Training manual
H-5489-8415-01-C

RENISHAW
apply innovation™

Renishaw incise DM10 Training Manual

incise™

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Renishaw part no: H-5489-8415-01-C

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Contents

Before you begin

Safety

Information to the machine supplier/ installer

It is the machine supplier's responsibility to ensure that the user is made aware of any hazards involved in operation, including those mentioned in Renishaw product literature, and to ensure that adequate guards and safety interlocks are provided.

The Renishaw Dental Milling Machine is used to machine dental frameworks. The machine should be used only within a dental laboratory environment. It is assumed that the user is thoroughly familiar with the operation of the milling machine and its software.

If this product is not used in its intended manner, any protection provided may be impaired.

WARNINGS

The sound level at 1 m is >80 dB(A). Ear protection should be worn.

The equipment is isolated from ac power by disconnection of the mains leads from all units. If any additional means of isolation is required, it must be specified and fitted by the installer of the product. The isolator must be sited within easy reach of the operator and comply with IEC61010 and any additional national wiring regulations for the country of installation.

Under no circumstances must any moving components be touched whilst they are in motion. Before operating the machine, secure all loose clothing and hair so that there is no risk of them becoming entangled in the rotating spindle.

The tooling is sharp. Take care when operating the machine and changing tools.

Lifting

Boxed Milling Machine: A two-person lift is required.
Standalone Milling Machine: A one-person lift is required. Use the handle on the rear of the machine and the foot at the front.
Mobile Ancillary Unit: The MAU is 68 kg, a mechanical aid should be used for lifting.

CAUTIONS

Use only the power supply unit (PSU) supplied with your milling machine. No other power supplies are to be used.

The milling machine PSU and spindle frequency converter must be connected to a supply that incorporates a protective earth conductor via a 3-core mains cable (line cord).

Permanent magnets are used in some components of the incise™ system and associated products. It is important to keep them away from items that may be affected by magnetic fields, e.g. data storage systems, pacemakers and watches etc.

Do not attempt to take the Renishaw dental milling machine apart or try to modify it. The milling machine contains no parts that can be serviced or repaired by the user.

The spindle will not operate when the front cowl is in the upper position. During a cutting operation, the machine will stop if the cowl is lifted.

Tools and services

In order to follow this manual through and complete the process of machine installation, framework milling and machine maintenance, we recommend that you have access to the following:

- Air line
- Grit blaster and grit
- 13 A power
- Furnace tile (optional)
- Face mask
- Eye protection
- Safety gloves

Installation

Kit contents

- Renishaw Dental Milling Machine
- Probe and stylus assembly
- Cleaning kit
- Ancillary unit cable
- USB cable
- PSU AC-DC 70 W 18 V
- USB smartcard reader
- 6 mm black air pipe
- Spanner (× 2)
- Renishaw incise™ CAM software (CD-ROM)

Hardware

Packaging

CAUTION:

The original packaging should be stored for use if the units are to be relocated.

Renishaw Dental Milling Machine

Unit to be unpacked by trained Renishaw personnel only.

