



XEBEC Back Burr Cutter & Path™

Instruction Manual

For Machining Center

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Thank you for your purchase of XEBEC Technology “XEBEC Back Burr Cutter & Path”. Before use, please be sure to read the contents of this manual carefully and use the product correctly. After reading, store in a safe place that is readily available for reference by the operator.

SAFETY PRECAUTIONS

Be sure to read.

The meanings of the indications and symbols related to matters which must be observed in order to ensure the safety of this product are as explained below.

Be sure to observe the contents of this manual.

Using the product in a way that is not consistent with the contents of this manual may result in serious injury or death.

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury

NOTICE

NOTICE is used to address practices not related to physical injury

Symbols



This is the safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

WARNING

- Check that the Cutter is free of any abnormalities before using it.

If there is chipping, significant wear, or other Cutter abnormality, there is the risk that it may be damaged and pieces may fly off during use.

- **DO NOT** touch the Cutter while it is rotating.

Before rotating the Cutter, be sure to close the equipment door and take other necessary action.

- If oscillation or other abnormality occurs during use, discontinue use immediately.

This is dangerous and there is the risk of Cutter falling off, breaking, or rupturing.

- Use protective gloves and other protective gear when touching the Cutter.

There is a risk of injury and burns if the Cutter blade is touched with bare hands.



Use of protective equipment

Wear personal protective gear including goggles, masks, gloves, and earmuffs to prevent loss of sight, injury, or lung damage caused by damaged parts flying off the product.

Wear clothing with long sleeves or other clothing that does not expose the skin, and fasten the cuffs and hems tightly.



Precaution regarding cutting particles

Fragments, cutting particles, and other substances generated during work will be scattered into the surrounding area. Be sure to use a dust collector or other means to collect them.



Attention to the work area

- Install an enclosure so that persons other than the operator do not enter the work area, and ensure that all persons, if any, in the work area are wearing protective equipment.
- In particular be careful that children do not enter the work area.
- Keep the floor of the work area clean at all times to prevent the risk of slipping or tripping on dust, cutting particles, oil, water, or other substance.
- There is the risk of fire caused by heating, sparks, or other factor resulting from use of the product. Do not use the product close to a flammable liquid or in an explosive atmosphere. Also be sure to enact fire prevention measures.

WARNING

- **Be sure to check the dimensions prior to use.**
There is the risk of injury or burns if a person touches the Cutter blade directly with a hand.
- **During use, the workpiece must be fastened securely to the machine tool or jig so that it does not move.**
If the workpiece moves during machining, there is the risk of damage to the Cutter or flying pieces of the workpiece.
- **Before performing actual machining, use no-load running, machining simulation software, or other means to check the operation until it is confirmed that there are no errors in the Path.**
If there is an error in the Path, there is the risk of damage to the Cutter or workpiece.
- **Before use, set the tool length offset using the tip of the Cutter in point group data of the Path.**
Use of a Path with tool length offset that does not use the tip of the Cutter is dangerous and there is the risk of Cutter breakage or machine accident.
- **Perform positioning correctly to minimize the accumulative error in the position and size of each hole.**
There is the risk of breakage caused by interference with the Cutter head. In particular, set tool length offset using the tip of the Cutter. If you continue to use the product exceeding the accumulative error allowance, the Cutter may break.
- **When installing onto the tool holder, install with runout of 0.01 mm or less.**
If runout is large when the tool is installed, there is the risk of chipping and breakage when the tool starts rotating and when it cuts into the workpiece.
- **Use the correct controlling mode (incremental command, absolute command) for the point group data that is used.**
Use point group data with the correct command type for the product type you are using. Unexpected operation of the machine may result in damage to the product, jig, and machine.

NOTICE

If you continue to use the product exceeding the accumulative error allowance, there may be a deterioration in the quality of the edge after removing burrs.

SAFETY PRECAUTIONS

Be sure to read.

Pre-work inspection

WARNING

- **Select and use a coolant/cutting fluid that is suitable for the purpose.**
Depending on the type of coolant/cutting fluid, there is the risk of fire caused by overheating, sparks, or other problem. If heating or sparks are expected, be sure to implement fire prevention measures.

NOTICE

- **Check in advance that the Cutter shank and tool holder do not contact the workpiece or other objects.**
Select and install a Cutter with consideration for the movement path of this product.
- **If the product will be used for wet machining, adjust so that the coolant/cutting fluid properly contacts the blade tip.**
If the amount of coolant/cutting fluid contacting the tip is not sufficient, the blade tip temperature will rise and its tool life may be shortened.
- **Suppress the size of burrs occurring at the previous machining process as small as possible.**
If the burr root thickness from the previous process is larger than the depth of cut set in the Path, there is the risk that burrs will not be fully removed.

Precautions for use

WARNING

- **DO NOT use at the excessive rotational speed.**
The rotational speed for this product varies depending on the Cutter size. If used at excessive rotational speed, there is the risk of Cutter chipping or breakage during cutting.
- **DO NOT use the product rotating in the reverse direction.**
This product is ordinarily used rotating clockwise. Using the product rotating counterclockwise is dangerous and the Cutter is certain to be damaged when it cuts into the workpiece.
- **DO NOT use this product with manual tools or similar equipment.**
This product is a dedicated tool for use only with numerical control processing machines. Using the product with a manual tool or similar equipment is dangerous and there is the risk of injury resulting from damage to the Cutter.
- **DO NOT use this product for any purpose other than deburring or chamfering.**
This product was designed for workpiece deburring and chamfering. If it is used for curved face machining or other machining which it was not designed for, there is the risk that the Cutter will be unable to withstand the load and will break.

NOTICE

- **If the location of deburring has an intermittent shape, check the conditions of use carefully.**
If there is a notch or other intermittent shape at the location of deburring, chipping of the blade will be more likely, and depending on the depth of cut the Cutter tool life may be significantly reduced.

Regular maintenance

- When changing the Cutter, remove any dirt from the tool holder grip and Cutter shank, and keep these parts clean.

Introduction

Product overview Product contents


The XEBEC Back Burr Cutter and XEBEC Path for Back Burr Cutter are a dedicated cutter and dedicated path specifically for the purpose of removing burrs at crossing edges that are produced by hole drilling.

Notes when using the XEBEC Path for Back Burr Cutter

The XEBEC Path for Back Burr Cutter may be used only by those customers who at the time of purchase agreed to the terms of use. These terms prohibit use with any equipment other than the XEBEC Back Burr Cutter, and also prohibit the transfer or provision of the generated paths to another company.

Be sure to observe these terms of use.

This product is composed of the following parts. Please check the product contents at the time of purchase.

- XEBEC Back Burr Cutter 
- XEBEC Path for Back Burr Cutter (Delivery with data. Indicated in this manual as “XEBEC Back Burr Path”.)
- Path code sheet

Features

XEBEC Back Burr Cutter

- **Use of micro-grain cemented carbide**
Higher cutting ability and longer tool life
- **Available in heat resistant AlTiCrN variants and uncoated variants with sharp cutting edges**
AlTiCrN coated variants are suitable with difficult-to-machine materials such as medium tensile steel (S45C, AISI1045, C45), stainless steel, titanium and Inconel alloys. Uncoated variants feature sharp cutting edges that are effective in preventing built-up edges and formation of secondary burrs, even with plastics and aluminum (uncoated variants are available only in Regular type).
- **Optimal blade shape for deburring**
A helical Cutter is used for better cutting performance and fewer secondary burrs.
- **3 types of neck lengths**
Available in three types of neck lengths, Short type, Regular type, and Straight type, making this tool suitable with wide range of edges. Short type features 3 blades and a short neck length, only 3 times the Cutter diameter, enabling rapid feed rate and longer tool life. Regular type and Straight type feature longer neck lengths that enable longer reach, making deburring of deep holes possible. The neck length is 5 times the Cutter diameter with Regular type and 15 times the Cutter diameter with Straight type.

XEBEC Back Burr Path

- **Generation of the optimal machining paths for deburring**
Machining with the optimal cutting for 3D free curved surface edges suppresses the occurrence of secondary burrs. The best depth of cut for the designated cutting width is calculated to produce an uniform machining shape.
- **Capable of deburring a variety of deburring holes including orthogonal cross holes, off-center cross holes, and flat surface cross holes.**
With orthogonal cross holes and off-center cross holes (examples: P6, Figure 2-1), a Path is generated that can deburr cross holes at the parts indicated by the red lines, which were previously difficult to deburr.
- **Longer tool life for lower running costs**
The optimal machining path reduces the amount of cutting, reducing wear caused by heating. The entire blade is used while changing the point that contacts the workpiece, extending the Cutter tool life.

Introduction (continued)

XEBEC Back Burr Path

- **Fast deburring with contour machining operation**
Can complete deburring in 1/5 - 1/10 the machining time required with a spring-type deburring tool.
- **Can perform deburring at multiple locations with a single direction approach.**
Thanks to the long neck length, a Path is generated which allows 1 Cutter to deburr multiple locations with an approach from a single direction.

Introduction (continued)

Supported machine tools

Can be used with numerical processing machines that are capable of XYZ 3-Axis simultaneous control.

Axis orientation of machining centers where XEBEC Back Burr Path can be used

As shown in Figure 1, an axis configuration where the Cutter is inserted in the Z- direction is necessary.

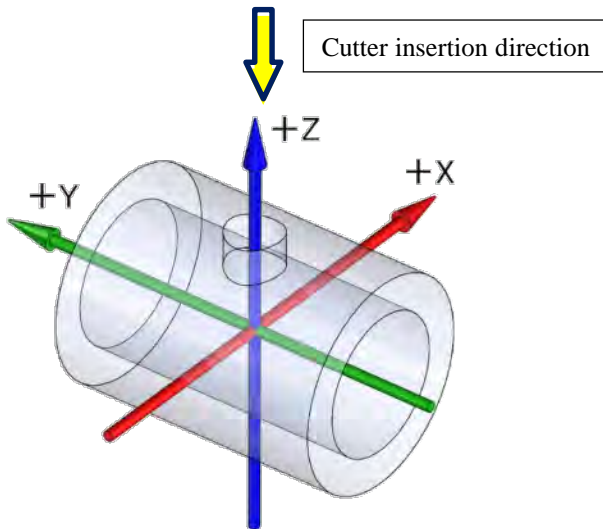


Figure 1

Deburring locations

The red lines in Figures 2-1 and 2-2 are examples of the deburring locations.

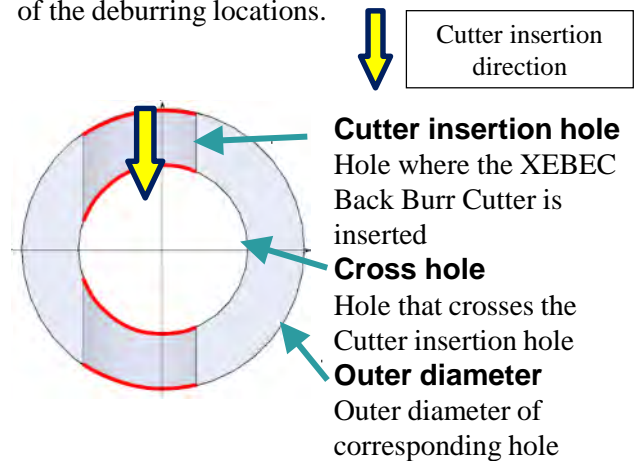


Figure 2-1

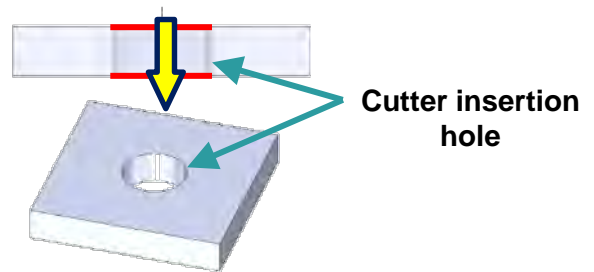


Figure 2-2

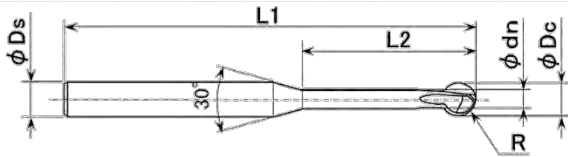
[Note]

Depending on the combination of holes, there is the possibility that a Path cannot be generated. For the restricting conditions and precautions, check the "Path Code Sheet" that was provided at the time of the order.

Product specifications

XEBEC Back Burr Cutter specifications

[Short / Regular type]



[Straight type]

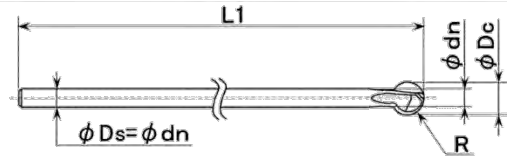


Figure 3

	AITiCrN coated	Steel P	Stainless M	Cast iron K	Super-alloys S	Non-ferrous metal N		
	Product code	Cutter radius R (mm)	Cutter diameter ϕD_c (mm)	Head diameter ϕd_n (mm)	Neck Length L2 (mm)	Full length L1 (mm)	Shank diameter ϕD_s (mm)	Number of blades
Short	XC-08-AS-3F	0.4	0.8	0.48	3	60	3	3
	XC-13-AS-3F	0.65	1.3	0.78	5	60	3	3
	XC-18-AS-3F	0.9	1.8	1.1	6	60	3	3
	XC-23-AS-3F	1.15	2.3	1.4	7.5	70	3	3
	XC-28-AS-3F	1.4	2.8	1.7	9	70	4	3
	XC-33-AS-3F	1.65	3.3	2.0	10.5	70	4	3
	XC-38-AS-3F	1.9	3.8	2.4	12	70	4	3
	XC-48-AS-3F	2.4	4.8	3.0	15	70	6	3
	XC-58-AS-3F	2.9	5.8	3.5	18	70	6	3
	XC-78-AS-3F	3.9	7.8	4.7	24	100	8	3
	XC-98-AS-3F	4.9	9.8	5.9	30	120	10	3
Regular	XC-08-A	0.4	0.8	0.48	5	60	3	2
	XC-13-A	0.65	1.3	0.78	8	60	3	2
	XC-18-A	0.9	1.8	1.1	10	60	3	2
	XC-23-A	1.15	2.3	1.4	12.5	70	3	2
	XC-28-A	1.4	2.8	1.7	15	70	4	2
	XC-33-A	1.65	3.3	2.0	17.5	70	4	2
	XC-38-A	1.9	3.8	2.4	20	70	4	2
	XC-48-A	2.4	4.8	3.0	25	70	6	2
	XC-58-A	2.9	5.8	3.5	30	70	6	2
	XC-78-A	3.9	7.8	4.7	40	100	8	3
	XC-98-A	4.9	9.8	5.9	50	120	10	3
Straight	XC-18-B	0.9	1.8	1.1	-	50	1.1	2
	XC-23-B	1.15	2.3	1.4	-	60	1.4	2
	XC-28-B	1.4	2.8	1.7	-	70	1.7	2
	XC-33-B	1.65	3.3	2.0	-	80	2.0	2
	XC-38-B	1.9	3.8	2.4	-	85	2.4	2
	XC-48-B	2.4	4.8	3.0	-	105	3.0	2
	XC-58-B	2.9	5.8	3.5	-	120	3.5	2
	XC-78-B	3.9	7.8	4.7	-	150	4.7	3
	XC-98-B	4.9	9.8	5.9	-	180	5.9	3

