

**MA**

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**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.



AU-40

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# 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 the **large diameter tube sheet holes**.

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

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

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

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

# MaTIG-500

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

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

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

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



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**MA-500**

Tube sheet  
max diameter  
1000 mm (40")

Tube sheet  
max thickness  
200 mm (8")

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

AU-42

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# MA-500

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

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

## ● High technology

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

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

## ● Maximum productivity

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

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



Photograph  
By the kind  
permission of **BLOKSMA** 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

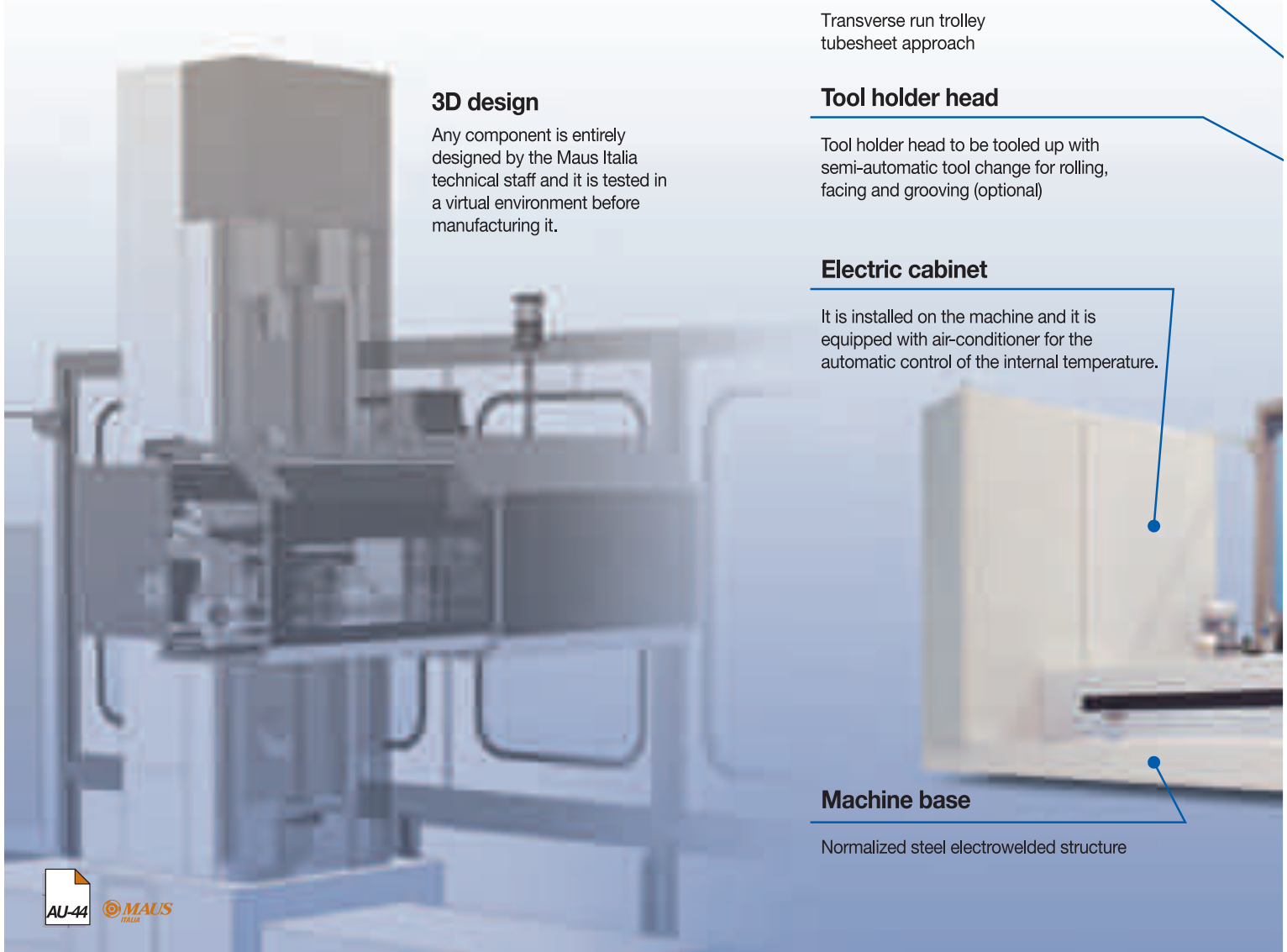
It is installed on the machine and it is equipped with air-conditioner for the automatic control of the internal temperature.

