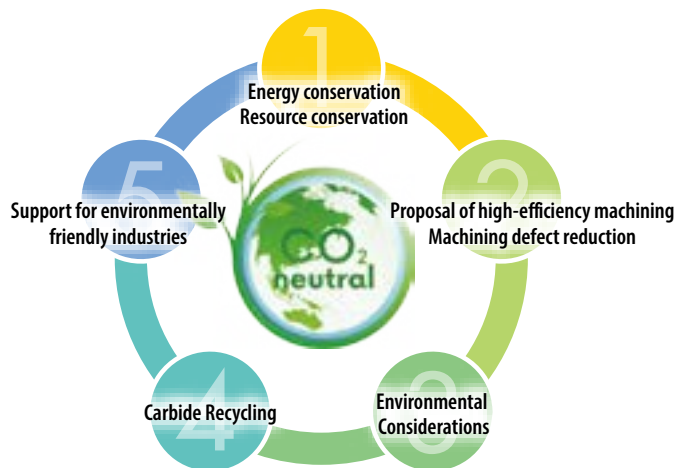




High Efficiency and High Feed Cutter

MFH Series



Case Study Book

This catalog is based on case studies of how high-efficiency machining can reduce CO₂ emissions from a carbon-neutral viewpoint.

Technology Leads to a Bright Future

This brochure introduces various examples of Kyocera's high efficiency and high feed cutter MFH series from the viewpoint of carbon neutrality.

We would like to contribute to our customers' bright future.

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Kyocera Group Sustainability

The Management Rationale of the Kyocera Group is "To provide opportunities for the material and intellectual growth of all our employees, and through our joint efforts, contribute to the advancement of society and humankind." We believe that upholding our Management Rationale will naturally lead to achieving our SDGs on an international basis, and that our mission is to conduct business in ways that fulfill societal needs.

The Kyocera Group starts by considering social conditions, trends in the international community and the external environment surrounding our company, and key social and management priorities identified through stakeholder dialogue. Then the Kyocera Group CSR Committee deliberates and identifies top priorities for the Kyocera Group to address so that important issues to be resolved through business.

Read here for website of the Kyocera Group Sustainability



Carbon Neutrality in Kyocera Cutting Tools Business

Kyocera Industrial Tool Group will strive to minimize CO₂ emissions throughout the entire Cutting Tool value chain, from product development, procurement, distribution, sales, machining, resource recovery and reuse, and disposal.

"High Efficiency Machining = Energy Conservation"

- High-efficiency machining = Energy conservation with a wide range of machines
- High-quality machining by our new products
- Providing JTA-approved environmentally conscious products

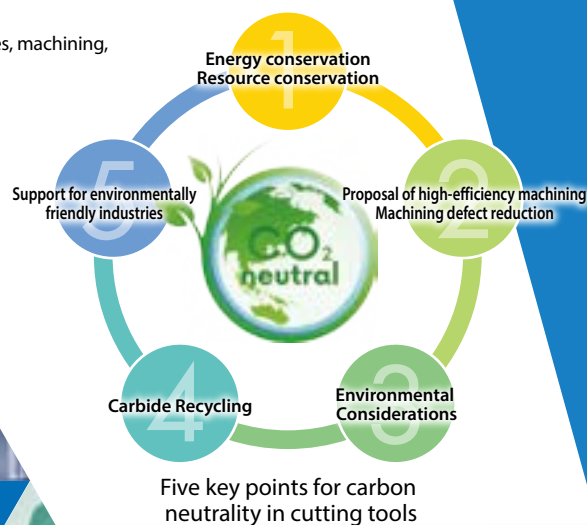
Kyocera Aims to Guide the Future of Manufacturing

Utilizing DX Technology
From a world determined
After machining to a world we can
see before machining takes place

- Dynamic tool proposal using analysis technology
- Reduce cutting time by optimizing machining conditions
- Predetermine machining problems and take countermeasures in advance

Pursuing higher efficiency machining

- Drastic improvement in productivity through development of high value-added tools
- Active efforts to build new development methods
- Complete tooling for next-generation components and environmentally friendly industrial components



We are committed to carbon neutrality by working with our customers to enhance our technological capabilities, improve productivity, and create added value.