Product specifications

XEBEC Back Burr Cutter specifications

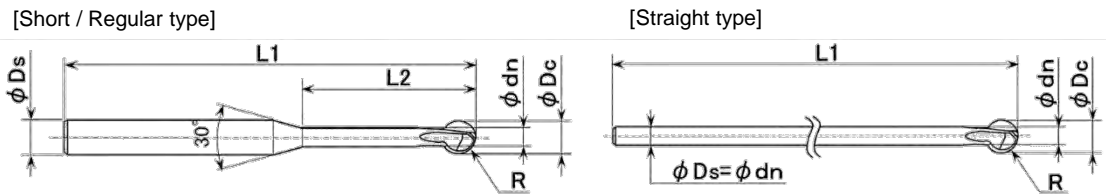


Figure 3

	Uncoated	Non-ferrous metal N		Plastics N				
	Product code	Cutter radius R (mm)	Cutter diameter ϕD_c (mm)	Head diameter ϕd_n (mm)	Neck Length L2 (mm)	Full length L1 (mm)	Shank diameter ϕD_s (mm)	Number of blades
Regular	XC-08-A-N	0.4	0.8	0.48	5	60	3	2
	XC-13-A-N	0.65	1.3	0.78	8	60	3	2
	XC-18-A-N	0.9	1.8	1.1	10	60	3	2
	XC-23-A-N	1.15	2.3	1.4	12.5	70	3	2
	XC-28-A-N	1.4	2.8	1.7	15	70	4	2
	XC-33-A-N	1.65	3.3	2.0	17.5	70	4	2
	XC-38-A-N	1.9	3.8	2.4	20	70	4	2
	XC-48-A-N	2.4	4.8	3.0	25	70	6	2
	XC-58-A-N	2.9	5.8	3.5	30	70	6	2
	XC-78-A-N	3.9	7.8	4.7	40	100	8	3
	XC-98-A-N	4.9	9.8	5.9	50	120	10	3

Cautions regarding the settings for the XEBEC Back Burr Cutter

1. If machining is performed using the wrong size cutter, considering the interference between the tool, workpiece, jig, and chuck, there is a risk of damage to the product, jig, and machine, so make sure you check the dimensions before use.
2. When installing the cutter on a milling holder, set the appropriate projection for the location to be machined.
3. Secure the cutter firmly in the milling holder so that it does not move during use.
4. After attaching the cutter to the milling holder, confirm that the runout of the cutter is 0.01 mm or less.
5. Point group data is calculated using the center and tip of the Cutter, so tool length offset should be set on the center and tip of the Cutter. (Refer to "Set position for tool length offset" on page 13)
6. There is a danger that there will be interference with the cutter head, so care should be taken when positioning so that there is minimal accumulative error with the Cross hole and outside diameter, and the position and hole diameter of the Cutter insertion hole.

Product specifications (continued)

XEBEC Back Burr Cutter standard machining conditions

AlTiCrN coated							
			P	M	K	S	N
Product code	Cutter diameter øDc (mm)	Projection (mm)	Rotational speed n (min ⁻¹)	feedrate Vf (mm/min)	Rotational speed n (min ⁻¹)	feedrate Vf (mm/min)	
Short	XC-08-AS-3F	0.8	3Dc	20000	1080	20000	1170
	XC-13-AS-3F	1.3	3Dc	20000	1080	20000	1170
	XC-18-AS-3F	1.8	3Dc	20000	1080	20000	1170
	XC-23-AS-3F	2.3	3Dc	15000	1350	18000	1710
	XC-28-AS-3F	2.8	3Dc	12500	1800	15000	2520
	XC-33-AS-3F	3.3	3Dc	10600	1890	12700	2250
	XC-38-AS-3F	3.8	3Dc	9200	2160	11000	2880
	XC-48-AS-3F	4.8	3Dc	7200	1980	8500	2880
	XC-58-AS-3F	5.8	3Dc	6000	1620	7000	2160
	XC-78-AS-3F	7.8	3Dc	4500	1620	5400	1920
XC-98-AS-3F	9.8	3Dc	3600	1320	4300	1560	
Regular	XC-08-A	0.8	5Dc	20000	600	20000	650
	XC-13-A	1.3	5Dc	20000	600	20000	650
	XC-18-A	1.8	5Dc	20000	600	20000	650
	XC-23-A	2.3	5Dc	15000	750	18000	950
	XC-28-A	2.8	5Dc	12500	1000	15000	1400
	XC-33-A	3.3	5Dc	10600	1050	12700	1250
	XC-38-A	3.8	5Dc	9200	1200	11000	1600
	XC-48-A	4.8	5Dc	7200	1100	8500	1600
	XC-58-A	5.8	5Dc	6000	900	7000	1200
	XC-78-A	7.8	5Dc	4500	1350	5400	1600
XC-98-A	9.8	5Dc	3600	1100	4300	1300	

1. Rotational speed and feedrate are a guide for initial machining.
2. To improve the machining conditions, take steps such as adjusting the rotational speed and feedrate, or changing to a Path with a different deburring amount.
3. If oscillation or noise occurs, or if the rotational speed or feedrate does not satisfy the value in the standard machining conditions table, lower the rotational speed and feedrate by the same proportional amount.
4. Depending on the type of cross hole, care needs to be taken with the setting conditions, so refer to the pages for start points for the type of intersecting edge used in "Machining edge variation" (page 17).
5. It is possible to reduce machining shape error by using functions such as advanced preview control.

POINT Setting processing conditions

Secondary burring may occur depending on the state of the intersecting edges. Keep the tool projection as short as possible, set feedrate to 50% of the initial condition, and try starting from a small deburring amount.

Product specifications (continued)

XEBEC Back Burr Cutter standard machining conditions

AlTiCrN coated

P M K S

N

	Product code	Cutter diameter øDc (mm)	Projection (mm)	Rotational speed n (min ⁻¹)		feedrate Vf (mm/min)	
				Rotational speed n (min ⁻¹)	feedrate Vf (mm/min)	Rotational speed n (min ⁻¹)	feedrate Vf (mm/min)
Straight	XC-18-B	1.8	6Dc	9700	480	9700	480
			10Dc	4400	220	4400	220
			15Dc	2200	110	2200	110
	XC-23-B	2.3	6Dc	7900	480	7900	480
			10Dc	3500	220	3500	220
			15Dc	2200	110	2200	110
	XC-28-B	2.8	6Dc	6200	620	6200	620
			10Dc	2800	220	2800	220
			15Dc	2200	110	2200	110
	XC-33-B	3.3	6Dc	5400	460	5400	460
			10Dc	2400	190	2400	190
			15Dc	1900	95	1900	95
	XC-38-B	3.8	6Dc	4600	460	4600	460
			10Dc	2000	160	2000	160
			15Dc	1600	80	1600	80
XC-48-B	4.8	6Dc	3600	360	3600	360	
		10Dc	1600	120	1600	120	
		15Dc	1300	60	1300	60	
XC-58-B	5.8	6Dc	3000	300	3000	300	
		10Dc	1300	100	1300	100	
		15Dc	1000	50	1000	50	
XC-78-B	7.8	6Dc	1600	240	1600	240	
		10Dc	650	70	650	70	
		15Dc	200	10	200	10	
XC-98-B	9.8	6Dc	1300	200	1300	200	
		10Dc	500	50	500	50	
		15Dc	200	10	200	10	

1. Rotational speed and feedrate are a guide for initial machining.
2. To improve the machining conditions, take steps such as adjusting the rotational speed and feedrate, or changing to a Path with a different deburring amount.
3. If oscillation or noise occurs, or if the rotational speed or feedrate does not satisfy the value in the standard machining conditions table, lower the rotational speed and feedrate by the same proportional amount.
4. Depending on the type of cross hole, care needs to be taken with the setting conditions, so refer to the pages for start points for the type of intersecting edge used in "Machining edge variation" (page 17).
5. It is possible to reduce machining shape error by using functions such as advanced preview control.

POINT Setting processing conditions

Secondary burring may occur depending on the state of the intersecting edges. Keep the tool projection as short as possible, set feedrate to 50% of the initial condition, and try starting from a small deburring amount.

Product specifications (continued)

XEBEC Back Burr Cutter standard machining conditions

Uncoated

N

O

	Product code	Cutter diameter øDc (mm)	Projection (mm)	Rotational speed n (min ⁻¹)	feedrate Vf (mm/min)
Regular	XC-08-A-N	0.8	5Dc	20000	650
	XC-13-A-N	1.3	5Dc	20000	650
	XC-18-A-N	1.8	5Dc	20000	650
	XC-23-A-N	2.3	5Dc	18000	950
	XC-28-A-N	2.8	5Dc	15000	1400
	XC-33-A-N	3.3	5Dc	12700	1250
	XC-38-A-N	3.8	5Dc	11000	1600
	XC-48-A-N	4.8	5Dc	8500	1600
	XC-58-A-N	5.8	5Dc	7000	1200
	XC-78-A-N	7.8	5Dc	5400	1600
XC-98-A-N	9.8	5Dc	4300	1300	

1. Rotational speed and feedrate are a guide for initial machining.
2. To improve the machining conditions, take steps such as adjusting the rotational speed and feedrate, or changing to a Path with a different deburring amount.
3. If oscillation or noise occurs, or if the rotational speed or feedrate does not satisfy the value in the standard machining conditions table, lower the rotational speed and feedrate by the same proportional amount.
4. Depending on the type of cross hole, care needs to be taken with the setting conditions, so refer to the pages for start points for the type of intersecting edge used in "Machining edge variation" (page 17).
5. It is possible to reduce machining shape error by using functions such as advanced preview control.

POINT Setting processing conditions

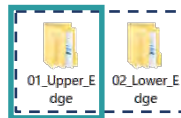
Secondary burring may occur depending on the state of the intersecting edges. Keep the tool projection as short as possible, set feedrate to 50% of the initial condition, and try starting from a small deburring amount.

Product specifications (continued)

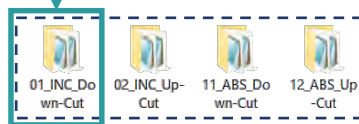
Configuration of folders and point group data

XEBEC Back Burr Path is contained as shown in Figure 4, and the stored data is divided into a folder hierarchy.

- **First level**
 - Folder for each machining edge



- **Second level**
 - Incremental command data (INC)
 - Absolute command data (ABS)
 - Down cut machining (Down Cut)
 - Up cut machining (Up Cut)



- **Third level**
 - 5 types of deburring amount (Edge Break Amount) data □□_Edge Break Amount_□□



- **Point group data**

The data information is indicated at the start of the data.

The deburring hole information and Path information are provided as comments in ().

Check that the XEBEC Back Burr Path point group data is correct for the purpose of use.

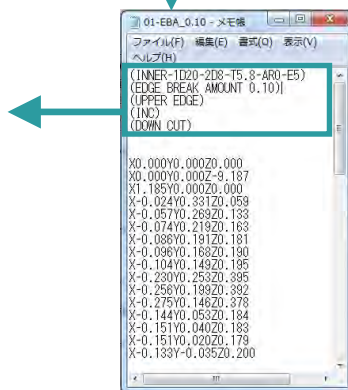


Figure 4

[Notice]

Depending on the edge type, only the upper edge data may be provided. In this case, 20 data types are provided.

Data example

For example, for an inner diameter edge there are a total of 40 data types (2 types × 2 types × 2 types × 5 types).

- **First level** (2 types)
 - Upper edge or lower edge
- **Second level** (2 types × 2 types)
 - Up cut and down cut data
 - Incremental or absolute data
- **Third level** (5 types)
 - 5 types of individual deburring amount data

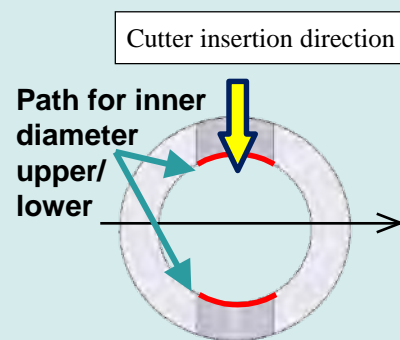


Figure 5

Product specifications (continued)

Set position for tool length offset

The point group data for XEBEC Back Burr Path is calculated using the tip of the Cutter.

Set tool length offset for the XEBEC Back Burr Cutter using the tip of the Cutter so that it is as shown on the OK side in Figure 6.



CAUTION

Set the Path point group data using the tip of the Cutter.

Use of a path with tool length offset that does not use the tip of the Cutter is dangerous and there is the risk of Cutter breakage or machine accident.

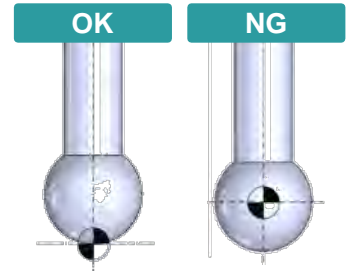


Figure 6

Accumulative error

The 5 deburring amounts (Figure 7: Surface width after burr removal by the Cutter) that are provided with XEBEC Back Burr Path must be selected with consideration for the accumulative error from previous machining.

Use a deburring amount Path that is suitable for the processing accuracy of the workpiece hole diameter, hole position, and other dimensions.

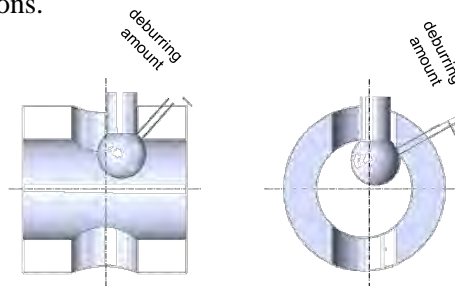


Figure 7

- If the Cutter does not contact the edge due to machining variation of hole position or excessive hole size, check using a Path with a larger deburring amount.
- If the deburring amount is too large because the actual dimension (diameter) of the machined hole is small, check using a Path with a smaller deburring amount.

Product code	Cutter diameter Dc (mm)	Deburring amount / Edge Break Amount (mm)					Allowable accumulative error (mm)
		①	②	③	④	⑤	
XC-08-A	0.8	0.02	0.04	0.06	0.08	0.10	0.03
XC-13-A	1.3	0.04	0.06	0.08	0.10	0.12	0.05
XC-18-A , XC-18-B	1.8	0.07	0.09	0.11	0.13	0.15	0.08
XC-23-A , XC-23-B	2.3	0.07	0.09	0.11	0.13	0.15	0.09
XC-28-A , XC-28-B	2.8	0.08	0.11	0.14	0.17	0.20	0.10
XC-33-A , XC-33-B	3.3	0.08	0.11	0.14	0.17	0.20	0.11
XC-38-A , XC-38-B	3.8	0.09	0.13	0.17	0.21	0.25	0.12
XC-48-A , XC-48-B	4.8	0.10	0.15	0.20	0.25	0.30	0.15
XC-58-A , XC-58-B	5.8	0.10	0.15	0.20	0.25	0.30	0.18
XC-78-A , XC-78-B	7.8	0.10	0.15	0.20	0.25	0.30	0.24
XC-98-A , XC-98-B	9.8	0.10	0.15	0.20	0.25	0.30	0.34

Product specifications (continued)

About the start points

“Start point” refers to the machining start position where the Cutter is operated correctly based on the point group data in the XEBEC Back Burr Path. In the main program for machining the product, position the XEBEC Back Burr Cutter axis center and tip of XEBEC Back Burr Cutter at the start point in advance, and then immediately execute the XEBEC Back Burr Path. An example of the start point is shown below. (Figure 8: Example of on-center cross hole, Figure 9: Example of off-center cross hole)

The start point XY coordinates are the center of the Cutter insertion hole. The Z coordinate is shifted vertically from the center of the Cross hole by half of $\phi D1$.