### Machine base

Normalized steel electrowelded structure

### 3D design

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



# MA-500

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

## Machine status signalling

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

## Control console

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

## X axis

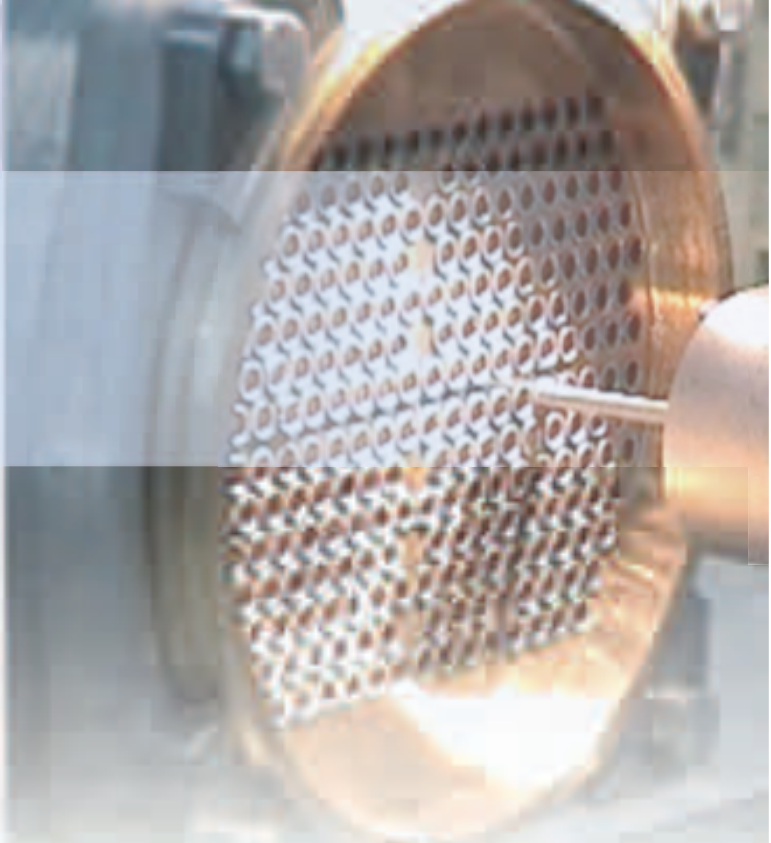
Column support trolley for horizontal positioning.