High Efficiency and High Feed Cutter

MFH Series

1

Reduce Cutting Force at Initial Impact with Stable Machining, Excellent Chattering Resistance, and a Convex Helical Edge Design



MFH Micro



MFH Mini

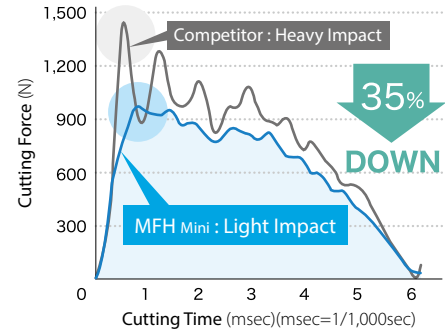


MFH Harrier



MFH Boost

Cutting Force and Vibration when Approaching the Workpiece
(Internal Evaluation)
(a_p : Half of Cutter Diameter)



Cutting Conditions : $V_c = 150$ m/min, $a_p \times a_e = 0.5 \times 8$ mm, $f_z = 1.0$ mm/t, Dry
Cutter Dia. $\phi 16$ mm Workpiece : S50C

MFH Usage

MFH Micro

Low Resistance and Durable Against Chatter for Highly Efficient Machining



Point	General Use Size (Dia.)	BT30
Replaces Solid End Mills to Reduce Machining Costs	10 12	MFH Micro $\phi 8 \sim \phi 16$
Cutting Force Oriented	20 25	MFH Mini $\phi 16 \sim \phi 50$
Cutting Edge Strength Oriented	50 63	
Pocketing Excellent Side Surface Finish	25	

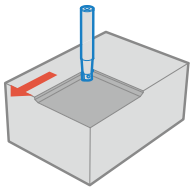
MFH Boost

High Feed Milling with Larger Depths of Cut Available for a Variety of Machining Applications

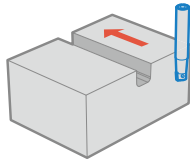


2

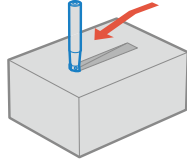
Wide Application Range for
Multiple Metalworking Processes



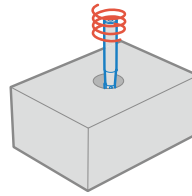
Face Milling &
Shouldering



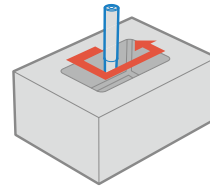
Slotting



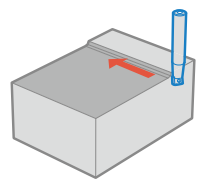
Ramping



Helical Milling



Pocketing



Contouring

BT40

BT50

$ap = 0.5\text{mm}$, $fz = 0.5\text{mm/t}$

$ap = 0.5\text{mm}$, $fz = 0.8\text{mm/t}$



MFH Harrier

$\varnothing 25 \sim \varnothing 160$ $ap = 1.0\text{mm}$, $fz = 1.0\text{mm/t}$



MFH Boost

$\varnothing 22 \sim \varnothing 80$ $ap = 1.0 \sim 2.5\text{mm (Max)}$, $fz = 0.4\text{mm/t}$

MFH Mini

Economical Inserts with
4 Cutting Edges



MFH Harrier

4 Different Insert Designs Offer a
Variety of Machining Options



CASE 1

Mold SKD 61

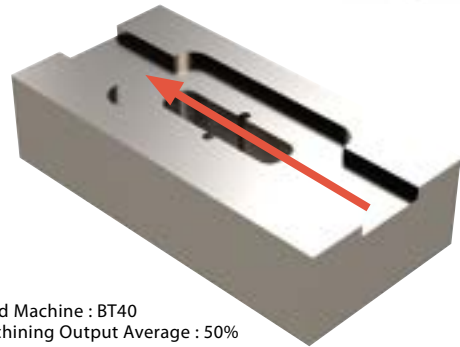
MFH Micro



Toolholder : MFH12-S12-01-3T
Insert : LPGT010210ER-GM PR1535

<Cutting Conditions>

$V_c = 90 \text{ m/min}$
 $n = 2,400 \text{ min}^{-1}$
 $a_p \times a_e = 0.3 \times \sim 7.0 \text{ mm}$
 $f_z = 0.27 \text{ mm/t}$
 $V_f = 1,930 \text{ mm/min}$
Dry