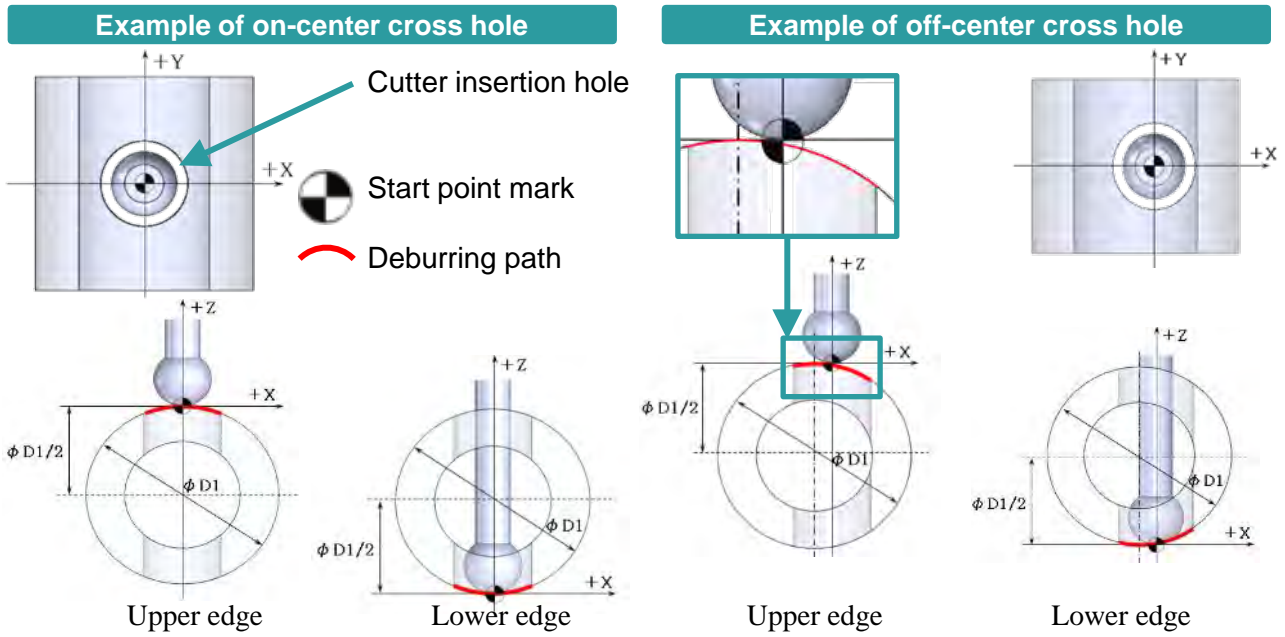


Figure 8

Figure 9

Procedure for implementing programs into the machine

Incremental command

The following is an example of incorporating incremental command point group data for XEBEC Back Burr Path into the machining program.

The control device conforms to the FANUC system. Adjust the G codes and other details in the program to match the numerical control machine tool that is used.

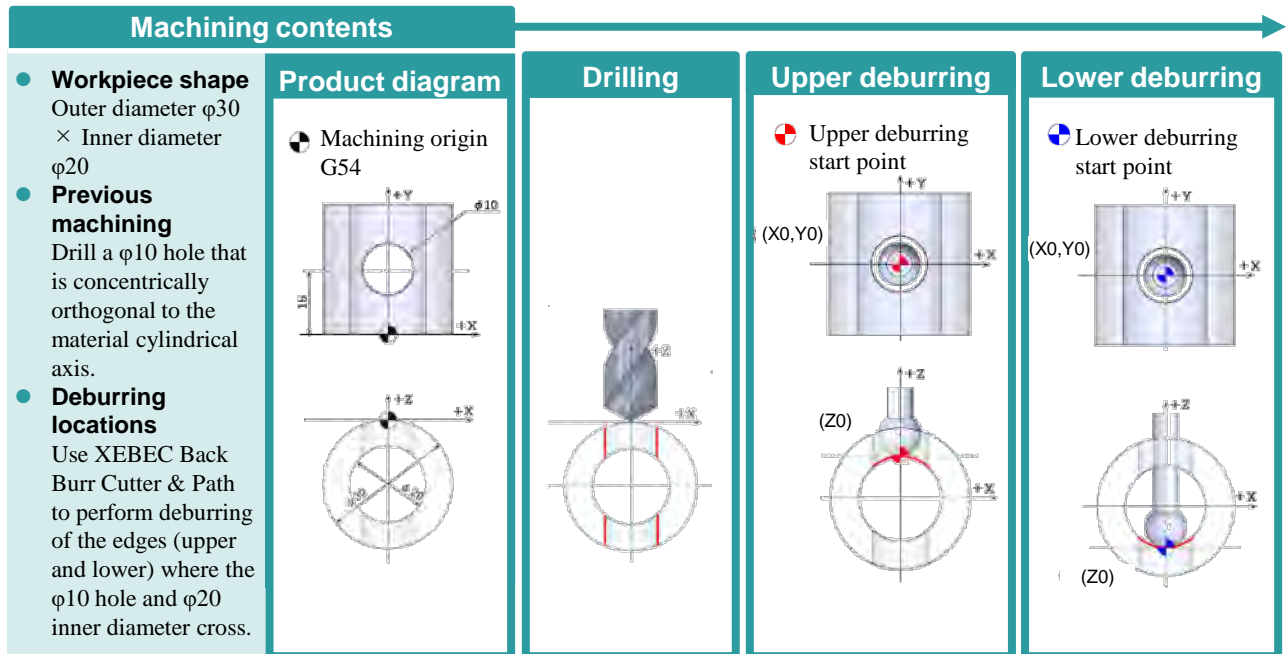
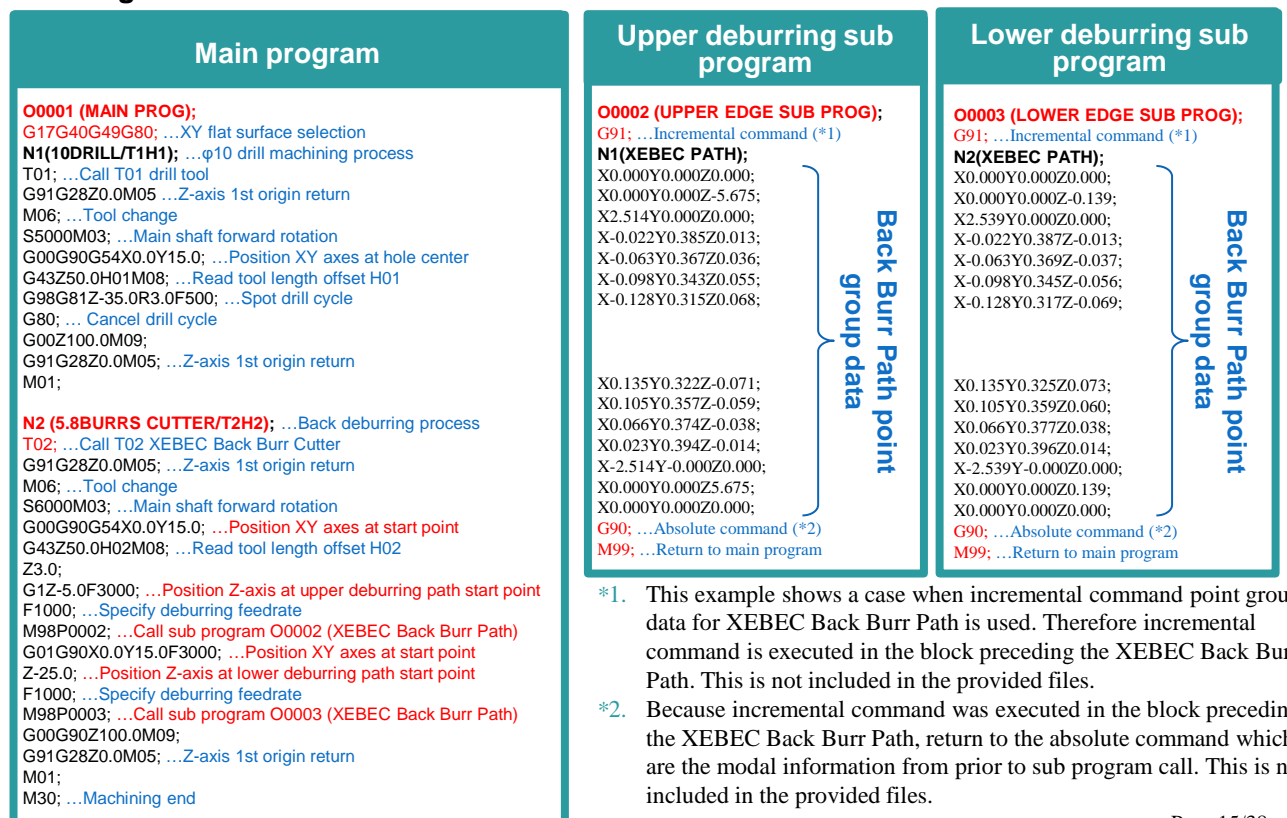


Figure 10

Program overview



Procedure for implementing programs into the machine (continued)

Absolute command

The following is an example of incorporating absolute command point group data for XEBEC Back Burr Path into the machining program.

The control device conforms to the FANUC system. Adjust the G codes and other details in the program to match the numerical control machine tool that is used.

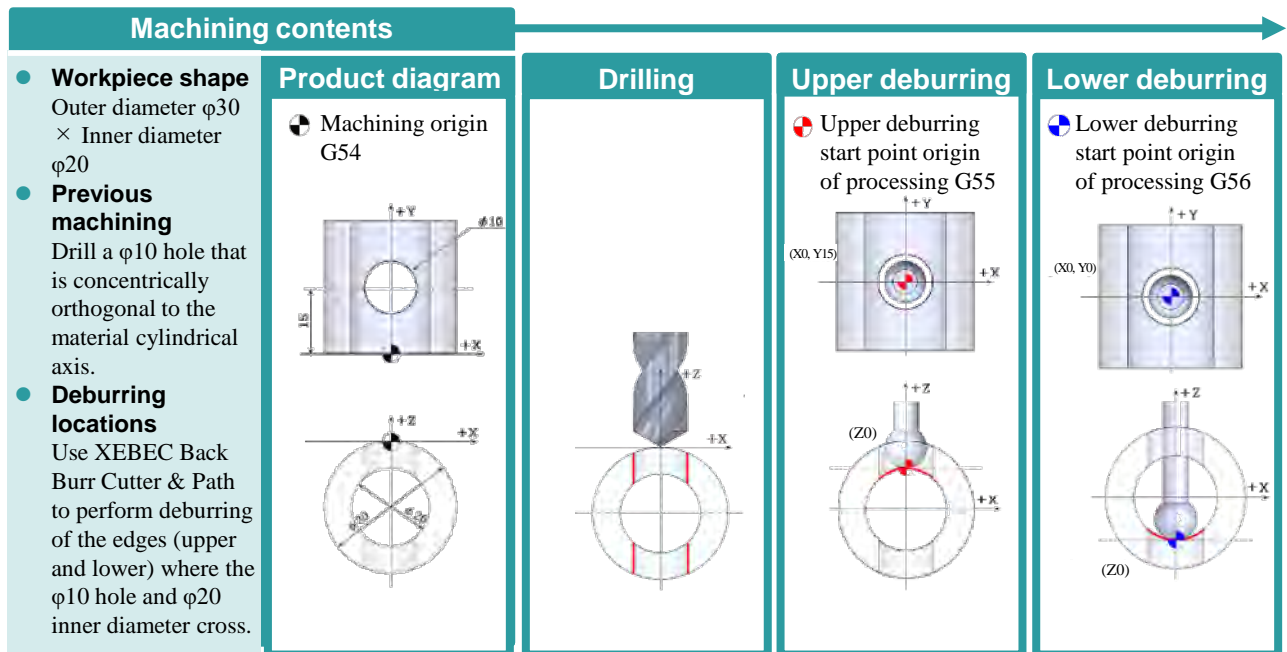
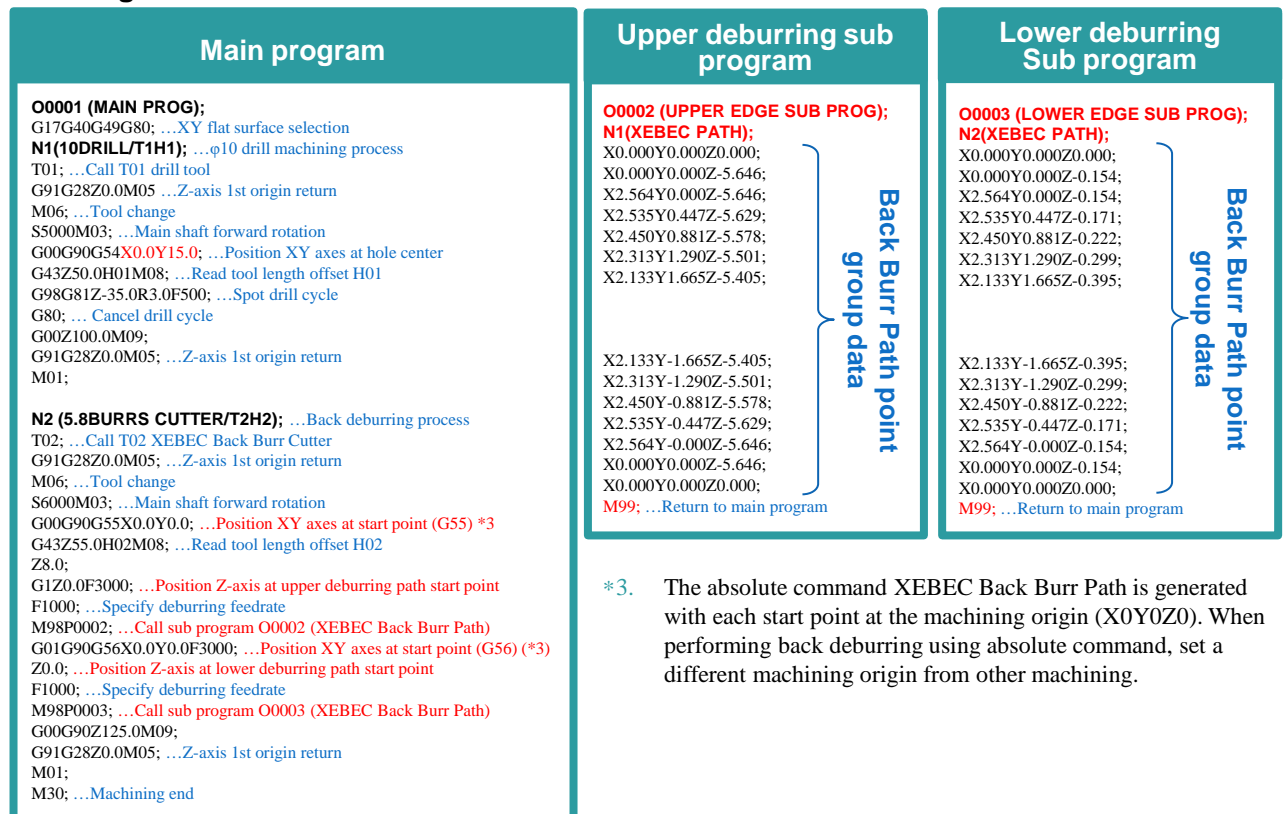


Figure 11

Program overview



*3. The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin (X0Y0Z0). When performing back deburring using absolute command, set a different machining origin from other machining.