## Remote control

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

# MA-500

## Positioning



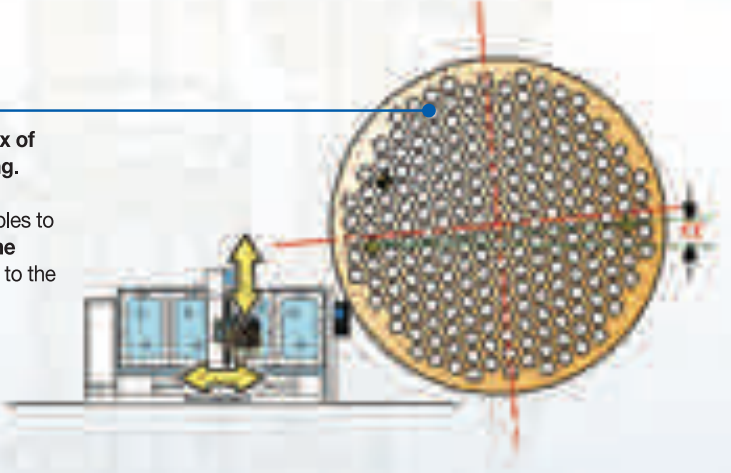
### 1 Positioning

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



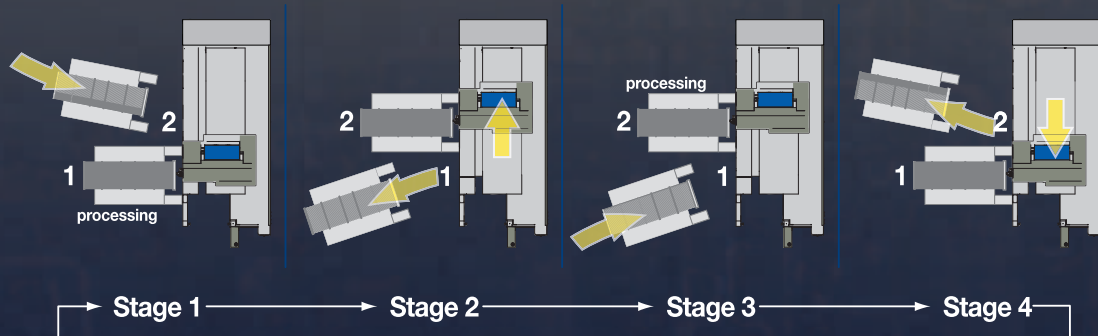
### 2 Zero setting

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



## Pendulum process with trolleys

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



# MA-500

Applied technologies

## Total quality



**TL**  
*Free tubes*

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

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



**RP**  
*Parallel roller*

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

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

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

The main **advantages** are:

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



**CPZ**  
*Automatic compensation of the expansion limit depth*

**Z axis zero setting automatic system:**

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



**CDAS**  
*Mandrel forward movement digital control*

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

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



**CVSC**  
*Speed continuous variation*

The latest innovation in rolling.

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

**Advantages:**

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



# Long-lasting reliability

## Tool lubrication

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



## Guide lubrication

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

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



## Climate-controlled electric cabinet

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



## Lamp

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



# MA-500

## Main components

### Ergonomic console and remote control

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



### Sinumerik 840 D

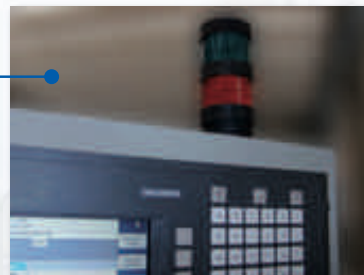
The **MA-2501** CNC group adopts the **Totally Integrated Automation SIEMENS®** solution that implies a uniform system of products in which every component is designed to work in synergy with the others.



### Alarm signalling lamp

Immediate signalling of the machine status

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



### Safety systems

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

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

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



### USB communication port

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



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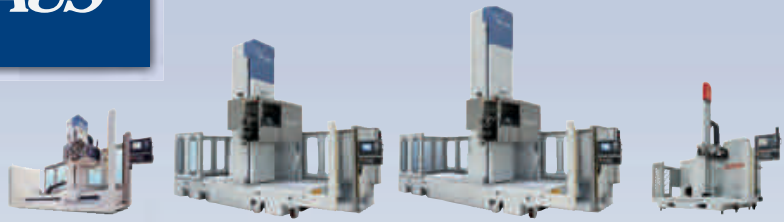
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Tube sheet diameter  
2500 mm (100")  
Tube sheet max  
thickness  
700 mm (27.5")  
tubes  
diameter  
9,5 ÷ 51 mm (3/8" ÷ 2")

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GROUP

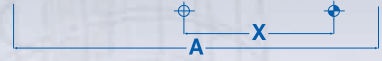
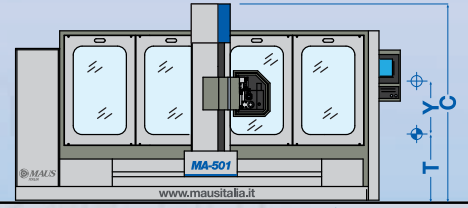
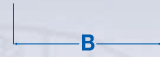
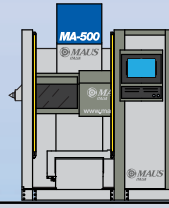
AU-50 **MAUS**  
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**ATTENZIONE**

