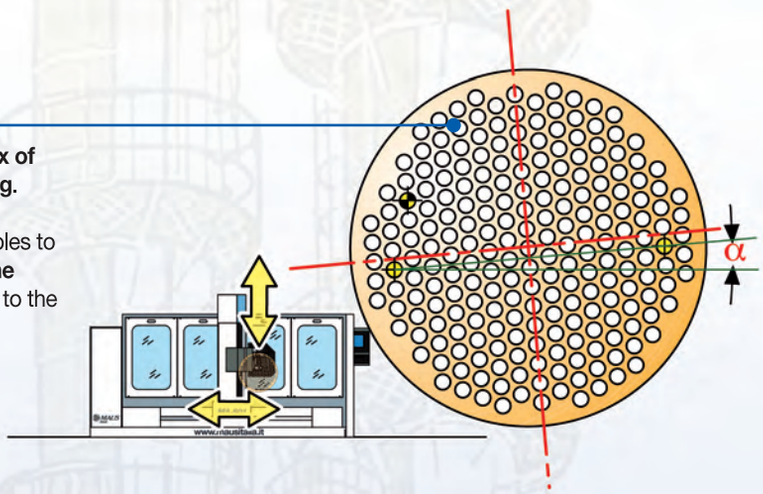
1 Positioning

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



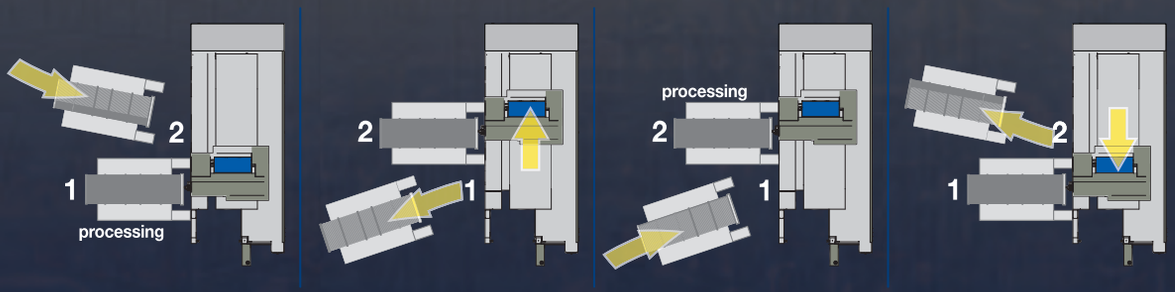
2 Zero setting

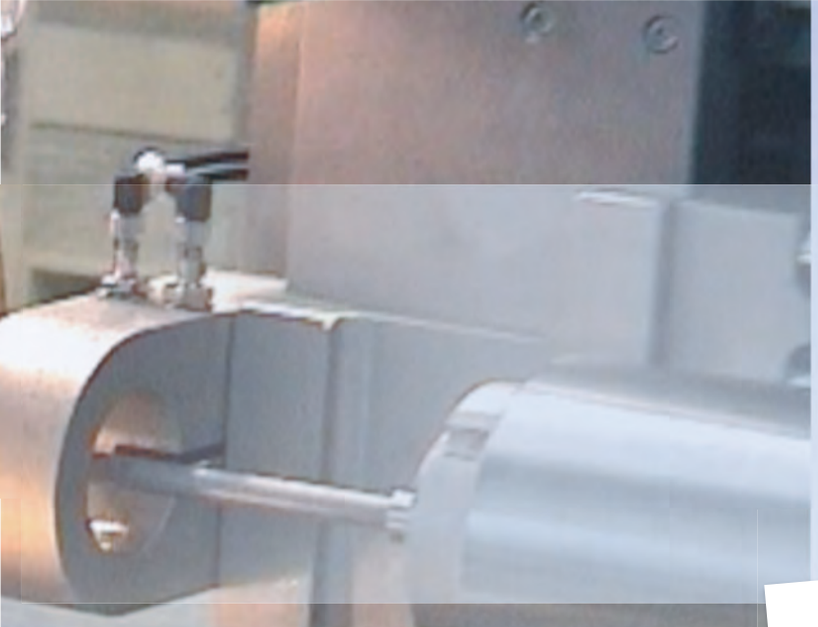
Collimation of the tubesheet hole centre **matrix of the cnc program to the machine zero setting.**
A semi-automatic procedure combined to the ***FOCS-2*** laser self-learning centring feeler enables to **calculate and store both the position and the actual rotation of the tube sheet** with regard to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





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MA

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 c**ompletely 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 a**dvantages** 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

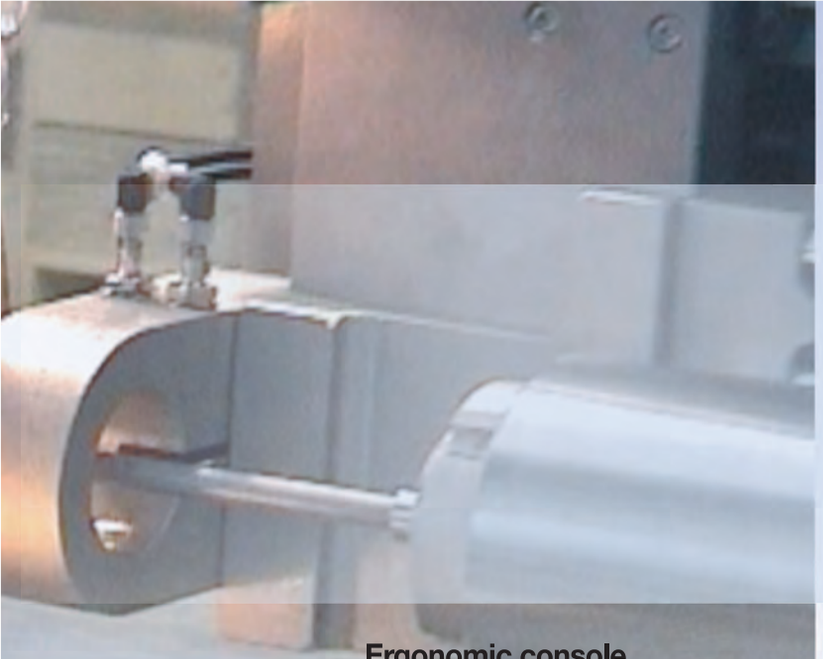
Grease lubrication gearcase for recirculating ball screws activated according to the number of meters covered by each machine axis.
The linear guides are instead equipped with a device directly applied to the runners which enables more than 10000 km *(approx 6200 mi)* covered without any maintenance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



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MA

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.

Sinumerilk 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.

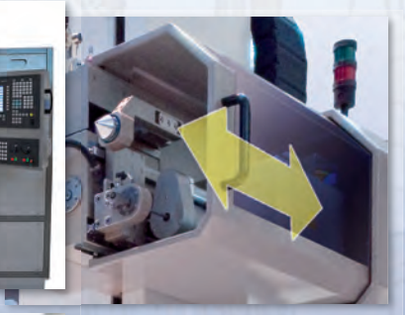
Alarm signalling lamp

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.

MA

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Tube sheet diameter
2500 mm (100”)

Tube sheet max thickness
700 mm (27.5”)

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

Photograph
By the kind permission of SICES GROUP

AU-50 MAUS ITALIA

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MA

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")*.

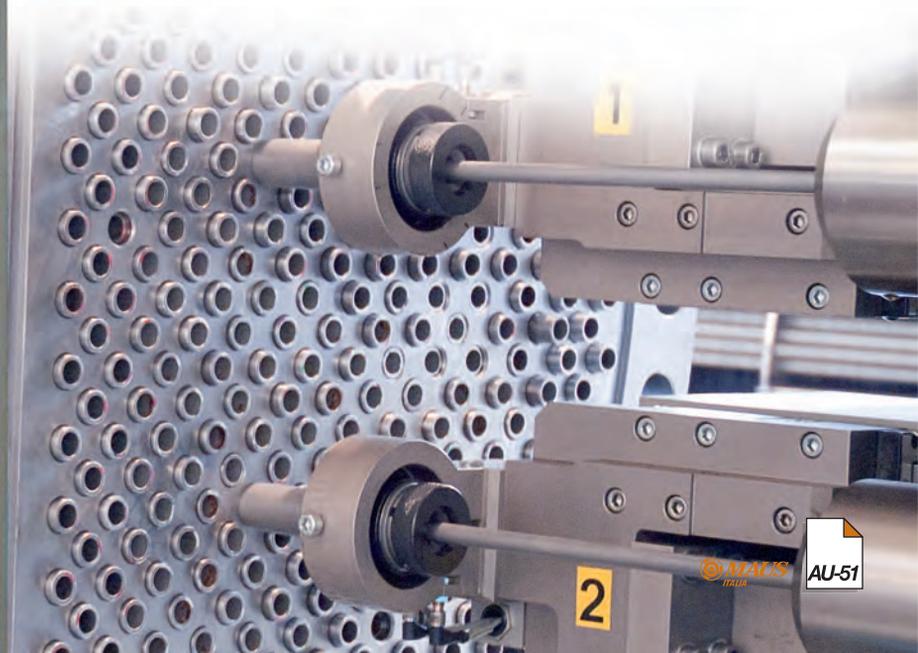
The setting of all the working and positioning parameters is operated by **Windows XP®** operating system with cutting edge graphical and multitasking features.

● *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

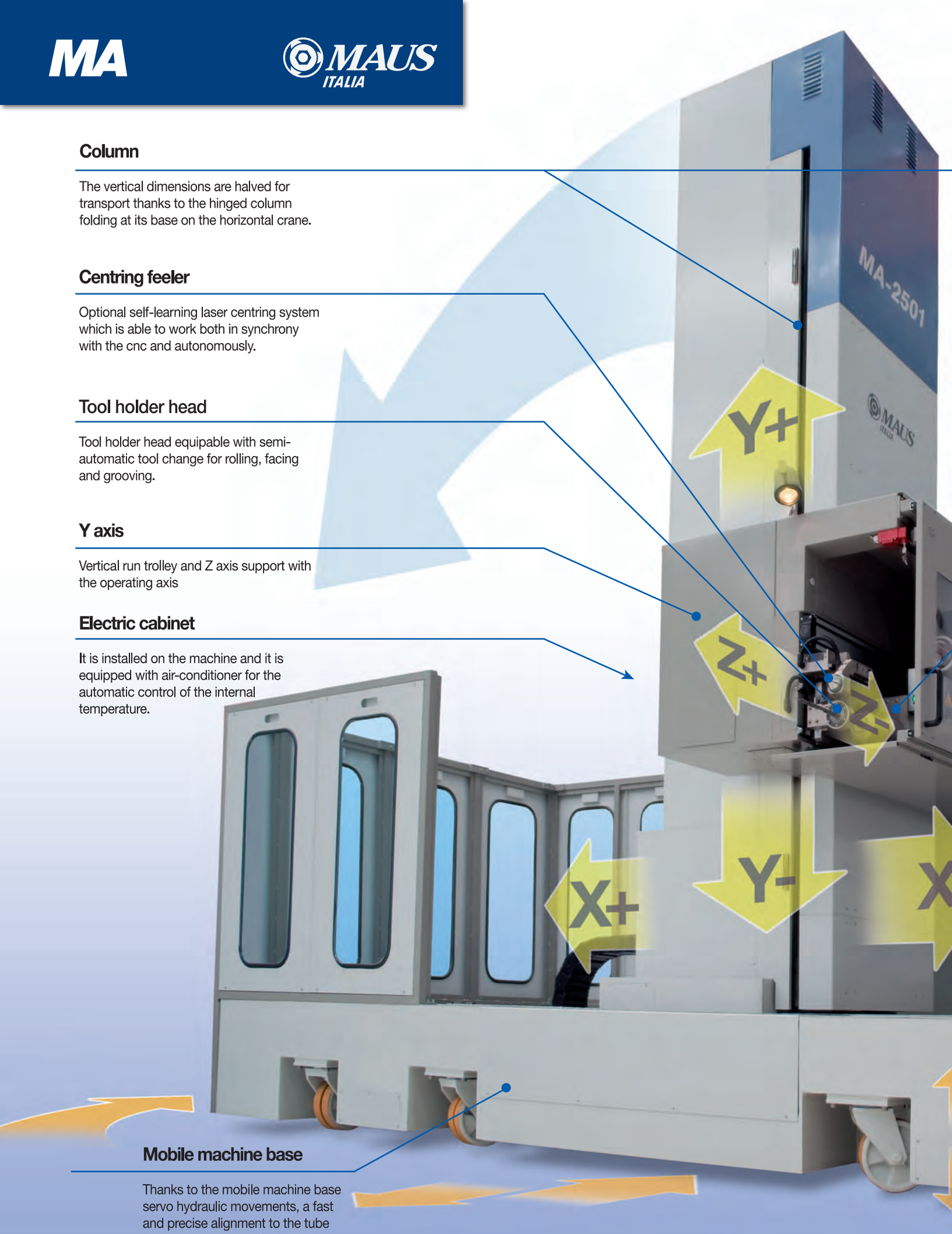
Tool holder head equipable with semi-automatic tool change for rolling, facing and grooving.

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.

Required time 15 min.

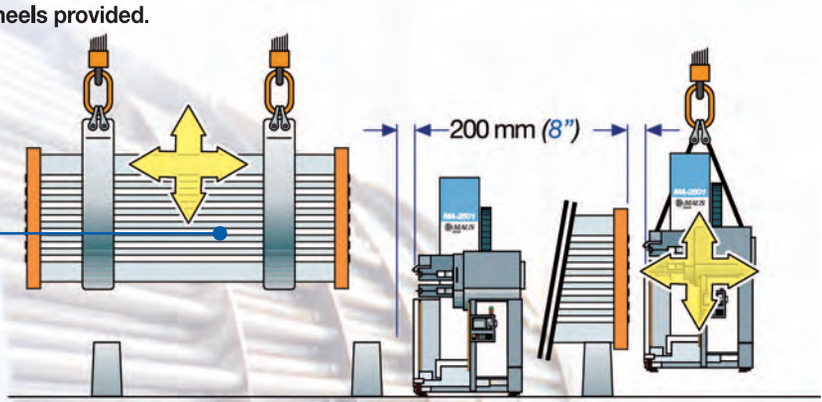
As for **quality**, a **precise alignment of the machine to the tube sheet** is essential. Having to deal with large heat exchange instruments, the thing that mainly concerns the technician is **how to manage such a tricky operation in a correct and safe way.**