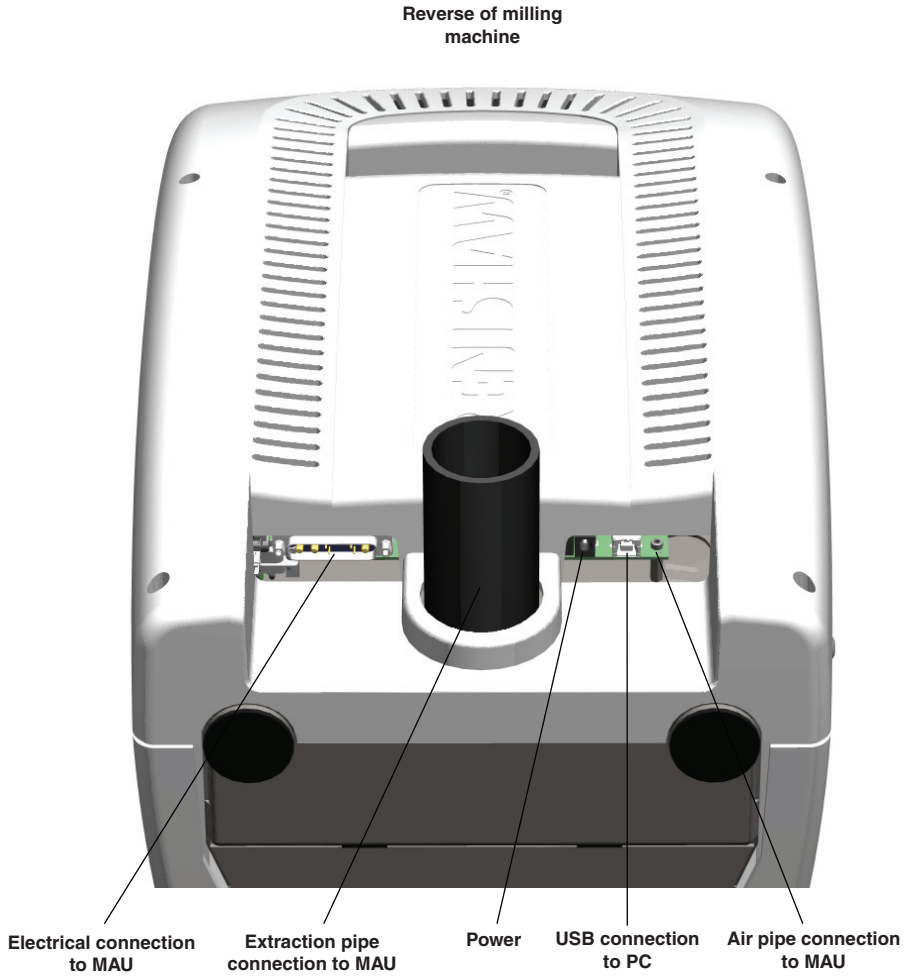
Mobile ancillary unit (MAU)

Unit to be unpacked by trained Renishaw personnel only.

Connections

Make the following connections:

- The air pipe between the milling machine and the MAU.
- The electrical cable between the milling machine and MAU.
- The extraction pipe between the milling machine and the MAU.
- The USB cable between the milling machine and the PC.
- The power lead to the MAU.
- The power lead to the Milling Machine.
- The extraction pipe to the inlet on top of the MAU.



Software

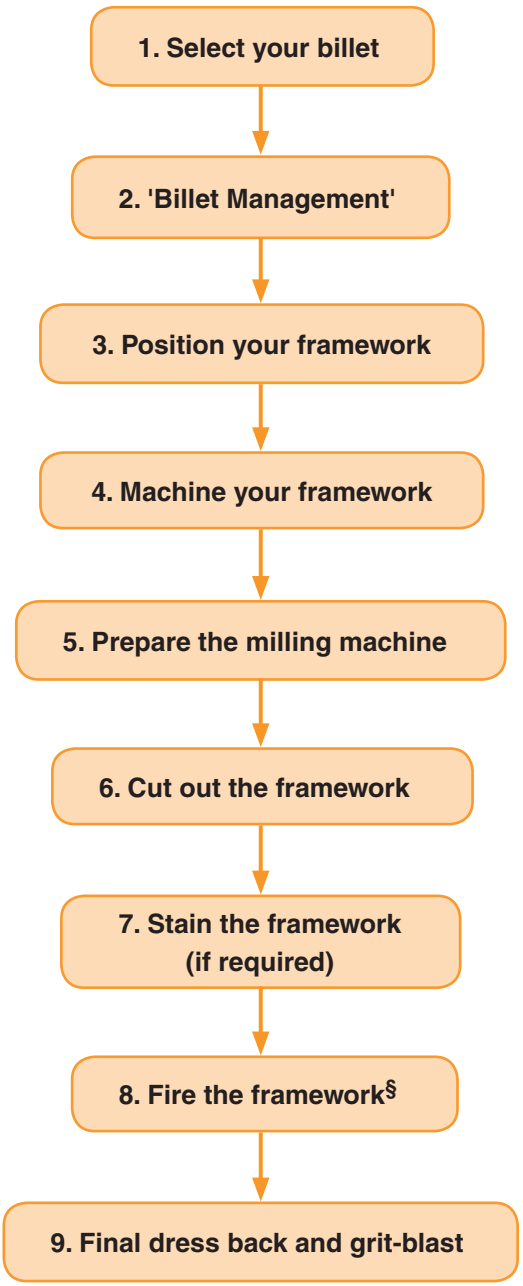
Load the software CD into the drive, follow the on-screen prompts and click 'Next' through all stages.