Used Machine : BT40
Machining Output Average : 50%

Machining Efficiency

MFH Micro

$Q = 4.1 \text{ cc/min}$

Competitor A

$Q = 3.0 \text{ cc/min}$

Machining
Efficiency

$\times 1.4$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 180 cc cutting

CO₂
Emissions

26
%

Competitor A

CO₂

3.5 kg-CO₂

Cycle Time : 1 hour

MFH

2.6 kg-CO₂

Cycle Time : 44 minutes

CASE 2

Industrial Machining Parts SUS 440C

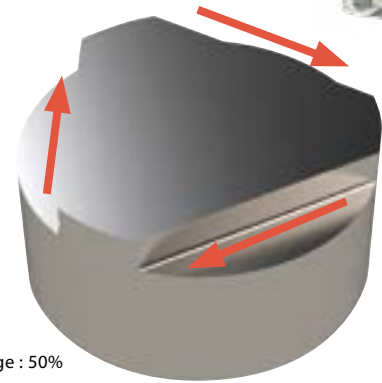
MFH Micro



Toolholder : MFH16-S16-01-4T
Insert : LPGT010210ER-GM PR1535

<Cutting Conditions>

$V_c = 180 \text{ m/min}$
 $n = 3,580 \text{ min}^{-1}$
 $a_p \times a_e = 0.4 \times 8 \text{ mm}$
 $f_z = 0.4 \text{ mm/t}$
 $V_f = 5,730 \text{ mm/min}$
Wet



Used Machine : BT40
Machining Output Average : 50%

Machining Efficiency

MFH Micro

$Q = 18.3 \text{ cc/min}$

Competitor B

$Q = 12.2 \text{ cc/min}$

Machining
Efficiency

$\times 1.5$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 732 cc cutting

CO₂
Emissions

34
%

Competitor B

CO₂

3.5 kg-CO₂

Cycle Time : 1 hour

MFH

2.3 kg-CO₂

Cycle Time : 40 minutes

CASE 3

Frame SUS304

MFH Mini



Toolholder : MFH20-S20-03-4T

Insert : LOGU030310ER-GM PR1525

<Cutting Conditions>

$V_c = 110 \text{ m/min}$

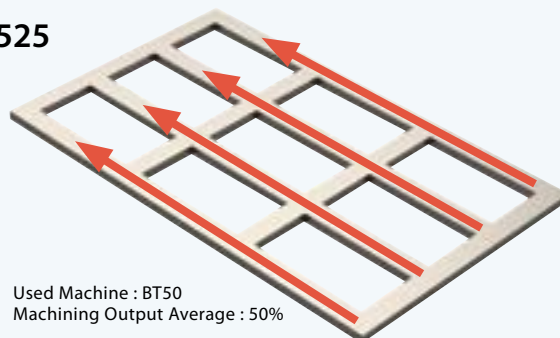
$n = 1,750 \text{ min}^{-1}$

$a_p \times a_e = 0.8 \times 20 \text{ mm}$

$f_z = 0.5 \text{ mm/t}$

$V_f = 3,500 \text{ mm/min}$

Wet



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Mini

$Q = 56 \text{ cc/min}$

Machining Efficiency
 $\times 2.0$

Competitor C

$Q = 28 \text{ cc/min}$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 1,680 cc cutting

Competitor C

CO₂
5.1 kg-CO₂

Cycle Time : 1 hour

MFH

2.5 kg-CO₂

Cycle Time : 30 minutes

CO₂ Emissions
50 %

CASE 4

Aircraft Parts Ti-6Al-4 V

MFH Harrier



Toolholder : MFH063R-10-6T-27M

Insert : SOMT100420ER-GM PR1535

<Cutting Conditions>

$V_c = 50 \text{ m/min}$

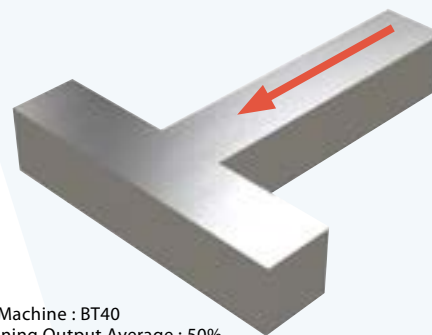
$n = 250 \text{ min}^{-1}$

$a_p \times a_e = 1.0 \times \sim 38 \text{ mm}$

$f_z = 0.3 \text{ mm/t}$

$V_f = 450 \text{ mm/min}$

Wet (External coolant)