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.**

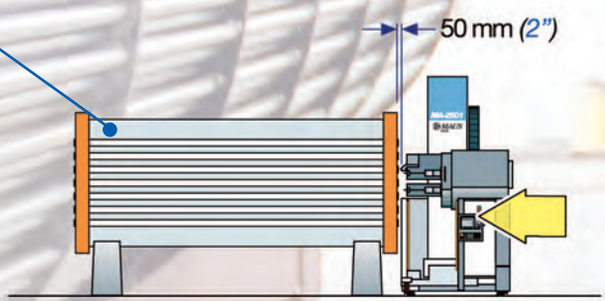
1 Approximate positioning

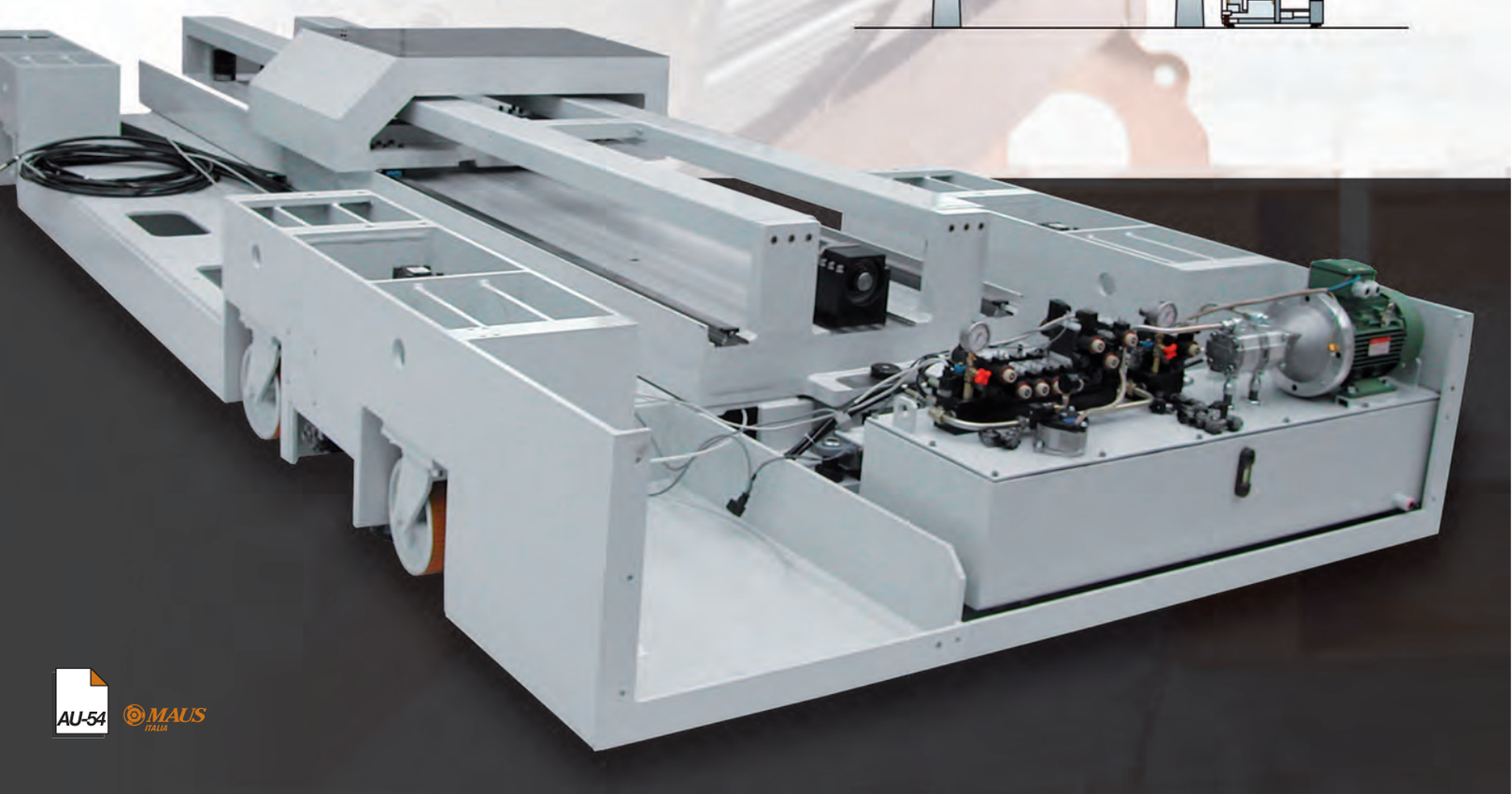
Using the regular hoisting devices available in the workshop **(gantry crane),** the operator **positions the tube bundle at a safety distance** of approx 200 mm (*8”*) **in a non definitive manner.**



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.





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MA

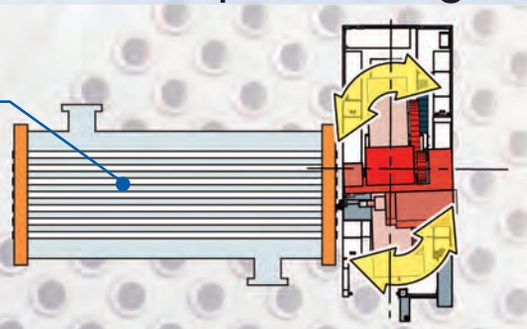
MA-2501

Optional

Servo hydraulic machine base: fast positioning

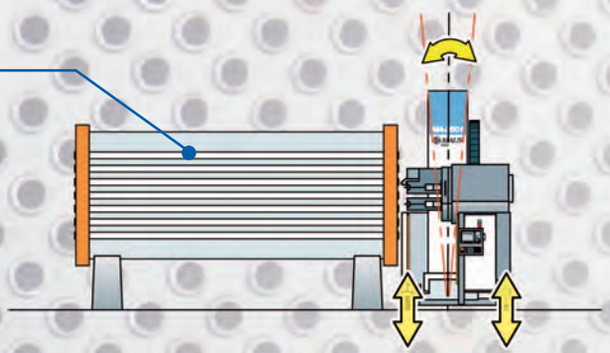
3 Horizontal alignment

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



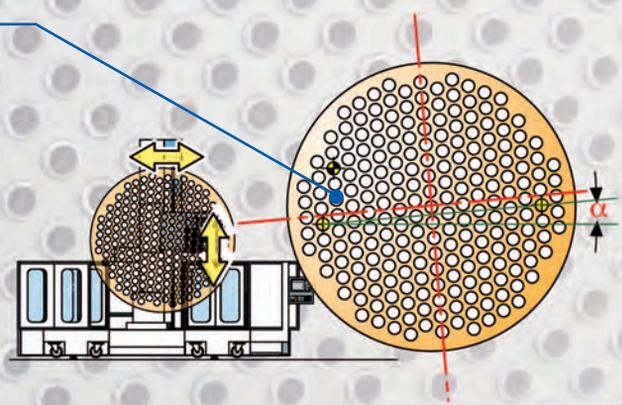
4 Vertical alignment

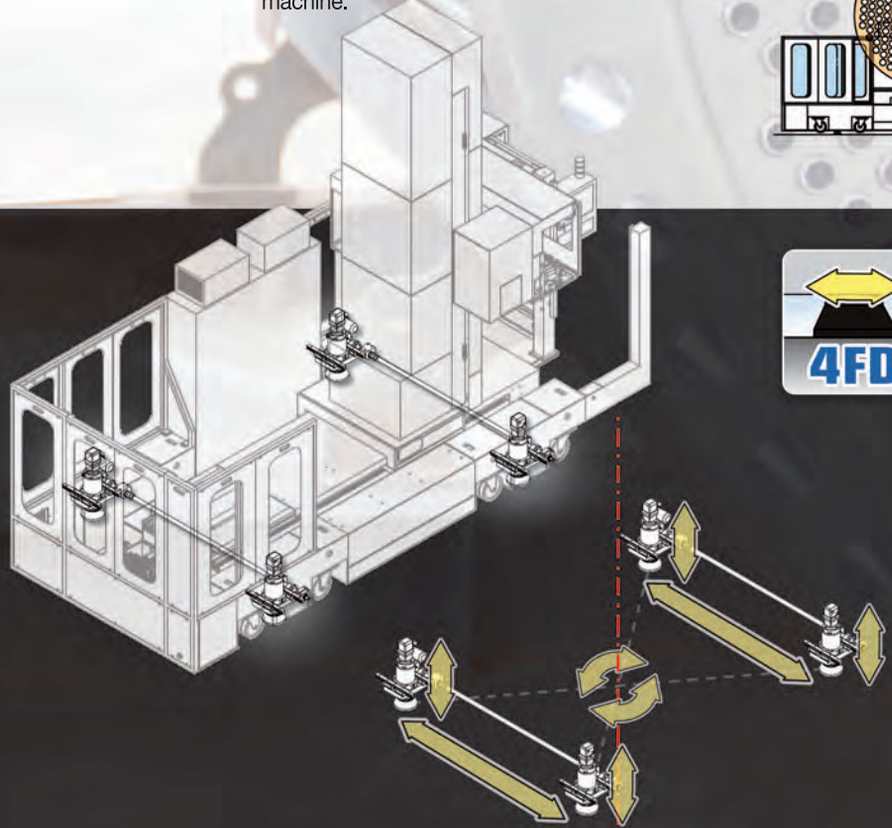
Thanks to the **4 independent servo hydraulic legs**, the operator can easily **verify and correct the vertical rod (Y axis) alignment to the tube sheet.**



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

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.

MA

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

MA-2501

Second axis: rolling, facing and grooving

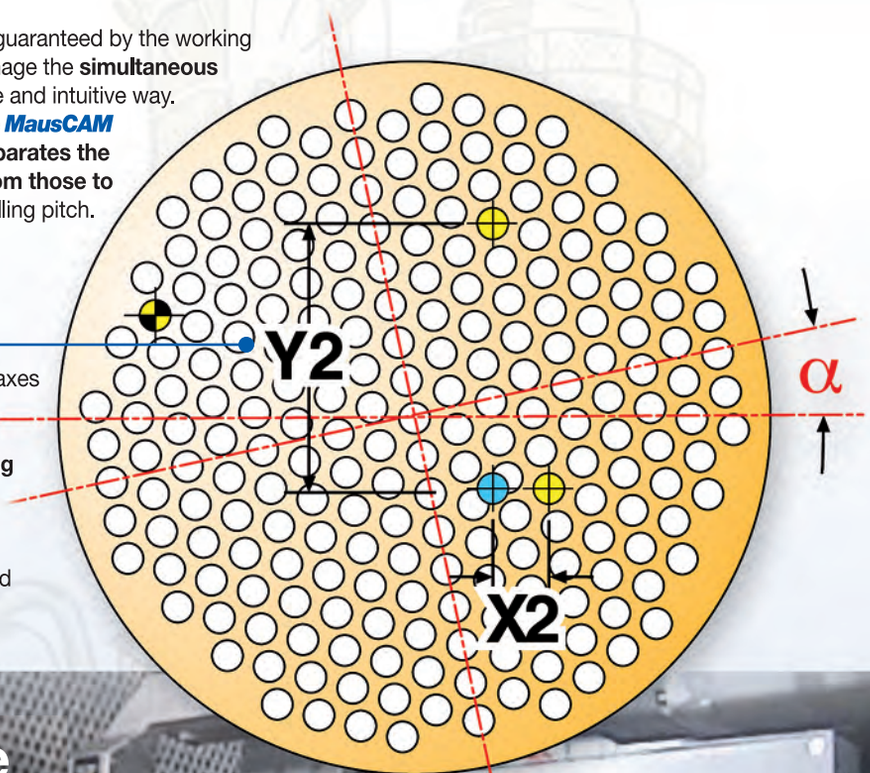
Optional

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.**

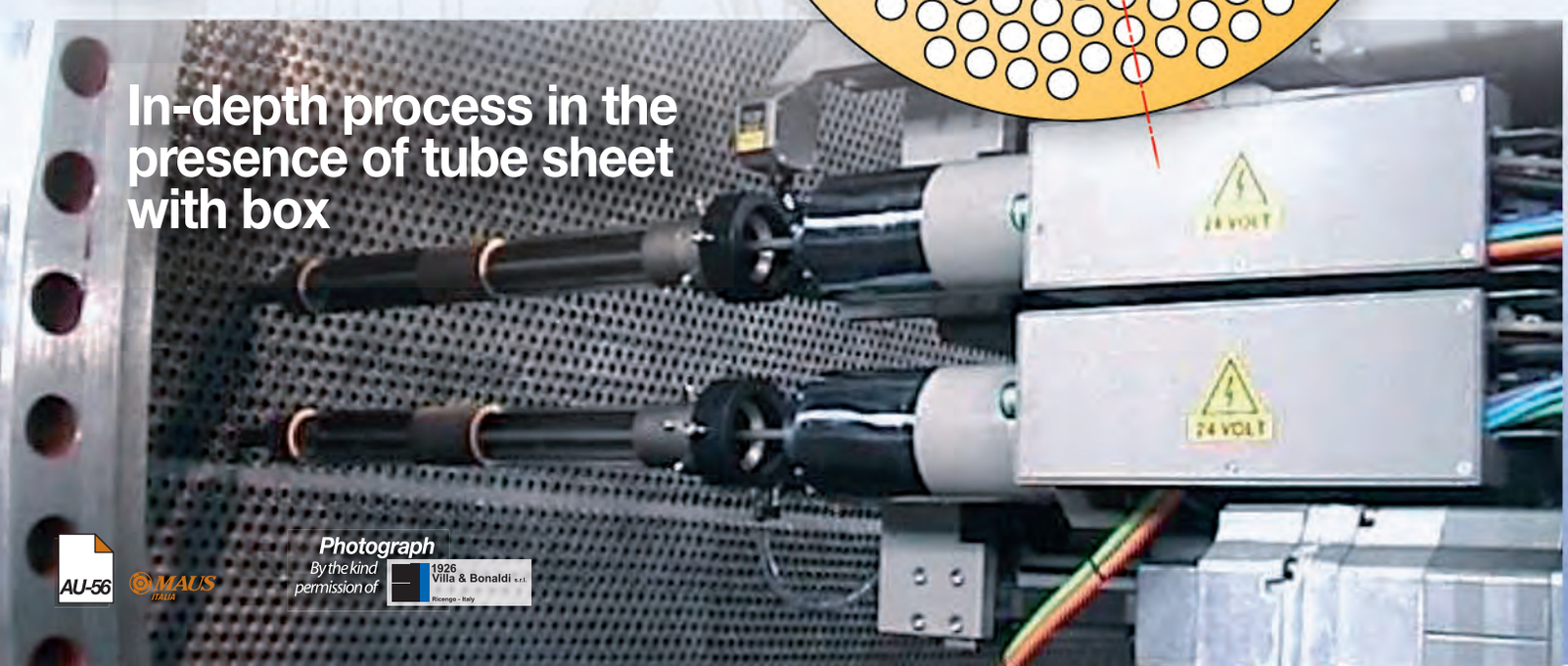
High productivity

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

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

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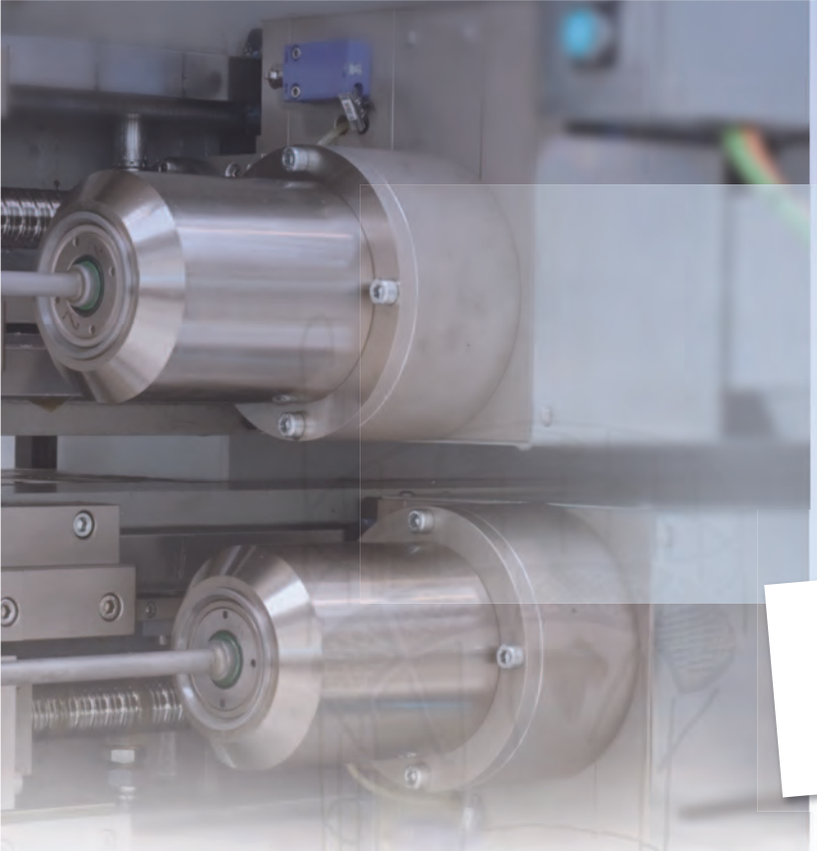

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MA

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 c**ompletely 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 a**dvantages** 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

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AU-58

MA-3501

MA-2501

Optional

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.