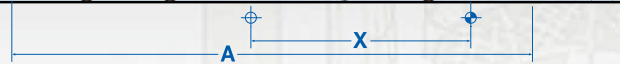
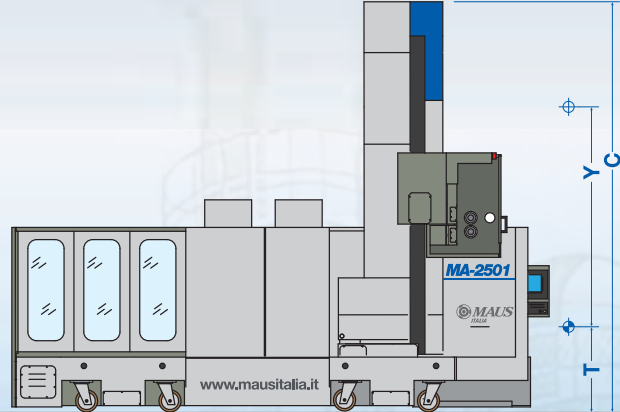
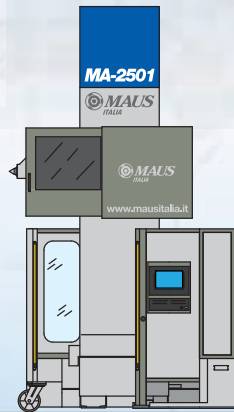


Supply		MA-500	MA-2501	MA-3501	MaTIG-500
Voltage	Volt - Ph	400 - 3	400 - 3	400 - 3	400 - 3
Frequency	Hz	50	50	50	50
Installed power	Kw	17	50	50	16
Dimensions		MA-500	MA-2501	MA-3501	MaTIG-500
Length	<b>A</b> mm (Ft)	4200 (13.78)	6500 (21.32)	7600 (24.93)	2700 (8.86)
Width	<b>B</b> mm (Ft)	1700 (5.58)	2350 (7.71)	2350 (7.71)	1425 (4.67)
Height	<b>C</b> 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)	---	1800x1400x1200	1800x1400x1200	---
	Kg	---	(6.00x4.60x4.00)	(6.00x4.60x4.00)	---
Additional weight	Kg (Lb)	---	280 (620)	310 (690)	---
Dimensional capacities		MA-500	MA-2501	MA-3501	MaTIG-500
Stroke	<b>X</b> mm (inches)	✱ 1700 (66.929)	2500 (98.425)	3500 (137.795)	1500 (59.055)
Stroke	<b>Y</b> mm (inches)	✱ 600 (23.622)	2500 (98.425)	3500 (137.795)	1800 (70.866)
Stroke	<b>Z</b> mm (inches)	400 (15.748)	800 (31.496)	800 (31.496)	300 (11.811)
Minimum height	<b>T</b> 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
<b>X</b> axis	m/min (Ft/min)	20 (98.4)	20 (65.6)	20 (32,8)	20 (65.6)
<b>Y</b> axis	m/min (Ft/min)	20 (98.4)	20 (65.6)	20 (32,8)	20 (65.6)
<b>Z</b> axis	m/min (Ft/min)	25 (98.4)	25 (82.0)	25 (82.0)	20 (65.6)
<b>U</b> 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)

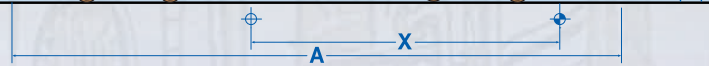
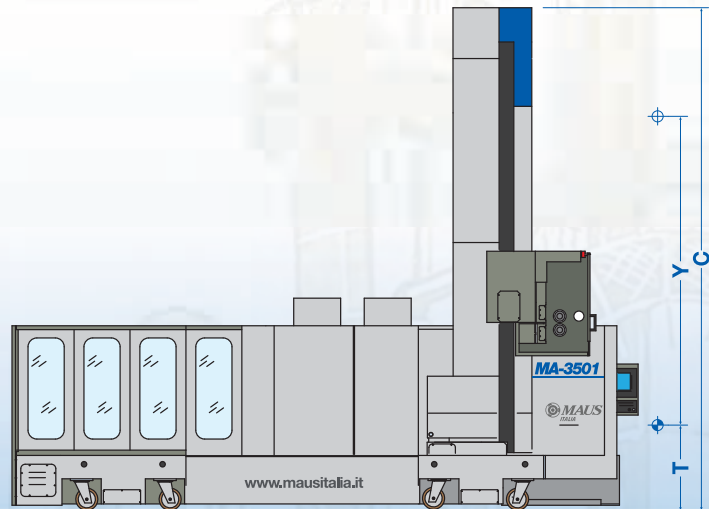
## MA-500



