

AFFOLTER

SOLUTIONS
FOR HIGH PRODUCTIVITY
AND PRECISION
GEAR HOBBING



- Stiffness
- Precision
- Flexibility
- Productivity



SUMMARY

GEAR LINE	4
COMPARISON	6
AUTOMATIONS	8
AF20 Drum Loader	8
AF45 Slide Loader	8
AF71 Universal Loader	9
AF72 Universal Loader	9
OPTIONS	10
Customizable coolant system	10
Counter Bearing HA	10
Collet Clamping System	10
Oil mist aspiration	10
Deburring	11
Dry Cutting	11
Skiving	11
Chip conveyor and filtration belt	11
SERVICES	12
Technology and Quality	12
Services	12
COMPARISON	13
Loading Systems	13
Options	13
SET UP	14
Clamping principle of tool and workpiece	14
Hob arbors	14
Driving centers and holders - fixed and actuating types	14
Hob cutter	15
Drive center tips	15
Retractable pin System	15
Collets	15
Workpiece presence control	15
DISTRIBUTION NETWORK	16

GEAR LINE

ASSETS AND ADVANTAGES

Affolter Group SA develops, constructs and manufactures CNC Gear Hobbing Machines for the watchmaking and micromechanical sectors.

Affolter Gear Line is a compact, precise and productive machine concept. Power, rigidity and precision combine with universal applicability, providing a means of manufacturing complex parts at the cutting edge of technology.

From standard products to custom-made developments - encompassing the full range of expertise in very stringent fields.

PRECISE High-precision machining, with a great quality of finish;

RIGID Thermal stability and mechanical rigidity guarantee consistent dimensions throughout the manufacturing process;

FAST Direct drive motor spindle, electronic synchronization up to 16'000 min⁻¹ giving speeds that are always suited to optimal cycle times;

FLEXIBLE Many configurations available for different applications;

COMPACT Reduced surface area for more productive manufacturing sites;

ERGONOMIC Design optimised for production and maintenance;

ENVIRONMENTALLY-FRIENDLY
Integrated protective fairing of the working area, containing oil mist and reducing noise;

UNIQUE A sole manufacturer ensuring service and flexibility to suit your needs (machines, mechanical components, digital control and software);

FULLY SAFETY Our CNC Gear Hobbing Machines are fully safe in setup machine mode too. Our products meet the highest safety standards and are CE marked.





the most compact



the most flexible

Fitted with Leste CNCs, these machines enable **hobbing** or **tooth by tooth** for...

AFFOLTER AF90

GEAR HOBBING MACHINE

- CNC axes **6**
- Max. module **0.8 mm**
- Max. cutting length **40 mm**
- Max. parts diameter **30 mm**
- Manual inclination **-/+ 10°**

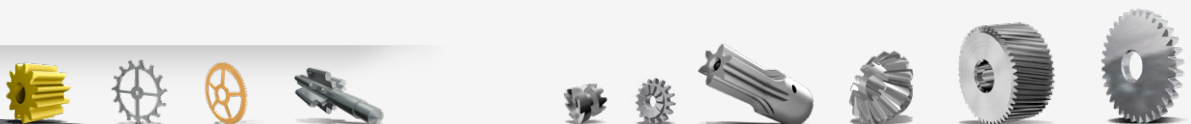
The AF90 is designed to be compact in order to replace conventional machines, while being just as productive and precise as the AF100 *plus*.

AFFOLTER AF100 *plus*

GEAR HOBBING MACHINE

- CNC axes **8**
- Max. module **0.8 mm**
- Max. cutting length **50 mm**
- Max. parts diameter **36 mm**
- Automatic inclination **-/+ 30°**

The AF100 *plus* is fitted with a variety of loader and options to offer solutions to suit many applications in the microtechnical industrial sectors. It is the most flexible GEAR line machines.



MICROTECHNICAL GEAR HOBBIING MACHINES



the most versatile

...spur, helical, bevel and crowned wheels, shafts, pinions and worm screw.

AFFOLTER AF160 POWERFUL GEAR HOBBIING MACHINE

- CNC axes 8
- Max. module 2.0 mm
- Max. cutting length 110-180 mm
- Max. parts diameter 60 mm
- Automatic inclination $-/+ 50^{\circ}$ (-115°)*

The AF160 is the most versatile Gear Hobbing Machine in the GEAR line, with increased performance and extra options dedicated to cutting larger parts.



