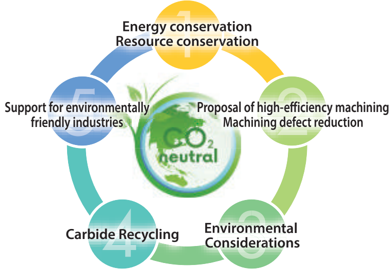
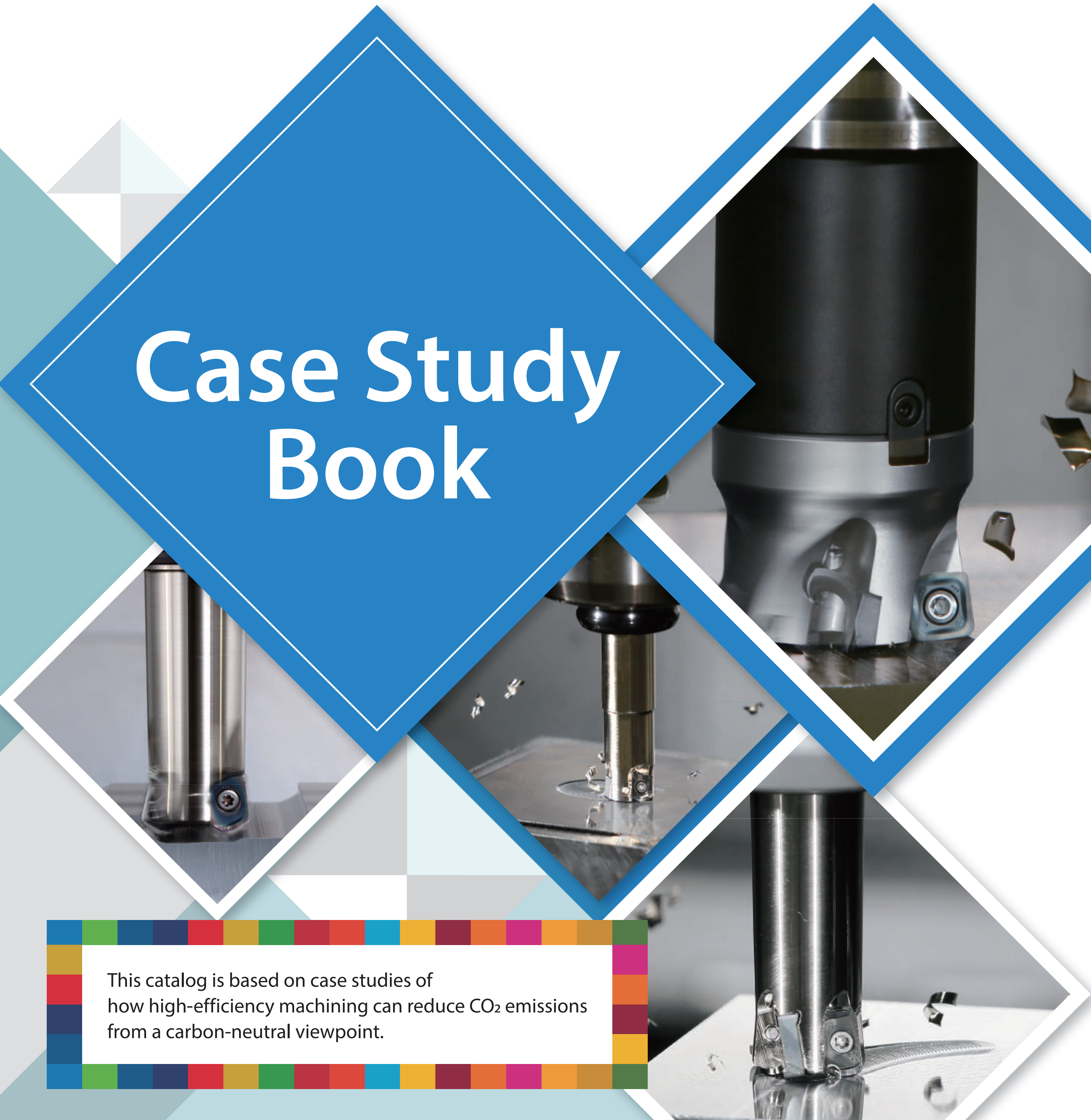
KYOCERA