Examples of machining edge start points and upper point group data

Machining edge variation

For the machining edges (types) that are used, refer to the Path Code Sheet.

Type	Name	Specification	corresponding edge(s)	Reference destination
A	Orthogonal cross hole : Outer diameter (Cutter insertion hole < Outer diameter)	On-/off-center	Upper/lower	Page 18
B	Orthogonal cross hole : Inner diameter (Cutter insertion hole ≤ Cross hole)	On-/off-center	Upper/lower	Page 19
C	Flat surface hole	–	Back/front	Page 20
D	Angled cross hole : Outer diameter	On-/off-center	Upper	Page 21–22
E	Angled cross hole : Inner diameter	On-/off-center	Upper	Page 21 – 22
F	Angled surface hole	–	Back/front	Page 23
G	Slotted hole parallel with Cross hole axis : Outer diameter	On-/off-center	Upper	Page 24 – 26
H	Slotted hole parallel with Cross hole axis : Inner diameter	On-/off-center	Upper	Page 24 – 26
I	Slotted hole perpendicular with Cross hole axis : Outer diameter	On-/off-center	Upper	Page 27 – 29
J	Slotted hole perpendicular with Cross hole axis : Inner diameter	On-/off-center	Upper	Page 27 – 29
K	Orthogonal cross hole : Inner diameter (Cutter insertion hole > Cross hole)	On-/off-center	Front/rear	Page 30 – 31
L	Broken hole : Inner diameter (Cutter insertion hole ≤ Cross hole)	Off-center	–	Page 32
M	Broken hole : Inner diameter (Cutter insertion hole > Cross hole)	Off-center	–	Page 33
N	Angled cross hole : Inner diameter (Cutter insertion hole > Cross hole)	On-/off-center	Front/rear	Page 34

● XEBEC Back Burr Path for Tapped Hole

Type	Name	Specification	corresponding edge(s)	Reference destination
P	Orthogonal cross hole Tapped : Inner diameter (Cutter insertion hole ≤ Cross hole)	On-/off-center	Upper	Page 36
Q	Flat surface hole Tapped	–	Back	Page 37
R	Angled surface hole Tapped	–	Back	Page 38

Examples of machining edge start points and upper point group data (continued)

Type A: Orthogonal cross hole : Outer diameter (Cutter insertion hole < Outer diameter)

An example of the start point is shown below. (Figure 12: Example of on-center cross hole, Figure 13: Example of off-center cross hole)

The start point XY coordinates are the center of the Cutter insertion hole. The Z coordinate is shifted vertically from the center of the Cross hole by half of $\phi D1$.

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of on-center cross hole

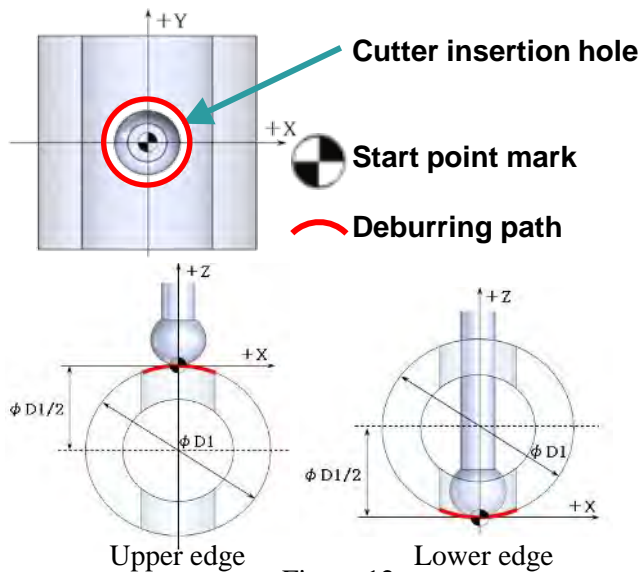


Figure 12

Example of off-center cross hole

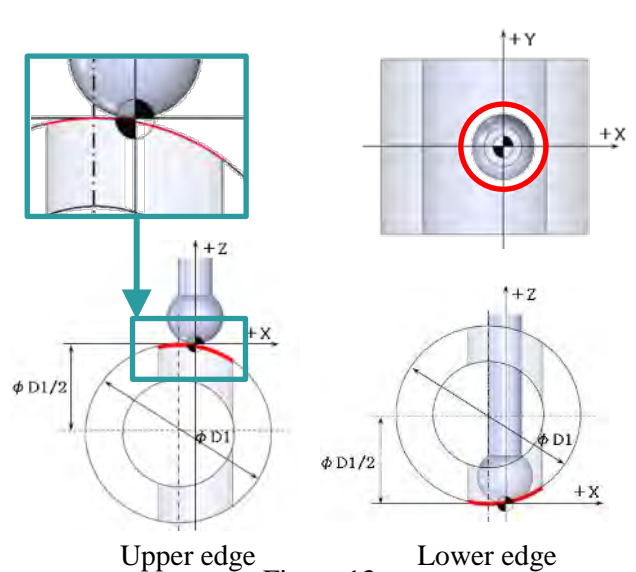


Figure 13

Upper point group data information

The data information is indicated at the start of the data.

- (INNER-1D20-2D10-T5.8-AR0-E5);
- (EDGE BREAK AMOUNT 0.10);
- (UPPER EDGE);
- (INC);
- (DOWN CUT);

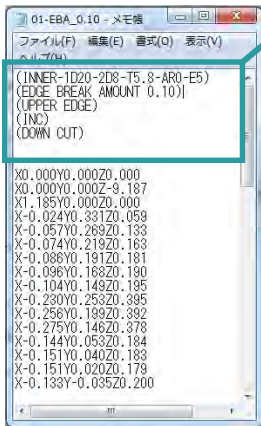


Figure 14

INNER	: Inner diameter edge machining [OUTER: Outer diameter edge machining]
1D20	: Cross hole diameter $\phi 20$
2D10	: Cutter insertion hole diameter $\phi 10$
T5.8	: Cutter diameter $\phi 5.8$
AR0	: Cross hole orientation 0°
E5	: Off-center to Cross hole axis +5 mm
EDGE BREAK AMOUNT 0.10	: Deburring amount 0.10
UPPER EDGE	: Upper edge [LOWER: Lower edge]
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

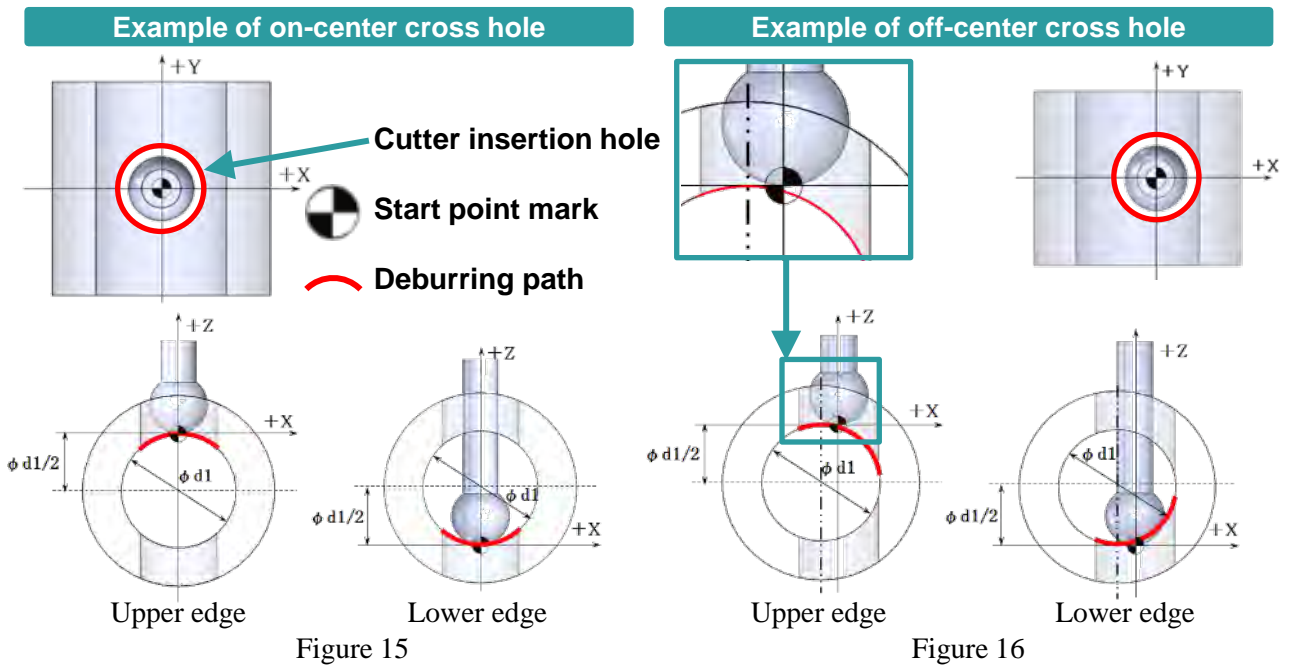
Examples of machining edge start points and upper point group data (continued)

Type B: Orthogonal cross hole : Inner diameter (Cutter insertion hole \leq Cross hole)

An example of the start point is shown below. (Figure 15: Example of on-center cross hole, Figure 16: Example of off-center cross hole)

The start point XY coordinates are the center of the Cutter insertion hole. The Z coordinate is shifted vertically from the center of the Cross hole by half of $\phi d1$.

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.



Upper point group data information

The data information is indicated at the start of the data.

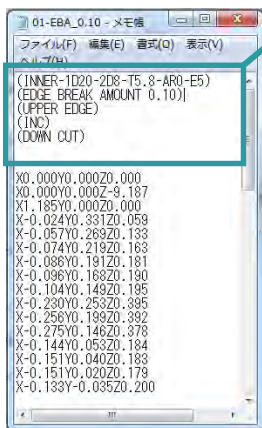


Figure 17

- (INNER-1D20-2D10-T5.8-AR0-E5);
- (EDGE BREAK AMOUNT 0.10);
- (UPPER EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining [OUTER: Outer diameter edge machining]
1D20	: Cross hole diameter $\phi 20$
2D10	: Cutter insertion hole diameter $\phi 10$
T5.8	: Cutter diameter $\phi 5.8$
AR0	: Cross hole orientation 0°
E5	: Off-center to Cross hole axis +5 mm
EDGE BREAK AMOUNT 0.10	: Deburring amount 0.10
UPPER EDGE	: Upper edge [LOWER: Lower edge]
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type C: Flat surface hole

An example of the start point is shown below. (Figure 18: Example of flat surface hole)

The start point XY coordinates are the center of the Cutter insertion hole. The Z coordinate is the flat surface top position (or bottom position).

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of flat surface cross hole

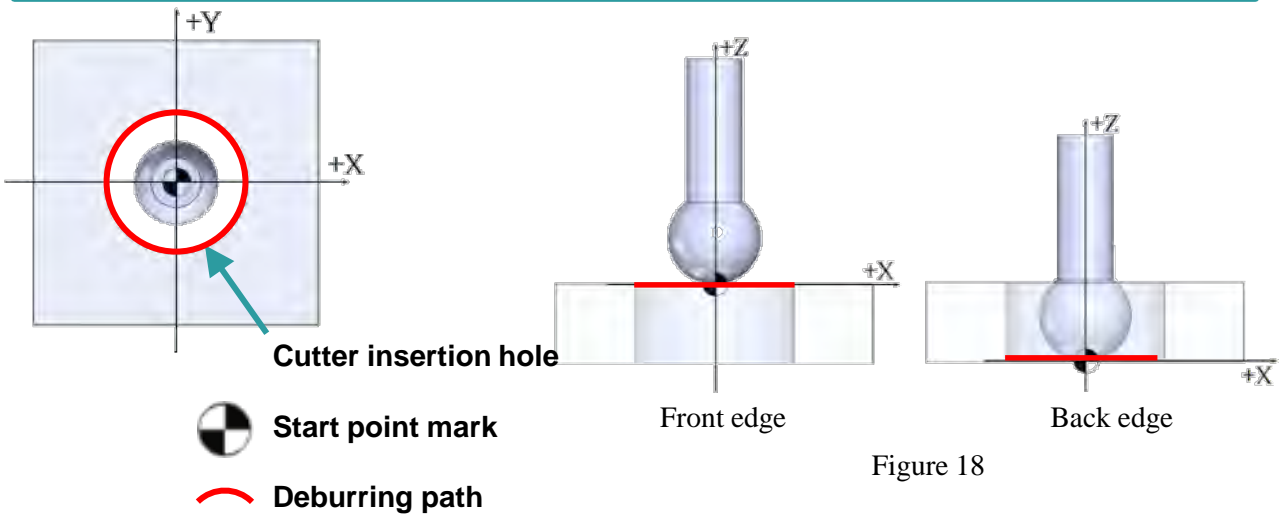


Figure 18

Upper point group data information

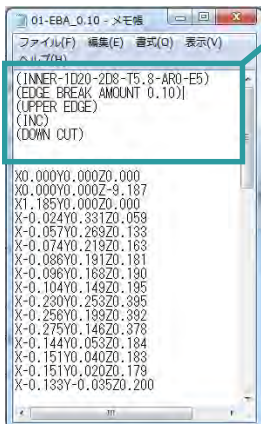


Figure 19

The data information is indicated at the start of the data.