For new installations, type in the 28-digit customer serial number which is supplied by Renishaw.

Creating frameworks

In-lab machining overview

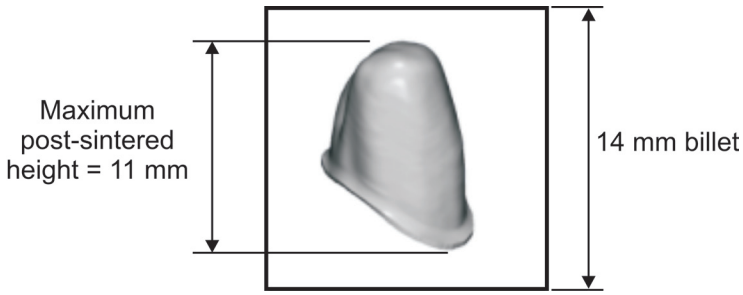
Following the scanning process and submission to local manufacturing, the framework(s) will now be ready for machining. Work through the following steps:

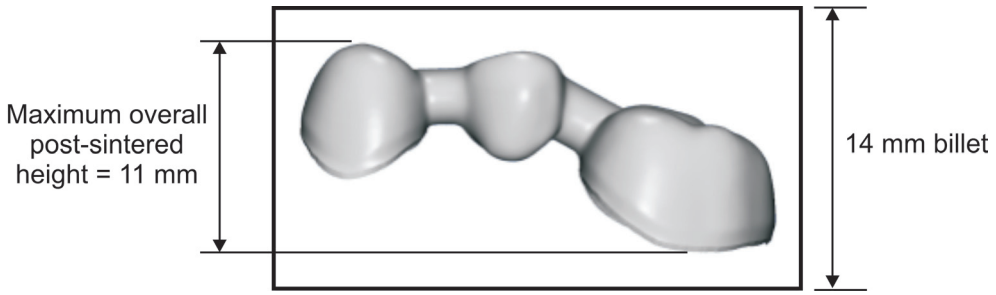


§ Refer to H-5489-8500, 'Clinical and laboratory recommendations'