COMPARISON

FULL RANGE

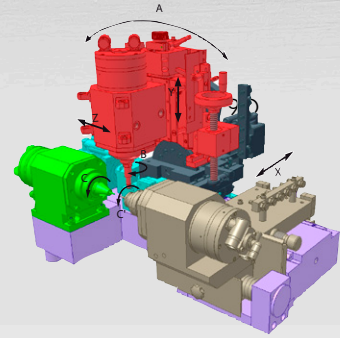
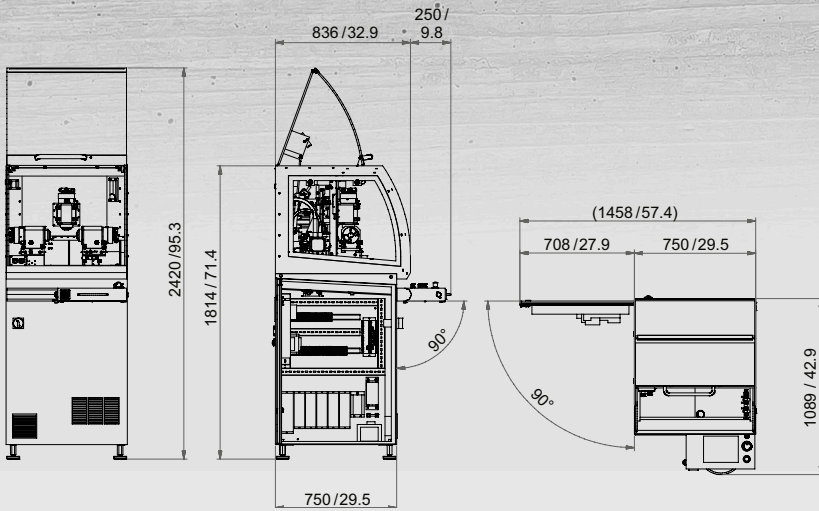
Technical data

	AF90	AF100 plus	AF160
Parts data			
Max. part diameter	30 mm/1.181 in.	36 mm/1.417 in.	60 mm/2.36 in.*
Max. cutting length	40 mm/1.574 in.	50 mm/1.968 in.	110-180 mm/ 4.33-7.0 in.**
Max. Headstock and tailstock rotation	5,000 rpm	5,000 rpm	5,000-12,000 rpm ***
Minimal module / DP	0.02 mm/1270 DP	0.02 mm/1270 DP	0.02 mm/1270 DP
Maximum module (depending on the material and the number of passes)	0.5 - 0.8 mm/ 50 - 32 DP	0.5 - 0.8 mm/ 50 - 32 DP	2.0 mm / 12.7 DP
Tool data			
Max. hob cutter diameter	24 mm/0.944 in.	24 mm/0.944 in.	100 mm 3.94 in.
Max. hob cutter width	20 mm/0.787 in.	20 mm/0.787 in.	80 mm (2x40)/ 3.14 in.
Cutting spindle inclination angle	-/+10°	-/+30° auto	-/+50° auto / -115° ***
Max. cutting spindle rotation	16,000 rpm	16,000 rpm	9,000 - 16,000 rpm
Strokes			
Z / Z' axis headstock stroke -	64 mm/2.519 in.	82 mm/3.228 in.	200 mm/7.87 in.
Headstock/counter-headstock clearance	-	82 mm/3.228 in.	345mm / 13.58 in.***
X in-feed axis stroke (radial feed)	40 mm/1.574 in.	74 mm/2.913 in.	70 mm/2.76 in.
Y axis shifting stroke (tangential feed)	55 mm/2.165 in.	84 mm/3.307 in.	90 mm/3.54 in.
A axis inclination	-/+10°	-/+30° auto	-/+50° auto / -115° ***
Installation			
Dimensions (WxDxH) in mm/in.	750x836x1814/ 29.52x32.91x71.41	1180x1660x2589/ 46.46x65.35x102	1,500x2,010x2,65/ 59.05x79.13x10.43
Weight (unladen)	710 kg/1562 lbs	1'505 kg/ 3318 lbs	2,700 kg/ 5,952 lbs

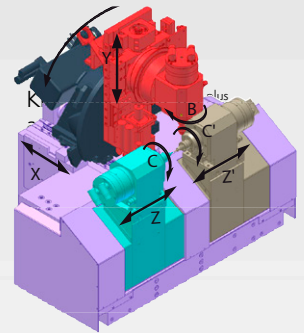
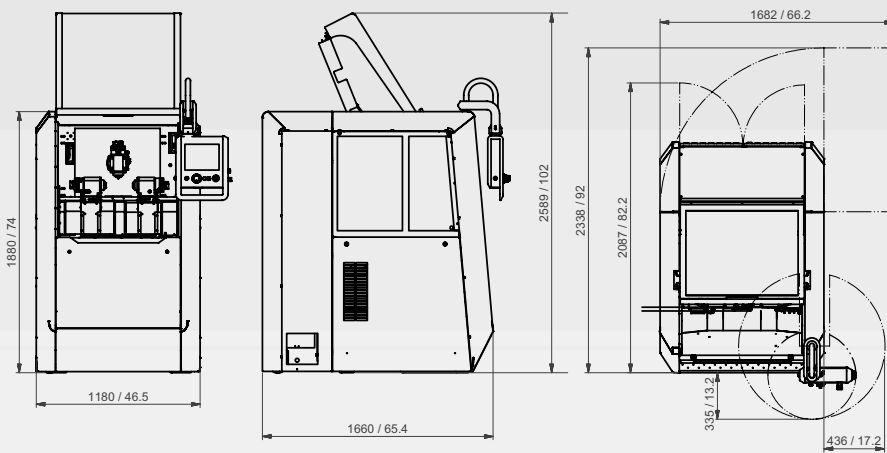
* According to the setup and the quality required. | ** According to clamping of tools. | *** Option.



