



## LFV technology

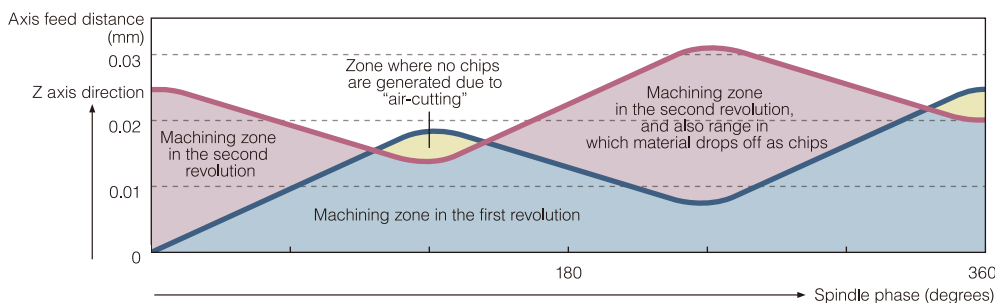
Low frequency vibration cutting technology

### What is Low Frequency Vibration Cutting?

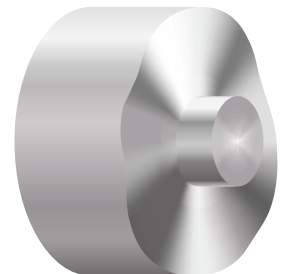
The servo axes are vibrated in the axial direction and cutting is performed while synchronizing this vibration with the rotation of the spindle. Because "air-cutting" times are provided during cutting, it is characterized by intermittent expulsion of chips.

This widely applicable cutting technology – able to handle a broad range of machining shapes and materials – is ideal for cutting difficult-to-cut materials like iniconel, stainless steel and copper. It is state-of-the-art and suppresses various risks associated with these materials, such as entanglement of chips and built-up edges.

#### ■ Z axis feed distance per spindle revolution and the low frequency vibration waveform



#### ■ Representation of the cutting



### Chip Shapes

Depending on the material being cut, a variety of problems can be caused by chips getting entangled with each other, including increased cutting resistance, scarring, changes in the texture of the machined surface, tool nose damage, and built-up edges due to cutting heat. In low frequency vibration cutting, "air cutting" time provided during cutting serves to break chips up finely and expel them. This "air cutting" time also prevents the machining temperature rising, which both prolongs tool lives and gives relief from various problems caused by chips.

#### ■ Shape differences of chips of the same weight (SUS304)



Chips generated by low frequency vibration cutting

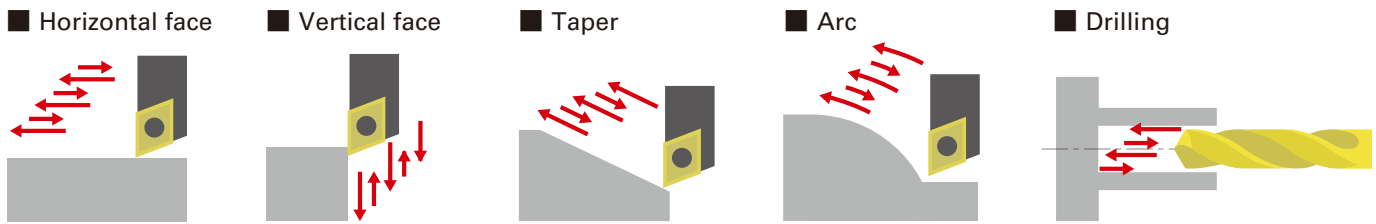


Chips generated by conventional cutting

## Variety of Machinable Geometries

Vibration cutting can handle a variety of types of machining in addition to linear machining on faces, including tapers, arcs, and drilling.

Vibration cutting can be turned ON and OFF just by inserting G codes into a program, giving relief from chip entanglement and problems with the tool nose, depending on the material being machined.



## Vibration mode

The optimum vibration mode can be selected depending on the purpose of machining.

### Vibration mode 1

Breaking up chips



### Vibration mode 2

Drilling, or turning where high peripheral speed is required



### Vibration mode 3 (under development)

Breaking up chips in thread cutting



### ■ Micromachining example (VC03)



Micromachining leaving  $\phi 0.2$  mm pin

### ■ Deep hole drilling with an oil hole drill



The broken up chips are expelled along the flutes in the drill.

## Models that can be equipped with LFV

Model	Type	Front LFV (X1, Z1)	Back LFV (X2, Z2)	
<b>VC03</b>		○	---	
<b>L20</b>	VIII, IX	○	○	
	X, XII	○	×	
<b>L12</b>	VII	○	○	
Model	Type	Module 1	Module 2	Module 3
<b>MC20</b>	III	○	○	○

We plan to gradually expand the number of models that can be equipped with LFV: look out for changes.

\*1. In principle, LFV machining in two axis control groups simultaneously is not possible.

### CITIZEN MACHINERY CO., LTD.

# CITIZEN

#### JAPAN

CITIZEN MACHINERY CO., LTD.  
4107-6 Miyota, Miyota-machi, Kitasaku-gun, Nagano-ken, 389-0206, JAPAN

TEL.81-267-32-5901 FAX.81-267-32-5908

#### SOUTH ASIA / KOREA

CITIZEN MACHINERY CO., LTD.  
4107-6 Miyota, Miyota-machi, Kitasaku-gun, Nagano-ken, 389-0206, JAPAN

TEL.81-267-32-5916 FAX.81-267-32-5928

#### TAIWAN

CINCOM MIYANO TAIWAN CO., LTD.  
10FL, No.174, Fuh Sing N. Rd., Taipei, TAIWAN

TEL.886-2-2715-0598 FAX.886-2-2718-3133

#### CHINA

CITIZEN (CHINA) PRECISION MACHINERY CO., LTD.  
10058, XINHUA ROAD OF ZHOUCUN, ZIBO, SHANDONG, P.R. CHINA

TEL.86-533-6150560 FAX.86-533-6161379

#### EUROPE-Germany

CITIZEN MACHINERY EUROPE GmbH  
Mettinger Strasse 11, D-73728 Esslingen, GERMANY

TEL.49-711-3906-100 FAX.49-711-3906-106

#### EUROPE-UK

CITIZEN MACHINERY UK LTD  
1 Park Avenue, Bushey, WD23 2DA, UK

TEL.44-1923-691500 FAX.44-1923-691599

#### EUROPE-Italia

CITIZEN MACCHINE ITALIA s.r.l.  
Via Campo Romano, 13 24050 Spirano (BG) ITALY

TEL.39-035-877-738 FAX.39-035-876-547

#### AMERICA

MARUBENI CITIZEN-CINCOM INC.  
40 Boroline Road Allendale, NJ 07401, U.S.A.

TEL.1-201-818-0100 FAX.1-201-818-1877

URL:<http://cmj.citizen.co.jp/>

All specifications are subject to change without prior notice. This product is an export control item subject to the foreign exchange and foreign trade act. Thus, before exporting this product, or taking it overseas, contact your CITIZEN machine dealer. Please inform your CITIZEN machine dealer in advance of your intention to re-sell, export or relocate this product. For the avoidance of doubt products includes whole or part, replica or copy, technologies and software. In the event of export, proof of approval to export by government or regulatory authority must be evidenced to CITIZEN. You can operate the machines after the confirmation of CITIZEN. CITIZEN is a registered trademark of Citizen Watch Co., Japan.