High Efficiency and High Feed Cutter
MFH Series
Case Studies



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 CO_2 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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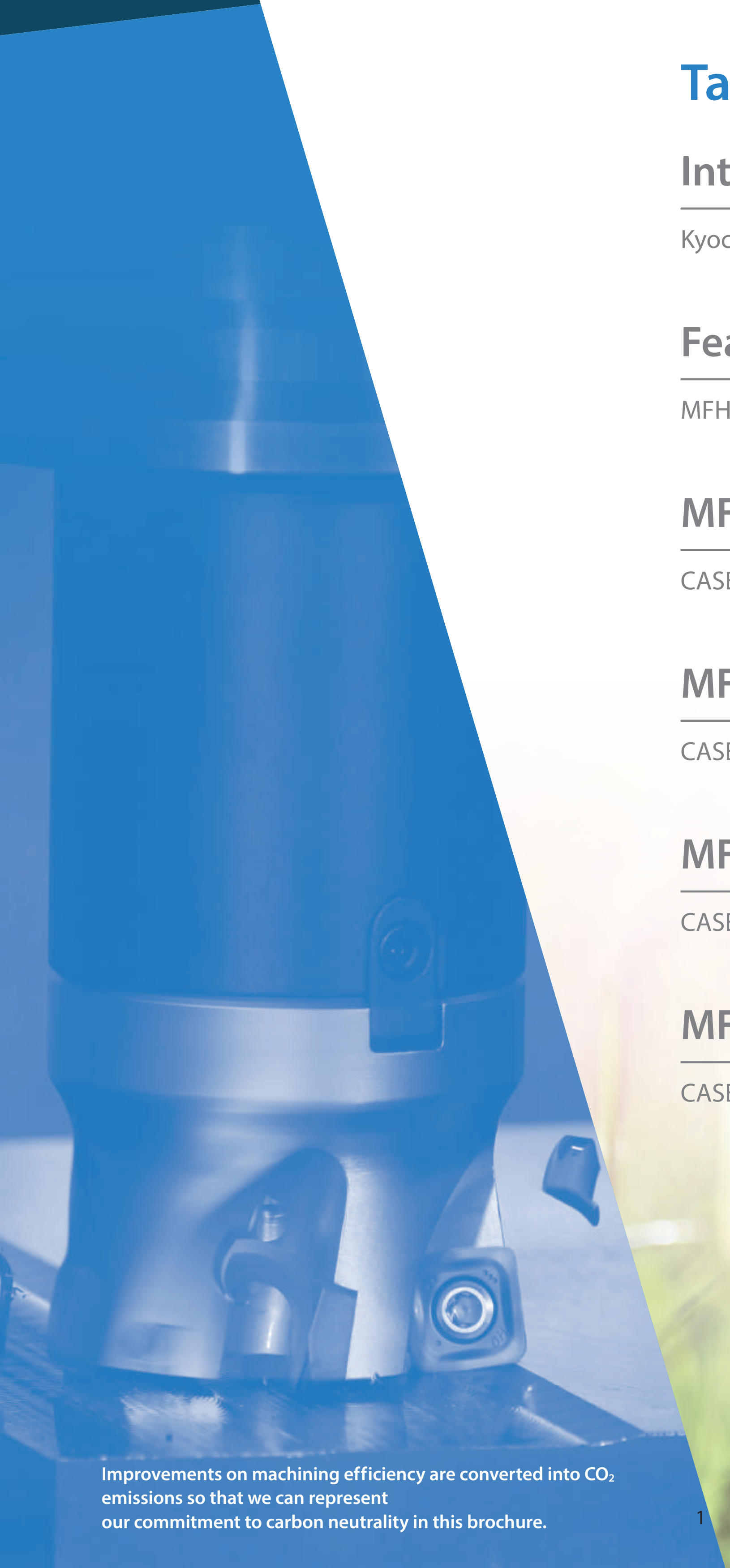


Improvements on machining efficiency are converted into CO_2 emissions so that we can represent
our commitment to carbon neutrality in this brochure.

Kyocera Group Sustainability

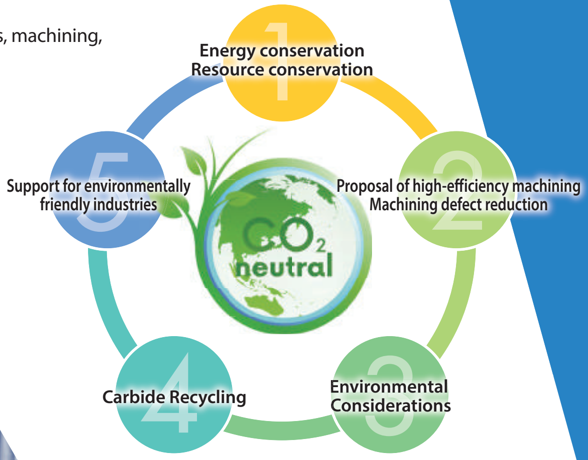
The Management Rationale of the Kyocera Group is "To provide opportunities for the material and intellectual growth of all our employees, and through our joint efforts, contribute to the advancement of society and humankind." We believe that upholding our Management Rationale will naturally lead to achieving 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.

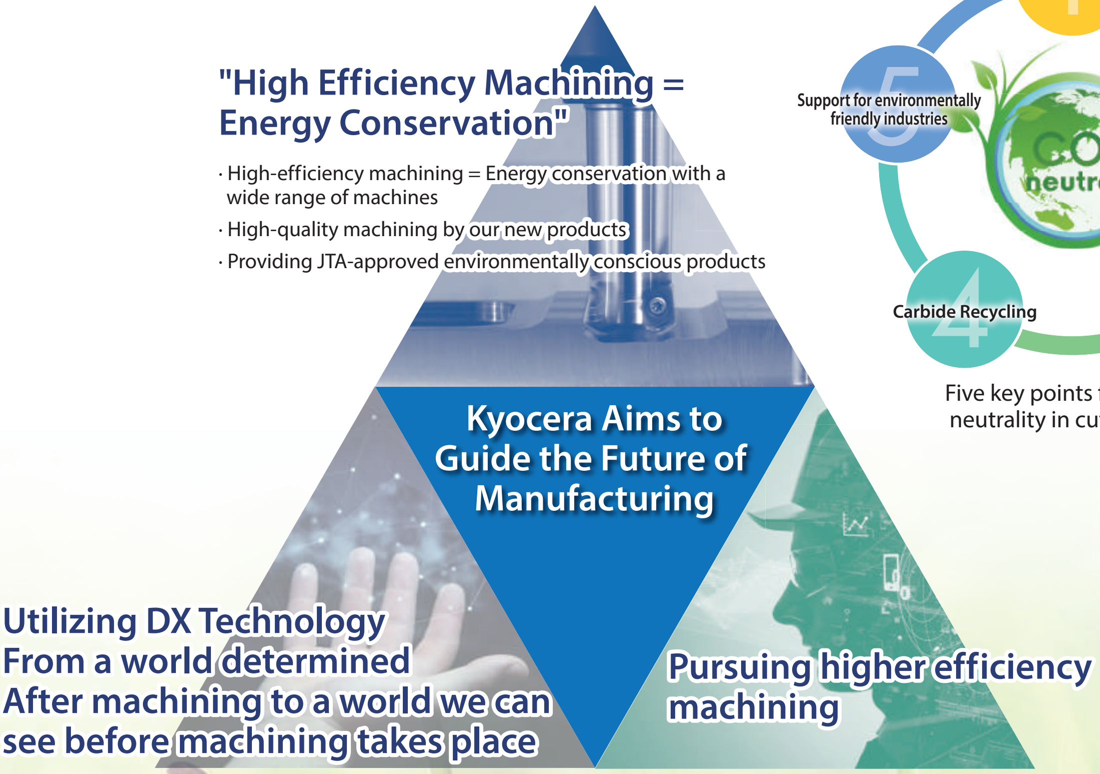
Read here for website of the Kyocera Group Sustainability

Carbon Neutrality in Kyocera Cutting Tools Business

Kyocera Industrial Tool Group will strive to minimize CO_2 emissions throughout the entire Cutting Tool value chain, from product development, procurement, distribution, sales, machining, resource recovery and reuse, and disposal.