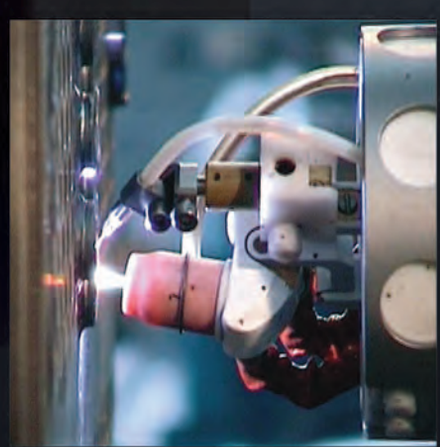
Welding torch lock

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



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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

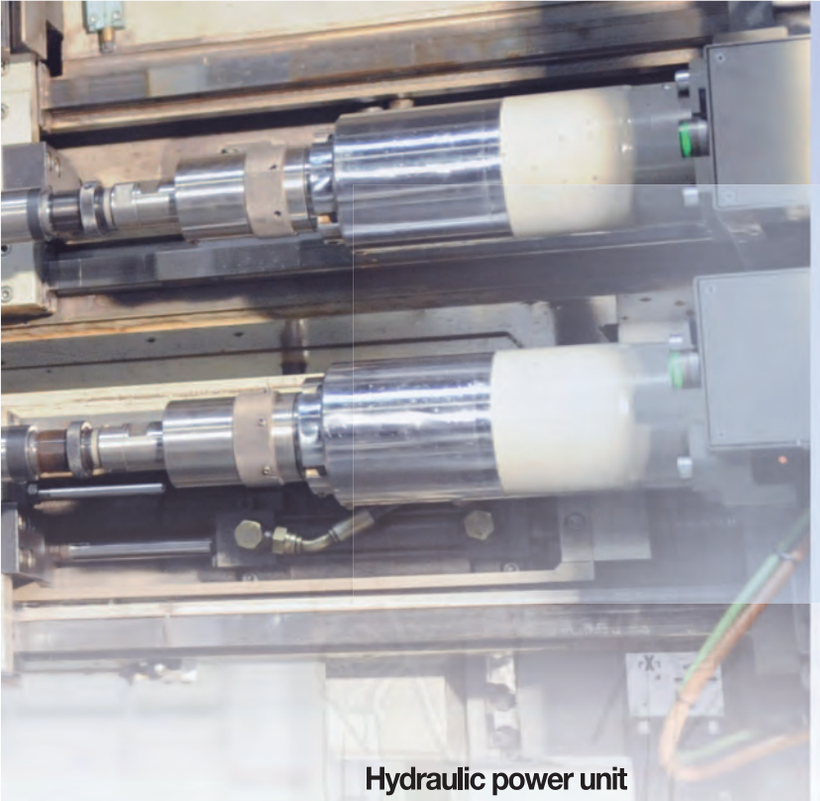
A double air-conditioner controls and automatically manages the temperature in order to protect the electronic equipment on the machine.

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.



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MA

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.

Sinumerilk 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.

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Tube sheet diameter 1500 mm (59”)

Tubes diameter 4 ÷ 51 mm (5/32” ÷ 2”)

Photograph
By the kind permission of KOCH HEAT TRANSFER COMPANY

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MA

MaTIG-500

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

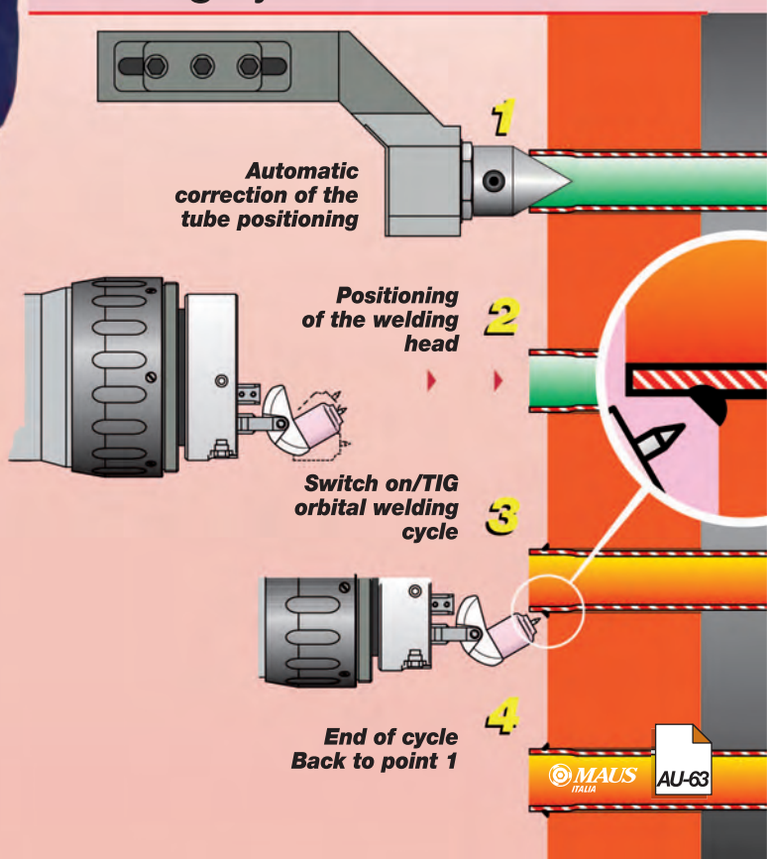
MaTIG-500 enables to perform completely automatic and cost efficient tube-to-tube sheet **TIG** orbital welding with a remarkable reduction in the production time.

The exclusive ***FOCS2*** centring system combined to the cnc ***replaces the traditional mechanic contact centring accessories (mandrel + cartridge)***, eliminating the inevitable limits of such a system and guaranteeing an extremely high precision in the welded joint geometry.

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

All the latest techniques and functions of the tube-to-tube sheet welding technology are provided. These features have been elaborated and developed thanks to ***the constant work of the Maus Italia technicians to deal with the issues submitted by the exchanger manufacturers.***

Working cycle



Vertical column

Extremely tough and compact, with aluminium profiles, integrated ball guides, and internal element protection in reinforced polyurethane.

Y axis

Vertical run trolley and Z axis support with welding torch

Centring feeler

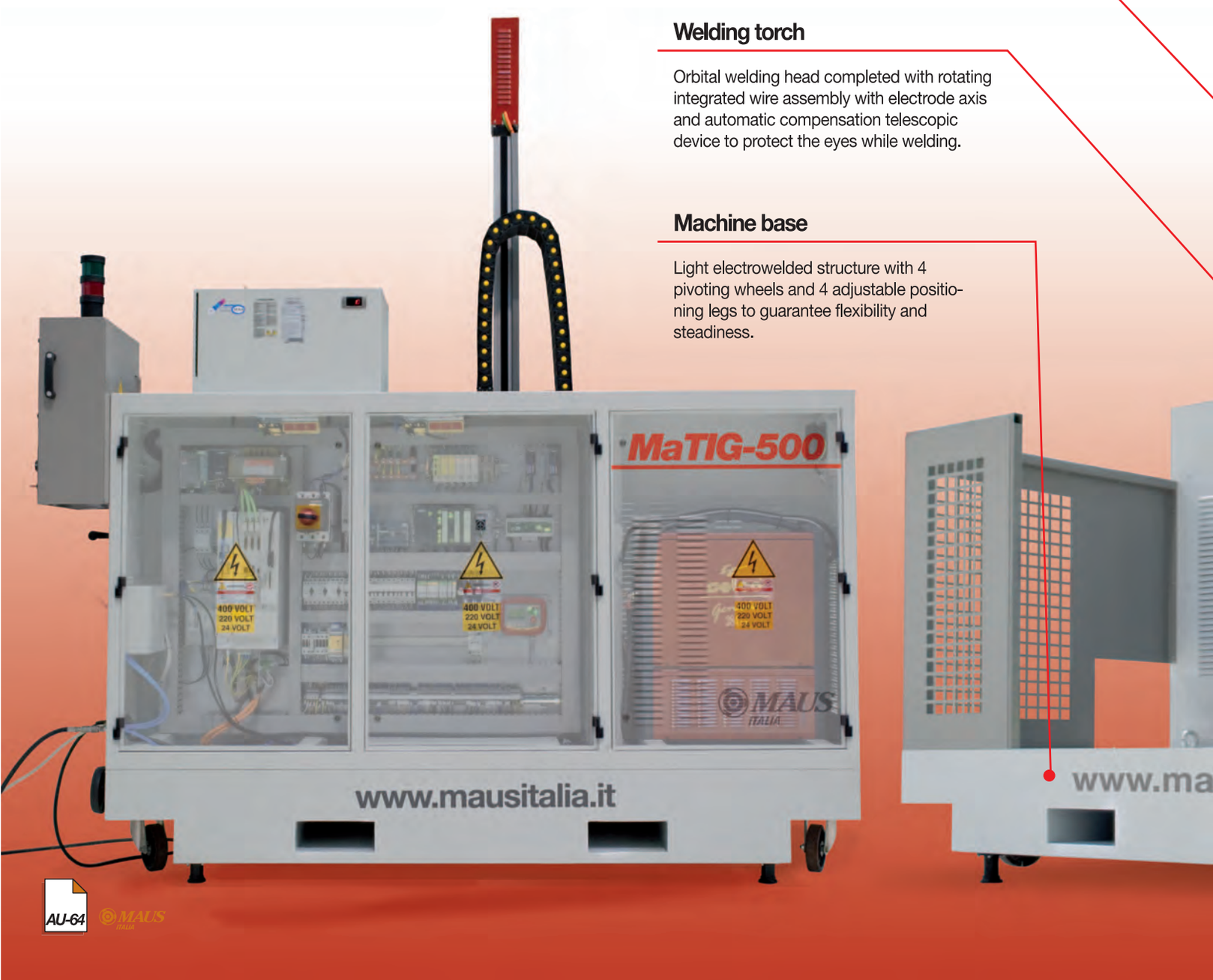
Optional self-learning laser centring system which is able to work both in synchrony with the cnc and autonomously.

Welding torch

Orbital welding head completed with rotating integrated wire assembly with electrode axis and automatic compensation telescopic device to protect the eyes while welding.

Machine base

Light electrowelded structure with 4 pivoting wheels and 4 adjustable positioning legs to guarantee flexibility and steadiness.



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MaTIG-500

Single axis series ***MA*** cnc working centre for the **TIG** *orbital* welding of the tube bundle tubes.

Z axis

Transverse run trolley to approach the tubesheet, equipped with ***AVC*** electrode-puddle distance control digitally managed by the cnc in continuous modulation.

Electric cabinet

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

Control console

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

Machine status signalling

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

Welding gas control

Two separate GAS lines complete the outfit. They are completed with pressure control and protection gas flow.

X axis crane

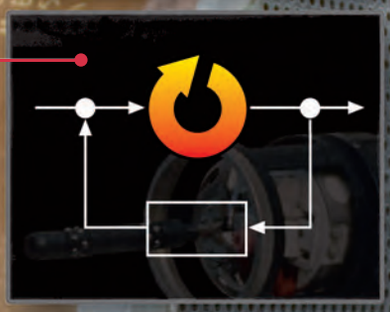
Column support trolley for horizontal positioning.

Axes digital control

Maus Italia adopted the **SIEMENS 810 D** ***Power Line*** control system, a single compact unit to control all the CNC communications, PLC ***communications***, and welding parameters.

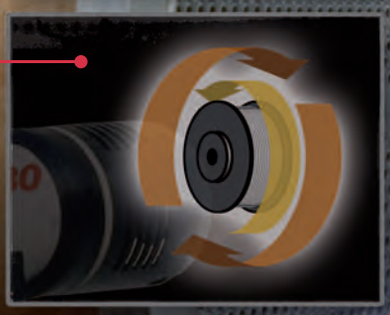
Torch rotation control

Continuous **feedback** control of the ***orbital*** torch rotation speed by a **tachometric dynamo** *(angular-speed transducer which provides a voltage proportional to the rotation speed of the motor).*



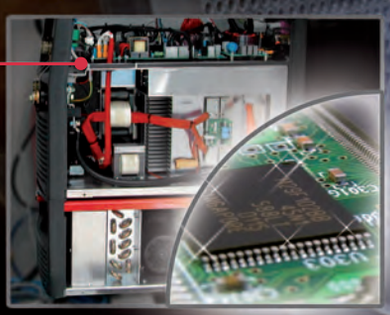
Weld material control

Unique system, which endlessly pulls the **rotating wire along** the orbital axis *(to infinite)*, to achieve a **regular flow** of the welding wire to the puddle during the welding process.



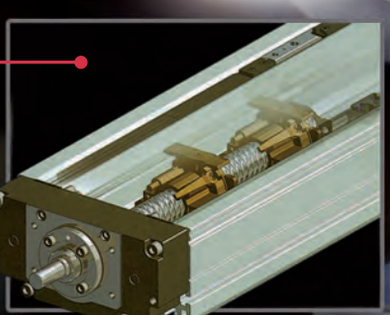
Inverter generator

The **inverter technology** guarantees a **perfectly linear** current thus obtaining a particularly **stable and precise** welding arc as well as high quality welding and an overall improvement in performance.



Guides

The linear guide systems mounted on the ***MaTIG-500*** guarantee high run speed as well as precision thanks to the rail ball guides and to its tough mechanical structure.



Photograph
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MaTIG-500

Applied technologies

Electrode centring and distance

Elimination of the mechanical devices for the orbital head position and centring to the tube to be welded.

Automatic positioning error compensation by self-learning ***FOCS2*** laser feeler.

AVC - **electrode-puddle distance control digitally** managed by the cnc in continuous modulation.

Welding wire

Integrated and orbital filler wire system, with presence control and welding wire feeding.

Transport and positioning

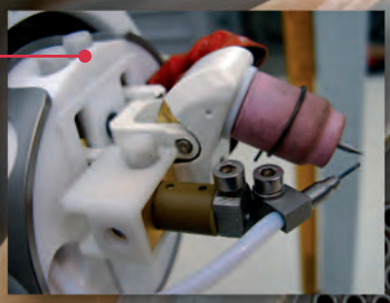
Four adjustable positioning legs **guarantee the positioning, the alignment and the steadiness** of the ***MaTIG-500*** in front of the exchanger.

Its light weight and the four tough pivoting wheels **make the exchanger displacement unnecessary.**

Four handy eyebolts enable a **rapid aerial displacement** inside the workshop.

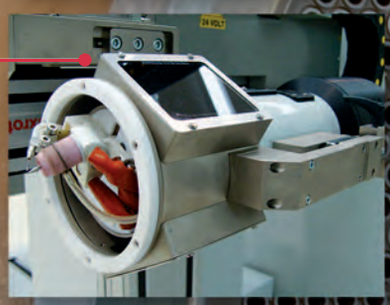
Totally adjustable

Maximum flexibility in setting the welding torch geometry thanks to the triple freedom degre of both the electrode support and the wire assembly which are totally independent.



Mobile protection

Automatic compensation telescopic device for eye protection during welding operations.
It enables to see the ongoing welding operation through a dark glass according to the DIN GS0196 standard CE

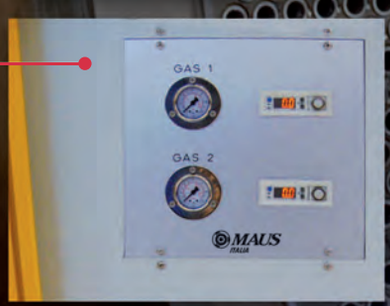


USB communication port

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

GAS flow control

Two different GAS lines controlled by digital flowmeters complete the supply.



GAS2 digital tank

It enables welding operations in protective atmosphere. It is used for titanium tube welding.