Used Machine : BT40
Machining Output Average : 50%

Machining Efficiency

MFH Harrier

$Q = 17.1 \text{ cc/min}$

Machining Efficiency
 $\times 2.1$

Competitor D

$Q = 8.3 \text{ cc/min}$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 498 cc cutting

Competitor D

CO₂
3.5 kg-CO₂

Cycle Time : 1 hour

MFH

1.7 kg-CO₂

Cycle Time : 29 minutes

CO₂ Emissions
52 %

CASE 5

Head SCM

MFH Harrier



Toolholder : MFH40-S32-10-4T-250

Insert : SOMT100420ER-GM PR1525

<Cutting Conditions>

$V_c = 160 \text{ m/min}$

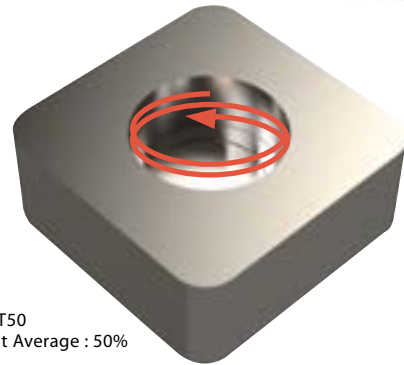
$n = 1,270 \text{ min}^{-1}$

$a_p \times a_e = 0.5 \times 40 \text{ mm}$

$f_z = 0.98 \text{ mm/t}$

$V_f = 5,000 \text{ mm/min}$

Wet



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Harrier

$Q = 100 \text{ cc/min}$

Competitor E

$Q = 54 \text{ cc/min}$

Machining Efficiency

$\times 1.9$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 3,240 cc cutting

Competitor E

CO₂
5.1 kg-CO₂

Cycle Time : 1 hour

MFH

2.7 kg-CO₂

Cycle Time : 32 minutes

CO₂ Emissions
46 %

CASE 6

Machining Tool Parts FC300

MFH Harrier



Toolholder : MFH100R-14-7T

Insert : SOMT140520-ER-GM PR1525

<Cutting Conditions>

$V_c = 180 \text{ m/min}$

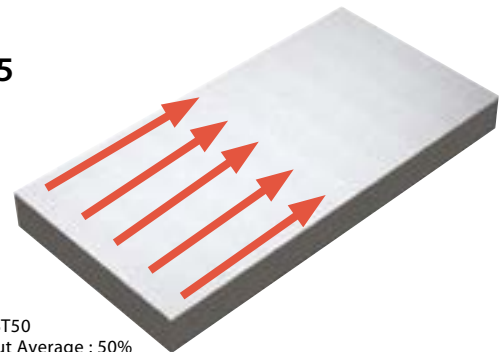
$n = 570 \text{ min}^{-1}$

$a_p \times a_e = 1.5 \times 62 \text{ mm}$

$f_z = 1.1 \text{ mm/t}$

$V_f = 4,390 \text{ mm/min}$

Dry



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Harrier

$Q = 408 \text{ cc/min}$

Competitor F

$Q = 179 \text{ cc/min}$

Machining Efficiency

$\times 2.3$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 10,740 cc cutting

Competitor F

CO₂
5.1 kg-CO₂

Cycle Time : 1 hour

MFH

2.2 kg-CO₂

Cycle Time : 26 minutes

CO₂ Emissions
56 %

CASE 7

Generator Parts SUS

MFH Harrier



Toolholder : MFH100R-14-6T

Insert : SOMT140520ER-GM PR1535

<Cutting Conditions>

$V_c = 220 \text{ m/min}$

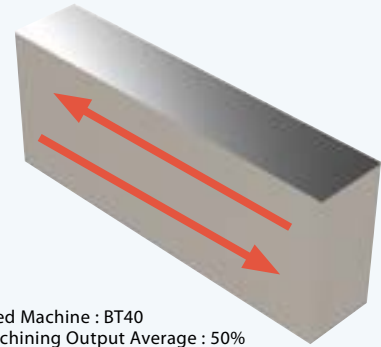
$n = 700 \text{ min}^{-1}$

$a_p \times a_e = 1.5 \times 50 \text{ mm}$

$f_z = 0.3 \text{ mm/t}$

$V_f = 1,260 \text{ mm/min}$

Dry



Used Machine : BT40
Machining Output Average : 50%

Machining Efficiency

MFH Harrier

$Q = 94.5 \text{ cc/min}$

Machining
Efficiency

$\times 2.6$

Competitor G

$Q = 36.9 \text{ cc/min}$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 2,214 cc cutting