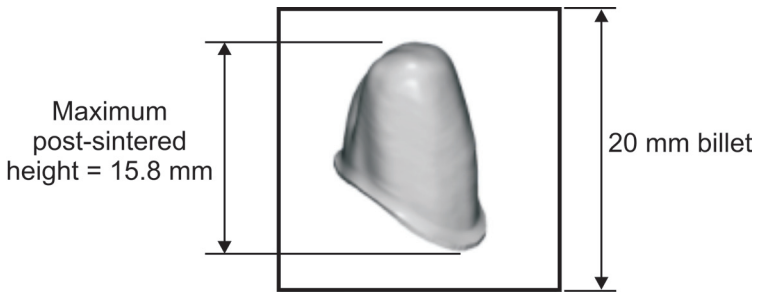
Select your billet

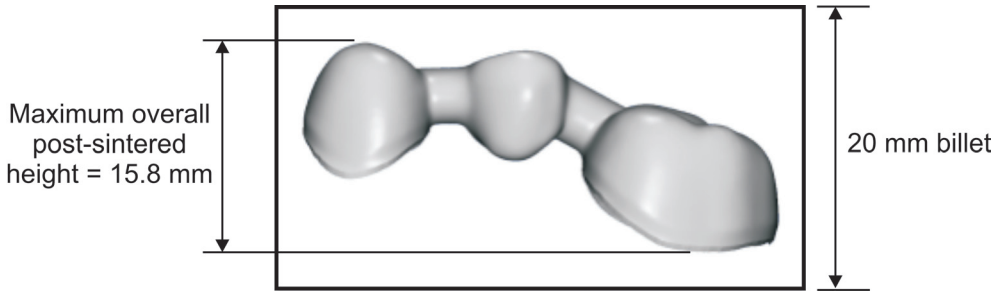
14 mm billet





20 mm billet



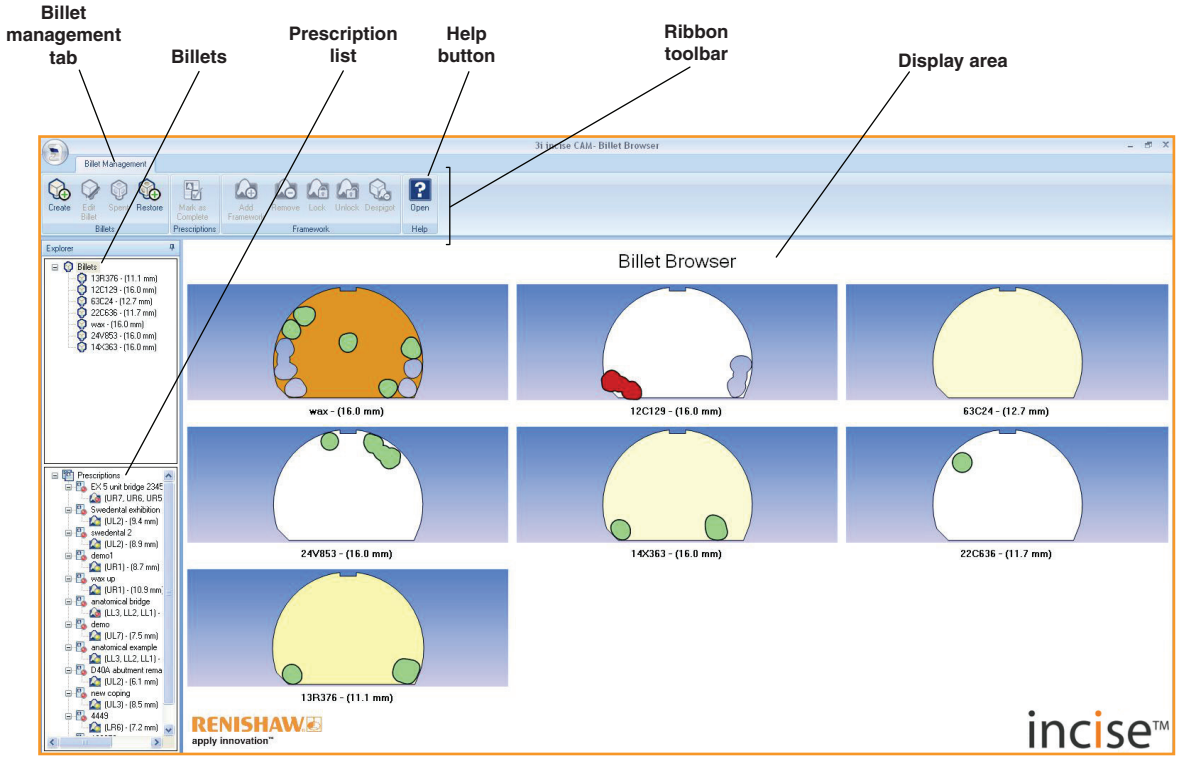


NOTES:
The software generates cutting paths automatically once a framework is positioned.
During machining, more frameworks can be added to the billet. They will be generated and machined automatically.