Climate-controlled electric cabinet

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

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MaTIG-500

Features and functions to be pointed out

Photograph
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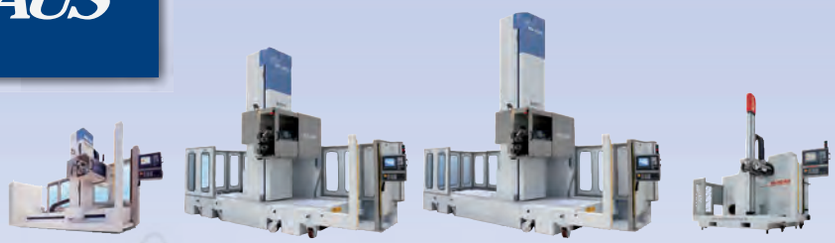

Supply		MA-500	MA-2501	MA-3501	MaTIG-500
Voltage	Volt - Ph	400 - 3	400 - 3	400 - 3	400 - 3
Frequency	Hz	50	50	50	50
Installed power	Kw	17	50	50	16
Dimensions		**MA-500**	**MA-2501**	**MA-3501**	**MaTIG-500**
Length **A**	mm *(Ft)*	4200 *(13.78)*	6500 *(21.32)*	7600 *(24.93)*	2700 *(8.86)*
Width **B**	mm *(Ft)*	1700 *(5.58)*	2350 *(7.71)*	2350 *(7.71)*	1425 *(4.67)*
Height **C**	mm *(Ft)*	2160 *(7.10)*	4950 *(16.24)*	5155 *(16.91)*	3050 *(10.01)*
Heigh for transport	mm *(Ft)*	1850 *(6.10)*	2730 *(8.10)*	2730 *(8.10)*	2850 *(9.40)*
Weight	Kg *(Lb)*	7500 *(16540)*	13500 *(29770)*	16000 *(35300)*	850 *(1880)*
Colours	RAL	7030 - 7035	7030 - 7035	7030 - 7035	7030 - 7035
Additional packing		- - -	1	1	- - -
Additional packing dim.	*(Ft)* Kg	- - -	1800x1400x1200 (6.00x4.60x4.00)	1800x1400x1200 (6.00x4.60x4.00)	- - -
Additional weight	Kg *(Lb)*	- - -	280 *(620)*	310 *(690)*	- - -
Dimensional capacities		**MA-500**	**MA-2501**	**MA-3501**	**MaTIG-500**
Stroke **X**	mm *(inches)*	✲ 1700 *(66.929)*	2500 *(98.425)*	3500 *(137.795)*	1500 *(59.055)*
Stroke **Y**	mm *(inches)*	✲ 600 *(23.622)*	2500 *(98.425)*	3500 *(137.795)*	1800 *(70.866)*
Stroke **Z**	mm *(inches)*	400 *(15.748)*	800 *(31.496)*	800 *(31.496)*	300 *(11.811)*
Minimum height **T**	mm *(inches)*	780 *(30.709)*	920 *(36.220)*	950 *(33.465)*	500 *(19.685)*
Fast forward movement		**MA-500**	**MA-2501**	**MA-3501**	**MaTIG-500**
X axis	m/min *(Ft/min)*	20 *(98.4)*	20 *(65.6)*	20 *(32,8)*	20 *(65.6)*
Y axis	m/min *(Ft/min)*	20 *(98.4)*	20 *(65.6)*	20 *(32,8)*	20 *(65.6)*
Z axis	m/min *(Ft/min)*	25 *(98.4)*	25 *(82.0)*	25 *(82.0)*	20 *(65.6)*
U axis	m/min *(Ft/min)*	15 *(49.2)*	15 *(49.2)*	15 *(49.2)*	- - - - - -
Working capacity		**MA-500**	**MA-2501**	**MA-3501**	**MaTIG-500**
Tube sheet diameter	mm *(inches)*	1000 *(39") max.*	2500 *(100")*	3500 *(140")*	1500 *(3/8"÷5/8")*
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")*	4÷51 *(5/32"÷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**	**MaTIG-500**
Max welding current	Amp	- - -	6÷200	6÷200	6÷200
No-load voltage	Volt	- - -	81	81	81
Orbital speed	giri/min *(R.P.M)*	- - - - - -	0÷6	0÷6	0÷6
Welding wire speed	giri/min *(R.P.M)*	- - - - - -	0÷150	0÷150	0÷150
Welding wire spool	Kg/Ømm *(Lb/Øinches)*	- - - - - -	1-100 *(2.2/3,937)*	1-100 *(2.2/3,937)*	1-100 *(2.2/3,937)*
Cooling unit	Lt *(GalUS)*	- - - - - -	6 *(1,585)*	6 *(1,585)*	6 *(1,585)*
Cooling capacity	Kw	- - -	2	2	2
Electrode diameter	mm *(inches)*	- - - - - -	1÷3,2 *(0,039÷0,126)*	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)*	0,8÷1,2 *(0,031÷0,047)*

AU-70

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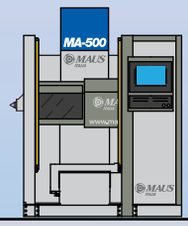
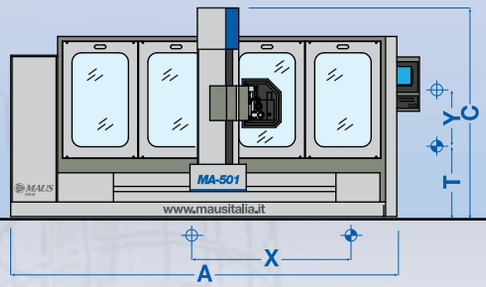
Optional

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

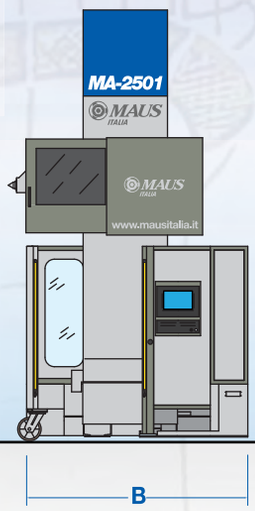
MA-500 ✲ "Heavy" tube expanders line upon request: workable tube max diameter: 9,5÷51 mm *(3/8"÷2")*

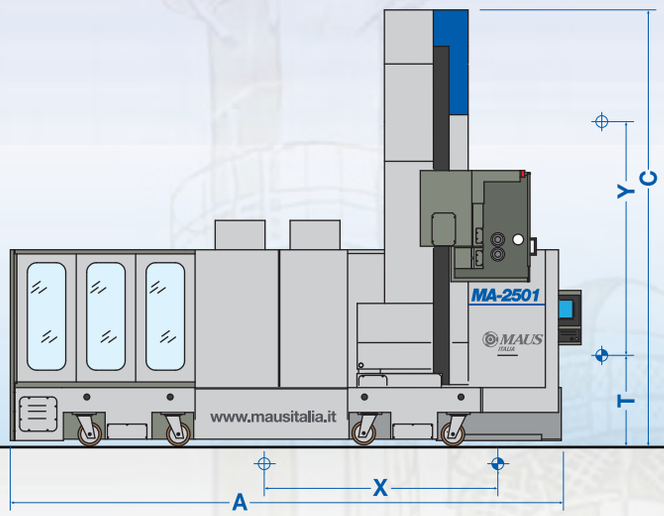
MA-500



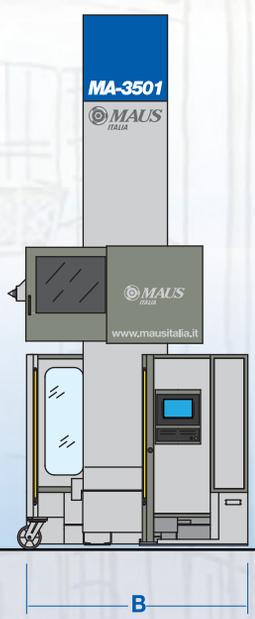


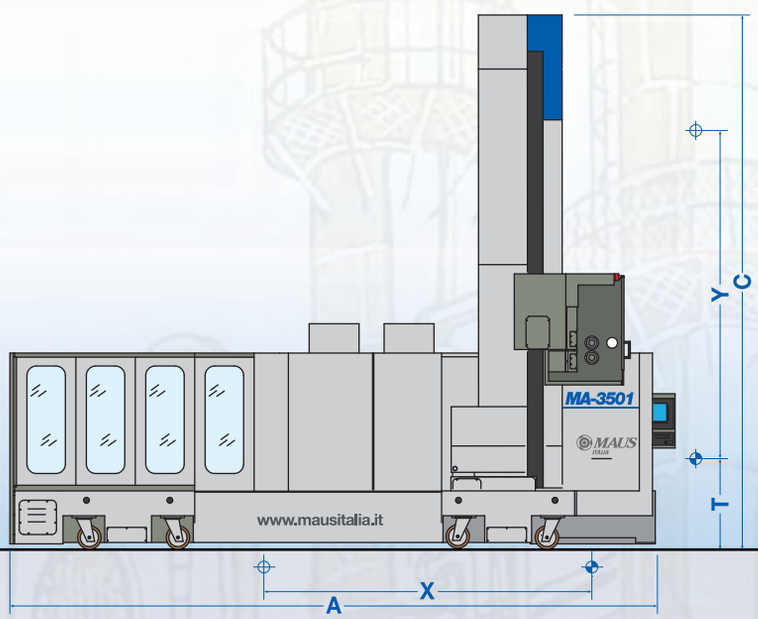
MA-2501



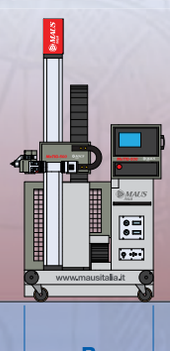


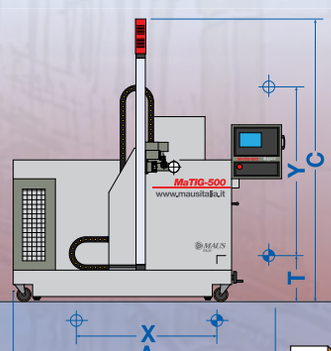
MA-3501





MaTIG-500





MA

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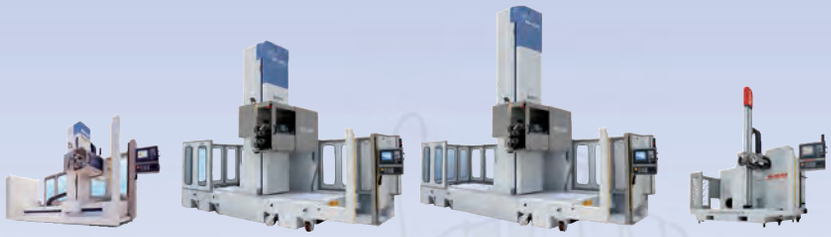
Processes	MA-500	MA-2501	MA-3501	MaTIG-500
Rolling	●	●	●	–
Welding	–	+	+	●
Facing	+	+	+	–
Grooving	+	+	+	–
Servo assisted positioning	**MA-500**	**MA-2501**	**MA-3501**	**MaTIG-500**
Servo hydraulic machine base	–	+	+	–
Z working axis	**MA-500**	**MA-2501**	**MA-3501**	**MaTIG-500**
Z1	●	●	●	●
Z2	+	+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

Provided ● *Optional* + *Not available* –



Main components	MA-500	MA-2501	MA-3501	MaTIG-500
Sinumerik	● 840 D	● 840 D	● 840 D	● 810 D
Quick tube expander change	●	●	●	–
Automatic tool lubrication	●	●	●	–
Guide lubrication	●	●	●	●
Air conditioned electric cabinet	●	●	●	●
Lamp	●	●	●	–
Ergonomic console	●	●	●	●
Hydraulic power unit	⊕	⊕	⊕	–
Alarm signalling lamp	●	●	●	●

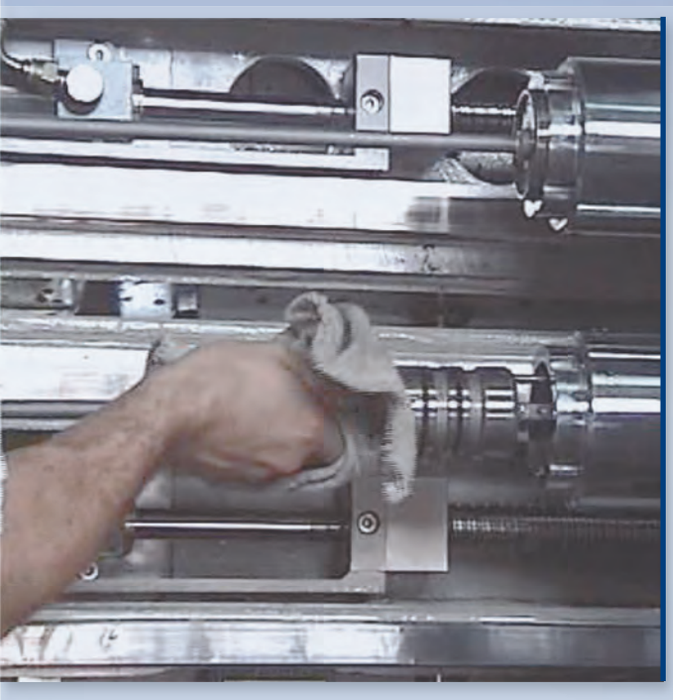
Safety	MA-500	MA-2501	MA-3501	MaTIG-500
Fixed mechanical protection	●	●	●	●
Fixed photoelectric barrier	●	●	●	●
Mobile photoelectric barriers	●	●	●	⊕
Cover with interlock	●	●	●	–

Applied technologies	MA-500	MA-2501	MA-3501	MaTIG-500
TL *Free tubes (with hydraulic head)*	⊕	⊕	⊕	–
RP *Parallel (and inclinated) rolls*	●	●	●	–
CPZ *Z automatic compensation*	⊕	⊕	⊕	–
CDAS *Mandrel forward movement digital control*	●	●	●	–
CVSC *Speed continuous variation*	●	●	●	–

Accessories	MA-500	MA-2501	MA-3501	MaTIG-500
Remote control	⊕	●	●	–

Provided ● *Optional* ⊕ *Not available* –

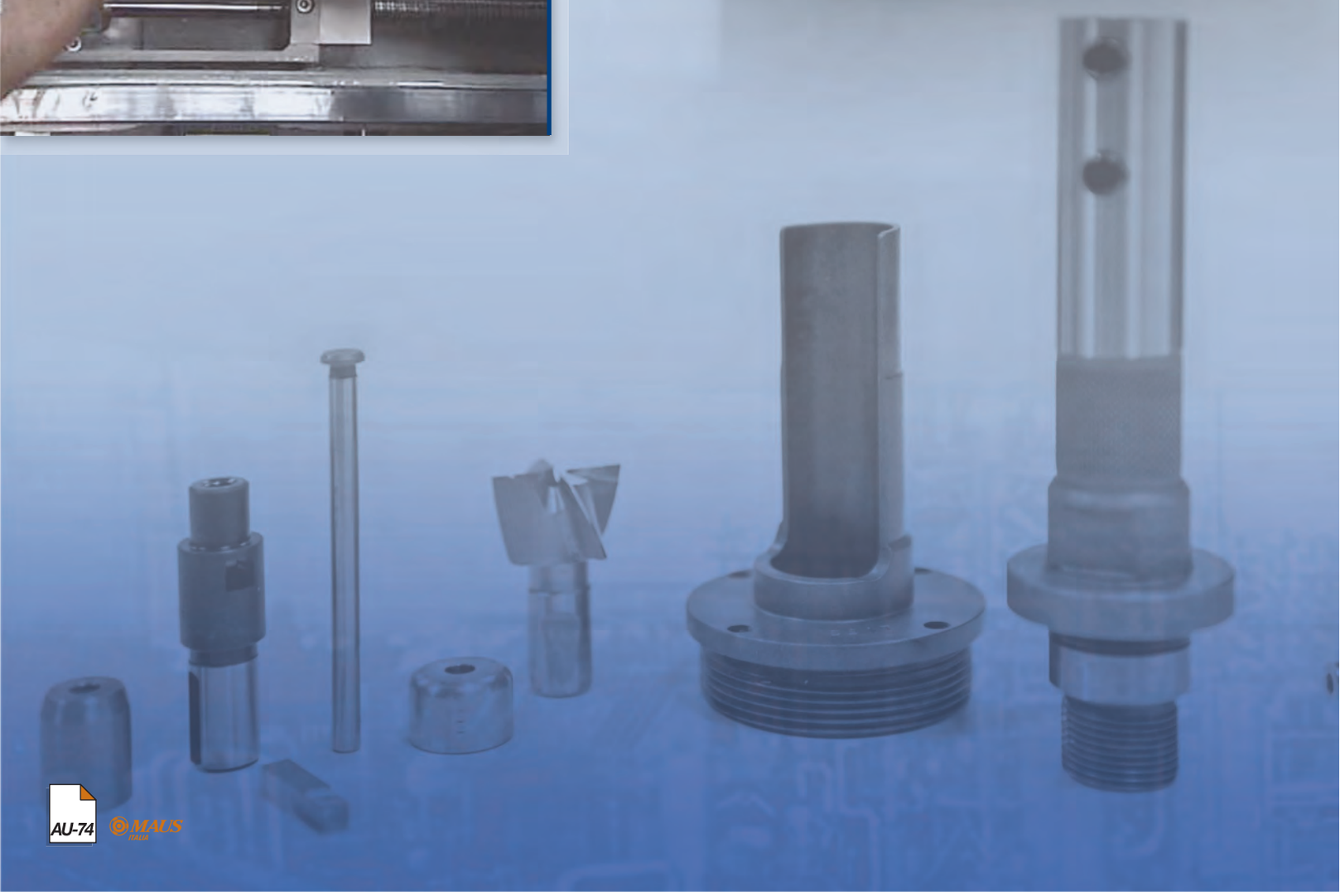
3 Accessories and tools for the MA series cnc working centres