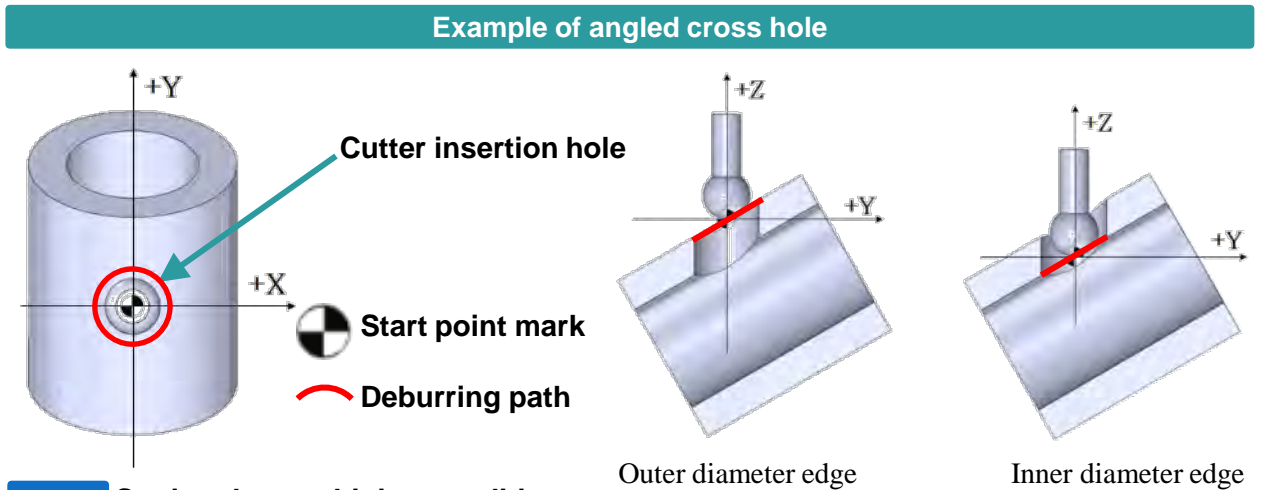
- (2D10-T5.8);
- (EDGE BREAK AMOUNT 0.10);
- (BACK EDGE);
- (INC);
- (DOWN CUT);

2D10	: Diameter of Cutter insertion hole in flat surface $\phi 10$
T5.8	: Cutter diameter $\phi 5.8$
EDGE BREAK	: Deburring amount 0.10
AMOUNT 0.10	
BACK EDGE	: Edge of exit side flat surface (back) [FRONT: Edge of insertion side flat surface (front)]
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type D/E: Angled cross hole : Outer/inner diameter

An example of the start point is shown below. (Figure 20: Example of angled cross hole (on-center cross hole)) The start point XY coordinates are the center of the Cutter insertion hole. The Z coordinate is the position where the axis of the Cutter insertion hole intersects the edge line (red line) of the Cross hole or outer diameter. The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.



POINT Setting the machining conditions

Depending on the cross edge shape, there is the concern of secondary burrs occurring. Keep the tool projection as short as possible, set feedrate to 50% of the initial condition, and try starting from a small deburring amount.

Figure 20

Upper point group data information

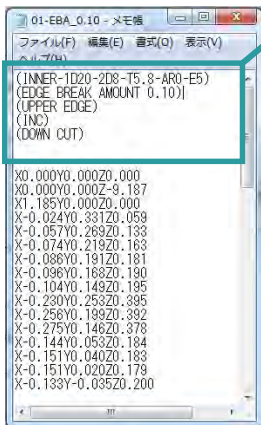


Figure 21

The data information is indicated at the start of the data.

- (INNER-1D20-2D10-T5.8-AR0-E0-AA60.);
- (EDGE BREAK AMOUNT 0.10);
- (UPPER EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining [OUTER: Outer diameter edge machining]
1D20	: Cross hole diameter $\phi 20$
2D10	: Cutter insertion hole diameter $\phi 10$
T5.8	: Cutter diameter $\phi 5.8$
AR0	: Cross hole orientation 0°
AA60	: Crossing angle $+ 60^\circ$
E0	: Off-center to Cross hole axis 0 mm
EDGE BREAK AMOUNT 0.10	: Deburring amount 0.10
UPPER EDGE	: Type D \rightarrow Upper edge [LOWER: Type E \rightarrow Lower edge]
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

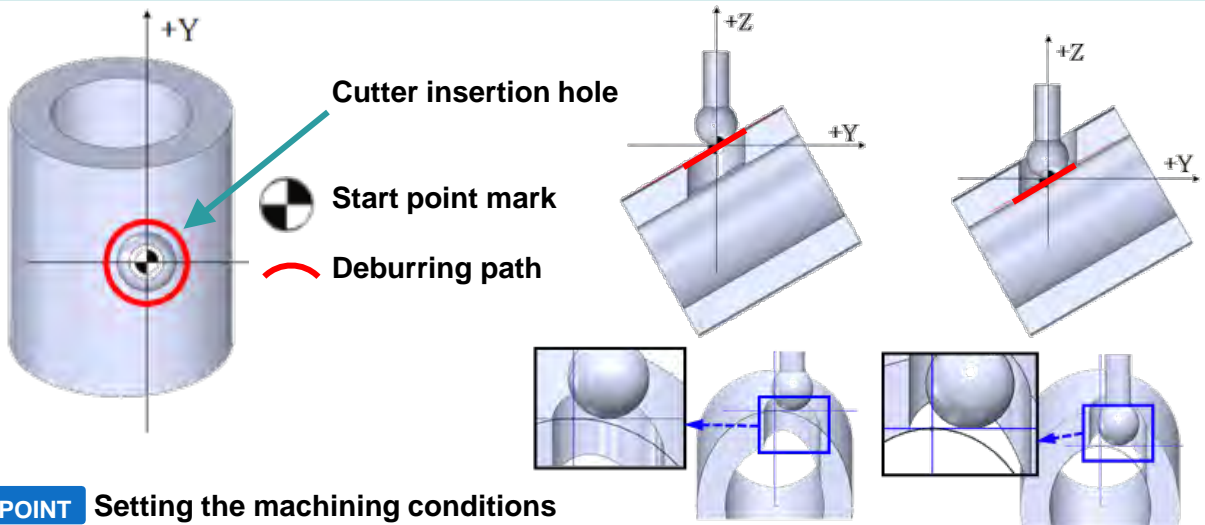
Type D/E: Angled cross hole : Off-center crossing outer/inner diameter

An example of the start point is shown below. (Figure 22: Example of angled cross hole (off-center cross hole))

The start point XY coordinates are the center of the Cutter insertion hole. The Z coordinate is the position of the highest Z value on the outer diameter (or Cross hole). (Refer the lower figure of Figure 22.)

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of angled cross hole (off-center cross hole)



POINT Setting the machining conditions

Depending on the cross edge shape, there is the concern of secondary burrs occurring. Keep the tool projection as short as possible, set feedrate to 50% of the initial condition, and try starting from a small deburring amount.

Figure 22

Upper point group data information

The data information is indicated at the start of the data.

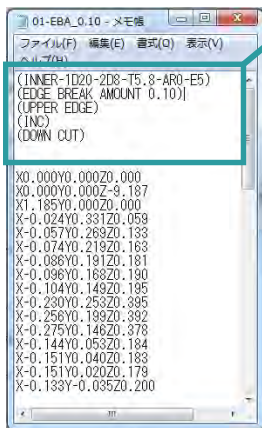


Figure 23

- (INNER-1D20-2D10-T5.8-AR0-E4.5-AA60.);
- (EDGE BREAK AMOUNT 0.10);
- (UPPER EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining [OUTER: Outer diameter edge machining]
1D20	: Cross hole diameter $\phi 20$
2D10	: Cutter insertion hole diameter $\phi 10$
T5.8	: Cutter diameter $\phi 5.8$
AR0	: Cross hole orientation 0°
AA60	: Crossing angle $+ 60^\circ$
E0	: Off-center to Cross hole axis $+4.5$ mm
EDGE BREAK AMOUNT 0.10	: Deburring amount 0.10
UPPER EDGE	: Upper edge [LOWER: Lower edge]
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type F: Angled surface hole

An example of the start point is shown below. (Figure 24: Example of angled surface hole)

The start point XY coordinates are the center of the outer insertion hole. The Z coordinate is the height at which the outer insertion hole axis intersects the angled surface.

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of angled surface hole

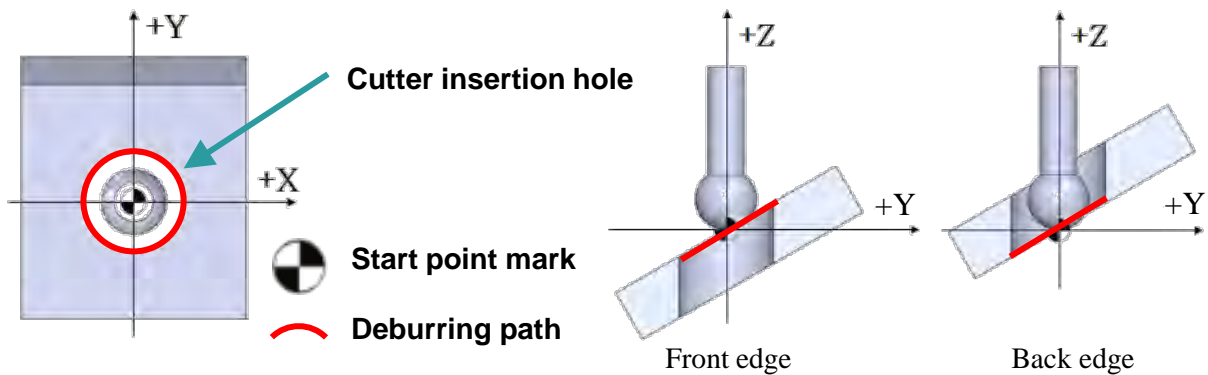


Figure 24

POINT Setting the machining conditions

Depending on the cross edge shape, there is the concern of secondary burrs occurring. Keep the tool projection as short as possible, set feedrate to 50% of the initial condition, and try starting from a small deburring amount.

Upper point group data information

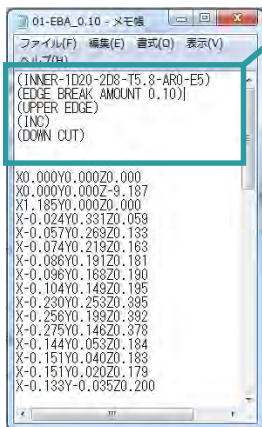


Figure 25

The data information is indicated at the start of the data.

- (2D10.-T5.8-AR0-AA60.);
- (EDGE BREAK AMOUNT 0.30);
- (BACK EDGE);
- (INC);
- (DOWN CUT);

2D10	: Diameter of Cutter insertion hole in angled surface $\phi 10$
T5.8	: Cutter diameter $\phi 5.8$
AR0	: Maximum angle of inclination relative to Y-axis 0°
AA60	: Angle of angled surface $+60^\circ$
EDGE BREAK AMOUNT 0.30	: Deburring amount 0.30
BACK EDGE	: Edge of exit side flat surface (back) [FRONT: Edge of insertion side flat surface (front)]
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type G/H: Slotted hole parallel with main bore axis($ar = 0^\circ$) :

Outer/inner diameter

An example of the start point is shown below. (Figure 26: Example of slotted hole parallel to Cross hole axis (on-center cross hole))

When $ar = 0^\circ$, the start point XY coordinates are at the R center position on the $-Y$ side of the slotted hole. The Z coordinate is the position of the largest Z value on the outer diameter (or inner diameter).

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of Slotted hole parallel with main bore axis

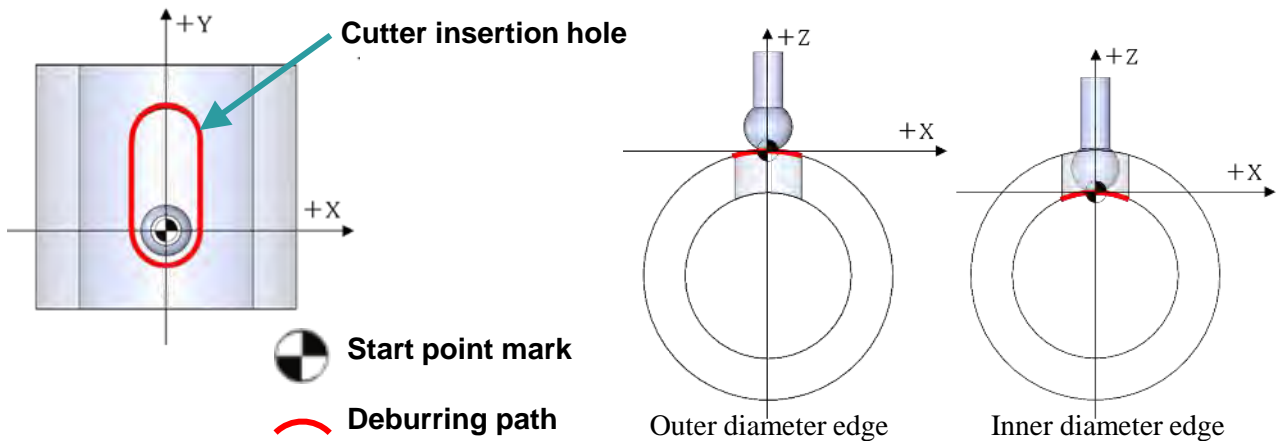


Figure 26

Upper point group data information

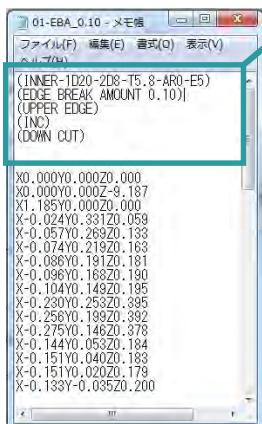


Figure 27

The data information is indicated at the start of the data.

- (INNER-1D20-2D8-T5.8-AR90-E3-L10.);
- (EDGE BREAK AMOUNT 0.30);
- (UPPER EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining [OUTER: Outer diameter edge machining]
1D20	: Cross hole diameter $\phi 20$
2D8	: Cutter insertion hole diameter $\phi 8$
T5.8	: Cutter diameter $\phi 5.8$
AR90	: Cross hole orientation 90°
E3	: Off-center to Cross hole axis +3 mm
L10	: Distance between slotted hole R centers 10 mm
EDGE BREAK AMOUNT 0.30	: Deburring amount 0.30 mm
UPPER EDGE	: Upper edge [G/H do not support lower edge machining]
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type G/H: Slotted hole parallel with main bore axis (ar = 0°) : Off-center crossing outer/inner diameter

An example of the start point is shown below. (Figure 28: Example of slotted hole parallel to cross hole axis (off-center cross hole))

The start point XY coordinates are at the R center position on the -Y side of the slotted hole. The Z coordinate is the position of the highest Z value on the outer diameter (or inner diameter).

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of Slotted hole parallel with main bore axis(off-center cross hole)

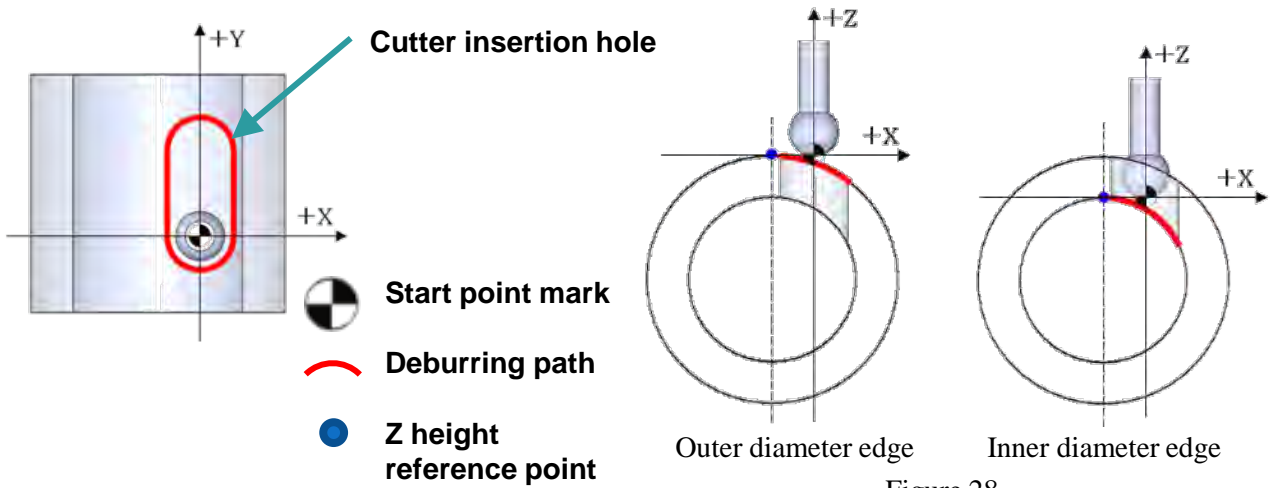


Figure 28

Upper point group data information

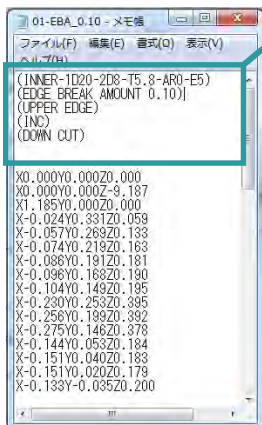


Figure 29

The data information is indicated at the start of the data.