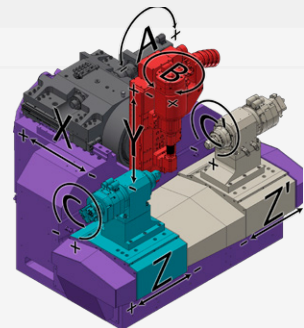
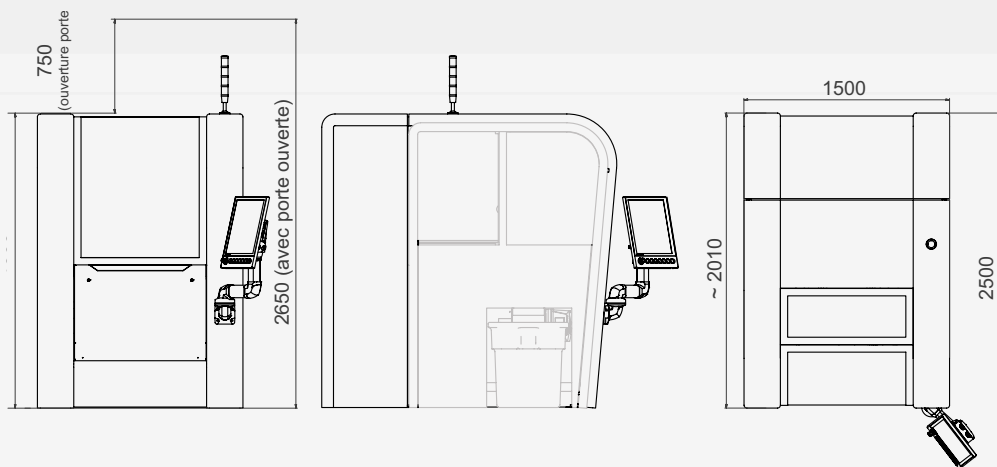
Space Requirement and kinematics (mm/inch)



Kinematic AF90



Kinematic AF100 plus



Kinematic AF160

AUTOMATIONS

LOADERS AND ROBOTS

GEAR Line machines can be fed manually or automatically.

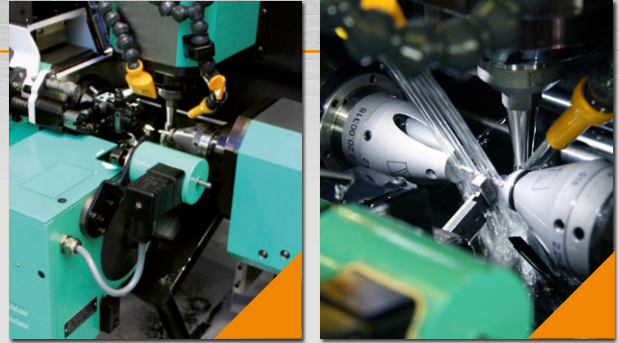
Affolter has a wide range of loaders and automation solutions available to suit the applications and series sizes produced on the machines.

AF20

Drum loader for small watchmaking and microtechnical parts.

This type of loader is a fast, cost-effective solution for hobbing medium to large series.

The drums and gripper are manufactured based on the part to be loaded.



Technical features:

Capacities	Data
∅ part (mm/inch):	0.4-6 / 0.015-0.242
Part length (mm/inch):	0.8-12 / 0.031-0.472
Feed time (secs):	0.3-1.2
Range:	up to 100,000 parts
Rotary drum performance:	symmetrical, asymmetrical, shaped

AF45

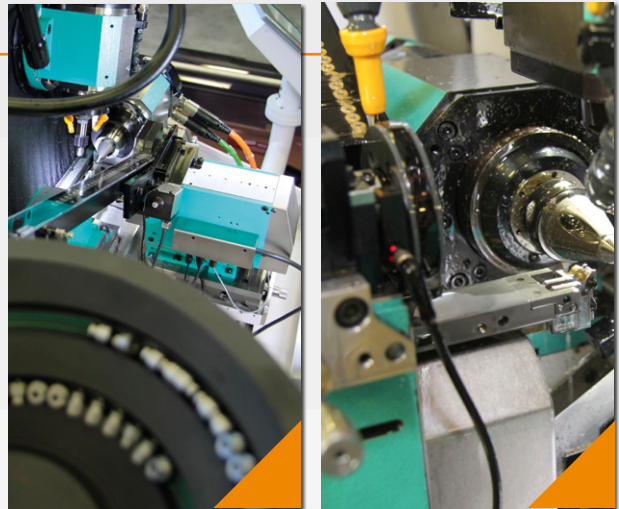
Slide loader for small and medium watchmaking and microtechnical parts.

This type of loader is a fast, precise solution for medium to large series gear hobbing.