Five key points for carbon neutrality in cutting tools



"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

Movie

Point 1 Reduce Cutting Force at Initial Impact with Stable Machining, Excellent Chattering Resistance, and a Convex Helical Edge Design

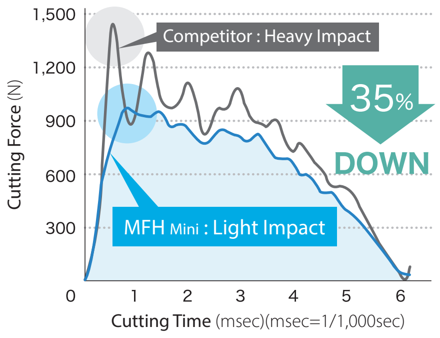

MFH Micro


MFH Mini


MFH Harrier


MFH Boost

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



Cutting Conditions : Vc = 150 m/min, ap × ae = 0.5 × 8 mm, fz = 1.0 mm/t, Dry
Cutter Dia. DC = ø16 mm Workpiece : S50C

MFH Micro

Low Resistance and Durable Against Chatter for Highly Efficient Machining

MFH Boost

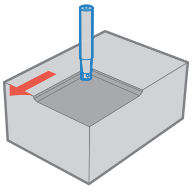
High Feed Milling with Larger Depths of Cut Available for a Variety of Machining Applications

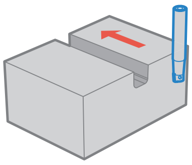
Movie

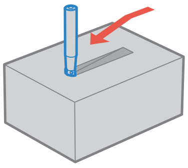
MFH Usage

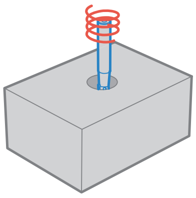
Point	General Use Size (Dia.)	BT30	
Replaces Solid End Mills to Reduce Machining Costs Mold SKD	10 12	 MFH Micro ø8 ~ ø16	
Cutting Force Oriented Small Parts FCD/SCM Semiconductor Related SUS	20 25	 MFH Mini ø16 ~ ø50	
Cutting Edge Strength Oriented Plate SS400 Frame FCD/FC	50 63		
Pocketing Excellent Side Surface Finish Hydraulic Component SUS316 Cast Iron Case SC450	25		

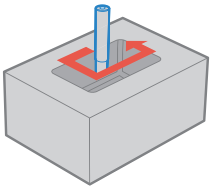
Wide Application Range for Multiple Metalworking Processes