Competitor G

CO₂
3.5 kg-CO₂

Cycle Time : 1 hour

MFH

CO₂
Emissions

61
%

1.4 kg-CO₂

Cycle Time : 23 minutes

CASE 8

Industrial Machining Parts SUS430

MFH Harrier



Toolholder : MFH32-S32-10-2T

Insert : SOMT100420ER-FL PR1535

<Cutting Conditions>

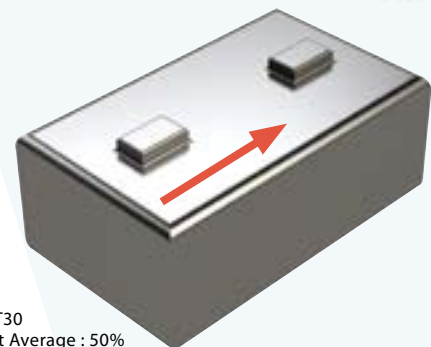
$V_c = 200 \text{ m/min}$

$n = 2,000 \text{ min}^{-1}$

$a_p \times a_e = 0.5 \sim 1.5 \times 18 \text{ mm}$

$f_z = 0.1 \sim 0.35 \text{ mm/t}$

$V_f = 400 \sim 1,400 \text{ mm/min}$



Used Machine : BT30
Machining Output Average : 50%

Machining Efficiency

MFH Harrier

$Q = 22.9 \text{ cc/min}$

Machining
Efficiency

$\times 2.4$

Competitor H

$Q = 9.6 \text{ cc/min}$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 576 cc cutting

Competitor H

CO₂
1.2 kg-CO₂

Cycle Time : 1 hour

MFH

CO₂
Emissions

58
%

0.5 kg-CO₂

Cycle Time : 25 minutes

CASE 9

Adapter FCD450

MFH Harrier



Toolholder : MFH050R-10-4T

Insert : SOMT100420ER-LD PR1510

<Cutting Conditions>

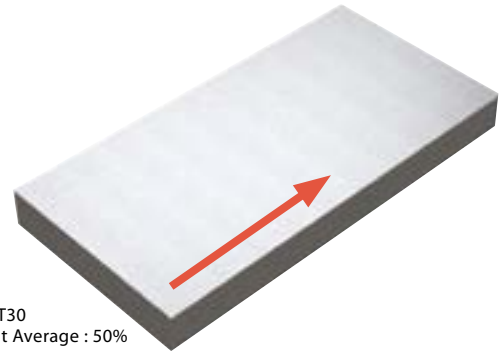
$V_c = 160 \text{ m/min}$

$n = 1,000 \text{ min}^{-1}$

$a_p \times a_e = 0.5 \times 30 \sim 50 \text{ mm}$

$f_z = 1.0 \text{ mm/t}$

$V_f = 4,000 \text{ mm/min}$



Used Machine : BT30
Machining Output Average : 50%

Machining Efficiency

MFH Harrier

$Q = 100 \text{ cc/min}$

Competitor I

$Q = 24 \text{ cc/min}$

Machining Efficiency

$\times 4.2$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 1,440 cc cutting