Three different types of units enable parts feeding:

- Cartridge magazine loader;
- Vibrating bowl feeding system;
- Oil pulse feeding system.

The magazine, gripper and vibrating bowl are adjustable to the part to be fed.



Technical features:

Feed type	magazine	vibrating bowl		oil pulse	
		thin parts	cubic parts	thin parts	cubic parts
Type of parts		thin parts	cubic parts	thin parts	cubic parts
∅ part (min.-max.) (mm/inch):	2-12 / 0.078-0.472	4-12 / 0.157-0.472	3-12 / 0.118-0.472	1-10 / 0.039-0.393	1-5 / 0.039-0.196
Part length (min.-max.) (mm/inch):	2-30 / 0.078-1.181	2-5 / 0.078-0.196	3-12 / 0.118-0.472	1-5 / 0.039-0.196	1-5 / 0.039-0.196
Max. fill volume (l)		1	1	0.06	0.06
Parts weight (min.-max.) gr.	0.5-5	0.2/8	0.2/8	- /0.2	
Feed time (secs):		0.5 - 1.0			
Repeatability (mm/inch):		0.01 / 0.0004			

AF71 UNIVERSAL LOADER

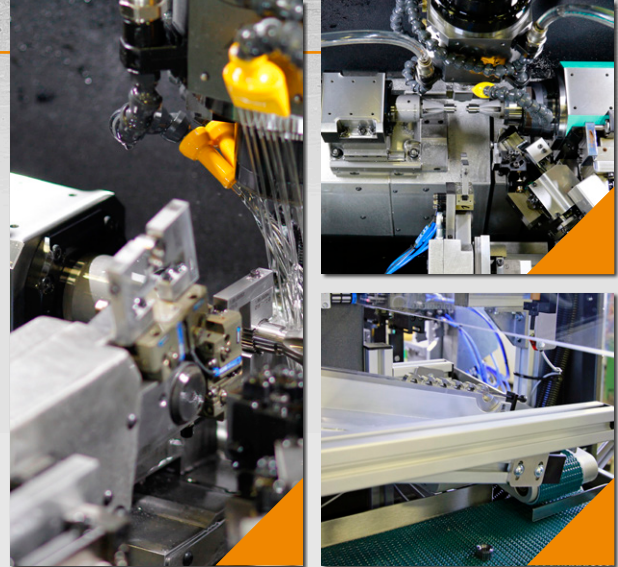
Universal feed and unloading system for all types of parts.

This loader with dual grip, is a fast, precise solution for medium to large series gear hobbing.

Three different types of units enable parts feeding:

- Adjustable feed rail;
- Belt conveyor;
- Vibrating bowl loader with feed rail.

This loader does not require specific tooling to the part. The grab clamps are adjusted to a range of diameters.



Technical features:

Capacities	feed rail	belt conveyor	vibrating bowl
∅ part (mm/in.):	50 / 1.96	50 / 1.96	20 / 0.78
Part length (mm/in.):	120 / 4.72	120 / 4.72	40 / 1.57
Maximum weight (g / oz):	300 / 11.81	300 / 11.81	40 / 1.57
Repeatability (mm/in.):	+/- 0.05 / 0.002		
Feed time (secs):	1.5-2		
Preparation time for a new part (secs):	5		

AF72 UNIVERSAL LOADER

Universal feed and unloading system for all types of larger parts.

This loader with dual grip, dedicated to the AF16O machine, is a fast, precise solution to cutting larger parts with medium to large autonomy series gear hobbing.

Three different types of units enable parts feeding:

- Adjustable feed rail;
- Vibrating bowl loader with feed rail;
- Robot.

This loader does not require specific tooling to the part. The grab clamps are adjusted to a range of diameters.

Technical features:

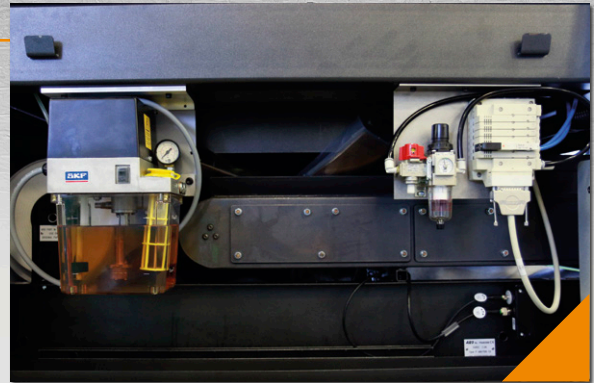
Capacities	feed rail	space requirement
∅ part (mm/in.):	60 / 2.36	L: 1,017 mm / 40 in.
Part length (mm/in.):	250 / 9.84	W: 1,787 mm / 70 in.
Maximum weight (g / oz):	2,500 / 98.42	H: 1,865 mm / 73.5 in.
Repeatability (mm/in.):	+/- 0.1 / 0.004	lb: 1,323
Feed time (secs):	1.5-2	
Preparation time for a new part (secs):	5	

OPTIONS

The GEAR line machines may be equipped with a wide range of options to provide a choice of suitable technical solutions for many gear hobbing and cutting applications.