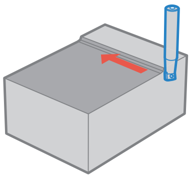

Face Milling & Shouldering

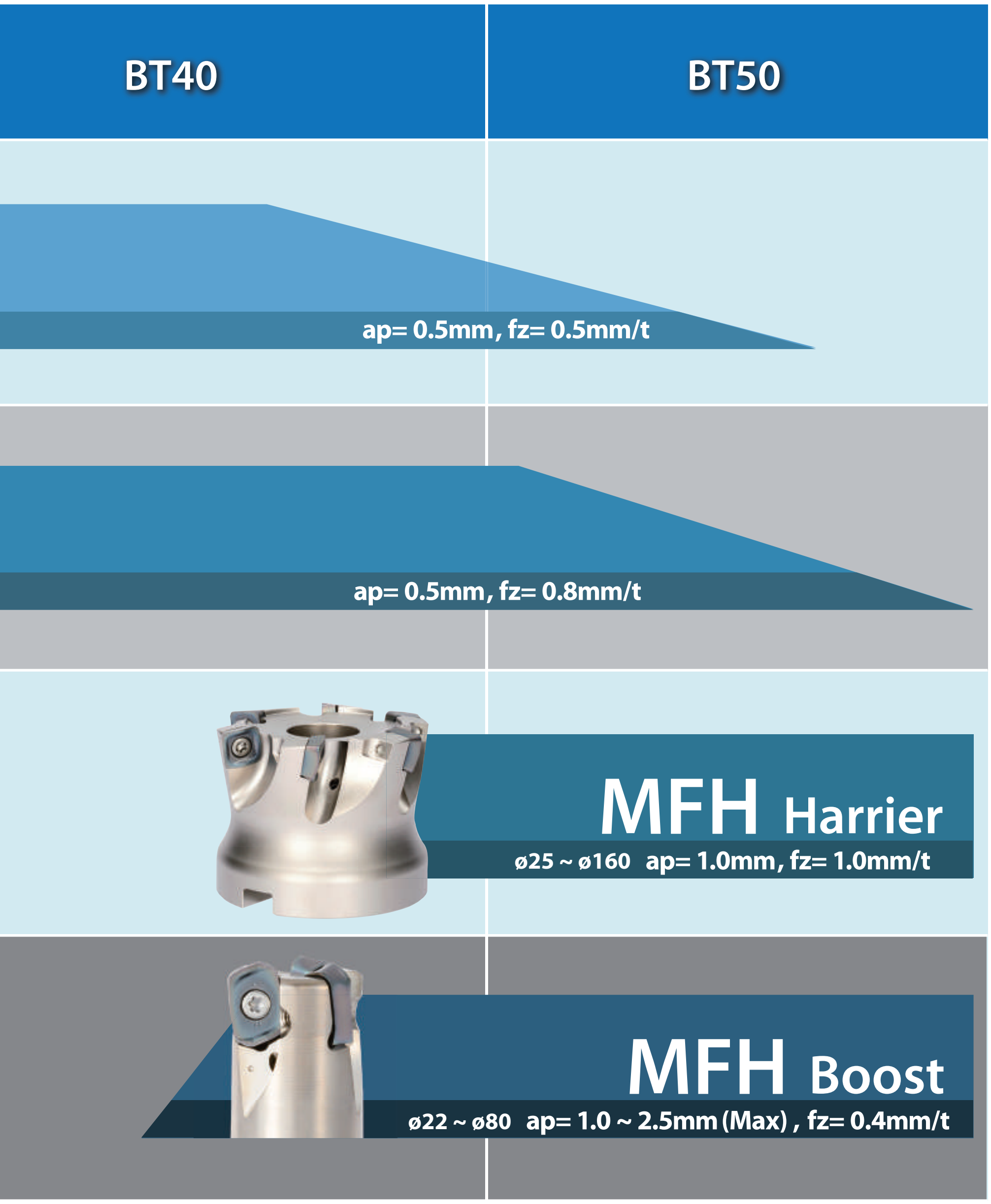

Slotting


Ramping


Helical Milling


Pocketing


Contouring



MFH **Mini**

Economical Inserts with
4 Cutting Edges

MFH **Harrier**

4 Different Insert Designs Offer a
Variety of Machining Options

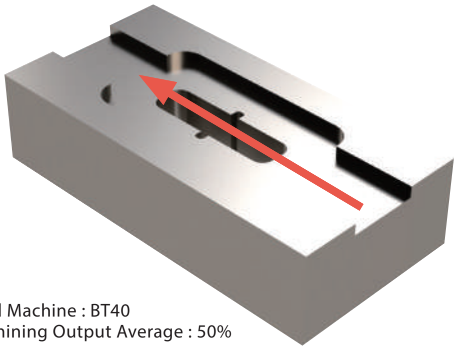
CASE 1

Mold SKD 61

MFH Micro

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

<Cutting Conditions>
Vc = 90 m/min
n = 2,400 min^{-1}
ap × ae = 0.3 × ~7.0 mm
fz = 0.27 mm/t
Vf = 1,930 mm/min
Dry



Used Machine : BT40
Machining Output Average : 50%

Machining Efficiency

MFH Micro
Q = **4.1** cc/min

Competitor A
Q = **3.0** cc/min

Machining Efficiency ×1.4

CO_2 Emissions

Calculating CO_2 emissions compared to cycle time required for 180 cc cutting

Competitor A
CO_2
3.5 kg-CO_2
Cycle Time : 1 hour

MFH
2.6 kg-CO_2
Cycle Time : 44 minutes

CO_2 Emissions **26** %

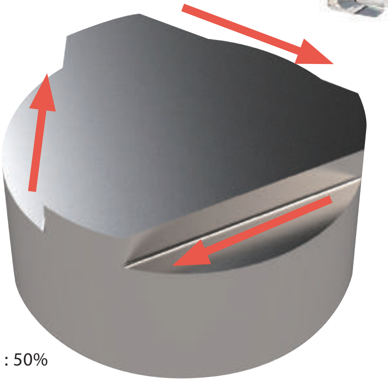
CASE 2

Industrial Machining Parts SUS 440C

MFH Micro

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

<Cutting Conditions>
Vc = 180 m/min
n = 3,580 min^{-1}
ap × ae = 0.4 × 8 mm
fz = 0.4 mm/t
Vf = 5,730 mm/min
Wet



Used Machine : BT40
Machining Output Average : 50%

Machining Efficiency

MFH Micro
Q = **18.3** cc/min

Competitor B
Q = **12.2** cc/min

Machining Efficiency ×1.5

CO_2 Emissions

Calculating CO_2 emissions compared to cycle time required for 732 cc cutting

Competitor B
CO_2
3.5 kg-CO_2
Cycle Time : 1 hour

MFH
2.3 kg-CO_2
Cycle Time : 40 minutes

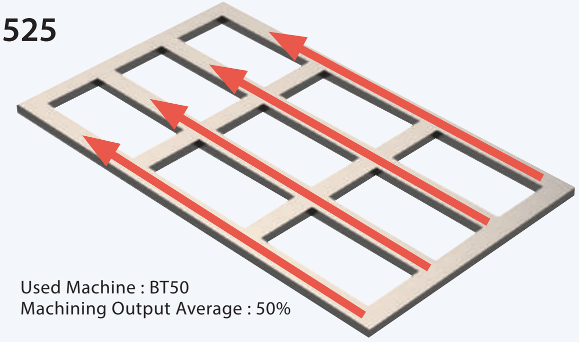
CO_2 Emissions **34** %

CASE 3 Frame SUS304

MFH Mini

Toolholder : MFH20-S20-03-4T
Insert : LOGU030310ER-GM PR1525

<Cutting Conditions>
Vc = 110 m/min
n = 1,750 min^{-1}
ap × ae = 0.8 × 20 mm
fz = 0.5 mm/t
Vf = 3,500 mm/min
Wet



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Mini
Q = 56 cc/min

Competitor C
Q = 28 cc/min

Machining Efficiency ×2.0

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

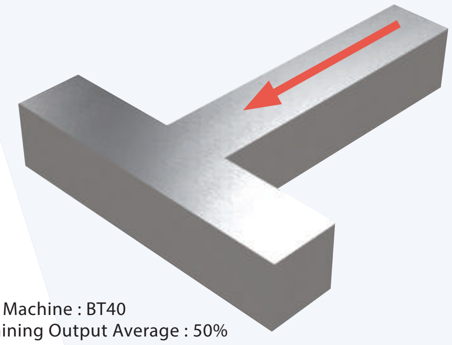
CO₂ Emissions 50 %

CASE 4 Aircraft Parts Ti-6Al-4 V

MFH Harrier

Toolholder : MFH063R-10-6T-27M
Insert : SOMT100420ER-GM PR1535

<Cutting Conditions>
Vc = 50 m/min
n = 250 min^{-1}
ap × ae = 1.0 × ~38 mm
fz = 0.3 mm/t
Vf = 450 mm/min
Wet (External coolant)