'Billet Management'

The Billet Management tab is used to manage billets and to lay out frameworks within a billet for manufacture. The Billet Management ribbon bar contains the following groups:

- Billets
- Prescriptions
- Framework
- Help



'Billet Management' icons

'Billets' group icons

	**Create**	This button is used to add a new billet to the system. The following information must be entered: • Reference: This is the name that is printed on the billet. It is used to track the billet through the system. • Material: This indicates the type and shade of the material. • Billet Type: This defines the shape, size and thickness of the billet. It must be selected from the drop-down list of supported billets. • Shrinkage: This value is supplied with the billet. It is used to calculate how much the material will shrink during firing.
	**Edit**	Adjust any of the fields listed above.
	**Spent**	After a billet is spent and all frameworks are marked as cut out, the billet cannot be used for further manufacture. Highlight it in the billet list and use this button to remove it from the list. This ensures that you are only offered billets with usable space in them for layout and machining.
	**Restore**	This is the opposite of the “Spent” option. It allows a billet that is marked incorrectly as spent to be returned to the available “Billets” list.

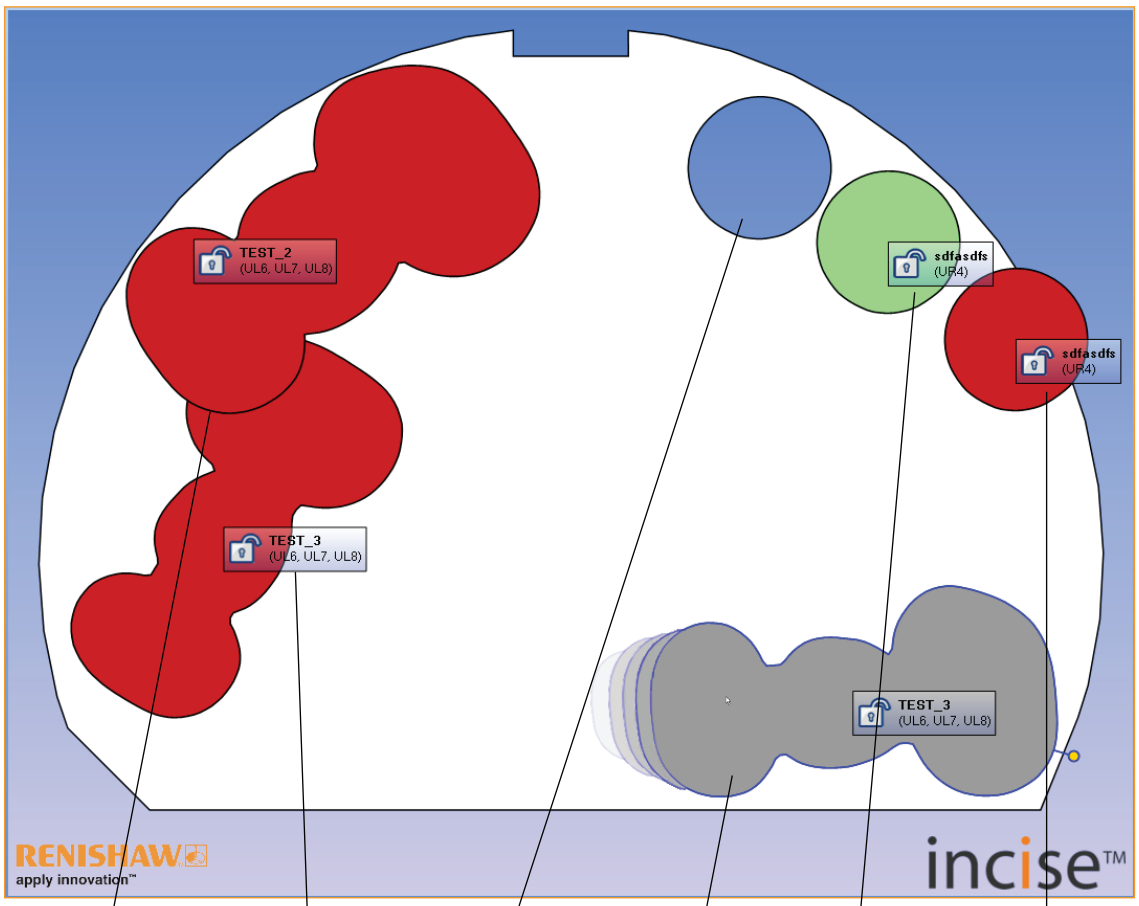
Prescription icon

When a prescription is submitted for local manufacturing in the incise™ CAD software, it appears automatically in the Prescription list.