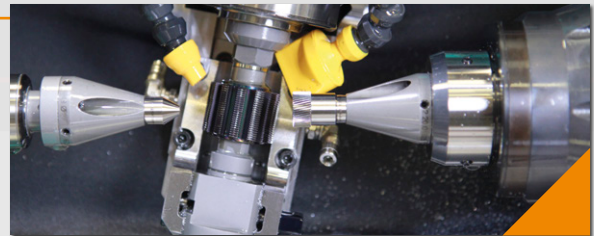
Customizable coolant system

Various options relating to the management of cutting oil liquid enable the relevant machine to be configured to the customer's specific needs. Indeed, it is possible to improve the quality of filtration and remove shavings independently and economically. The new system also allows for improved oil flow and pressure to optimize the quality of the work and removal of chips from the working area. Filtration quality of 80 microns for a flow of 40 l/min and 60 l/min for AF16O.



Counter Bearing HA

The counter Bearing increases the rigidity of the milling cutter with the addition of an end bearing on the milling cutter shaft. It also enables the milling cutter shaft to be held in place firmly top and bottom. It therefore improves the quality of the gear through the increased rigidity of the whole assembly.

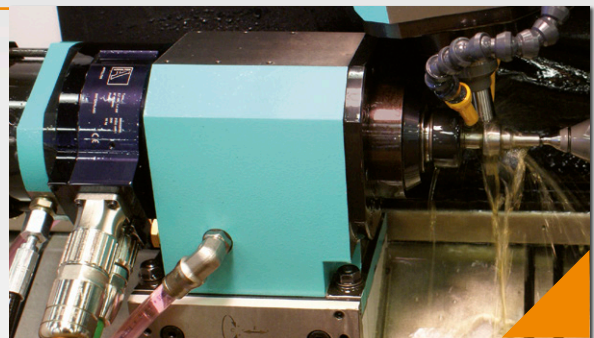


Collet Clamping System

The machine types AF100 *plus* and AF16O may be equipped with a headstock that utilizes a hydraulic collet clamping system. According to the application type there are two different systems available:

W15 or W20/W25 and B32 (AF16O)

The W. collet system pulls the collet into the taper. It is highly accurate and offers excellent radial run-out quality as well as adjustable clamping force control. This system is ideally suited for the location and workpiece clamping of gear-shafts and splines, and spline shafts with cylindrical gears.



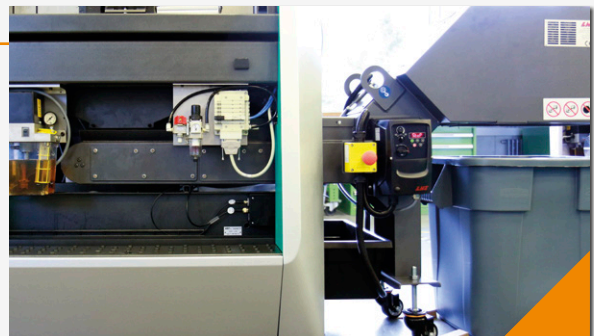
L10, F10, F15 or F25 (AF16O)

The L. or F. collet is clamped by the pushing movement against a stop nut. This prevents axial part movement which is especially important when height control is required for processing straight bevel gears, worm-wheels, and crown face gears.



Chip Conveyor And Filtration Belt

Available as an option, a chip conveyor belt can easily be fitted to the machine using the space designed for this purpose. A significant quantity of chips can therefore be transported out of the machine. A filtering belt with cartridge filters, also available as an option, ensures that chips over 50 microns / AF100 *plus* or 80 microns / AF16O are removed from the circuit.



Deburring

A unique process feature on the GEARLine machines offers three different methods for deburring:

X-axis deburring method (AF1xx):

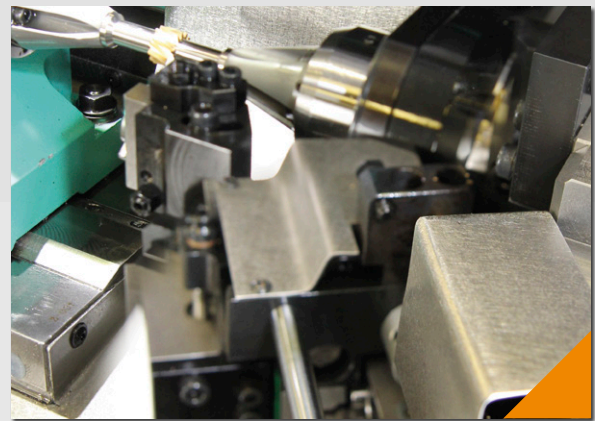
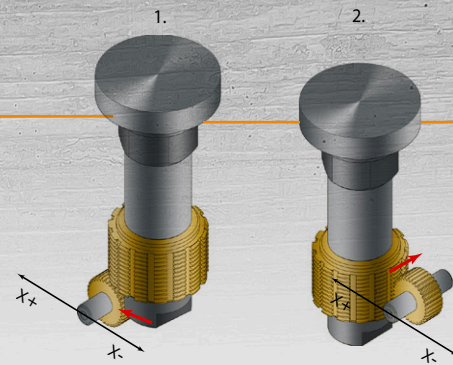
The hob is positioned in negative X-direction over the workpiece and cuts into the component from the front. And it moves to cut in to the component from behind and then forms the tooth width or axial length thereby automatically eliminating the burr.