Used Machine : BT40
Machining Output Average : 50%

Machining Efficiency

MFH Harrier
Q = 17.1 cc/min

Competitor D
Q = 8.3 cc/min

Machining Efficiency ×2.1

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

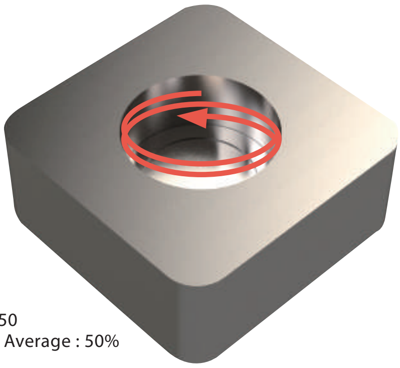
Head SCM

MFH Harrier

Toolholder : MFH40-S32-10-4T-250
Insert : SOMT100420ER-GM PR1525

<Cutting Conditions>

Vc = 160 m/min
n = 1,270 min^{-1}
ap × ae = 0.5 × 40 mm
fz = 0.98 mm/t
Vf = 5,000 mm/min
Wet



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Harrier

Q = **100** cc/min

Competitor E

Q = **54** cc/min

Machining Efficiency ×1.9

CO_2 Emissions

Calculating CO_2 emissions compared to cycle time required for 3,240 cc cutting

Competitor E

CO_2 5.1 kg-CO_2

Cycle Time : 1 hour

MFH

2.7 kg-CO_2

Cycle Time : 32 minutes

CO_2 Emissions 46 %

CASE 6

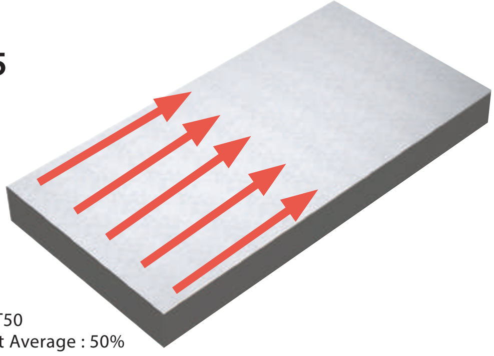
Machining Tool Parts FC300

MFH Harrier

Toolholder : MFH100R-14-7T
Insert : SOMT140520-ER-GM PR1525

<Cutting Conditions>

Vc = 180 m/min
n = 570 min^{-1}
ap × ae = 1.5 × 62 mm
fz = 1.1 mm/t
Vf = 4,390 mm/min
Dry



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Harrier

Q = **408** cc/min

Competitor F

Q = **179** cc/min

Machining Efficiency ×2.3

CO_2 Emissions

Calculating CO_2 emissions compared to cycle time required for 10,740 cc cutting

Competitor F

CO_2 5.1 kg-CO_2

Cycle Time : 1 hour

MFH

2.2 kg-CO_2

Cycle Time : 26 minutes

CO_2 Emissions 56 %

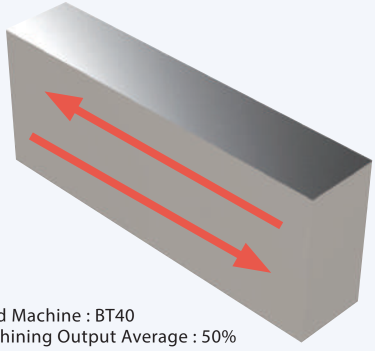
CASE 7 Generator Parts SUS

MFH Harrier

Toolholder : MFH100R-14-6T
Insert : SOMT140520ER-GM PR1535

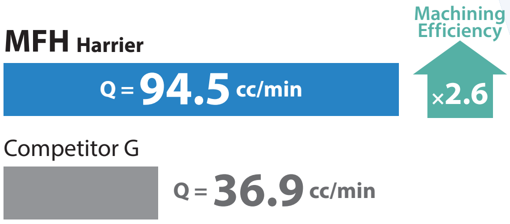
<Cutting Conditions>

Vc = 220 m/min
n = 700 min^{-1}
ap × ae = 1.5 × 50 mm
fz = 0.3 mm/t
Vf = 1,260 mm/min
Dry



Used Machine : BT40
Machining Output Average : 50%

Machining Efficiency



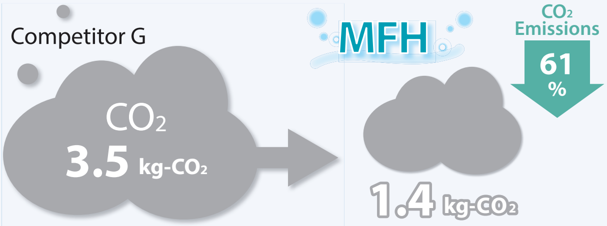
MFH Harrier Q = 94.5 cc/min

Competitor G Q = 36.9 cc/min

Machining Efficiency ×2.6

CO_2 Emissions

Calculating CO_2 emissions compared to cycle time required for 2,214 cc cutting



Competitor G: CO_2 3.5 kg-CO_2 — Cycle Time : 1 hour

MFH: 1.4 kg-CO_2 — Cycle Time : 23 minutes

CO_2 Emissions 61 %

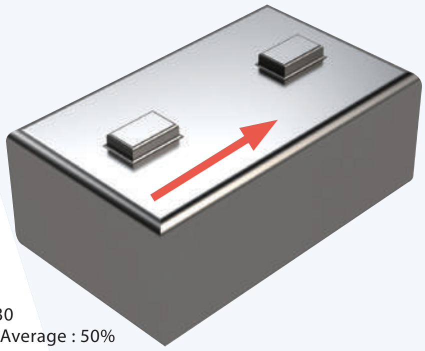
CASE 8 Industrial Machining Parts SUS430