	**Mark as Complete**	After all frameworks in a prescription have been machined and cut out, highlight the prescription. Use this button to remove it from the list.

Position your framework

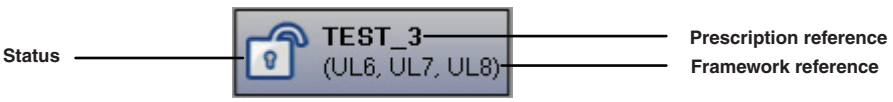
Locate the desired framework from the prescriptions section of the explorer, right click on it and select 'Add Framework'. It will appear on the billet where you can now position it as desired.



Framework position status

Red	Red indicates that the framework position is not acceptable as it overlaps the edge of the billet or another framework.
Green	Green indicates that the framework position is acceptable for manufacture. A framework cannot be locked for manufacture unless it is green.
Background colour	Where the background colour is displayed, this indicates areas of the billet that have already been machined and cut out.
White	White indicates unused areas of the billet.

Each framework has a tag that displays its identification and status.



Framework icons

The buttons shown below are used to control which frameworks are machined from which billets.

	**Add Framework**	Highlight the framework in the framework list and use this button to add it to the billet. This will display a silhouette of the framework within the billet which can then be moved to the required position for machining.
	**Remove Framework**	Using the left mouse button, select the framework in the display area then use this button to remove it from the billet.
	**Lock Framework**	Before a framework can be machined, it must be locked. This should be done after the framework has been placed in the correct position within the billet. The framework will then be visible in the machine tab when the billet is selected for a machine.
	**Unlock Framework**	If you want to reposition a framework after it has been locked, use this button to unlock it. Note that this is not possible when machining of the framework has started.
	**De-spigot**	After a framework has been machined and removed from the billet, use this button to remove it from the billet and show the area that the framework occupied as cut out or “de-spigotted”.

Status values

	**Unlocked**	The framework can be repositioned within the billet.
	**Locked**	The framework is locked ready for manufacture. It will be visible in the machine tab when the billet is selected for a machine.

NOTE:
The software generates cutting paths automatically once a framework is positioned.
More frameworks can be added to the billet. They will be generated and machined automatically.