Deburring with double hob method

Two hobs are mounted on the same hob arbor in opposite direction. Hob #1 cuts in and out only and Hob #2, rotating in the opposite direction makes the synchronized cut and then forms the tooth width or axial length thereby automatically eliminating the burr.

Deburring unit AF52 / AF54 (AF16O)

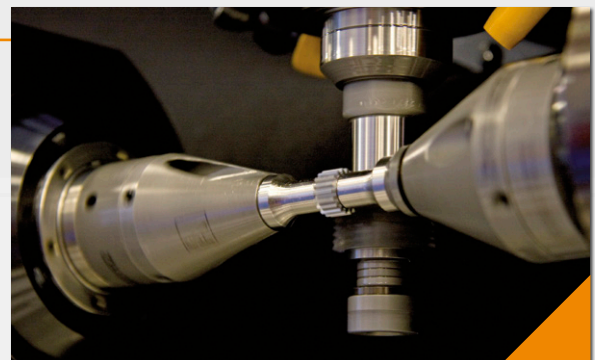
The Gear Line machines can be equipped with a mechanical deburring device with cutter or carbide wheel.



Dry Cutting

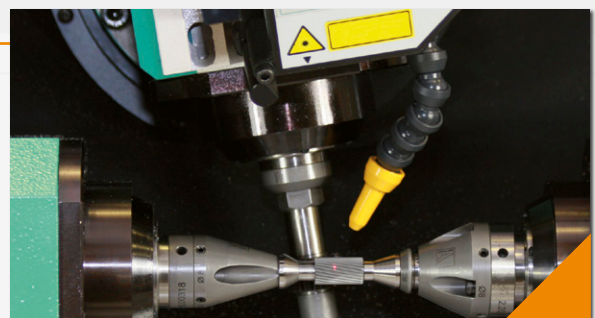
The machine types AF100 *plus* and AF16O are designed to cut with or without oil. We offer dry cutting for high speed cutting applications using coated solid carbide hobs and form relieved cutting tools. The AF16O is the most powerful machine with this option.

The option "Dry Cutting" includes air pressure cooling and chip aspiration / removal. Additionally, dry cutting technology is applicable to process gear hobbing and cutting of hardened blank materials, together with our "Skiving" option.



Skiving

As an alternative to the expensive process methods of profile form or generative gear grinding, Affolter Technologies offers the advanced "Skiving" process option. The parts are pre-hobbed leaving a minimal amount of stock per tooth flank to remove, the component is hardened and then re-loaded on the hobbing machine and finished by Skive hobbing.



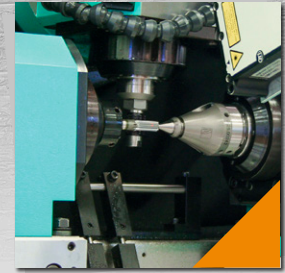
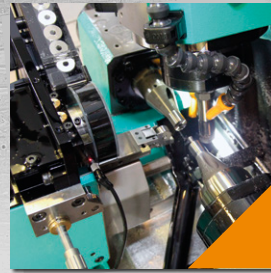
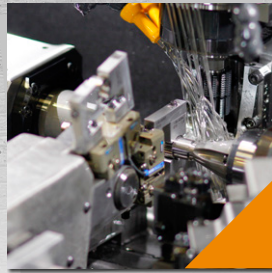
Oil mist aspiration

For increased or high production volumes it is recommended to add an oil mist collection and separation unit.

This unit may be adapted on the top of the machine to limit the floor space requirement. It is also possible to connect the machine to a centralized oil mist collection and separation system.

