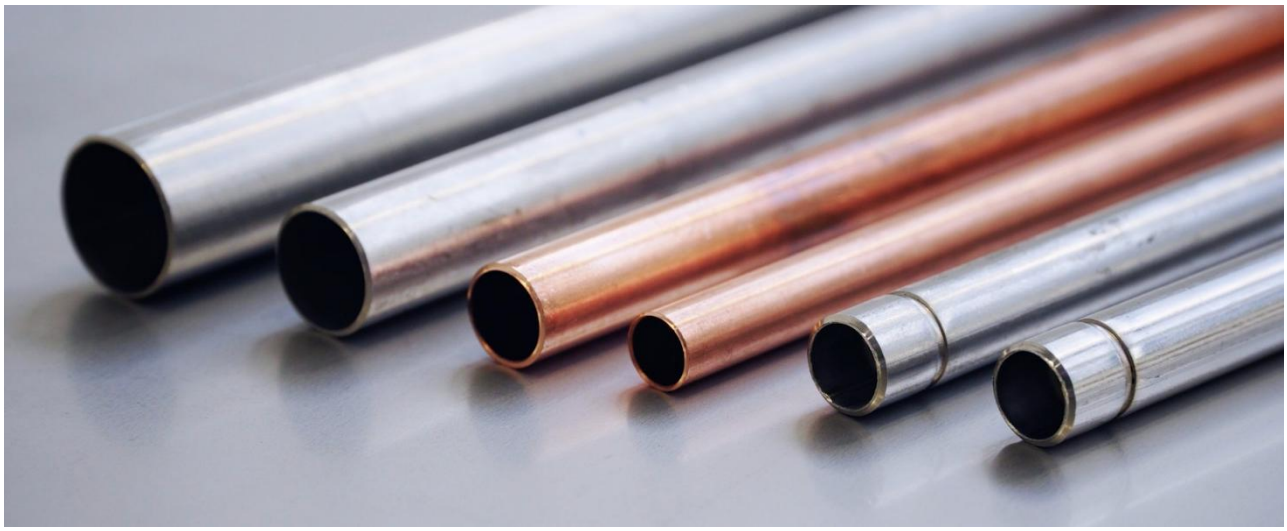
TUBE CUTTING MACHINE

FOR THE CUTTING OF TUBES IN BARS WITH SCORE AND PULL-APART SYSTEM



The tube cutting machine is a device suitable to cut tubes to a required length, starting from bars (straight lengths).

It has been developed to eliminate all the problems which exist with the orbital cutting systems, which are conceptually similar but realized with scoring wheels.

The main work of this device is to cut the tubes without causing a deformation of the tube in correspondence with the cut edge.

The cut, in fact, is not carried out by blades, which insist orthogonally on the wall of the tube, but is carried out through the combined action of:

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

Depending on the requested level of automation, the tube cutting line is available in 3 versions.

With the automatic version of the tube cutting line, the operator has only to place the straight lengths in the tube magazine; its loading, measurement, displacement, optimization of the cut lengths and unloading of the finished parts is automatic.

Summary

AUTOMATIC VERSION

WATCH THE VIDEO

The automatic version is designed to automate the cutting device, and it is complete with following components:

- numerical controlled feeder, for maximum tube length 6000 mm (standard, on request it is available in any length)
- device for tube cutting by score and break system
- unloading device, available also with selection on two sides

The table feeder is designed to feed tubes to the cutting device, where the tubes are cut in accordance to the length the numerical control feeder has pushed in. The feeder can be programmed to cut

- Same cut lengths from a bar
- Different cut lengths from the same bar (optimization of cut)
- End cutting of bars (to remove defects from the end or to cut to measure 6000mm bars supplied slightly longer)

All bars to be cut will be measured before the tube enters the cutting unit.