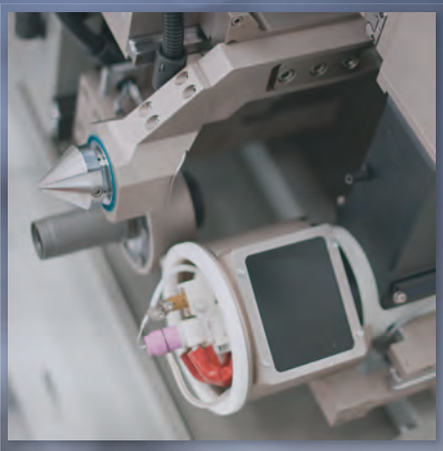


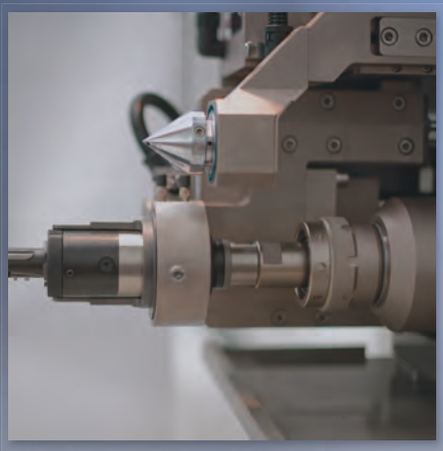
Maus Italia here presents a brief overview of the tools and the accessories designed for the ***MA-500***, ***MA-2501***, and ***MA-3501*** working centres.

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.





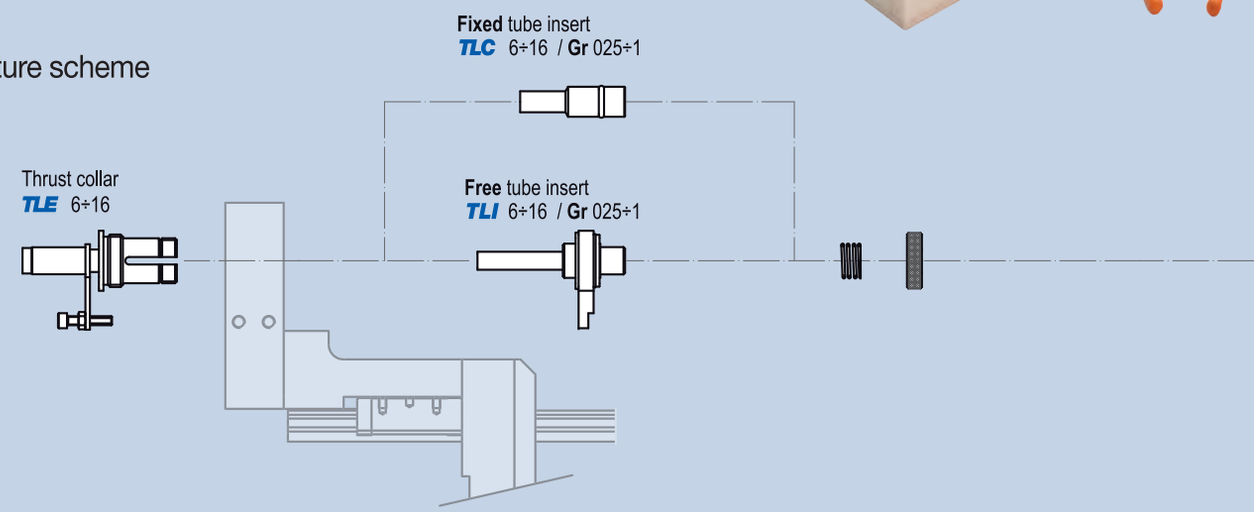


MA-500

Accessories and tools for tube expansion and facing

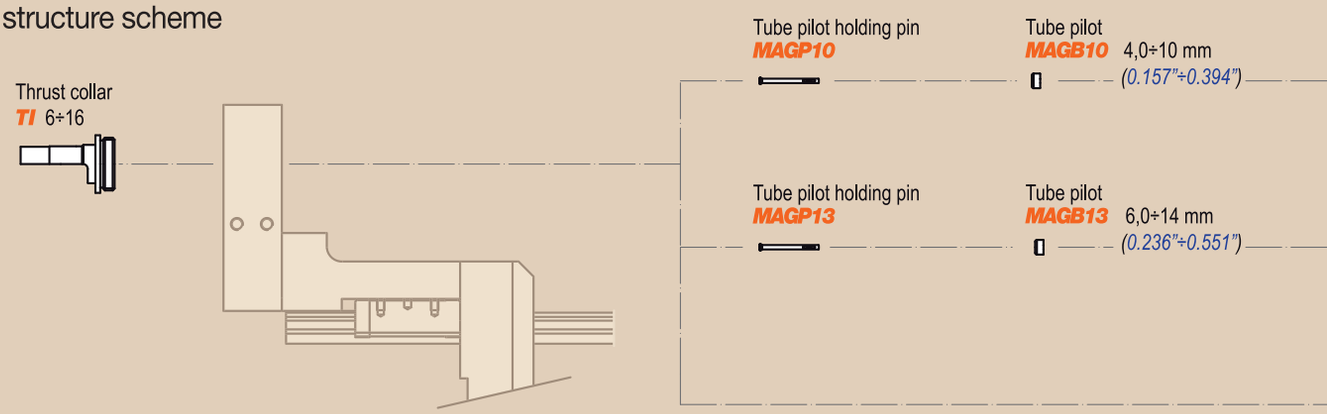
Rolling

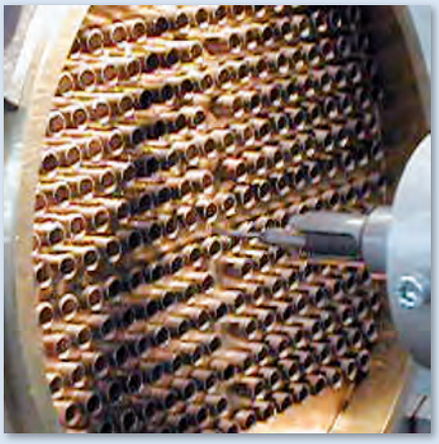
Tooling system structure scheme

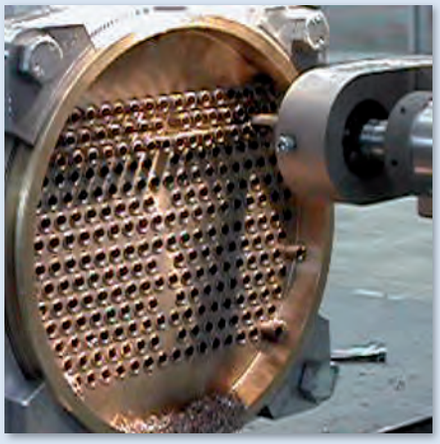


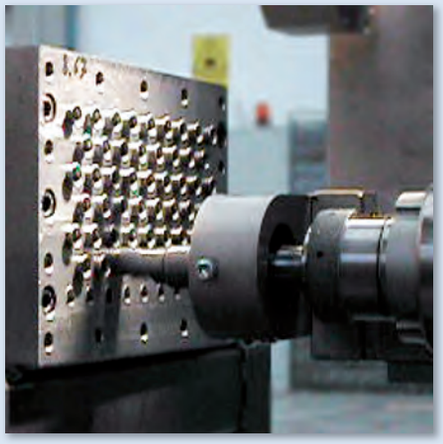
Facing

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")*

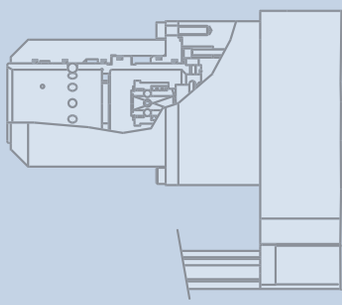
Gr 025÷1

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

Mandrel ***MA-500***
Gr 025÷1

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

MA-500



HSS facing tool
MAFHSS10 6÷11

HSS facing tool
MAFHSS-13 8÷18

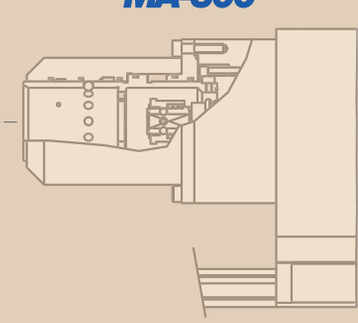
Bevelling/milling cutter 60°- 90°
MAS-13 8÷18

Holding shank
MAC500-10 **de** 5/16"÷3/8"

Holding shank
MAC500-13 **de** 3/8"÷1/2"

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

MA-500



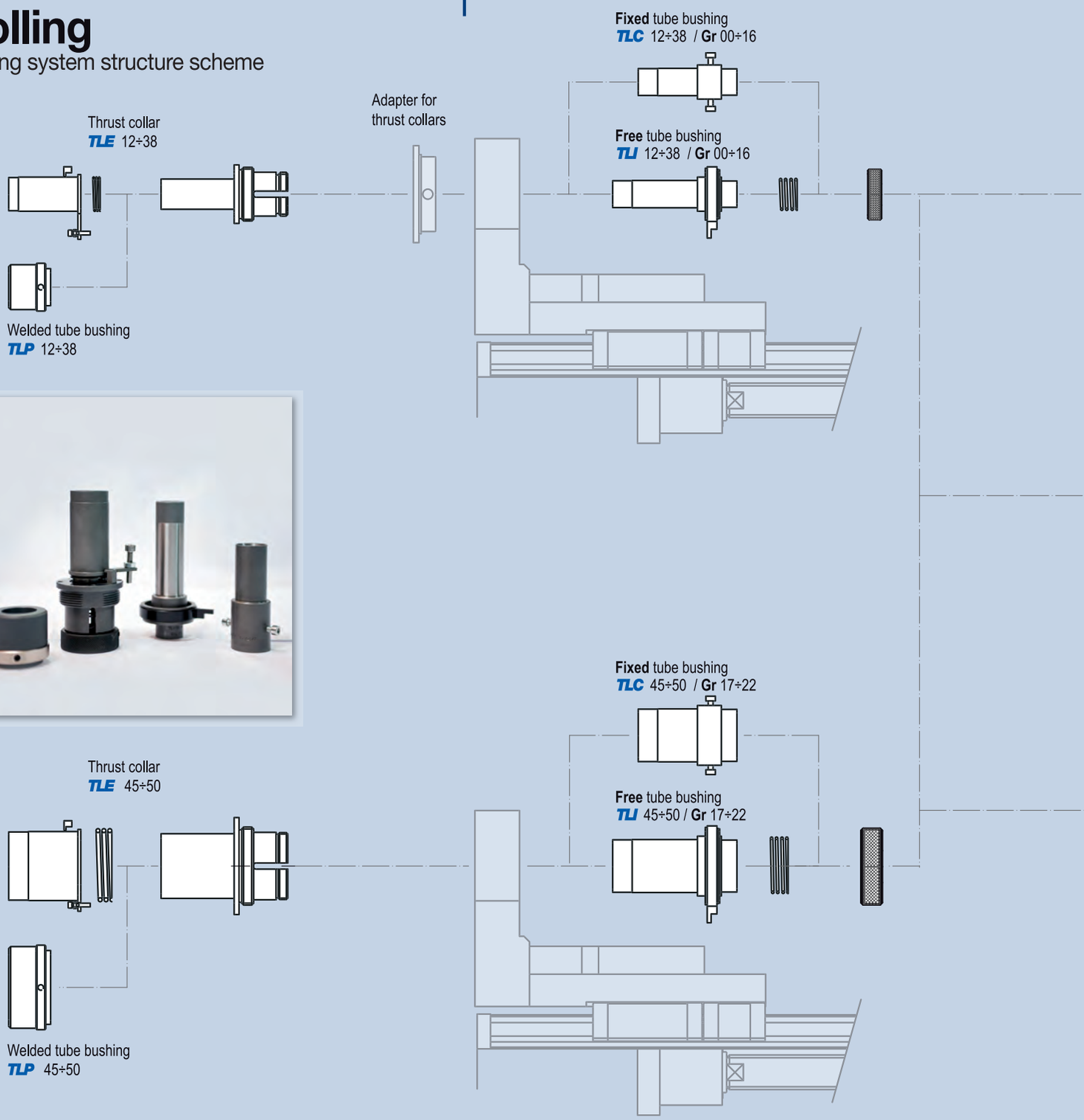
Gr size
de tube outside diameter
di tube inside diameter
Lu roll usefull length
RE expansion depth

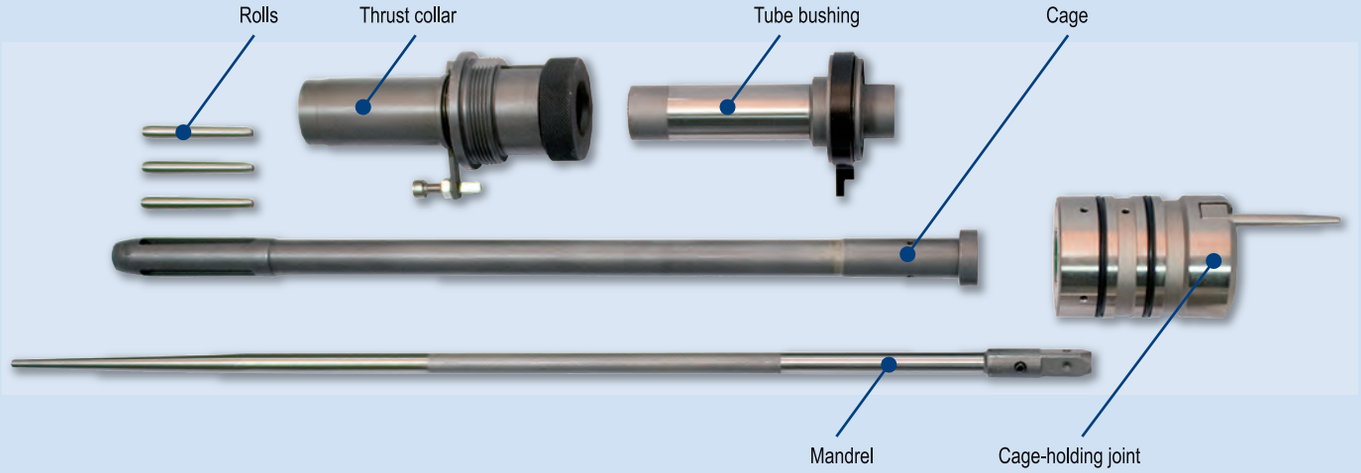
MA-2501

Accessories and tools for tube expansion

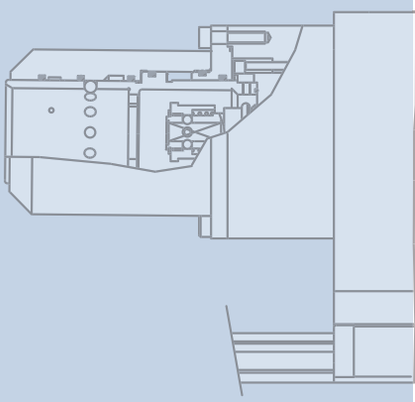
Rolling

Tooling system structure scheme





MA-2501
MA-3501



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

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

MA-2500 mandrels
Gr 00÷8

Quick connect
cage holder joint complete with
rotating distributor for lubrication
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")*