MFH Harrier

Toolholder : MFH32-S32-10-2T
Insert : SOMT100420ER-FL PR1535

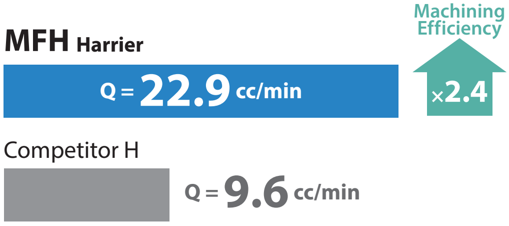
<Cutting Conditions>

Vc = 200 m/min
n = 2,000 min^{-1}
ap × ae = 0.5~1.5 × 18 mm
fz = 0.1~0.35 mm/t
Vf = 400~1,400 mm/min



Used Machine : BT30
Machining Output Average : 50%

Machining Efficiency



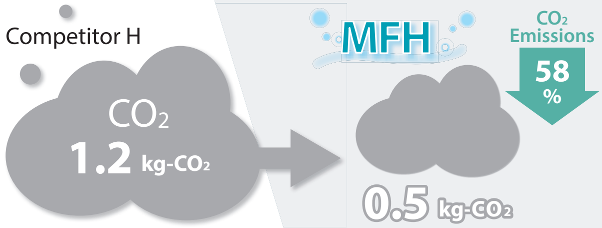
MFH Harrier Q = 22.9 cc/min

Competitor H Q = 9.6 cc/min

Machining Efficiency ×2.4

CO_2 Emissions

Calculating CO_2 emissions compared to cycle time required for 576 cc cutting



Competitor H: CO_2 1.2 kg-CO_2 — Cycle Time : 1 hour

MFH: 0.5 kg-CO_2 — Cycle Time : 25 minutes

CO_2 Emissions 58 %

CASE 9

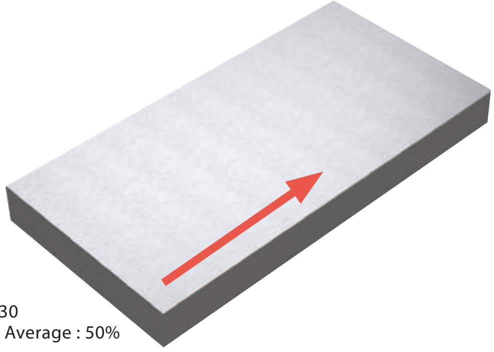
Adapter FCD450

MFH Harrier

Toolholder : MFH050R-10-4T
Insert : SOMT100420ER-LD PR1510

<Cutting Conditions>

Vc = 160 m/min
n = 1,000min^{-1}
ap × ae = 0.5 × 30~50 mm
fz = 1.0 mm/t
Vf = 4,000 mm/min



Used Machine : BT30
Machining Output Average : 50%

Machining Efficiency

MFH Harrier
Q = **100** cc/min

Competitor I
Q = **24** cc/min

Machining Efficiency ×4.2

CO$_2$ Emissions

Calculating CO$_2$ emissions compared to cycle time required for 1,440 cc cutting

Competitor I
CO$_2$ **1.2** kg-CO$_2$
Cycle Time : 1 hour

MFH
0.3 kg-CO$_2$
Cycle Time : 14 minutes

CO$_2$ Emissions **76** %

CASE 10

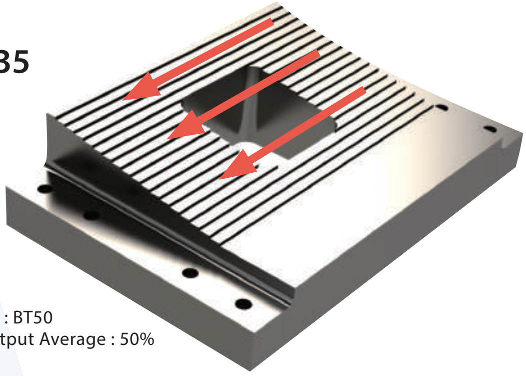
Mold SKD61

MFH Harrier

Toolholder : MFH32-S32-10-3T
Insert : SOMT100420ER-GM PR1535

<Cutting Conditions>

Vc = 100 m/min
n = 1,000 min^{-1}
ap × ae = 0.5 × 13 mm
fz = 0.8 mm/t
Vf = 2,400 mm/min