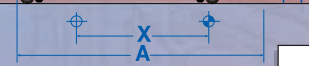
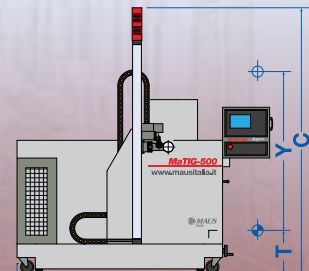
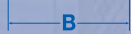
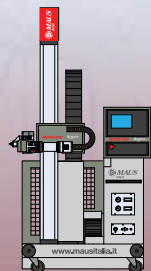
## MA-2501

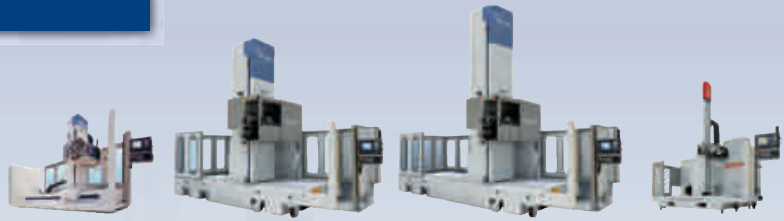


## MA-3501

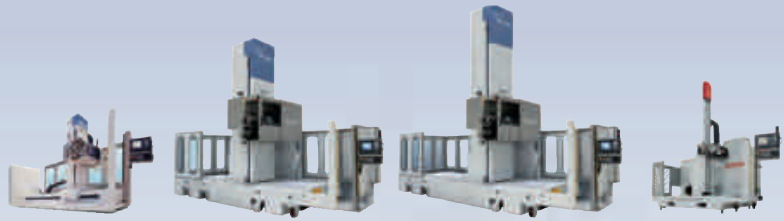


## MaTIG-500





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
<b>FOCS-2</b> (centring only)	+	—	—	+
<b>FOCS-3</b> (centring + tube sheet distance)	—	+	+	—
High quality	MA-500	MA-2501	MA-3501	MaTIG-500
Real time report (Rolling)	●	●	●	—
<b>AVC</b> (Welding)	—	+	+	●
Software	MA-500	MA-2501	MA-3501	MaTIG-500
<b>MausCAM</b>	+	+	+	+
Data exchange	MA-500	MA-2501	MA-3501	MaTIG-500
USB	●	●	●	●
RS232	●	●	●	●
Ethernet	●	●	●	●



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 inclined) 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

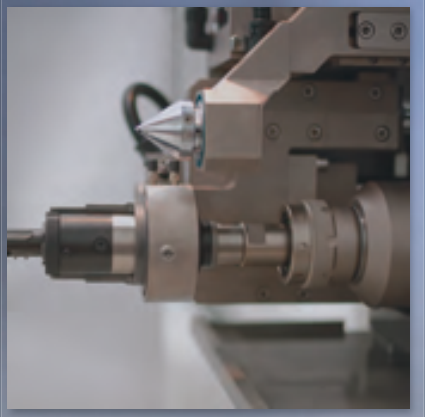


Maus Italia here presents a brief overview of the tools and the accessories designed for the **MA-500**, **MA-2501**, and **MA-3501** working centres.

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.