Competitor I

CO₂
1.2 kg-CO₂

Cycle Time : 1 hour

MFH

CO₂ Emissions
76 %

0.3 kg-CO₂

Cycle Time : 14 minutes

CASE 10

Mold SKD61

MFH Harrier



Toolholder : MFH32-S32-10-3T

Insert : SOMT100420ER-GM PR1535

<Cutting Conditions>

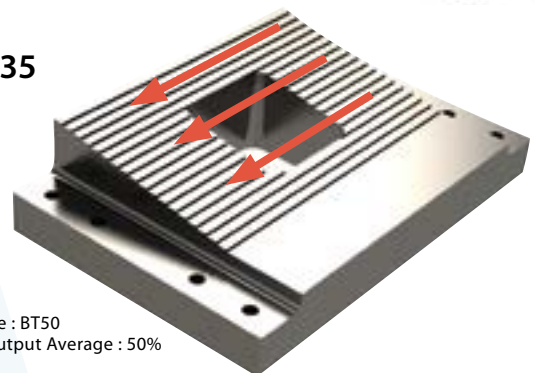
$V_c = 100 \text{ m/min}$

$n = 1,000 \text{ min}^{-1}$

$a_p \times a_e = 0.5 \times 13 \text{ mm}$

$f_z = 0.8 \text{ mm/t}$

$V_f = 2,400 \text{ mm/min}$



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Harrier

$Q = 15.6 \text{ cc/min}$

Competitor J

$Q = 10.3 \text{ cc/min}$

Machining Efficiency

$\times 1.5$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 618 cc cutting

Competitor J

CO₂
5.1 kg-CO₂

Cycle Time : 1 hour

MFH

CO₂ Emissions
34 %

3.3 kg-CO₂

Cycle Time : 40 minutes

CASE 11

Semiconductor Manufacturing Equipment SUS316L

MFH Boost

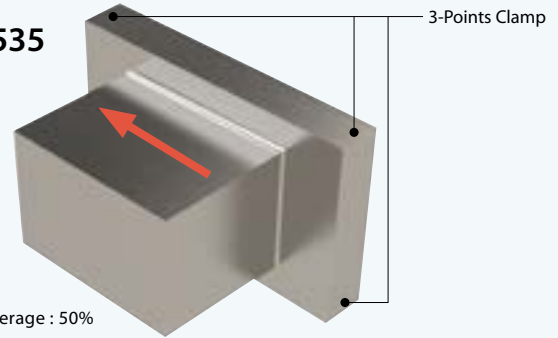


Toolholder : MFH32-S32-04-5T

Insert : LOMU040410ER-GM PR1535

<Cutting Conditions>

Vc = 100 m/min
n = 1,000 min⁻¹
ap × ae = 1.0 × 20 mm
fz = 0.6 mm/t
Vf = 3,000 mm/min
Dry



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Boost

Q = **60.0** cc/min

Machining Efficiency
×1.6

Competitor K

Q = **37.3** cc/min

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 2,238 cc cutting

Competitor K

CO₂
5.1 kg-CO₂

Cycle Time : 1 hour

MFH

CO₂ Emissions
38 %

3.2 kg-CO₂

Cycle Time : 37 minutes

CASE 12

Bearing Cap SCM435

MFH Boost



Toolholder : MFH080R-04-10T

Insert : LOMU040410ER-GM PR1535

<Cutting Conditions>

Vc = 160 m/min
n = 630 min⁻¹
ap × ae = 1.0 × 80 mm
fz = 0.70 mm/t
Vf = 4,410 mm/min
Dry



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Boost

Q = **353** cc/min

Machining Efficiency
×3.1

Competitor L

Q = **115** cc/min

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 6,900 cc cutting

Competitor L

CO₂
5.1 kg-CO₂

Cycle Time : 1 hour

MFH

CO₂ Emissions
67 %

1.7 kg-CO₂

Cycle Time : 20 minutes

CASE 13

Head FC300

MFH Boost



Toolholder : MFH40-S32-04-5T

Insert : LOMU040410ER-GM PR1510

<Cutting Conditions>

$V_c = 160 \text{ m/min}$

$n = 1,270 \text{ min}^{-1}$

$a_p \times a_e = 2.0 \times 40 \text{ mm}$

$f_z = 0.25 \text{ mm/t}$

$V_f = 1,590 \text{ mm/min}$

Dry



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Boost

$Q = 127.2 \text{ cc/min}$

Machining
Efficiency
 $\times 8.3$

Competitor M

$Q = 15.3 \text{ cc/min}$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 918 cc cutting

Competitor M

CO₂
5.1 kg-CO₂

Cycle Time : 1 hour

MFH

0.6 kg-CO₂

Cycle Time : 7 minutes

CO₂
Emissions
88 %

CASE 14

RoII SCM440

MFH Boost



Toolholder : MFH063R-04-7T-M

Insert : LOMU040410ER-GM PR1525

<Cutting Conditions>

$V_c = 160 \text{ m/min}$

$n = 810 \text{ min}^{-1}$

$a_p \times a_e = 1.5 \times 63 \text{ mm}$

$f_z = 0.3 \text{ mm/t}$

$V_f = 1,700 \text{ mm/min}$

Dry(Air)