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

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

MA-2500 mandrels
Gr 9÷14

Quick connect
cage holder joint complete with
rotating distributor for lubrication
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")*

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

MA-2500 mandrels
Gr 15÷22

Quick connect
cage holder joint complete with
rotating distributor for lubrication
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")*

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

MAUS ITALIA

MA-2501

Accessories and tools
for tube facing

Facing

Tooling system structure scheme

Thrust collar
TI 12÷38

Thrust collar
TI 45÷50

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"

Grooving

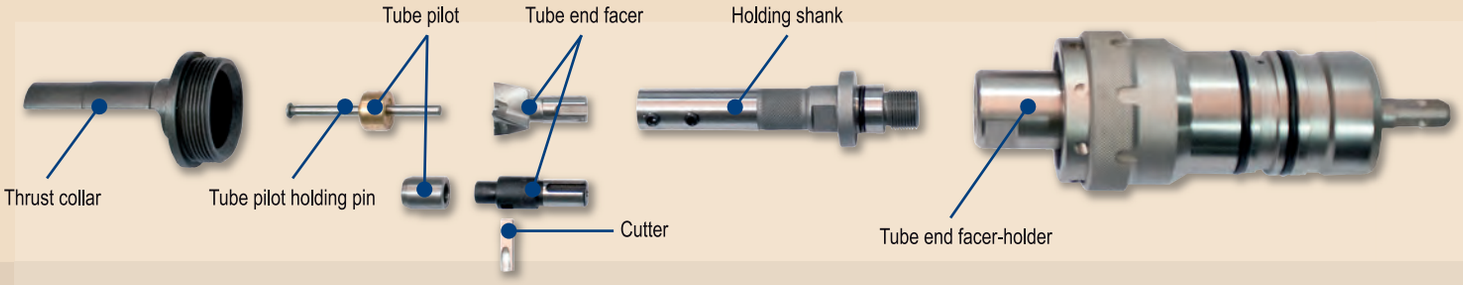
Tooling system structure scheme

Thrust collar
TFC 2÷4

AU-80 MAUS ITALIA

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

Holding shank
MAC-10 de 3/8"÷1/2"

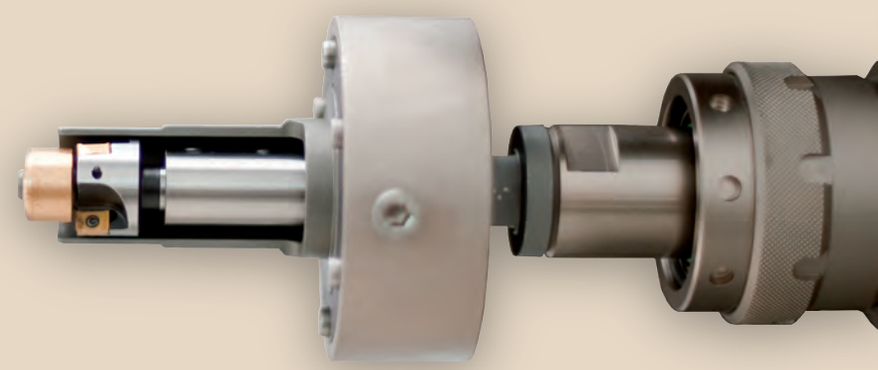
F751 tube end facer
MAF751 5/8"

Insert tube end facer
MAFAST13 5/8"

HSS tube end facer
MAFHSS13 15÷18

Bevelling
tool 60°- 90°
MAS13 10÷18

Holding shank
MAC-13 de 1/2"÷5/8"



F751 tube end facer
MAF751 3/4"÷1"

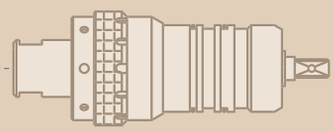
Insert tube end facer
MAFAST19 3/4"÷1"

HSS tube end facer
MAFHSS-9 22÷28

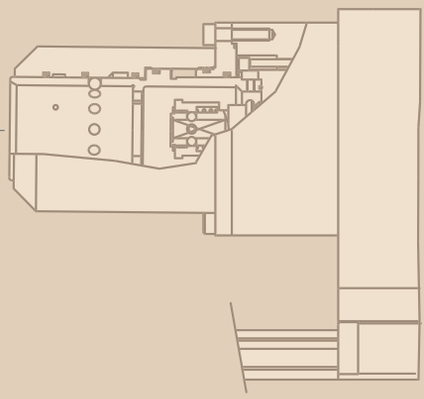
Bevelling
tool 60°- 90°
MAS19 22÷28

Holding shank
MAC-19 de 3/4"÷1"

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



MA-2501
MA-3501



F751 tube end facer
MAF751 1.1/4"÷2"

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

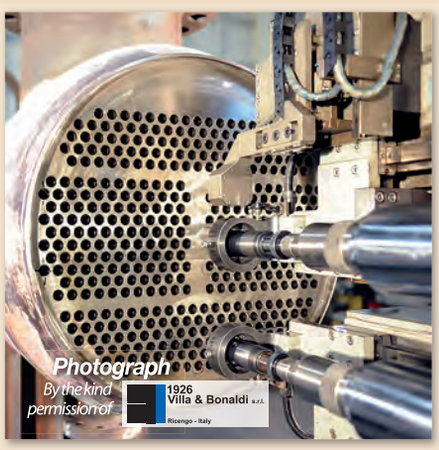
HSS tube end facer
MAFHSS32 34÷53

Bevelling
tool 60°- 90°
MAS32 34÷50

Holding shank
MAC-32 de 1.1/4"÷2"

F/26 grooving tool
de 5/8"÷1.1/4"

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



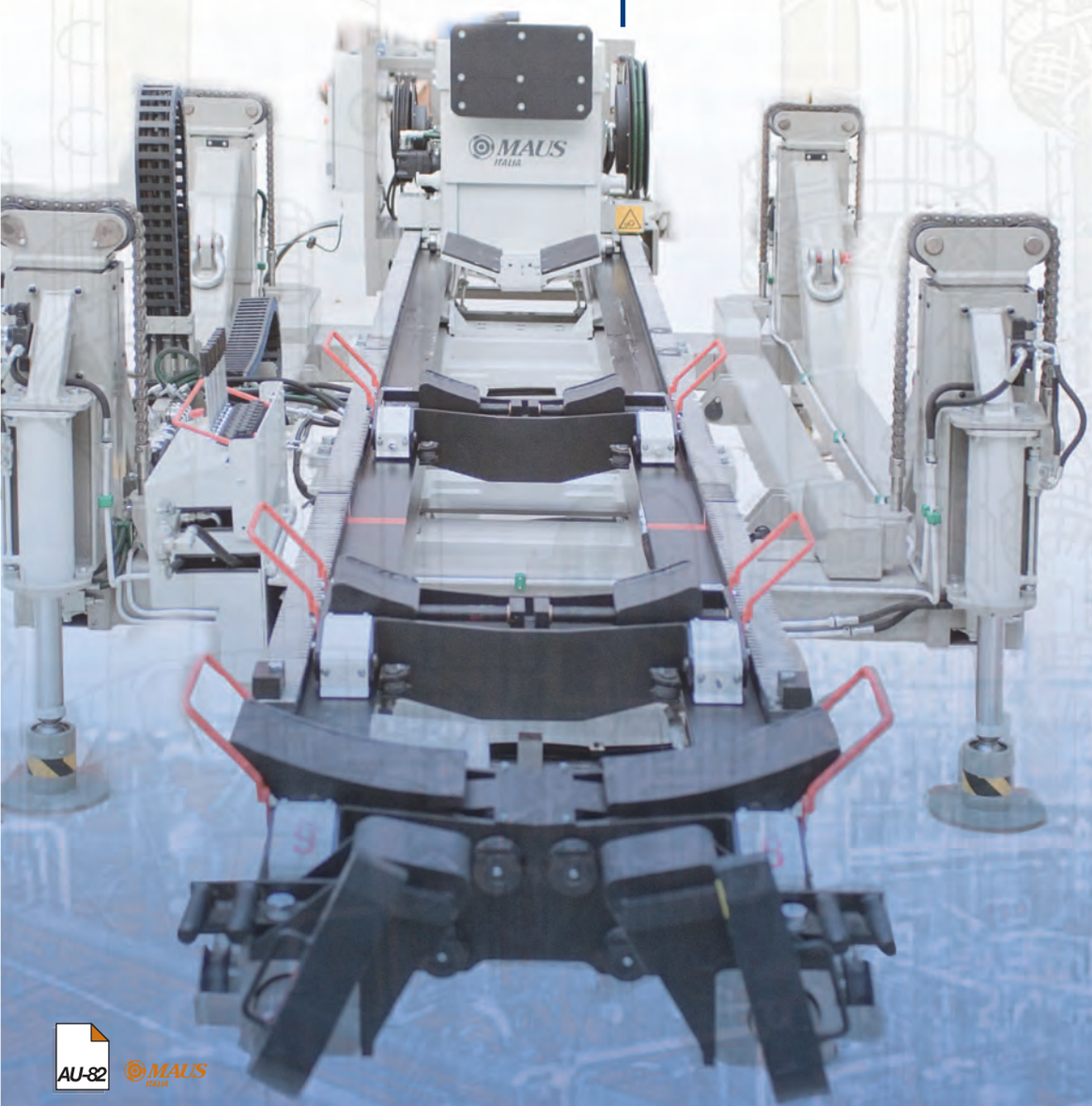
MAUS ITALIA

4 Special machines series IN for tube bundle insertion

In the final steps of the heat exchanger manufacturing cycle, the insertion of the tube bundle inside the shell threatens the integrity of the almost finished product.

Maus Italia, by its ***BundleIN*** and ***Mef shopIN*** machines, proposes two original solutions aimed at covering the wide range of requirements.

They have been designed to meet the crescent demand for quality, safety and operating speed.



BundleIN

Tube bundle inserter for heat exchangers.

AU-84

The ***BundleIN***, together with the gantry crane, enables to solve the problem of a **fast, accurate**, and **safe** insertion.
The original functioning based on two **synchronized hydraulic guns** stretching two steel wire ropes makes it possible to apply it to **tube sheets regardless of length limits** with the following main features:

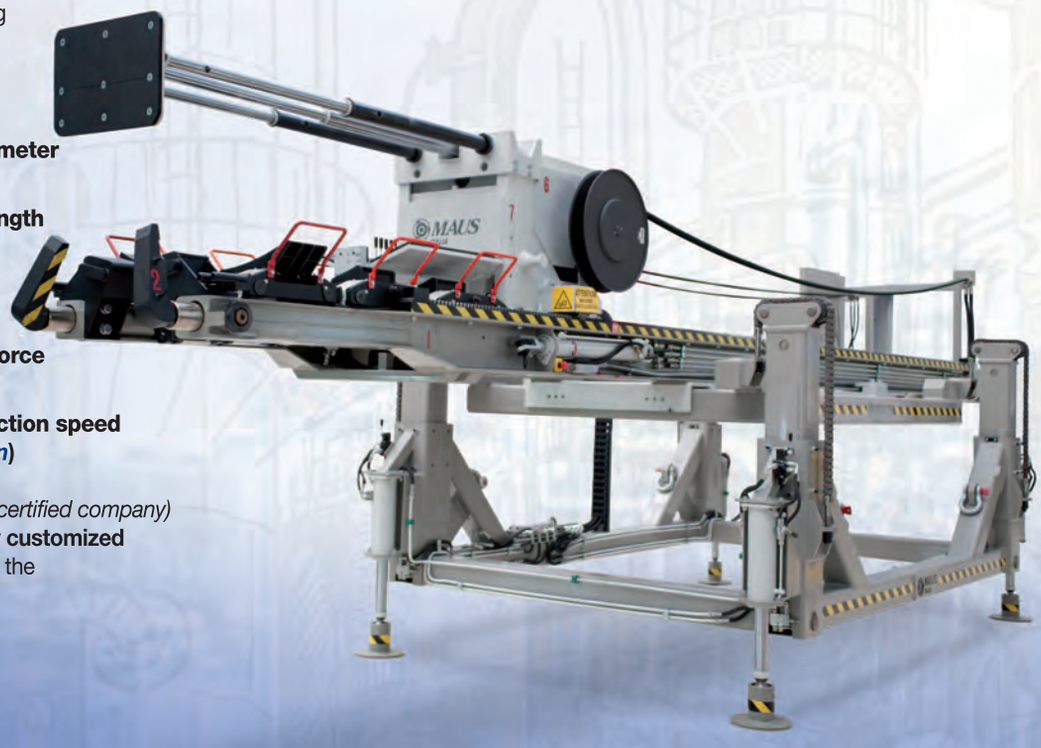
- **Tube sheet max diameter limitless**
- **Tube bundle max length limitless**
- **Max load capacity limitless (according to the gantry crane);**
- **Max pulling force 60 T (*132200 Lb*)**
- **Max insertion speed 2 m/min (*6.5 Ft/min*)**

Mef shopIN

Fixed station tube bundle heat exchangers **inserter/extractor.**

AU-88

The ***Mef shopIN*** is an **independent machine — no gantry crane required —** and it enables to solve the problem of **fast**, **accurate,** and **safe insertion and extraction**.
The Maus Italia expertise in **manufacturing extractors** *(aerial, self-positioning and off-shore extractors)* made it possible to create a machine dedicated to modern companies manufacturing heat exchangers with the following main features:



- **Tube sheet max diameter 2000 mm (*78"*)**
- **Tube bundle max length 7500 mm (*295"*)**
- **Max load capacity 22 T (*48500 Lb*)**
- **Max thrust/pulling force 35 T (*77100 Lb*)**
- **Max insertion/extraction speed 1,5 m/min (*4.9 Ft/min*)**

Maus Italia *(an **ISO 9001** certified company)* is able to provide **entirely customized** ***Mef shopIN*** according to the customers' requests.

MAUS ITALIA

Tube bundle length limitless

Max pulling force 60 T (132300 Lb)

Max insertion speed 2m/min (6.5 Ft/Lb)

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

MAUS ITALIA

BundleIN

Tube bundle inserter for heat exchangers.

According to the heat exchanger manufacturers, the insertion of long and **heavy tube bundle floating inside the shells** is one of the most challenging steps of the assembly cycle.

With its ***BundleIN***, Maus Italia proposes an equipment that, **together with the gantry crane, enables to solve** this kind of problem in a fast, accurate, and safe way.

The original functioning based on **two synchronized hydraulic guns stretching two steel wire ropes** makes it possible to apply it to tube sheets regardless of length limits.

Once the fixing point of the ropes to the shell has been identified, ***BundleIN*** is able to insert the tube bundle at a speed of **2m/min (*6.5 Ft/min*)**

The generated **coaxial force of 60 T (*132300 Lb*** (adjustable) leads the tube bundle inside the shell **smoothly and safely**.