MACHINE COMPOSITION

The unit is composed of:

- Automatic table type feeder for straightened tubes with adjustment of height to allow different diameters of tube to be fed
- Numerical control system to push the tube from the drop point into and through the cutting unit.
- Tube lock system to block tube during displacement sequences as well as removal of “cut off” (last piece left as scrap because it can not be cut)
- Off loading section for off cuts
- Two operating zeros (6m and 3m) to speed up recut of bars
- Command panel to set cutting operation (this command panel is common to the “score and break” unit and off loader)
- Score and break cutting unit complete to suit one diameter
- Off loader- One or two swivelling position pneumatically operated unloading unit for the cut tubes

Note: If the lengths of tube being fed (to be then cut) are grease/oil free then the tubes cut to size can be used directly in filling machines without having to be degreased.

Line set up

Adjustment of the automatic feeder

- When changing diameter of tube

  - adjust the opening of the feeder so that the tube can pass through
  - regulate the stops that allow the tube to be fed one at a time
  - replacement of the lock mechanism on pusher rod system to suit the diameter and wall thickness used
  - move the baffle that delimits the length of tube in the feeder

- When changing length:

  - select the zero reference to be used (6000mm or 3000 mm) depending on the tube length

Adjustment of the cutter

- When changing diameter of tube

  - replace the guide bushes
  - replace pincers in the pulling section
  - regulate the cutting bit depth
  - regulate the deburrer if being used
  - regulate speed of cut (bit in) and rotational speed of cutter

Line running

1) Prepare the feeder for the diameter you need
2) Set the correct pusher rod to suit the tube internal diameter
3) Chose the zero for the length of the tube to be cut on the console
4) Do a synch cycle
5) From the operator console select the mode of operation
   a) Trimming of bars (used to cut the excess of 6 meter bars)
   b) Cut lengths from a bar
      - Select manual option if you want to set manually the n° of pieces per bar
      - Select automatic if multi pieces need to be cut (the machine will calculate the number of pieces to be cut from each bar)
      - Optimization. This option can be selected if one needs to minimize off cuts by combining 2 or 3 different orders. The machine will optimize the cut lengths and quantity to cut from each bar to minimize off cut(scrap). In this case, where different lengths are cut from the same bar it is necessary to program the off loader to tell it to which side it needs to tilt when a particular length is cut. If 3 different lengths are being cut it is necessary to offload two to one side (say the shortest and longest length) and the other to the opposite side. This way it is easy for the operator to separate the two orders.

It is possible to enable a special function to cut a small length from the end to eliminate defects from the end of the tube. This function is possible to be used with all the different modes of b)

6) Input the data required, that is, pieces required and length
7) Start machine. The table feeder will off load the element onto the linear feeder. The pusher rod moves into the end away from the cutter, locks and moves forward to the cutting mechanism. Then the element is measured, the machine looks at the cutting program and moves forward in accordance to the program.
   a) Cut bars. Set the cut length required. The machine measures the tube and then moves the tube into the cutting device where the excess is cut off. The feeder then pulled the tube back and off loads it where normally the off cuts are offloaded.
   b) Cut lengths. The operation is basically the same whether you cut single pieces, multiple pieces from the same bar or different cut lengths from the same bar. When the start signal is given the table feeder will drop the tube into the linear feeder which will move the tube to the measuring station. Then the unit will determine what to do with reference to the length measured and the program set. After cutting the last piece the machine will have an off cut left on the pusher rod (about 55mm) which must be offloaded before the next bar is fed. So after the last cut the pusher rod moves back into the “cut off” off load area where the off cut will be offloaded.
   Note that the off cut may be long as well. If for example, you have a bar of 6000mm and decide to cut only a length of 2000mm then the off cut is 4000mm. This piece will be off loaded in the section mentioned above.
   When the program or programs have been completed the machine stops.

Special functions

a) Recuperate off cuts. Since the machine measures the length of the tube before cutting it, it is possible to put different off lengths on the feeder and set two or three orders to be cut as seen on 7b). In this case the machine drops one bar, feeds it forward, measures it and then compares the length to the lengths in the orders (cutting program) it has and determines what to cut with the smallest off cut scrapped. If the length fed cannot be used, it goes back, unloads it and loads a new bar (cut off)
b) Very small cuts (from 6-85mm). The feeder will permit the cutter to cut such short pieces if the cutter has the optional for very short pieces (which is an optional)