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Harrier
Q = **15.6** cc/min

Competitor J
Q = **10.3** cc/min

Machining Efficiency ×1.5

CO$_2$ Emissions

Calculating CO$_2$ emissions compared to cycle time required for 618 cc cutting

Competitor J
CO$_2$ **5.1** kg-CO$_2$
Cycle Time : 1 hour

MFH
3.3 kg-CO$_2$
Cycle Time : 40 minutes

CO$_2$ Emissions **34** %

CASE 11 Semiconductor Manufacturing Equipment SUS316L

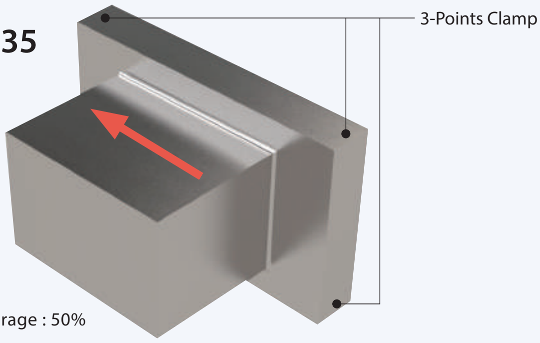
MFH Boost

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

CO_2 Emissions

Calculating CO_2 emissions compared to cycle time required for 2,238 cc cutting

Competitor K

CO_2 5.1 kg-CO_2

Cycle Time : 1 hour

MFH

CO_2 Emissions 38 %

3.2 kg-CO_2

Cycle Time : 37 minutes

CASE 12 Bearing Cap SCM435

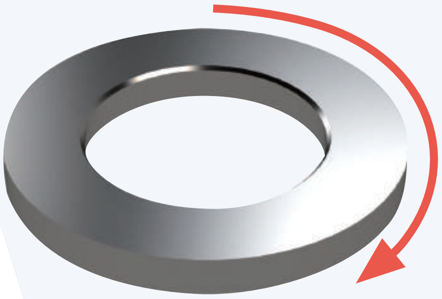
MFH Boost

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

CO_2 Emissions

Calculating CO_2 emissions compared to cycle time required for 6,900 cc cutting

Competitor L

CO_2 5.1 kg-CO_2

Cycle Time : 1 hour

MFH

CO_2 Emissions 67 %

1.7 kg-CO_2

Cycle Time : 20 minutes

CASE 13

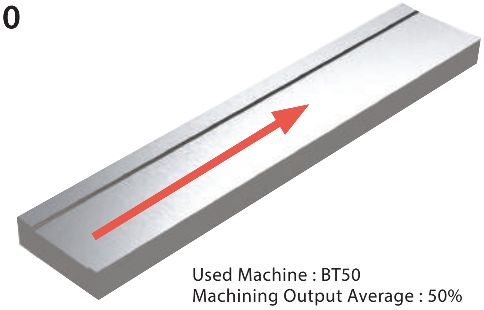
Head FC300

MFH Boost

Toolholder : MFH40-S32-04-5T
Insert : LOMU040410ER-GM PR1510

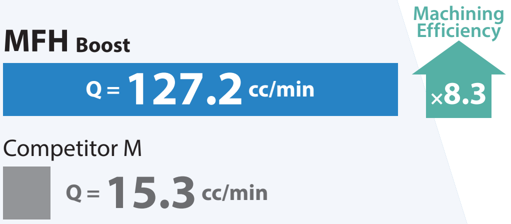
<Cutting Conditions>

Vc = 160 m/min
n = 1,270 min^{-1}
ap × ae = 2.0 × 40 mm
fz = 0.25 mm/t
Vf = 1,590 mm/min
Dry



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency



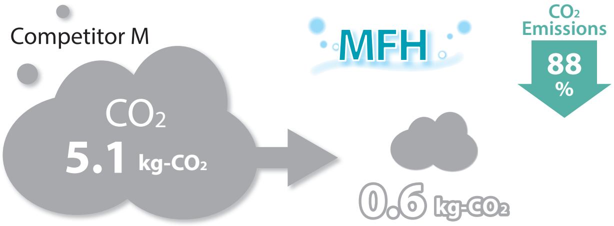
MFH Boost
Q = 127.2 cc/min

Competitor M
Q = 15.3 cc/min

Machining Efficiency
×8.3

CO_2 Emissions

Calculating CO_2 emissions compared to cycle time required for 918 cc cutting



Competitor M
CO_2
5.1 kg-CO_2
Cycle Time : 1 hour

MFH
0.6 kg-CO_2
Cycle Time : 7 minutes

CO_2 Emissions
88 %

CASE 14

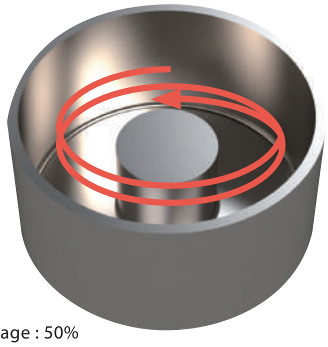
Roll SCM440

MFH Boost

Toolholder : MFH063R-04-7T-M
Insert : LOMU040410ER-GM PR1525

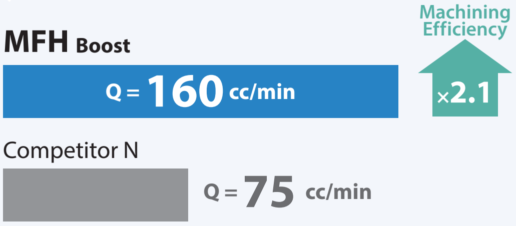
<Cutting Conditions>

Vc = 160 m/min
n = 810 min^{-1}
ap × ae = 1.5 × 63 mm
fz = 0.3 mm/t
Vf = 1,700 mm/min
Dry(Air)



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency



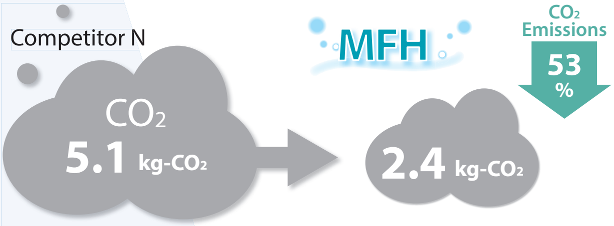
MFH Boost
Q = 160 cc/min

Competitor N
Q = 75 cc/min

Machining Efficiency
×2.1

CO_2 Emissions

Calculating CO_2 emissions compared to cycle time required for 4,500 cc cutting



Competitor N
CO_2
5.1 kg-CO_2
Cycle Time : 1 hour

MFH
2.4 kg-CO_2
Cycle Time : 28 minutes

CO_2 Emissions
53 %

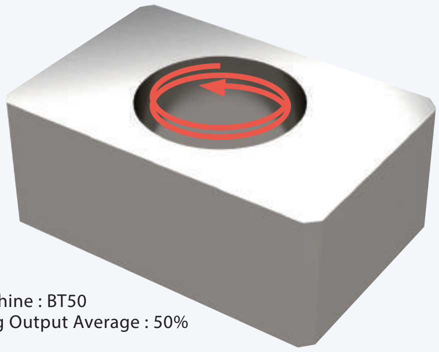
CASE 15

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

Competitor O
Q = **25.5** cc/min

Machining Efficiency ×2.5

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
2.0 kg-CO₂
Cycle Time : 24 minutes