High force
60 T (*132300 Lb*)

MAUS ITALIA

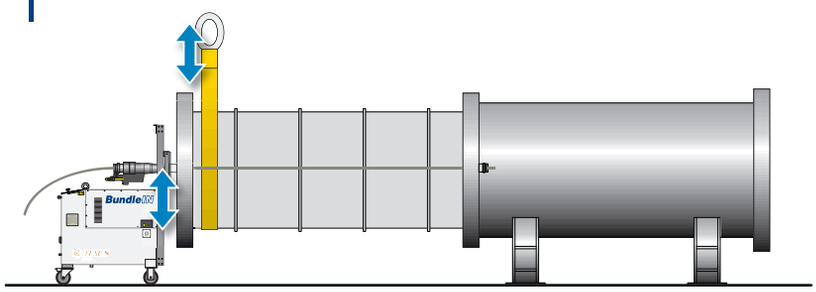
BundleIN

Tube bundles inserter for heat exchangers

Patented COS system to compensate the gantry crane oscillations on the Y axis

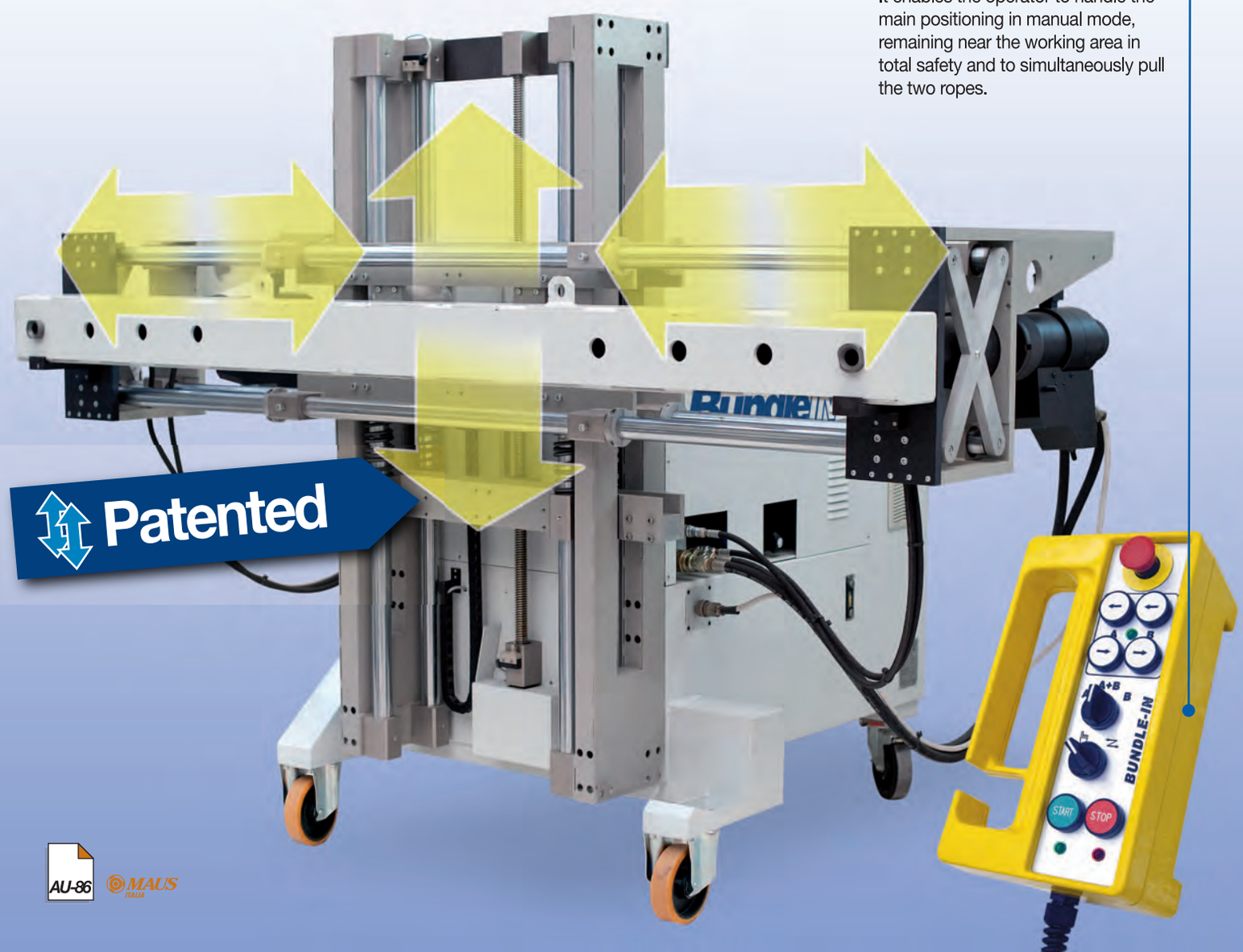
The patented **COS** system enables the **BundleIN** to make rapidly, accurately and safely the insertion, by compensating the inevitable oscillations due to the gantry crane movement during the insertion operation.

Thanks to the patented **COS** system, the loads generated by the oscillations of the tube bundle hung onto the gantry crane during the insertion operation are absorbed by the **BundleIN** thus preserving the wheel integrity and enabling a smooth movement on the floor.



Remote control

It enables the operator to handle the main positioning in manual mode, remaining near the working area in total safety and to simultaneously pull the two ropes.

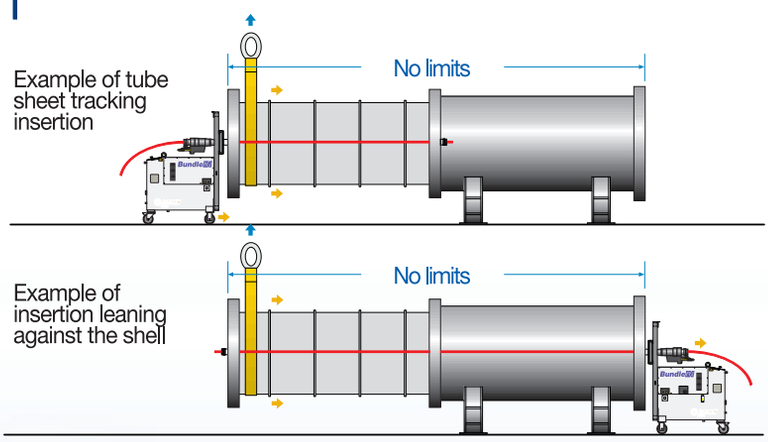


MAUS ITALIA

BundleIN

Tube bundles inserter for heat exchangers

Limitless
Tube sheet diameter
Tube sheet length
Load capacity



Traction devices

Independent hydraulic guns mounted on sliding supports

Positioner

Two-axis system
- Manual **horizontal**
- **Vertical** servo assisted equipped with **COS** system for gantry crane oscillation compensation.

Hydraulic power unit

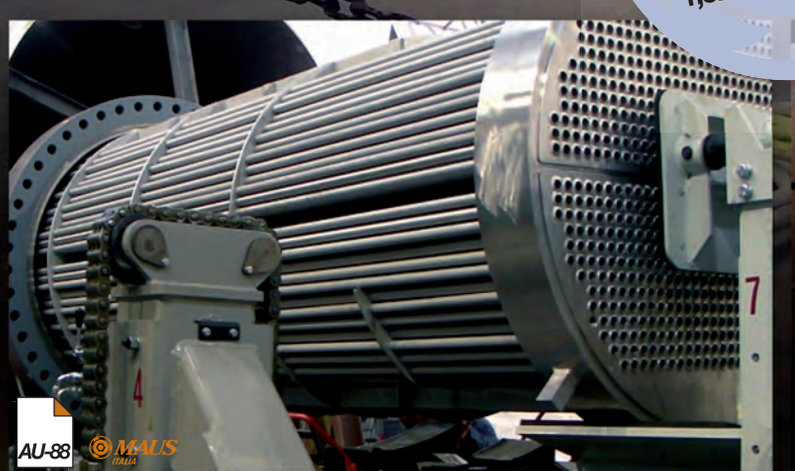
Electric cabinet

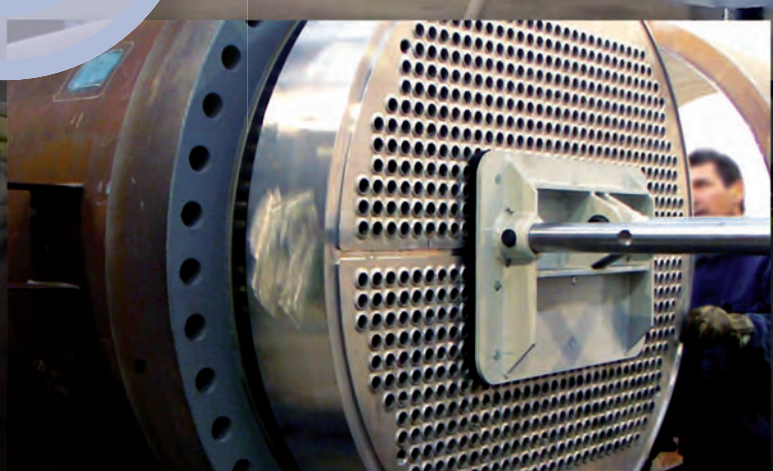
Installed on the machine with integrated aeration system.

MAUS ITALIA

Total safety
for both the operator and the product

Tube bundle max length
7500 mm (24.6 Ft)
Max thrust/pulling force
35 T (77200 Lb)
Max insertion speed
1,5m/min (4.9 Ft/Lb)





AU-88 MAUS ITALIA

MAUS ITALIA

Mef shopIN

Self positioning tube bundles inserter/extractor for shell and tube heat exchangers

The ***Mef shopIN*** **is an independent machine — no gantry crane required** — and it enables to solve the problem of fast, accurate, and safe **insertion** and **extraction.**

Thanks to its experience in **manufacturing maintenance extractors**, Maus Italia presents a machine dedicated to modern companies manufacturing heat exchangers with the following main features:

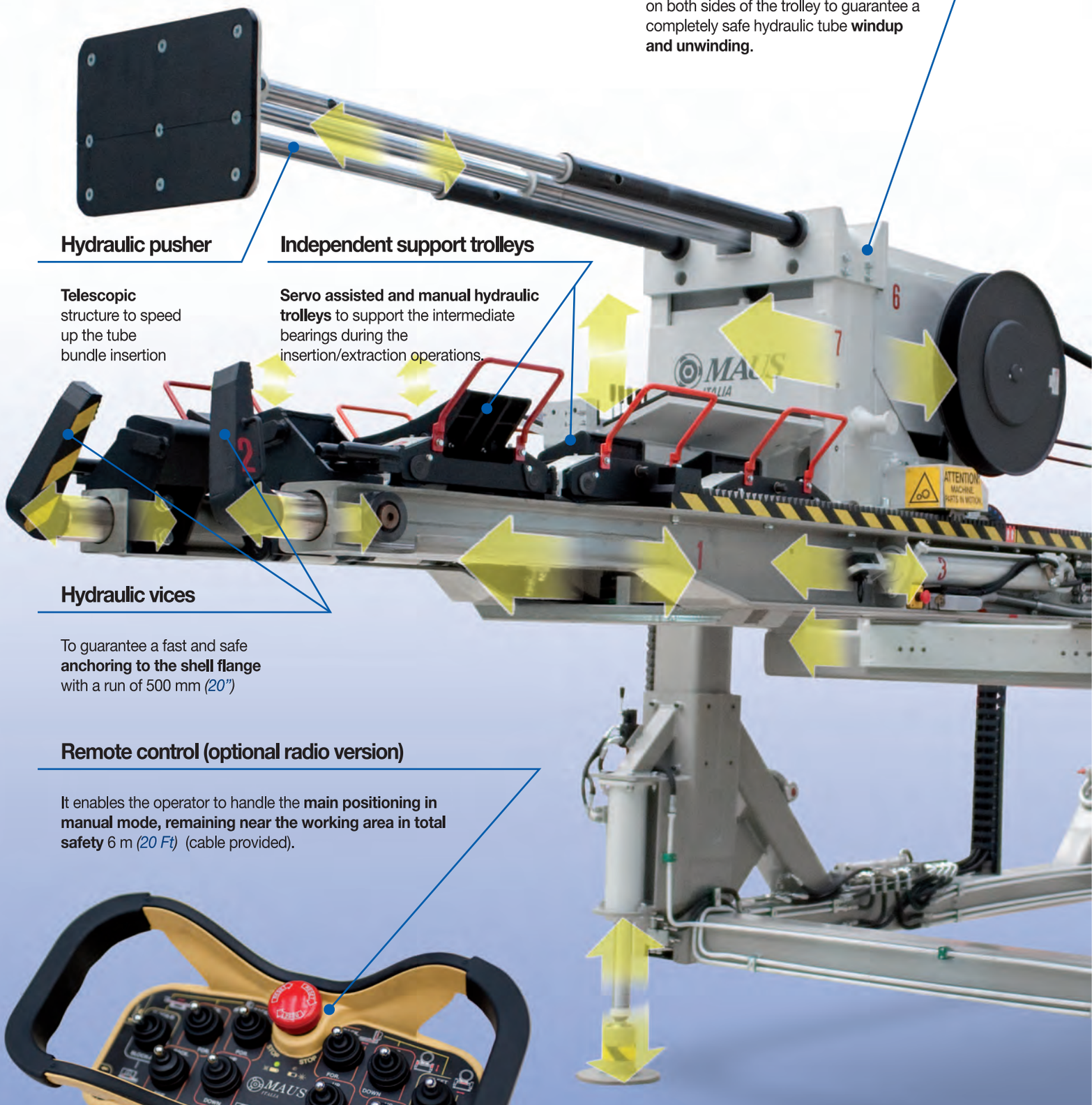
- **Tube sheet max diameter**
  2000 mm (*78”*);
- **Tube bundle max length**
  7500 mm (*295”*);
- **Max load capacity**
  22 T (*48500 Lb*);
- **Max thrust/tpulling force**
  35 T (*77100 Lb*);
- **Max insertion/extraction speed**
  1,5 m/min (*4.9 Ft/min*)

Maus Italia *(an **ISO 9001** certified company)* is able to provide **entirely customized *Mef shopIN*** according to the customers requests.

Main crane

Main part of the **Mef shopIN** to insert and extract the tube bundle; it is equipped with a **hydraulic driving bracket with a vertical run** of 300 mm *(11.8")* to support the tube bundle.

Two **hose winding wheels** are assembled on both sides of the trolley to guarantee a completely safe hydraulic tube **windup and unwinding.**



Hydraulic pusher

Telescopic structure to speed up the tube bundle insertion

Independent support trolleys

Servo assisted and manual hydraulic trolleys to support the intermediate bearings during the insertion/extraction operations.

Hydraulic vices

To guarantee a fast and safe **anchoring to the shell flange** with a run of 500 mm *(20")*

Remote control (optional radio version)

It enables the operator to handle the **main positioning in manual mode, remaining near the working area in total safety** 6 m *(20 Ft)* (cable provided).