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Boost

$Q = 160 \text{ cc/min}$

Machining
Efficiency
 $\times 2.1$

Competitor N

$Q = 75 \text{ cc/min}$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 4,500 cc cutting

Competitor N

CO₂
5.1 kg-CO₂

Cycle Time : 1 hour

MFH

2.4 kg-CO₂

Cycle Time : 28 minutes

CO₂
Emissions
53 %

CASE 15

Bearing SS400

MFH Boost

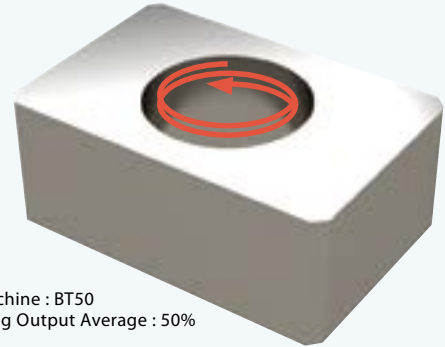


Toolholder : MFH35-M16-04-4T

Insert : LOMU040410ER-GM PR1535

<Cutting Conditions>

Vc = 200 m/min
n = 1,820 min⁻¹
ap × ae = 2.0 × 10 mm
fz = 0.44 mm/t
Vf = 3,200 mm/min
Dry



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Boost

Q = **64** cc/min

Machining
Efficiency

×2.5

Competitor O

Q = **25.5** cc/min

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 1,530 cc cutting

Competitor O

CO₂
5.1 kg-CO₂

Cycle Time : 1 hour

MFH

CO₂
Emissions

60
%

2.0 kg-CO₂

Cycle Time : 24 minutes

CASE 16

Table SUS

MFH Boost

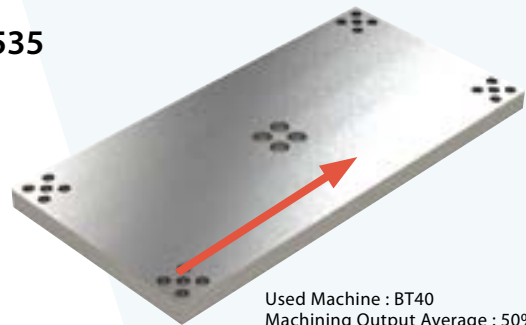


Toolholder : MFH25-S25-04-3T

Insert : LOMU040410ER-GM PR1535

<Cutting Conditions>

Vc = 140 m/min
n = 1,780 min⁻¹
ap × ae = 1.0 × 25 mm
fz = 0.5 mm/t
Vf = 2,670 mm/min
Wet



Used Machine : BT40
Machining Output Average : 50%

Machining Efficiency

MFH Boost

Q = **66.8** cc/min

Machining
Efficiency

×2.9

Competitor P

Q = **23.1** cc/min

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 1,386 cc cutting

Competitor P

CO₂
3.5 kg-CO₂

Cycle Time : 1 hour

MFH

CO₂
Emissions

65
%

1.2 kg-CO₂

Cycle Time : 21 minutes

CASE 17

Chamber SUS304

MFH Boost



Toolholder : MFH25-S25-04-3T

Insert : LOMU040410ER-GM PR1535

<Cutting Conditions>

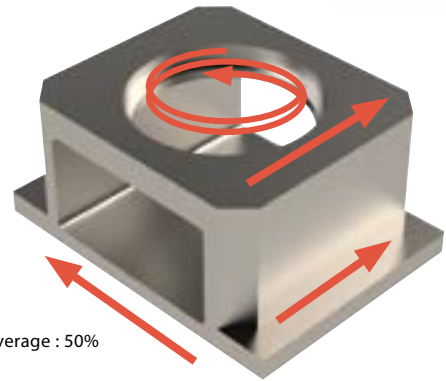
$V_c = 140 \text{ m/min}$

$n = 1,780 \text{ min}^{-1}$

$a_p \times a_e = 1.5 \times 25 \text{ mm}$

$f_z = 0.5 \text{ mm/t}$

$V_f = 2,670 \text{ mm/min}$



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Boost

$Q = 100 \text{ cc/min}$

Machining
Efficiency

$\times 6.3$

Competitor Q

$Q = 16 \text{ cc/min}$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 960 cc cutting