CO₂ Emissions **60** %

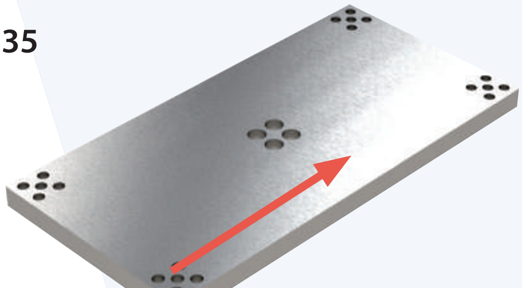
CASE 16

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

Competitor P
Q = **23.1** cc/min

Machining Efficiency ×2.9

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
1.2 kg-CO₂
Cycle Time : 21 minutes

CO₂ Emissions **65** %

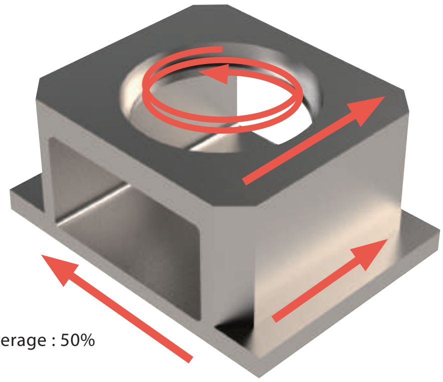
CASE 17

Chamber SUS304

MFH Boost

Toolholder : MFH25-S25-04-3T
Insert : LOMU040410ER-GM PR1535

<Cutting Conditions>
Vc = 140 m/min
n = 1,780 min^{-1}
ap × ae = 1.5 × 25 mm
fz = 0.5 mm/t
Vf = 2,670 mm/min



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Boost
Q = **100** cc/min

Machining Efficiency
×6.3

Competitor Q
Q = **16** cc/min

CO$_2$ Emissions

Calculating CO$_2$ emissions compared to cycle time required for 960 cc cutting

Competitor Q
CO$_2$
5.1 kg-CO$_2$
Cycle Time : 1 hour

MFH
0.8 kg-CO$_2$
Cycle Time : 10 minutes

CO$_2$ Emissions
84 %

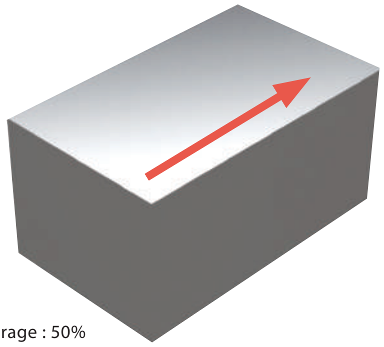
CASE 18

Machining Parts SKD11

MFH Boost

Toolholder : MFH28-S25-04-4T
Insert : LOMU040410ER-GM PR1525

<Cutting Conditions>
Vc = 120 m/min
n = 1,360 min^{-1}
ap × ae = 1.5 × 15 mm
fz = 0.6 mm/t
Vf = 3,280 mm/min
Dry



Used Machine : BT50
Machining Output Average : 50%

Machining Efficiency

MFH Boost
Q = **73.8** cc/min

Machining Efficiency
×2.1

Competitor R
Q = **35.8** cc/min

CO$_2$ Emissions

Calculating CO$_2$ emissions compared to cycle time required for 2,148 cc cutting

Competitor R
CO$_2$
5.1 kg-CO$_2$
Cycle Time : 1 hour

MFH
2.5 kg-CO$_2$
Cycle Time : 29 minutes

CO$_2$ Emissions
52 %

CASE 19

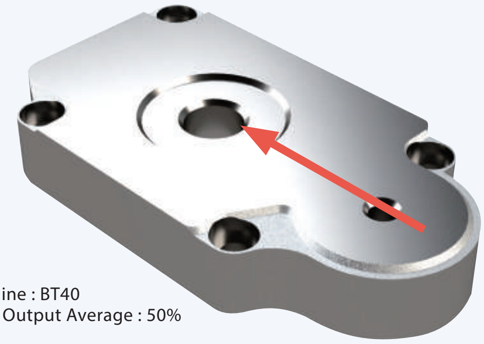
Hydraulic Part FCD400

MFH Boost

Toolholder : MFH080R-04-10T
Insert : LOMU040410ER-GM PR1535

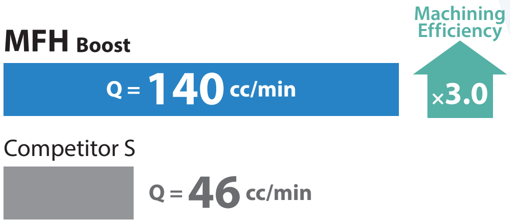
<Cutting Conditions>

Vc = 120 m/min
n = 480 min^{-1}
ap = 1, 1, 0.45 mm (3 Passes)
ae = 80 mm
fz = 0.45 mm/t
Vf = 2,160 mm/min



Used Machine : BT40
Machining Output Average : 50%

Machining Efficiency



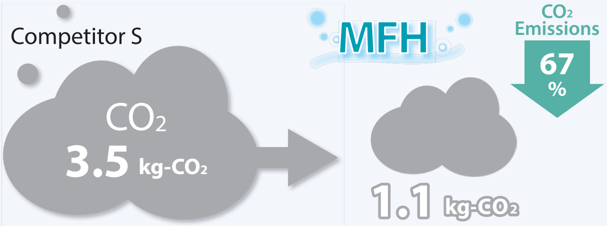
MFH Boost
Q = 140 cc/min

Competitor S
Q = 46 cc/min

Machining Efficiency ×3.0

CO₂ Emissions

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



Competitor S
CO₂
3.5 kg-CO₂

MFH
1.1 kg-CO₂

CO₂ Emissions 67 %

Cycle Time : 1 hour
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-CO$_2$/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.fepc.or.jp/environment/warming/kyouka/index.html

= CO$_2$ Emissions (kg-CO$_2$)

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*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.

High Feed and
Large Depth of Cut Milling

MFH Boost

The Newest Addition to the MFH Series

KYOCERA Corporation

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