Machine your framework

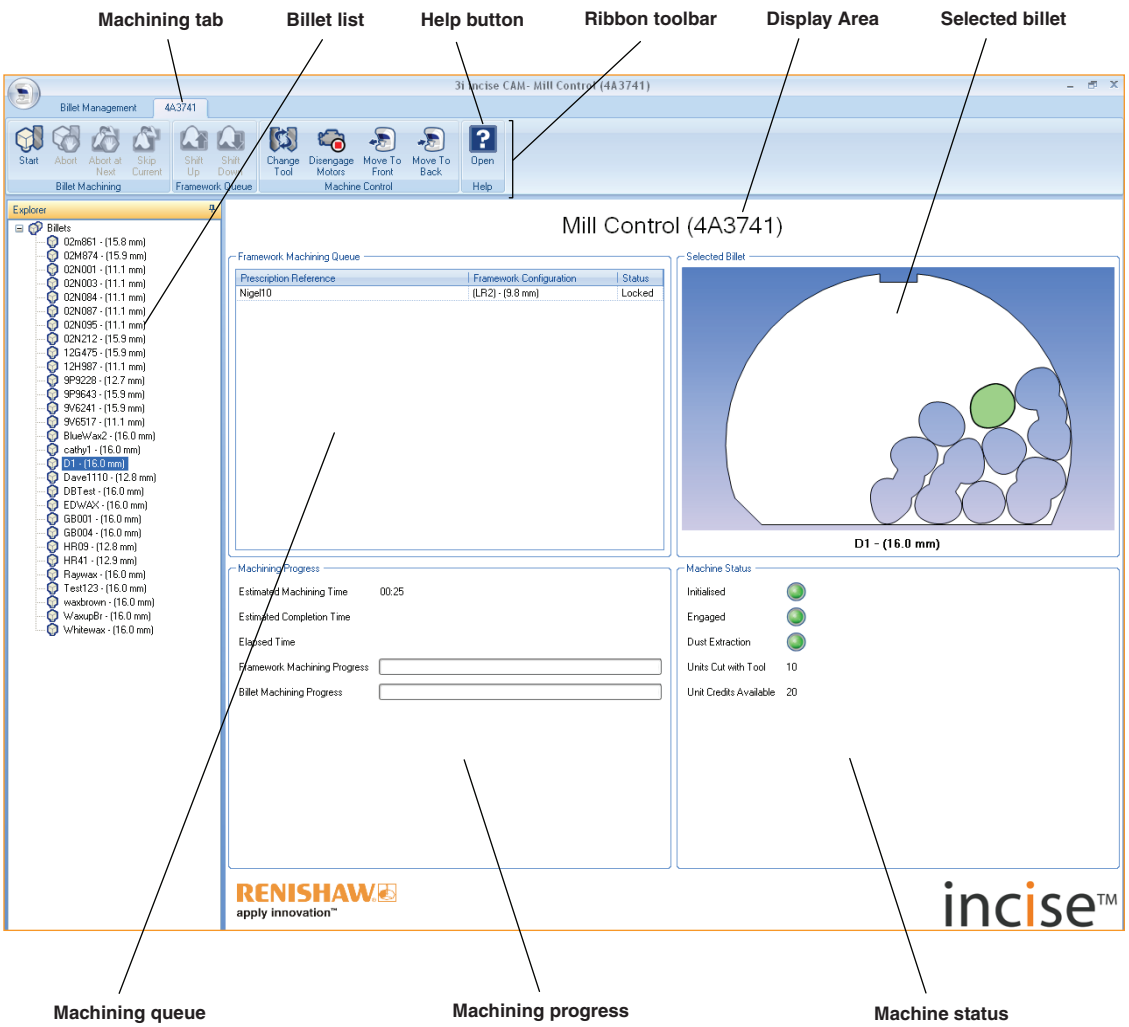
All the machining functions are located in the Machine Control tab which is located next to the Billet Management tab and represented by the serial number of connected milling machine(s). There is a Machine Control tab displayed for each milling machine that is connected to the system.

NOTES:
A tab is not displayed until the milling machine has been connected to the system and switched on. After switching on, the tab may take a couple of minutes to appear as the machine needs to download its software from the PC before it can be used.
To machine your frameworks, a valid smartcard with available credits is required. These are material specific and are included with billets purchased from Renishaw.
When the milling machine is initiated for the first time and when a tool is replaced, a 'tool set' will occur. This involves running the spindle for 5 minutes without any machine movement followed by a series of holes cut and measured in the billet. The machine will be fully operational again on completion.

Using the machining tab

The machine control ribbon toolbar contains the following groups:

- Billet Machining
- Framework Queue
- Machine control
- Help



Display area

The display area gives access to the following sections:

- **Framework machining queue**

This section lists all frameworks that are locked for manufacture within the current billet. The Status column can show one of the following:
Locked, generation in progress, ready for machining, being machined, machining completed, generation failed or machining failed.

- **Selected billet**

This section shows the contents of the billet that is currently being machined.

- **Machining progress**

This section gives an estimated time to machine the current framework and billet.

- **Machining status**

This section shows the status of the milling machine.