- (INNER-1D20-2D8-T5.8-AR90-E3-L10.);
- (EDGE BREAK AMOUNT 0.30);
- (UPPER EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining [OUTER: Outer diameter edge machining]
1D20	: Cross hole diameter $\phi 20$
2D8	: Cutter insertion hole diameter $\phi 8$
T5.8	: Cutter diameter $\phi 5.8$
AR90	: Cross hole orientation 90°
E3	: Off-center to Cross hole axis +3 mm
L10	: Distance between slotted hole R centers 10 mm
EDGE BREAK AMOUNT 0.30	: Deburring amount 0.30 mm
UPPER EDGE	: Upper edge
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type G/H: Slotted hole perpendicular with Cross hole axis(ar = 90°/-90°)

Cross hole orientation in X-axis direction

An example of the start point is shown below. (Figure 30: Example when Cross hole orientation is in the X-axis direction (ar = 90°/-90°))

When ar = 90°, where the Cross hole is oriented in the -X axis direction, the start point is the R center on the +X side. When ar = -90°, the start point is the R center on the -X side. This is handled in the same way for an off-center slotted hole.

Example when Cross hole orientation is in X-axis direction

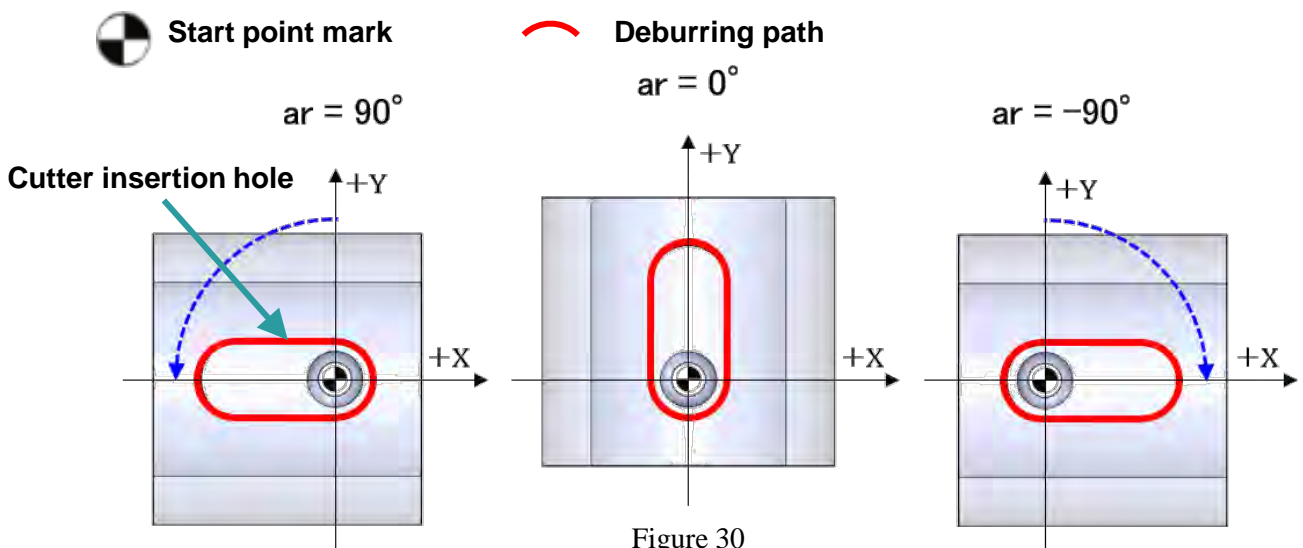


Figure 30

Upper point group data information

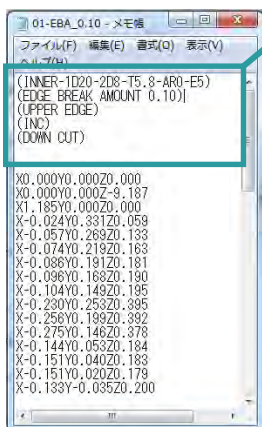


Figure 31

The data information is indicated at the start of the data.

- (INNER-1D20-2D8-T5.8-AR90-E3-L10.);
- (EDGE BREAK AMOUNT 0.30);
- (UPPER EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining [OUTER: Outer diameter edge machining]
1D20	: Cross hole diameter $\phi 20$
2D8	: Cutter insertion hole diameter $\phi 8$
T5.8	: Cutter diameter $\phi 5.8$
AR90	: Cross hole orientation 90°
E3	: Off-center to Cross hole axis +3 mm
L10	: Distance between slotted hole R centers 10 mm
EDGE BREAK AMOUNT 0.30	: Deburring amount 0.30 mm
UPPER EDGE	: Upper edge
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type I/J: Slotted hole perpendicular with Cross hole axis : Outer/inner diameter

An example of the start point is shown below. (Figure 32: Example of slotted hole perpendicular to Cross hole axis (orthogonal cross hole))

When $\alpha = 0^\circ$, the start point XY coordinates are at the R center position on the +X side of the slotted hole. The Z coordinate is the position of the highest Z value on the outer diameter (or inner diameter).

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of Slotted hole perpendicular with Cross hole axis

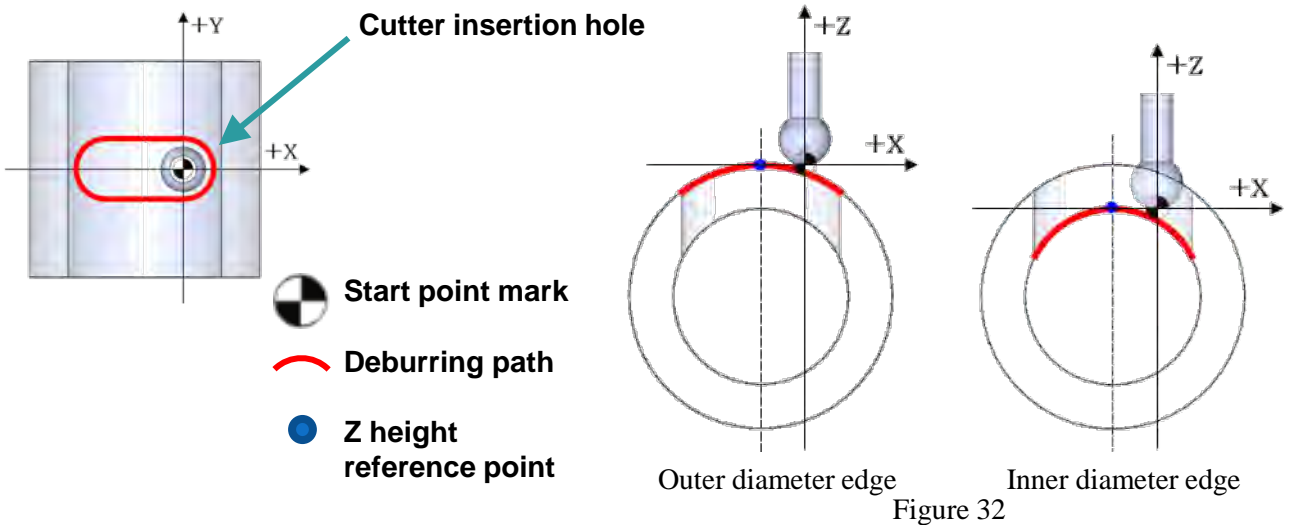


Figure 32

Upper point group data information

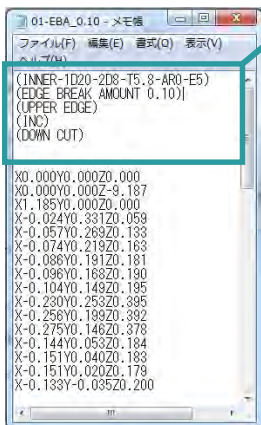


Figure 33

The data information is indicated at the start of the data.

- (INNER-1D20-2D8-T5.8-AR90-E1-L10.);
- (EDGE BREAK AMOUNT 0.30);
- (UPPER EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining [OUTER: Outer diameter edge machining]
1D20	: Cross hole diameter $\phi 20$
2D8	: Slotted hole width 8 mm
T5.8	: Cutter diameter $\phi 5.8$
AR90	: Cross hole orientation 90°
E1	: Off-center to Cross hole axis +1 mm
L10	: Distance between slotted hole R centers 10 mm
EDGE BREAK AMOUNT 0.30	: Deburring amount 0.30
UPPER EDGE	: Upper edge
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type I/J: Slotted hole perpendicular with Cross hole axis : Off-center crossing outer/inner diameter

An example of the start point is shown below. (Figure 34: Example of slotted hole perpendicular to Cross hole axis (off-center cross hole))

When $\alpha_r = 0^\circ$, the start point XY coordinates are at the R center position on the +X side of the slotted hole. The Z coordinate is the position of the highest Z value on the outer diameter (or inner diameter). The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of Slotted hole perpendicular with Cross hole axis(off-center cross hole)

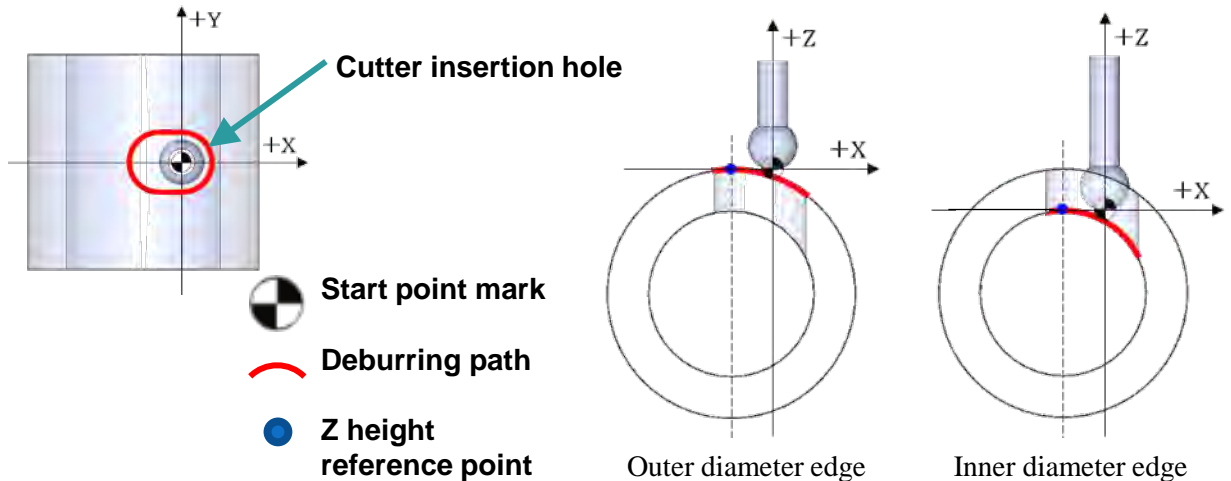


Figure 34

Upper point group data information

The data information is indicated at the start of the data.

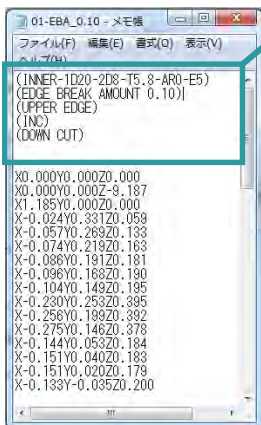


Figure 35

- (INNER-1D20-2D8-T5.8-AR90-E1-L10.);
- (EDGE BREAK AMOUNT 0.30);
- (UPPER EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining [OUTER: Outer diameter edge machining]
1D20	: Cross hole diameter $\phi 20$
2D8	: Slotted hole width 8 mm
T5.8	: Cutter diameter $\phi 5.8$
AR90	: Cross hole orientation 90°
E1	: Off-center to Cross hole axis +1 mm
L10	: Distance between slotted hole R centers 10 mm
EDGE BREAK AMOUNT 0.30	: Deburring amount 0.30
UPPER EDGE	: Upper edge
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type I/J: Slotted hole perpendicular with Cross hole axis($ar = 90^\circ/-90^\circ$)

Cross hole orientation in X-axis direction

An example of the start point is shown below. (Figure 36: Example when Cross hole orientation is in X-axis direction ($ar = 90^\circ/-90^\circ$))

When $ar = 90^\circ$, where the Cross hole is oriented in the $-X$ axis direction, the start point is the R center on the $+Y$ side. When $ar = -90^\circ$, the start point is the R center on the $-Y$ side.

This is handled in the same way for an off-center slotted hole.

Example when Cross hole orientation is in X-axis direction

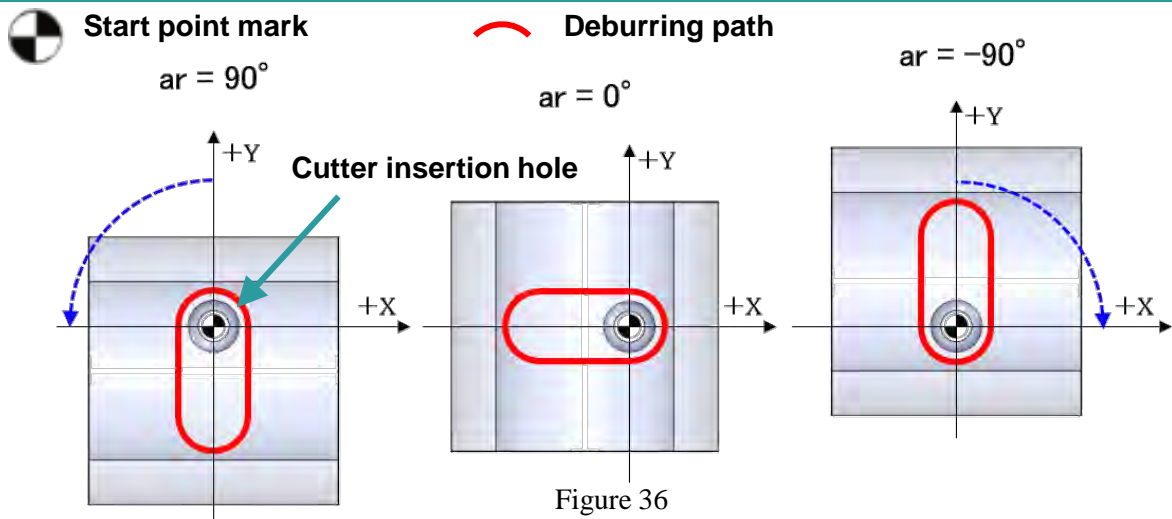


Figure 36

Upper point group data information

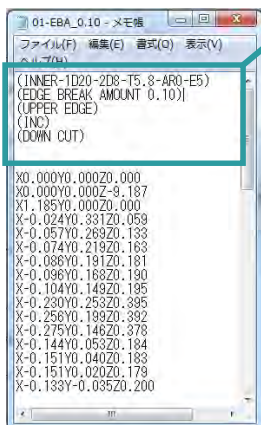


Figure 37

The data information is indicated at the start of the data.