COMPARISON CHART

LOADERS AND OPTIONS



LOADING SYSTEMS

	GEAR AF90 Workpiece capacity*	GEAR AF100 plus Workpiece capacity*	GEAR AF160 Workpiece capacity*
AF45 Linear slide axis loading system with 3 possible feeding units: <ol style="list-style-type: none"> Magazine Vibrating bowl Oil impulse 	✓	✓	✓
	1. Ø: 2-12 / 0.08-0.47 L: 2-30 / 0.08-1.18 2. Ø: 4-12 / 0.16-0.47 L: 3-12 / 0.12-0.47 3. Ø: 1-10 / 0.04-0.39 L: 1-5 / 0.04-0.20	1. Ø: 2-12 / 0.08-0.47 L: 2-30 / 0.08-1.18 2. Ø: 4-12 / 0.16-0.47 L: 3-12 / 0.12-0.47 3. Ø: 1-10 / 0.04-0.39 L: 1-5 / 0.04-0.20	1. Ø: 2-12 / 0.08-0.47 L: 2-30 / 0.08-1.18 2. Ø: 4-12 / 0.16-0.47 L: 3-12 / 0.12-0.47 3. Ø: 1-10 / 0.04-0.39 L: 1-5 / 0.04-0.20
AF71 & 72 UNIVERSAL LOADER Universal multi-axes part load and unload system with 3 possible feeding units: <ol style="list-style-type: none"> Adjustable feed rail unit Belt conveyor Vibrating bowl feeding system 	✗	✓	✓
		1. Ø: 50/1.96 L: 120/4.72 2. Ø: 50/1.96 L: 120/4.72 3. Ø: 20/0.78 L: 40/1.57	1. Ø: 60/2.36 L: 250/9.85

OPTIONS

	GEAR AF90	GEAR AF100 plus	GEAR AF160
Customizable coolant system	✗	✓	✓
Counter Bearing HA	✗	✓	✓
Collet clamping system L10, F10, F15, W15, F25, B32, W20 and W25 for AF160	✗	✓	✓
Deburring	✓ AF52 Debur. unit Double hob debur.	✓ AF52 Debur. unit Double hob debur. X-axis debur. End mill debur.	✓ AF54 Debur. unit Double hob debur. End mill debur.
Dry Cutting	✓	✓	✓
Skiving	✗	✓	✓
Chip conveyor and filtration belt	✗	✓	✓
Oil mist aspiration	✓	✓	✓

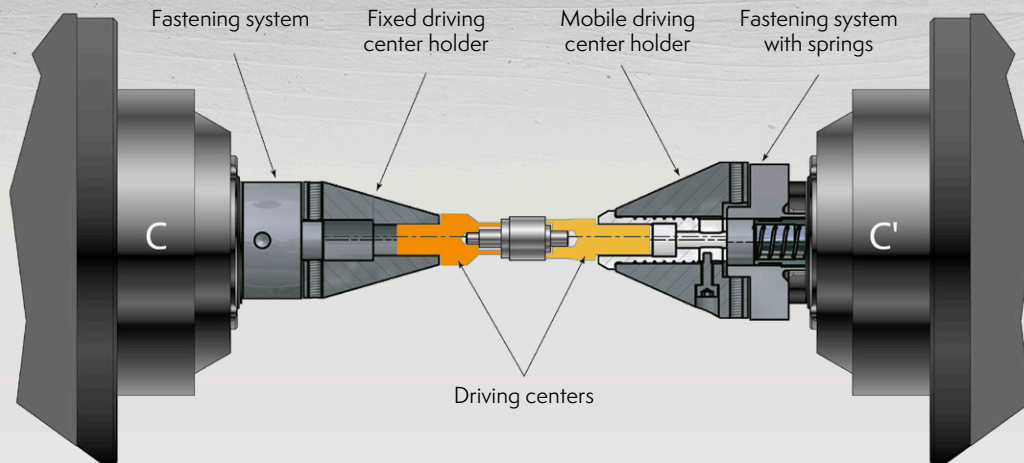
* All the data are in mm/inch

SETUP

TOOLING AND ACCESSORIES

Clamping principle of tool and workpiece

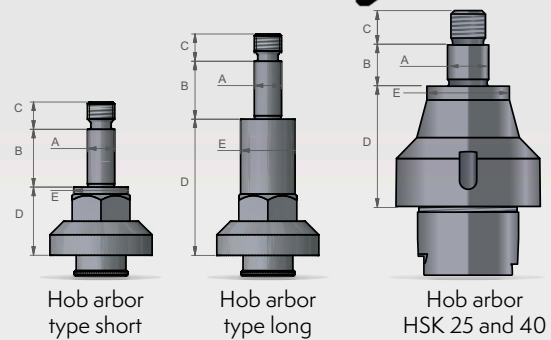
The hob cutter is held on a hob arbor and the part is clamped either between drive centers or in a collet. On the Gear Hobbing Machine AF160, the clamping force is controlled electrically and can be parameterized in the workpiece program.



Hob arbors

Affolter offers the following standard hob arbors, available from stock:

	A	B	C	D	E
Ø 3.5 type short (mm)	3.5	9	8	20	6
Ø 3.5 type long (mm)	3.5	9	8	40	6
Ø 4.5 type short (mm)	4.5	13	8	20	8
Ø 4.5 type long (mm)	4.5	13	8	40	8
Ø 5 type short (mm)	5	13	8	20	8
Ø 5 type long (mm)	5	13	8	40	8
Ø 6 type short (mm)	6	13	8	20	9
Ø 6 type long (mm)	6	13	8	40	9
Ø 8 type short (mm)	8	17	8	20	16
Ø 8 type long (mm)	8	17	8	40	16
Ø 10 type short (mm)	10	18	10	20	16
Ø 10 type long (mm)	10	18	10	40	16