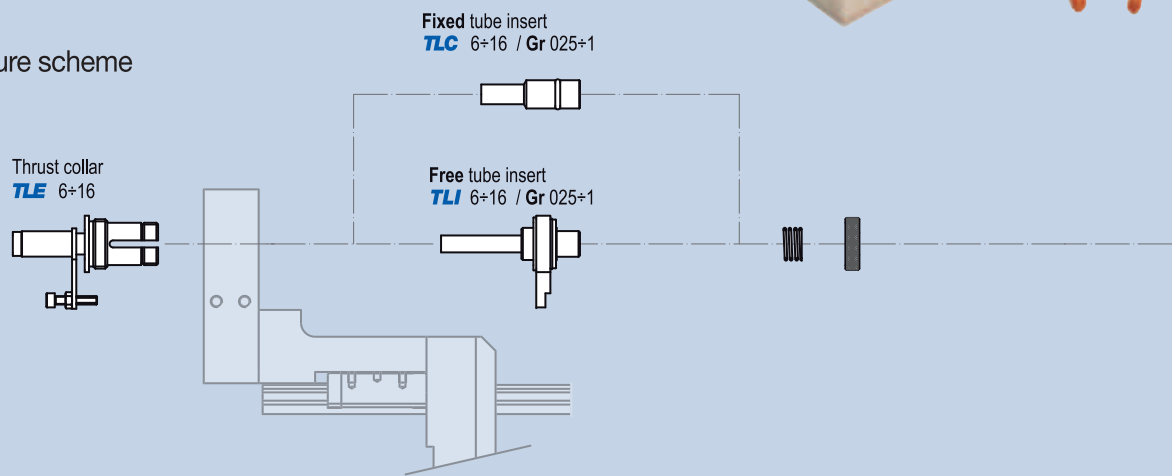
# MA-500

Accessories and tools  
for tube expansion  
and facing



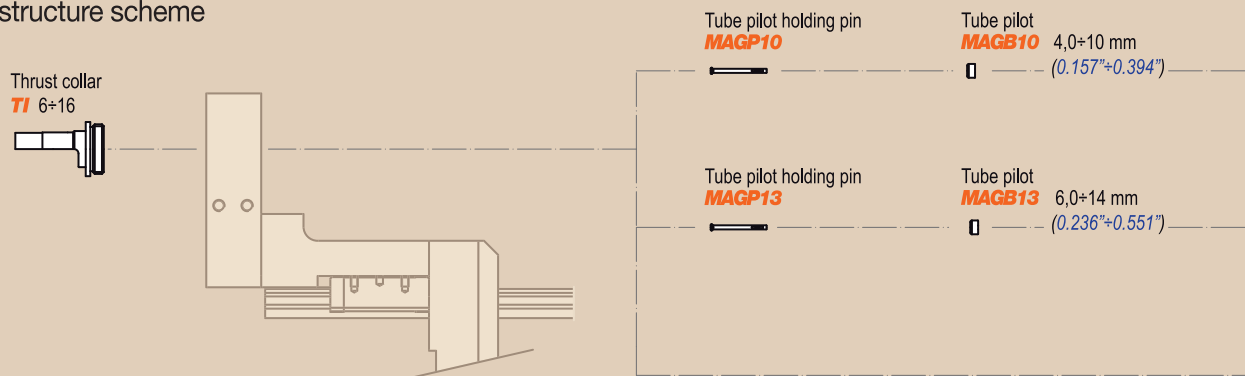
## Rolling

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

Mandrel **MA-500**  
Gr 025÷1

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

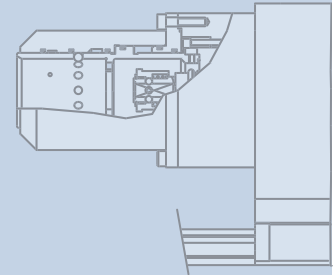
**MA-500**

Cage

Gr 025÷1

**di** 6,2÷15,5 mm (0.244"±0.610")

**RE** 0÷190 mm (0.000"±7.480")



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

**MA-500**

HSS facing tool  
**MAFHSS10** 6÷11



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



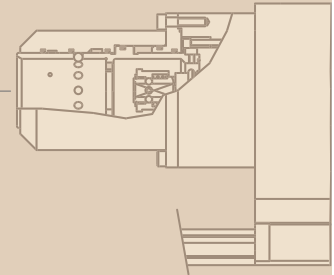
HSS facing tool  
**MAFHSS-13** 8÷18



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



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



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