- (INNER-1D20-2D8-T5.8-AR90-E1-L10.);
- (EDGE BREAK AMOUNT 0.30);
- (UPPER EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining [OUTER: Outer diameter edge machining]
1D20	: Cross hole diameter $\phi 20$
2D8	: Slotted hole width 8 mm
T5.8	: Cutter diameter $\phi 5.8$
AR90	: Cross hole orientation 90°
E1	: Off-center to Cross hole axis +1 mm
L10	: Distance between slotted hole R centers 10 mm
EDGE BREAK AMOUNT 0.30	: Deburring amount 0.30
UPPER EDGE	: Upper edge
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type K: Orthogonal hole : Inner diameter (Cutter insertion hole > Cross hole)

An example of the start point is shown below. (Figure 38: Example of Orthogonal hole and Off-center cross hole inner diameter)

The start point XY coordinates are the center of the Cutter insertion hole. The Z coordinate is the Cross hole center height.

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of orthogonal cross hole inner diameter

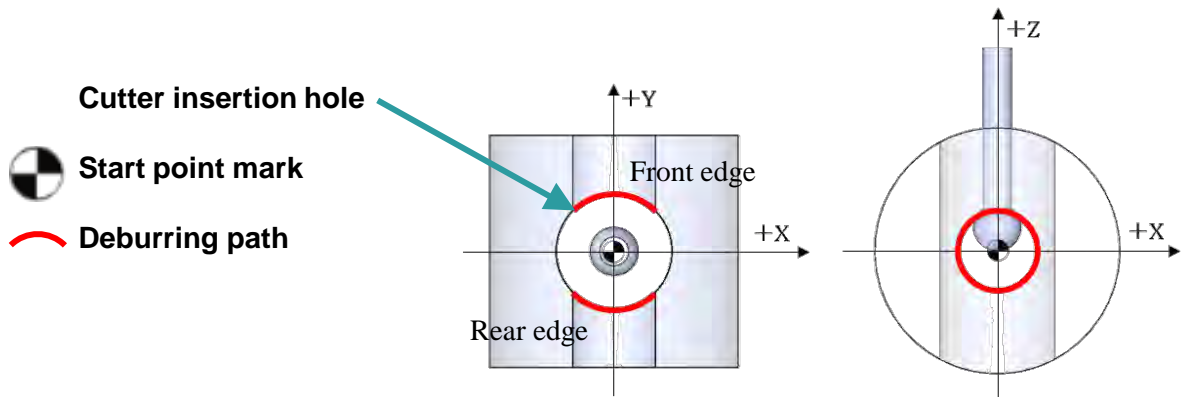


Figure 38

POINT Setting the machining conditions

Depending on the cross edge shape, there is the concern of secondary burrs occurring. Keep the tool projection as short as possible, set the feed to approximately 50% of the standard condition, and try starting from a small deburring amount.

Upper point group data information

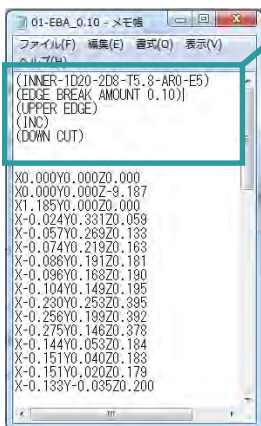


Figure 39

The data information is indicated at the start of the data.

- (INNER-1D8.-2D20.-T5.8-AR90.-E3.);
- (EDGE BREAK AMOUNT 0.30);
- (FRONT EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining [OUTER: Outer diameter edge machining]
1D8	: Cross hole diameter $\phi 8$
2D20	: Cutter insertion hole diameter $\phi 20$
T5.8	: Cutter diameter $\phi 5.8$
AR90	: Cross hole orientation 90°
E3	: Off-center to Cross hole axis +3 mm
EDGE BREAK AMOUNT 0.30	: Deburring amount 0.30
FRONT EDGE	: Front edge [REAR EDGE: Rear edge data]

Examples of machining edge start points and upper point group data (continued)

Type K: Orthogonal cross hole (ar = 90°/-90°)

Cross hole orientation in X-axis direction

An example of the start point is shown below. (Figure 40: Example when Cross hole orientation is in X-axis direction (ar = 90°/-90°))

When the Cross hole is oriented in the Y-axis direction and ar = 0°, the +Y side is the front edge and the -Y side is the rear edge. If the Cross hole orientation is changed, the positions of the front and rear edges are as shown in Figure 40.

Example when Cross hole orientation is in X-axis direction

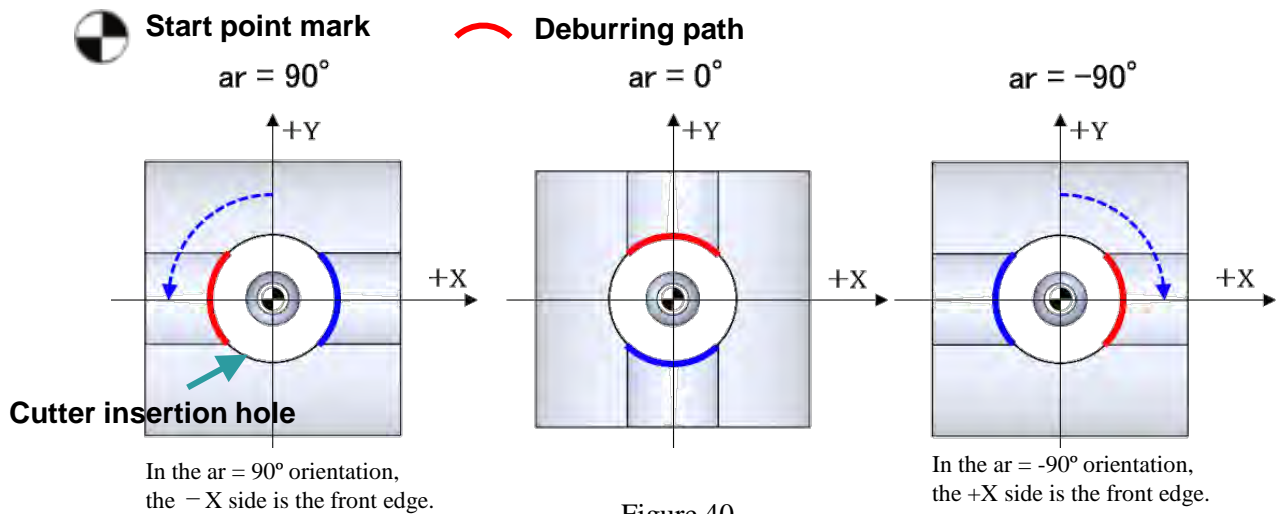
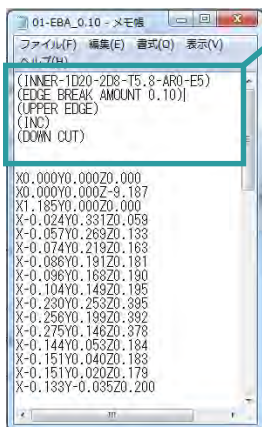


Figure 40

Upper point group data information



The data information is indicated at the start of the data.

- (INNER-1D8.-2D20.-T5.8-AR90.-E3.);
- (EDGE BREAK AMOUNT 0.30);
- (FRONT EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining [OUTER: Outer diameter edge machining]
1D8	: Cross hole diameter $\phi 8$
2D20	: Cutter insertion hole diameter $\phi 20$
T5.8	: Cutter diameter $\phi 5.8$
AR90	: Cross hole orientation 90°
E3	: Off-center to Cross hole axis +3 mm
EDGE BREAK AMOUNT 0.30	: Deburring amount 0.30
FRONT EDGE	: Front edge [REAR EDGE: Rear edge data]
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Figure 41

Examples of machining edge start points and upper point group data (continued)

Type L: Broken hole inner diameter (Cutter insertion hole \leq Cross hole)

An example of the start point is shown below. (Figure 42: Example of broken hole inner diameter)

The start point XY coordinates are the center of the Cutter insertion hole. The Z coordinate is the Cross hole center height.

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of broken hole inner diameter

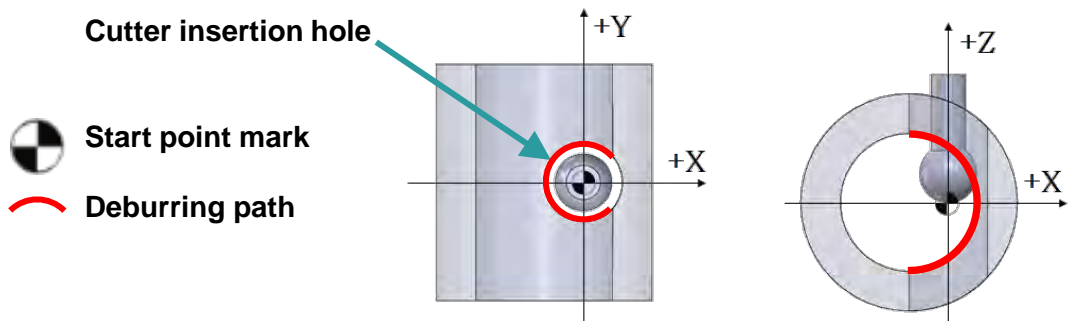


Figure 42

POINT Setting the machining conditions

Depending on the cross edge shape, there is the concern of secondary burrs occurring. Keep the tool projection as short as possible, set feedrate to approximately 50% of the standard condition, and try starting from a small deburring amount.

Upper point group data information

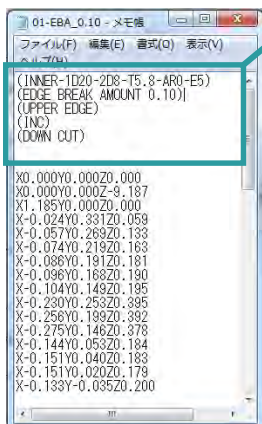


Figure 43

The data information is indicated at the start of the data.

- (INNER-1D14.-2D9.-T5.8-AR0-E4.5);
- (EDGE BREAK AMOUNT 0.10);
- (UPPER EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining
1D14	: Cross hole diameter $\phi 14$
2D9	: Cutter insertion hole diameter 9 mm
T5.8	: Cutter diameter $\phi 5.8$
AR0	: Cross hole orientation 0°
E4.5	: Off-center to Cross hole axis +4.5 mm
EDGE BREAK AMOUNT 0.10	: Deburring amount 0.10
UPPER EDGE	: Upper edge [Because L does not support upper/lower, for convenience this is considered upper.]
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type M: Broken hole inner diameter (Cutter insertion hole > Cross hole)

An example of the start point is shown below. (Figure 44: Example of breach hole inner diameter)

The start point XY coordinates are the center of the outer insertion hole. The Z coordinate is the Cutter insertion hole center height.

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of broken hole inner diameter

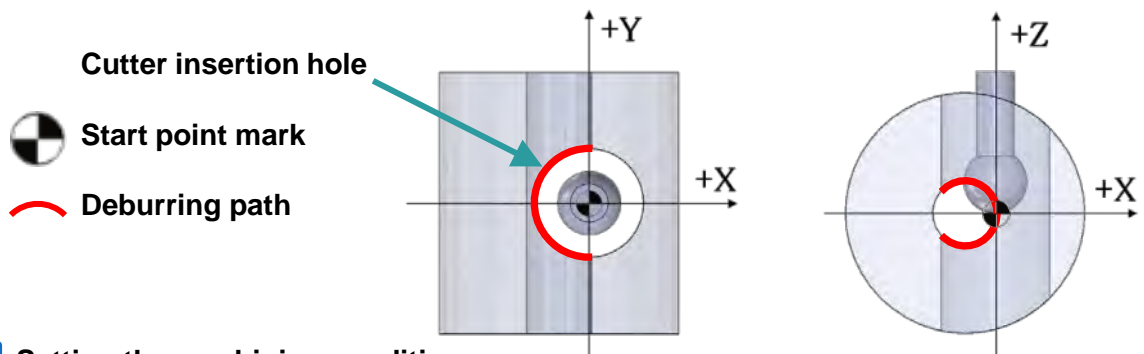


Figure 44

POINT Setting the machining conditions

Depending on the cross edge shape, there is the concern of secondary burrs occurring. Keep the tool projection as short as possible, set feedrate to approximately 50% of the standard condition, and try starting from a small deburring amount.

Upper point group data information

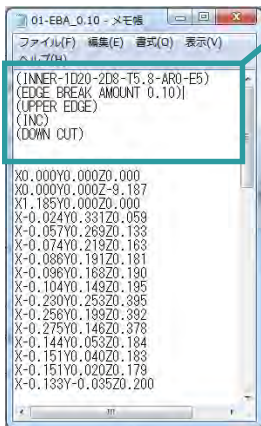


Figure 45

The data information is indicated at the start of the data.

- (INNER-1D8.-2D9.-T5.8-AR0-E3.5);
- (EDGE BREAK AMOUNT 0.10);
- (UPPER EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining
1D8	: Cross hole diameter $\phi 8$
2D9	: Cutter insertion hole diameter 9 mm
T5.8	: Cutter diameter $\phi 5.8$
AR0	: Cross hole orientation 0°
E3.5	: Off-center to Cross hole axis +3.5 mm
EDGE BREAK AMOUNT 0.10	: Deburring amount 0.10
UPPER EDGE	: Upper edge [Because M does not support upper/lower, for convenience this is considered upper.]
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type N: Angled cross hole inner diameter (Cutter insertion hole > Cross hole)

An example of the start point is shown below. (Figure 46: Example of angled cross hole (orthogonal cross hole))

The start point XY coordinates are the center of the Cutter insertion hole.

The Z coordinate is the position where the central axes of Cutter insertion hole and Cutter insertion hole intersect.