HSK 25 / 40	φA	B	C	D	φE
40 - Ø 8 short (mm)	8	24	10	25	12
40 - Ø 8 long (mm)	8	50	30	44.5	14
40 - Ø 12 short (mm)	12	22	10	35	24
40 - Ø 13 long (mm)	13	59	38	33	22
40 - Ø 16 long (mm)	16	59	38	33	28
40 - Ø 22 long (mm)	22	79	41	25	35
25 - Ø 13 long (mm)	13	59	38	15	22
25 - Ø 22 short (mm)	22	19	41	55	35

Driving centers and holders - fixed and actuating types

The drive center holder is the standard interface between the machine and the drive center. The headstock on the left side is equipped with a fixed drive center holder (or with a collet). The tailstock is equipped with an actuating drive center holder which is spring loaded for the clamping force (also called mobile drive center holder).

The diameter and type of the drive center holder is designed and manufactured to interface to the drive center.

Special centers are available upon customer request.

AFFOLTER offers the following standard drive center holders, available from stock:

- Ø2 / cylindrical
- Ø5 / cylindrical
- Ø8 / cylindrical
- Ø5 / 1°50' taper
- Ø8 / cylindrical (AF160)
- Ø30 / cylindrical (AF160)
- Ø3 / cylindrical
- Ø7 / cylindrical
- Ø5 / 2° taper
- Ø8 / 2° taper
- Ø15 / cylindrical (AF160)

Hob cutter

AFFOLTER works together with selected partners in order to offer the following cutting tools:

- Single start hob and Multi start hob
- Single start index cutter and Multi start index cutter
- Power skiving cutter
- Chamfering cutter

- Worm milling cutter and Worm generation cutter
- CYLKRO cutter
- Straight bevel gear cutter (CONIXS / CONIKRON).
- Shank type hob



Drive center tips

In addition to the fundamental machine design, rigidity, and axes alignments, the drive center tips are the most important tooling components for precise part location and clamping. Their manufactured accuracy is decisive for producing the desired component part quality.

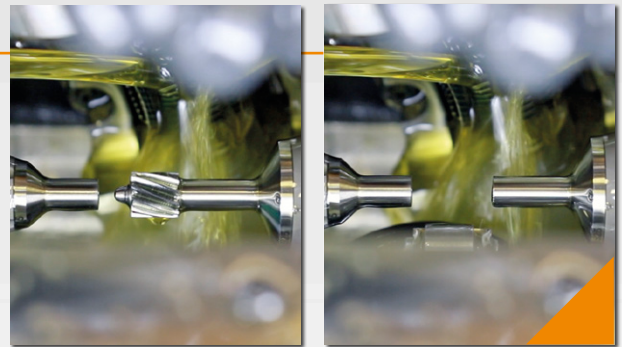
AFFOLTER have many years of experience and know-how in the design and manufacturing of these critical drive centers and we offer the transfer of this know-how to our customers. Our drive centers are designed in accord with the customer part drawing or adapted to existing blank parts and held to precise μm or μin manufacturing tolerances!



Retractable Pin system

The retractable pin system is an efficient and simple system for piece extraction.

It is designed so that the space around the working zone is kept to a minimum. This facilitates integration and adjustment of additional options such as a deburrer, the Counter Bearing HA, a loading system, etc. It is also a time-saver in the working cycle, as there is less movement of axes when extracting the piece.



Collets

AFFOLTER works together with selected partners in order to offer the collets type in different executions :

- L10 / F10;
- F15 / W25;
- F25 (AF16O);
- B32 (AF16O);
- W20, W25 (AF16O).



Workpiece presence control

The GEAR Line machines may be equipped with a workpiece presence or proximity control sensor. This allows the machine, after part loading, to automatically check if the part was correctly loaded or not. If not, the loading cycle is immediately repeated.

This option is also beneficial for checking to avoid axes collisions due to incorrectly loaded and unloaded parts.

CONTACT US

Distribution Network

Switzerland/EU: Affolter Group SA
www.affoltergroup.ch

USA: Rotec Tools, Mahopac/NY
www.rotectools.com

Germany: D&M GMBH, Dürnau
www.dm-maschinen.com

UK: 3A Technologies Ltd, Leicester
www.3atechnologies.co.uk

Italie: G.R.A Srl
www.grasrl.it

Eastern Europe: Alfleth Engineering AG, Lenzburg
www.alfleth.com

China: Corremax International, Chongqing
www.corremax-taiwan.com.tw

Korea: LB Tech, Seoul
www.lbtech.kr

Taiwan: Corremax International, Taipei
www.corremax-taiwan.com.tw

Japan: YKT Corporation, Tokyo
www.ykt.co.jp

South East Asia: Corremax International, Taipei
www.corremax-taiwan.com.tw

Turkey: Selçuklu Horology Mikroteknik Ltd Şti
www.selcukluhoroloji.com

India: Srujan Automations
srujanmc@rediffmail.com



AFFOLTER GROUP SA \ SWITZERLAND
www.affoltergroup.ch
ISO 9001 : 2015 Certificated