TECHNICAL FEATURES

Material of the tube to be cut	: steel, stainless steel, copper and aluminium	
Tube thickness	: mm	0.3-1.0
Outer tube diameter (to be defined)	: mm	6-22
Max. length of tube to be cut	: mm	6100
Cutting length	: mm	to be defined
Cutting tolerance for cut lengths up to 1500 mm	: mm	±0,8
Cutting tolerance for cut lengths between 1500 mm and 4300 mm	: mm	±1
Capacity of the automatic feeder with diameter 7,5mm	: pcs.	50
Space available in the feeder hopper	: mm	440
Min. length to be cut	: mm	100
Min length of tube scrapped per bar (for tubes with outer diameter over 10 mm)	: mm	65
Min length of tube scrapped per bar (for tubes with outer diameter below 10 mm)	: mm	340
Installed power	: KW	3
Voltage	: V/ ph/ Hz	400/ 3 phase/ 50 Hz
Pneumatic supply	: bar	6
Set up time when changing tube diameter	: min.	10-15

Times

Cutting cycle rate:	wall thickness 0.3 mm	: sec	2.4
	wall thickness 0.4 mm	: sec	2.6
	wall thickness 0.5 mm	: sec	2.8
	wall thickness 0.8 mm	: sec	3.5
	wall thickness 1.0 mm	: sec	4
Pull/break		: sec	0.5
Move forward feeding		: m/sec	1
Drop new piece		: sec	1
Block pushing rod		: sec	0.5
Move back to unload of cut to 6000 mm zero		: m/sec	1.33
Move back to unload of cut to 3000 mm zero		: m/sec	1.33
Offload cut piece		: sec	0.8

AVAILABLE VERSIONS

Mod. 140/50.TM6000 Automatic feeder with numerical control pusher system, for tube length from 400 to 6000 mm (available in any length)

Mod. 112/09.SBM000 Cutting device by score and break system. Tube diameter between 6 – 22 mm, thickness between 0,3 – 1,0 mm

Mod. 100/38.D0X000 Device to collect and unload the tube through pneumatic tray (available in any length)

Mod. 100/38.E0X000 Device to collect and unload the tube through pneumatic tray with selection on two sides (available in any length)

The machine comes with one set of parts needed for one outer diameter/ thickness combination (for example 8x0,5 mm), as follows:

- Mod. 112/00.SB0011: parts for the cutting device (specific for one outer tube diameter), composed by two clamps to break the tube and three bushings to guide the tube in the cutting device.
- Mod. 140/50.TM0010: Parts for the pusher rod of the automatic feeder (specific for one inner tube diameter). In particular the machine comes with one of the following set-up, depending on the selected range:
    - Range A: for tubes with inner diameter in the range 5,0 – 7,0 mm
    - Range B: for tubes with inner diameter in the range 7,1 – 21,0 mm

In the example 8x0,5 mm (inner diameter 7,0 mm), the machine comes with parts for the pusher for range A.

OPTIONAL PARTS

- **For different outer diameter or different thickness**

In case the customer needs to cut tube with different outer diameter or different thickness, the following parts need to be ordered:

	Outer diameter	Inner diameter	Example based on 8x0,5 mm (inner dia 7 – range A)
Mod. 140/50.TM0015	Same	Different inner diameter in the same range (A or B)	8x0,6 mm (inner dia 6,8 mm, range A)
Mod. 140/50.TM0010	Same	Different inner diameter in a different range (A or B)	8x0,4 mm (inner dia 7,2 mm, range B)
Mod. 112/00.SB0011 + 140/50.TM0015	Different	Different inner diameter in the same range (A or B)	7,5x0,5 mm (inner dia 6,5 mm, range A)
Mod. 112/00.SB0011 + 140/50.TM0010	Different	Different inner diameter in a different range (A or B)	10x0,5 mm (inner dia 9 mm, range B)

- **For producing short parts**

Mod. 112/09.SB0100 Device to cut short tubes with length between 6 and 80 mm.
When this option is used, the cutting operation is done with score only, because the part is too short to be pulled apart. This may leave some residual burrs on tube's edge.

Mod. 112/09.SB0101 Set of parts for second diameter of tube – cutting device for short parts

LAYOUT OF THE AUTOMATIC VERSION

MOD. 140/50.TM6000 + 112/09.SBM000 + 100/38.E06000