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of angled cross hole

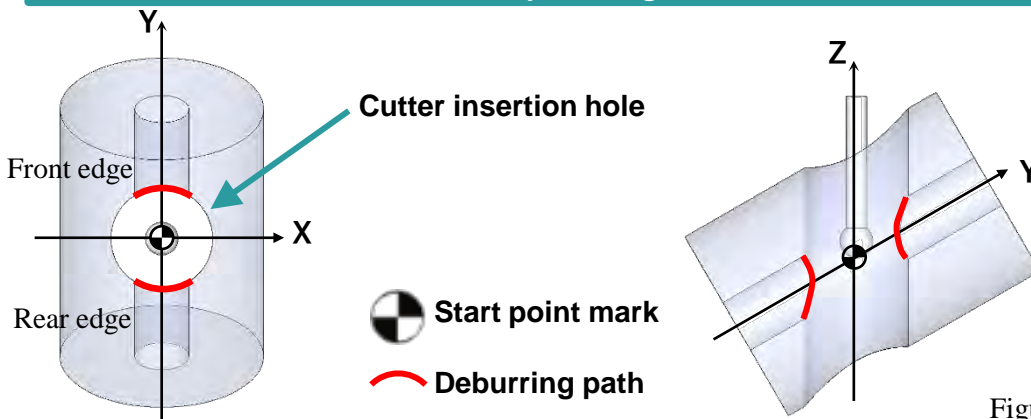


Figure 46

POINT Setting the machining conditions

Depending on the cross edge shape, there is the concern of secondary burrs occurring. Keep the tool projection as short as possible, set feedrate to 50% of the initial condition, and try starting from a small deburring amount.

POINT Front edge and Rear edge

Refer to page 30 for the relation between the front and rear edges when the cross hole orientation is other than 0°.

Upper point group data information

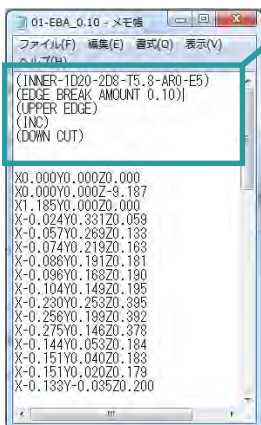


Figure 47

The data information is indicated at the start of the data.

- (INNER-1D8-2D20-T5.8-AR0-E0-AA60.);
- (EDGE BREAK AMOUNT 0.10);
- (FRONT EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining
1D20	: Cross hole diameter $\phi 8$
2D10	: Cutter insertion hole diameter $\phi 20$
T5.8	: Cutter diameter $\phi 5.8$
AR0	: Cross hole orientation 0°
AA60	: Crossing angle + 60°
E0	: Off-center to Cross hole axis 0 mm
EDGE BREAK AMOUNT 0.10	: Deburring amount 0.10
FRONT EDGE	: Front edge [REAR EDGE: Rear edge data]
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points and upper point group data (continued)

Type N: Angled cross hole inner diameter (Cutter insertion hole > Cross hole)

An example of the start point is shown below. (Figure 47: Example of angled cross hole (off-center cross hole))

The start point XY coordinates are the center of the Cutter insertion hole.

The Z coordinate is the position where the central axes of Cutter insertion hole and Cutter insertion hole intersect.

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of angled cross hole (off-center cross hole)

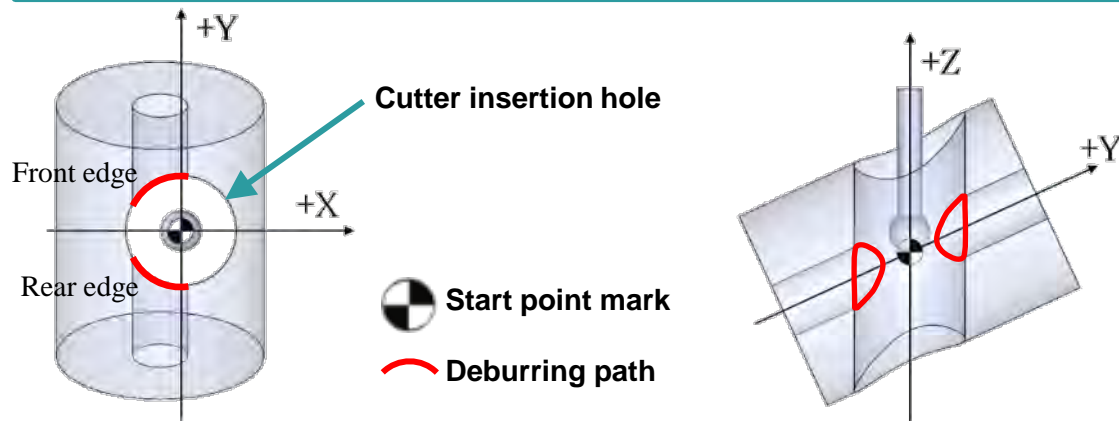


Figure 48

POINT Setting the machining conditions

Depending on the cross edge shape, there is the concern of secondary burrs occurring. Keep the tool projection as short as possible, set feedrate to 50% of the initial condition, and try starting from a small deburring amount.

POINT Front edge and Rear edge

Refer to page 30 for the relation between the front and rear edges when the cross hole orientation is other than 0°.

Upper point group data information

The data information is indicated at the start of the data.

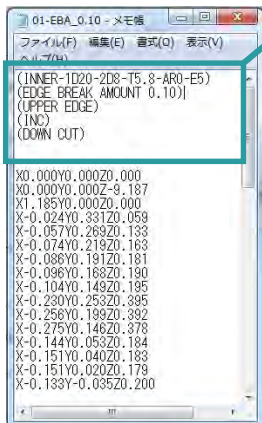


Figure 49

- (INNER-1D8-2D20-T5.8-AR0-E4.5-AA60.);
- (EDGE BREAK AMOUNT 0.10);
- (FRONT EDGE);
- (INC);
- (DOWN CUT);

INNER	: Inner diameter edge machining
1D20	: Cross hole diameter $\phi 8$
2D10	: Cutter insertion hole diameter $\phi 20$
T5.8	: Cutter diameter $\phi 5.8$
AR0	: Cross hole orientation 0°
AA60	: Crossing angle + 60°
E4.5	: Off-center to Cross hole axis +4.5 mm
EDGE BREAK AMOUNT 0.10	: Deburring amount 0.10
FRONT EDGE	: Front edge [REAR EDGE: Rear edge data]
INC	: Incremental data [ABS: Absolute data]
DOWN CUT	: Down cut machining [UP CUT: Up cut]

Examples of machining edge start points (continued)

Type P: Orthogonal cross hole and off-center cross hole: Tapped (Cutter insertion hole \leq Cross hole)

An example of the start point is shown below.

(Figure 50: Example of one-center cross hole) (Figure 51: off-center cross hole)

The start point XY coordinates are the center of the Cutter insertion hole. The Z coordinate is shifted vertically from the center of the Cross hole by half of ϕd_1 .

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of on-center cross hole and off-center cross hole: Tapped

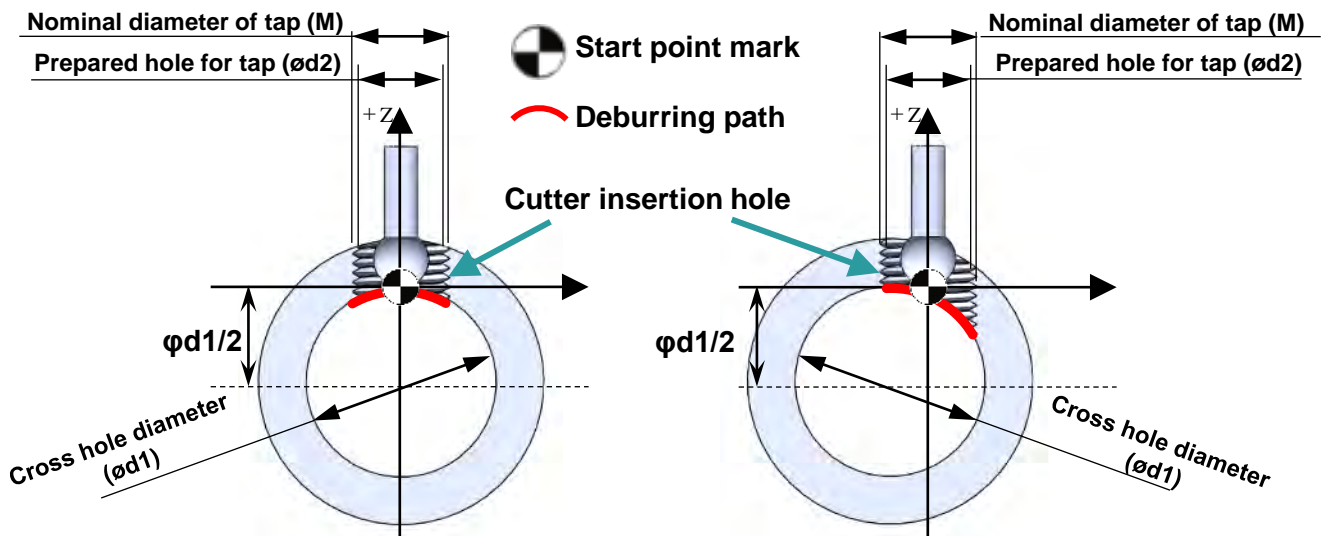


Figure 50 : On-center cross hole

Figure 51 : Off-center crossing

Content of included program

- **Path for chamfering before tapping: Pre**
 - This performs larger chamfering on the edge at the intersection between the exit surface and the prepared hole for tapping.
 - Cutting is divided into 3 parts to alleviate cutting resistance.
- **Path for chamfer finishing after tapping: Finish**
 - Finishing at a depth of cut of 0.02mm is applied after tapping.
 - Use when secondary burrs occurs due to the machining done with the Pre path.

NOTICE

Use only the Pre path if roll taps are used.

As the inside diameter gets smaller if the Finish path is used on roll tap machined areas, the cutter head will interfere with the expanding inside diameter, presenting the risk of breakage. Do not use the Finish path on roll tap machined areas.

Path integration sequence (basic sequence)

- ① Machining of prepared hole for tap
- ② Chamfering with the Pre path before tapping
- ③ Tapping
- ④ Chamfer finishing with the Finish path after tapping

POINT

When omitting the Pre path and processing only with the Finish path, reduce the feed speed when cutting, then change to feedrate for processing.

Path integration sequence (to reduce cycle time)

- ① Machining of prepared hole for tap
- ② Chamfering with the Finish path
- ③ Tapping

Examples of machining edge start points (continued)

Type Q: Flat surface hole: Tapped

An example of the start point is shown below. (Figure 52: Example of flat surface hole)

The start point XY coordinates are the center of the Cutter insertion hole. The Z coordinate is the flat surface bottom position.

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of flat surface hole back edge

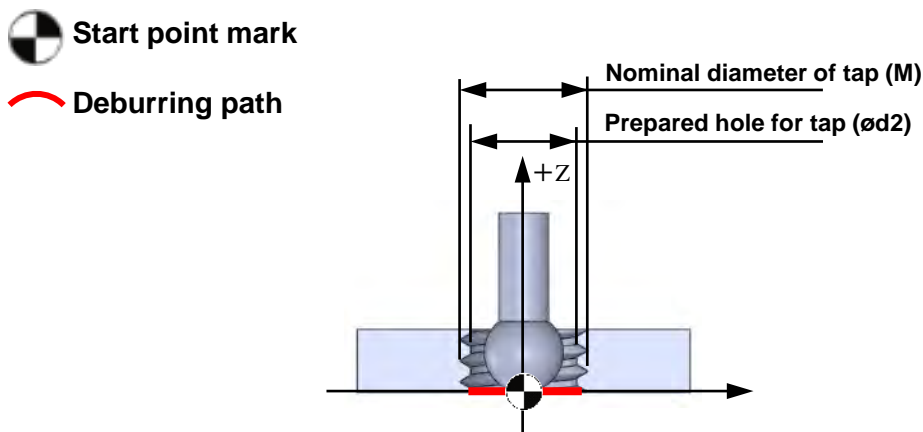


Figure 52

Content of included program

- Path for chamfering before tapping: Pre
 - This performs larger chamfering on the edge at the intersection between the exit surface and the prepared hole for tapping.
 - Cutting is divided into 3 parts to alleviate cutting resistance.
- Path for chamfer finishing after tapping: Finish
 - Finishing at a depth of cut of 0.02mm is applied after tapping.
 - Use when secondary burrs occurs due to the machining done with the Pre path.

NOTICE

Use only the Pre path if roll taps are used.

As the inside diameter gets smaller if the Finish path is used on roll tap machined areas, the cutter head will interfere with the expanding inside diameter, presenting the risk of breakage. Do not use the Finish path on roll tap machined areas.

Path integration sequence (basic sequence)

- ① Machining of prepared hole for tap
- ② Chamfering with the Pre path before tapping
- ③ Tapping
- ④ Chamfer finishing with the Finish path after tapping

Path integration sequence (to reduce cycle time)

- ① Machining of prepared hole for tap
- ② Chamfering with the Finish path
- ③ Tapping

POINT

When omitting the Pre path and processing only with the Finish path, reduce the feed speed when cutting, then change to feedrate for processing.

Examples of machining edge start points (continued)

Type R: Angled surface hole: Tapped

An example of the start point is shown below. (Figure 53: Example of angled surface hole)

The start point XY coordinates are the center of the outer insertion hole. The Z coordinate is the height at which the outer insertion hole axis intersects the angled surface.

The absolute command XEBEC Back Burr Path is generated with each start point at the machining origin.

Example of angled surface hole

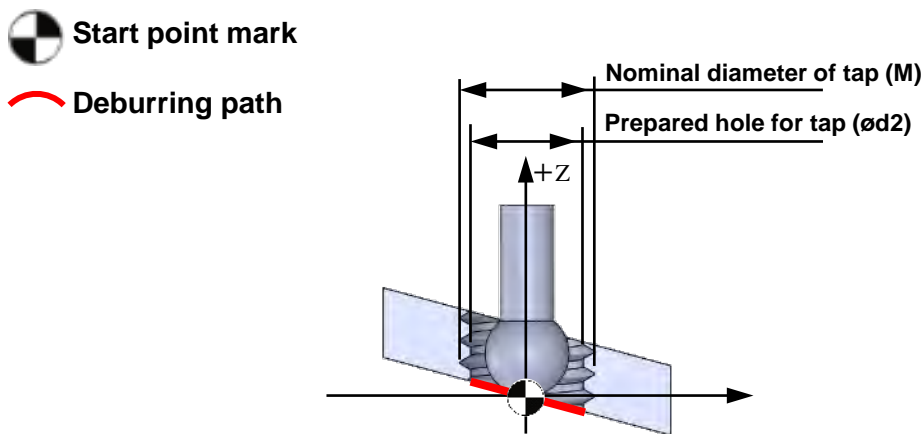


Figure 53

Content of included program

- Path for chamfering before tapping: Pre
 - This performs larger chamfering on the edge at the intersection between the exit surface and the prepared hole for tapping.
 - Cutting is divided into 3 parts to alleviate cutting resistance.
- Path for chamfer finishing after tapping: Finish
 - Finishing at a depth of cut of 0.02mm is applied after tapping.
 - Use when secondary burrs occurs due to the machining done with the Pre path.

NOTICE

Use only the Pre path if roll taps are used.

As the inside diameter gets smaller if the Finish path is used on roll tap machined areas, the cutter head will interfere with the expanding inside diameter, presenting the risk of breakage. Do not use the Finish path on roll tap machined areas.

Path integration sequence (basic sequence)

- ① Machining of prepared hole for tap
- ② Chamfering with the Pre path before tapping
- ③ Tapping
- ④ Chamfer finishing with the Finish path after tapping

POINT

Path integration sequence (to reduce cycle time)

- ① Machining of prepared hole for tap
- ② Chamfering with the Finish path
- ③ Tapping

When omitting the Pre path and processing only with the Finish path, reduce the feed speed when cutting, then change to feedrate for processing.



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