Competitor Q

CO₂

5.1 kg-CO_2

Cycle Time : 1 hour

MFH

CO₂
Emissions

84%

0.8 kg-CO_2

Cycle Time : 10 minutes

CASE 18

Machining Parts SKD11

MFH Boost



Toolholder : MFH28-S25-04-4T

Insert : LOMU040410ER-GM PR1525

<Cutting Conditions>

$V_c = 120 \text{ m/min}$

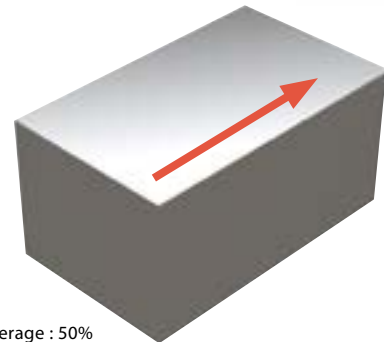
$n = 1,360 \text{ min}^{-1}$

$a_p \times a_e = 1.5 \times 15 \text{ mm}$

$f_z = 0.6 \text{ mm/t}$

$V_f = 3,280 \text{ mm/min}$

Dry



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Boost

$Q = 73.8 \text{ cc/min}$

Machining
Efficiency

$\times 2.1$

Competitor R

$Q = 35.8 \text{ cc/min}$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 2,148 cc cutting

Competitor R

CO₂

5.1 kg-CO_2

Cycle Time : 1 hour

MFH

CO₂
Emissions

52%

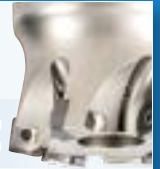
2.5 kg-CO_2

Cycle Time : 29 minutes

CASE 19

Hydraulic Part FCD400

MFH Boost



Toolholder : MFH080R-04-10T

Insert : LOMU040410ER-GM PR1535

<Cutting Conditions>

$V_c = 120 \text{ m/min}$

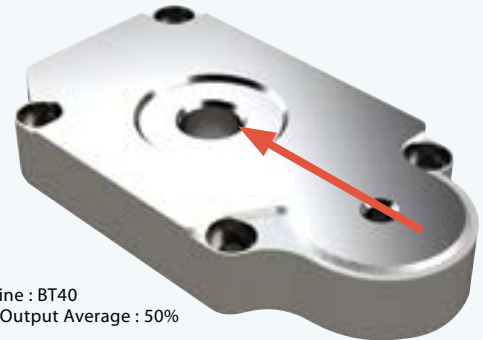
$n = 480 \text{ min}^{-1}$

$a_p = 1, 1, 0.45 \text{ mm (3 Passes)}$

$a_e = 80 \text{ mm}$

$f_z = 0.45 \text{ mm/t}$

$V_f = 2,160 \text{ mm/min}$



Used Machine : BT40
Machining Output Average : 50%

Machining Efficiency

MFH Boost

$Q = 140 \text{ cc/min}$

Machining
Efficiency
×3.0

Competitor S

$Q = 46 \text{ cc/min}$

CO₂ Emissions

Calculating CO₂ emissions compared to cycle time required for 2,760 cc cutting

Competitor S

CO₂
3.5 kg-CO₂

Cycle Time : 1 hour

MFH

CO₂
Emissions
67 %

1.1 kg-CO₂

Cycle Time : 20 minutes

CO₂ Emissions Calculations

Power Consumption

Machine Rated Power Consumption (kW)

BT30 : 5kW
BT40 : 15kW
BT50 : 22kW

×

Machining
Output Average
50%

×

CO₂ Emission
Coefficient
0.463
(kg-CO₂/kWh)

×

Cycle Time
(h)

Set the average value* for machine use, assuming that 100% is achieved when machine performance is pushed to the limit.

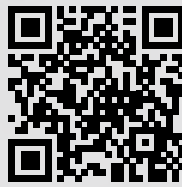
*Average Value : Processing mode varies from rough to finished, and the load is not always constant.

*CO₂ emission coefficient for fiscal 2018 in Japan calculated by the Federation of Electric Power Companies of Japan
<https://www.fepec.or.jp/environment/warming/kyouka/index.html>

= **CO₂ Emissions** (kg-CO₂)

*1 CO₂ emissions are estimated based on the CO₂ emission coefficient (0.463 kg-CO₂/kWh) announced by the Federation of Electric Power Companies of Japan.

*2 Machining efficiency and CO₂ emissions are rounded to the first decimal place.



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