MAUS ITALIA

Mef shopIN

Self positioning tube bundles inserter/extractor for shell and tube heat exchangers

Mobile frame

Normalized steel electrowelded structure to handle the tube sheet with:

X transverse stroke: ±100 mm *(3.9")*

Z longitudinal stroke: 1500 mm *(59.0")*

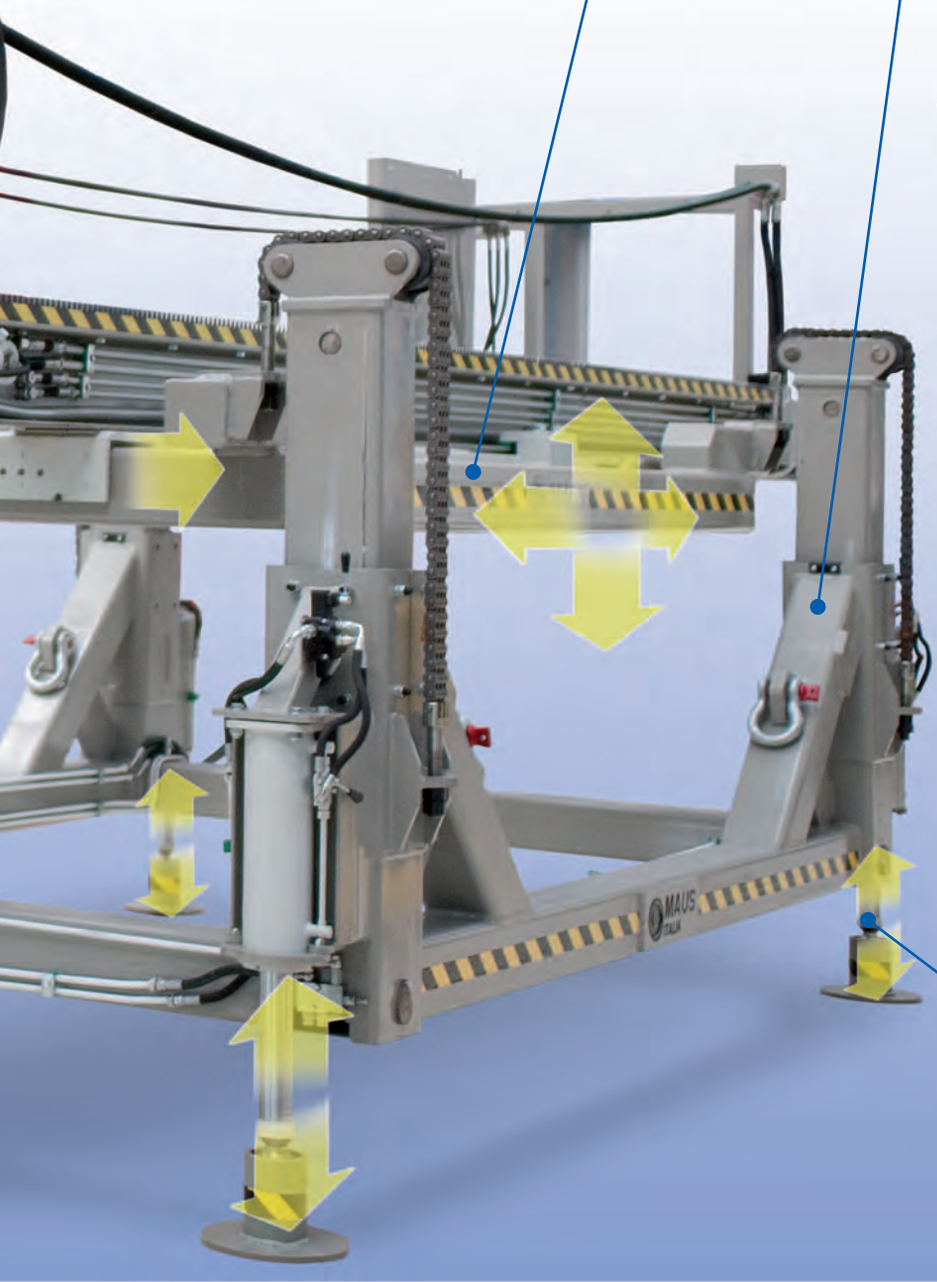
Y vertical stroke 1000 mm *(39.3")* + 270 mm *(10.7")*

Fixed frame

Normalized steel electrowelded structure equipped with four lifting columns and stabilizing legs.

Power unit

Independent **electric hydraulic** power unit of suitable capacity and **performance with trolley**
Completed with **winding wheels** with blocking system to guarantee a release and a simple and fast manoeuvrability to the operator.



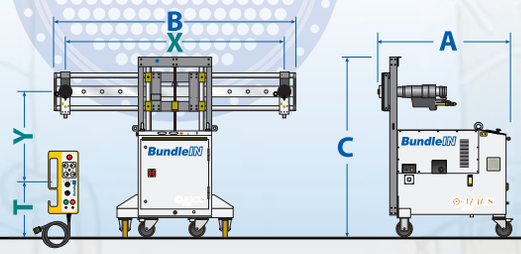
Stabilizing legs

4 independent hydraulic stabilizing **legs to position** the ***Mef shopIN*** **along the axis** of the exchanger shell.

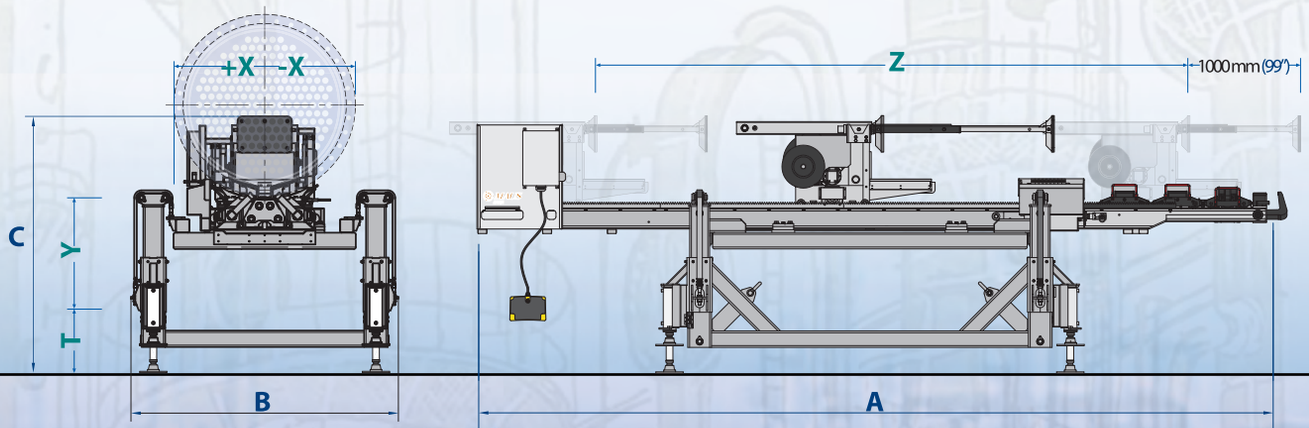
Supply			BundleIN	Mef shopIN
Voltage		Volt - Ph	400 - 3	400 - 3
Frequency		Hz	50	50
Power		Kw	8	15
Protection degree		IP	44	44
Dimensions			**BundleIN**	**Mef shopIN**
Length	A	mm *(Ft)*	2700 *(9.0)*	8770 *(28.9)*
Width	B	mm *(Ft)*	1500 *(5.0)*	2950 *(9.7)*
Height	C	mm *(Ft)*	2000 *(6.6)*	2540 *(8.4)*
Heigh for transport		mm *(Ft)*	2000 *(6.6)*	1540 *(5.1)*
Weight		Kg *(Lb)*	800 *(1764)*	8350 *(18400)*
Colours		RAL	7030 - 7035	7030 - 7035
Additional packing (external unit)			- - -	1
Additional packing dim.		mm *(Ft)*	- - -	1110x1 800x1350 *(5.6x5.9x4.5)*
Additional packing weight		Kg *(Lb)*	- - -	500 *(1100)*
Dimensional capacities			**BundleIN**	**Mef shopIN**
Stroke	X	mm *(inches)*	1000÷2400 *(39÷94)*	±100 *(±4)*
Stroke	Y	mm *(inches)*	1000 *(39)*	1000+270 *(39+10.5)*
Stroke	Z	mm *(inches)*	**limitless**	**6500**+1000 ***(256+39)***
Minimum height	T *(under the TS)*	mm *(inches)*	600 *(24)*	700 *(28)*
Tank capacity		Lt *(GalUS)*	150 *(39)*	150 *(39)*
Working capacity			**BundleIN**	**Mef shopIN**
Tube sheet diameter		mm *(inches)*	**limitless**	2000 *(295")*
Tube bundle length		mm *(inches)*	**limitless**	7500 *(78")*
Max load capacity		T *(Lb)*	✲ **limitless**	22 *(48500)*
Tube sheet max thickness		mm *(inches)*	**limitless**	500 *(3.688)*
Thrust/pulling force		**T *(Lb)***	**60 *(132300)***	**35 *(77200)***
Ins./ext. max speed		**m/min *(Ft/min)***	**2,0 *(6.5)***	**1,5 *(4.9)***
Max pressure		Bar *(Psi)*	300 *(4350)*	180 *(2600)*
Pump capacity		Lt/min *(US gpm)*	60 *(15.8)*	30 *(7.9)*

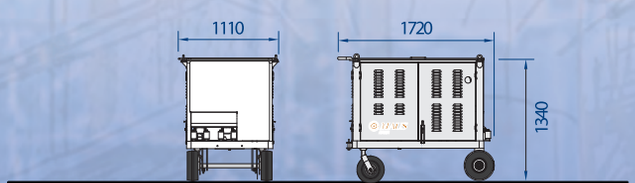
✲ according to the gantry crane load

BundleIN



Mef shopIN

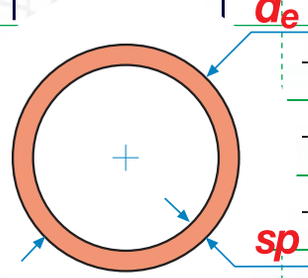


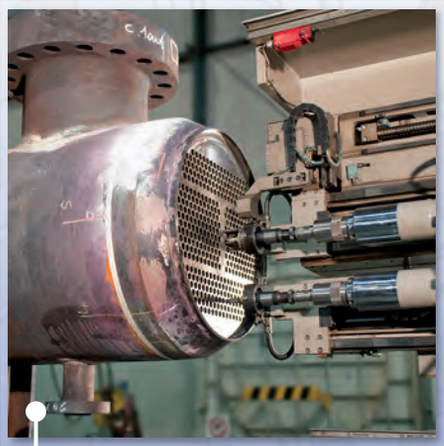


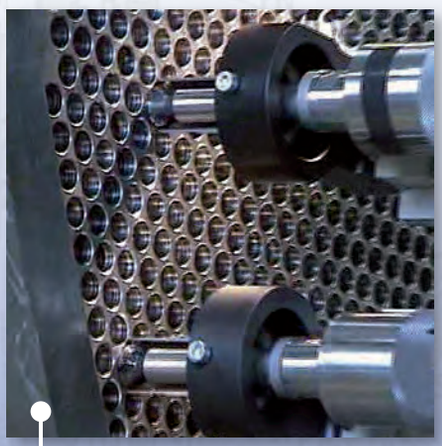
Notes

BWG

de “ mm	00 BWG “	mm	0 BWG “	mm	1 BWG “	mm	2 BWG “	mm	3 BWG “	mm	4 BWG “	mm	5 BWG “	mm	6 BWG “	mm	7 BWG “	mm	8 BWG “	mm	9 BWG “	mm	10 BWG “	mm	11 BWG “	mm
sp →	0.380	9,65	0.340	8,64	0.300	7,62	0.284	7,21	0.259	6,58	0.238	6,05	0.220	5,59	0.203	5,16	0.180	4,57	0.165	4,19	0.148	3,76	0.134	3,40	0.120	3,05
3/8” (9,5)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1/2” (12,7)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5/8” (15,9)	-	-	-						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/4” (19,0)	-	-	-						-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.482	12,2	0.510	12,9
7/8” (22,2)	-	-	-						-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.607	15,4	0.635	16,1
1” (25,4)	-	-	-	-					-	-	-	-	-	-	-	-	-	-	0.670	17,0	0.704	17,9	0.732	18,6	0.760	19,3
1.1/4” (31,8)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.890	22,6	0.920	23,4	0.954	24,3	0.982	25,0	1.010	25,7
1.1/2” (38,1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.140	28,9	1.170	29,7	1.204	30,6	1.232	31,3	1.260	32,0
1.3/4” (44,4)	-	-	-	-	-	-	-	-	-	-	-	-	1.310	33,2	1.344	34,1	1.390	35,2	1.420	36,0	1.454	36,9	1.482	37,6	1.510	38,3
2” (50,8)	-	-	-	-	-	-	-	-	-	-	1.524	38,7	1.560	39,6	1.594	40,5	1.640	41,6	1.670	42,4	1.704	43,3	1.732	44,0	1.760	44,7







Photograph
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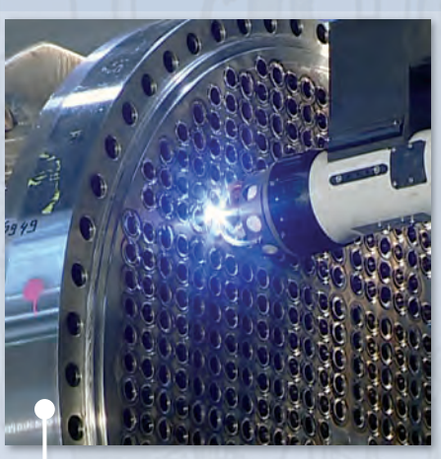
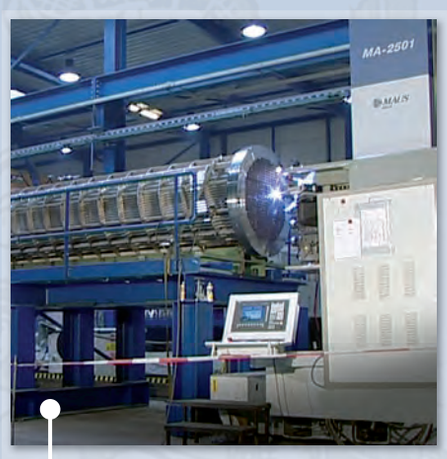
1926 Villa & Bonaldi s.r.l. Ricengo - Italy

12 BWG		13 BWG		14 BWG		15 BWG		16 BWG		17 BWG		18 BWG		19 BWG		20 BWG		21 BWG		22 BWG		23 BWG		24 BWG		de
“	mm	“	mm	“	mm	“	mm	“	mm	“	mm	“	mm	“	mm	“	mm	“	mm	“	mm	“	mm	“	mm	mm
0.109	2,77	0.095	2,41	0.083	2,11	0.072	1,83	0.065	1,65	0.058	1,47	0.049	1,24	0.042	1,07	0.035	0,89	0.032	0,81	0.028	0,71	0.025	0,64	0.022	0,56	← sp
-	-	-	-	0.209	5,3	0.231	5,8	0.245	6,2	0.259	6,5	0.277	7,0	0.291	7,3	0.305	7,7	0.311	7,9	0.319	8,1	0.325	8,2	0.331	8,4	3/8” (9,5)
-	-	0.310	7,9	0.334	8,5	0.356	9,0	0.370	9,4	0.384	9,7	0.402	10,2	0.416	10,5	0.430	10,9	0.436	11,1	0.444	11,3	0.450	11,4	0.456	11,6	1/2” (12,7)
0.407	10,3	0.435	11,1	0.459	11,7	0.481	12,2	0.495	12,6	0.509	12,9	0.527	13,4	0.541	13,7	0.555	14,1	0.561	14,3	0.569	14,5	0.575	14,6	0.581	14,8	5/8” (15,9)
0.532	13,4	0.560	14,2	0.584	14,8	0.606	15,3	0.620	15,7	0.634	16,0	0.652	16,5	0.666	16,8	0.680	17,2	0.686	17,4	0.694	17,6	0.700	17,7	0.706	17,9	3/4” (19,0)
0.657	16,6	0.685	17,4	0.709	18,0	0.731	18,5	0.745	18,9	0.759	19,2	0.777	19,7	0.791	20,0	0.805	20,4	0.811	20,6	0.819	20,8	0.825	20,9	0.831	21,1	7/8” (22,2)
0.782	19,8	0.810	20,6	0.834	21,2	0.856	21,7	0.870	22,1	0.884	22,4	0.902	22,9	0.916	23,2	0.930	23,6	0.936	23,8	0.944	24,0	0.950	24,1	0.956	24,3	1” (25,4)
1.032	26,2	1.060	27,0	1.084	27,6	1.106	28,1	1.120	28,5	1.134	28,8	1.152	29,3	1.166	29,6	1.180	30,0	1.186	30,2	1.194	30,4	1.200	30,5	1.206	30,7	1.1/4” (31,8)
1.282	32,5	1.310	33,3	1.334	33,9	1.356	34,4	1.370	34,8	1.384	35,1	1.402	35,6	1.416	35,9	1.430	36,3	1.436	36,5	1.444	36,7	1.450	36,8	1.456	37,0	1.1/2” (38,1)
1.532	38,8	1.560	39,6	1.584	40,2	1.606	40,7	1.620	41,1	1.634	41,4	1.652	41,9	1.666	42,2	1.680	42,6	1.686	42,8	1.694	43,0	1.700	43,1	1.706	43,3	1.3/4” (44,4)
1.782	45,2	1.810	46,0	1.834	46,6	1.856	47,1	1.870	47,5	1.884	47,8	1.902	48,3	1.916	48,6	1.930	49,0	1.936	49,2	1.944	49,4	1.950	49,5	1.956	49,7	2” (50,8)





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