Initialised		The machine is fully operational.
		Waiting for the machine to initialise. Machine not connected.
Engaged		The motors are engaged. The machine can be moved under program control.
		The motors are disengaged. The motors must be engaged using the “Engage Motors” button before the machine can be used.
Dust extraction		The dust extraction system is OK.
		The dust extraction bag must be emptied.
Units cut with tool	This shows the total number of units that have been cut since the last tool change. When this number reaches 24, a tool change is automatically enforced.	
Unit credits available	Once a billet is loaded, this shows the number of credit units left on the smartcard. This number must be at least equal to the number of units in a framework for that framework to be machined. If this is not the case, subsequent frameworks will be machined if they require fewer units.	

Start machining

1. Ensure the correct billet is selected and the framework is in place.
2. Click on 'Start Machining' 
3. Follow the on-screen instructions to load the billet, tool and probe.

Prepare the milling machine

Loading a billet

To ensure the highest standard of fit, we recommend that only billets supplied by Renishaw are used with the system. Other billets could have inaccurate shrinkage factors resulting in ill-fitting frameworks and/or premature ageing of the tool.

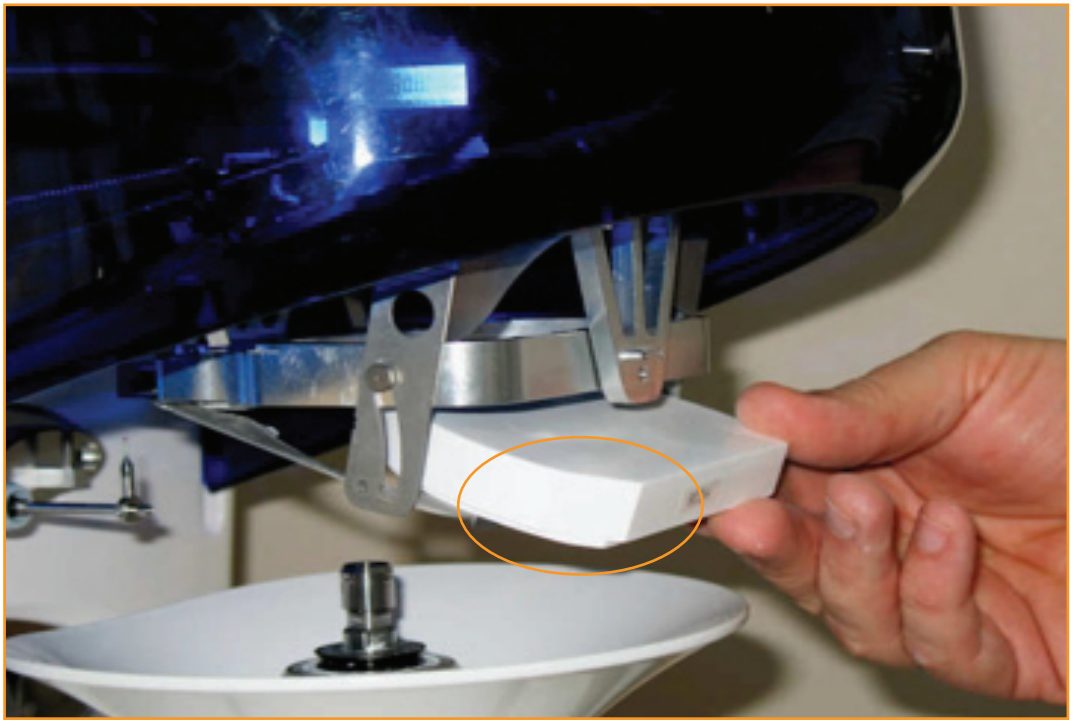
A billet should be loaded only when requested by the system. The billet carrier is then driven to the billet change position.

1. To open the billet carrier, place your thumbs on the front of the carrier with one finger either side in the slots in the side arms.

2. Push up the side arms and rotate them towards the front of the machine. The carrier tray will drop down to allow the billet to be inserted.

3. Load the billet with the chamfered corner to the left and the flat edge towards the front of the machine.

4. When the billet is in position, close the carrier by pushing the carrier shelf up and rotating the side arms down and towards the back of the machine to lock them in place.



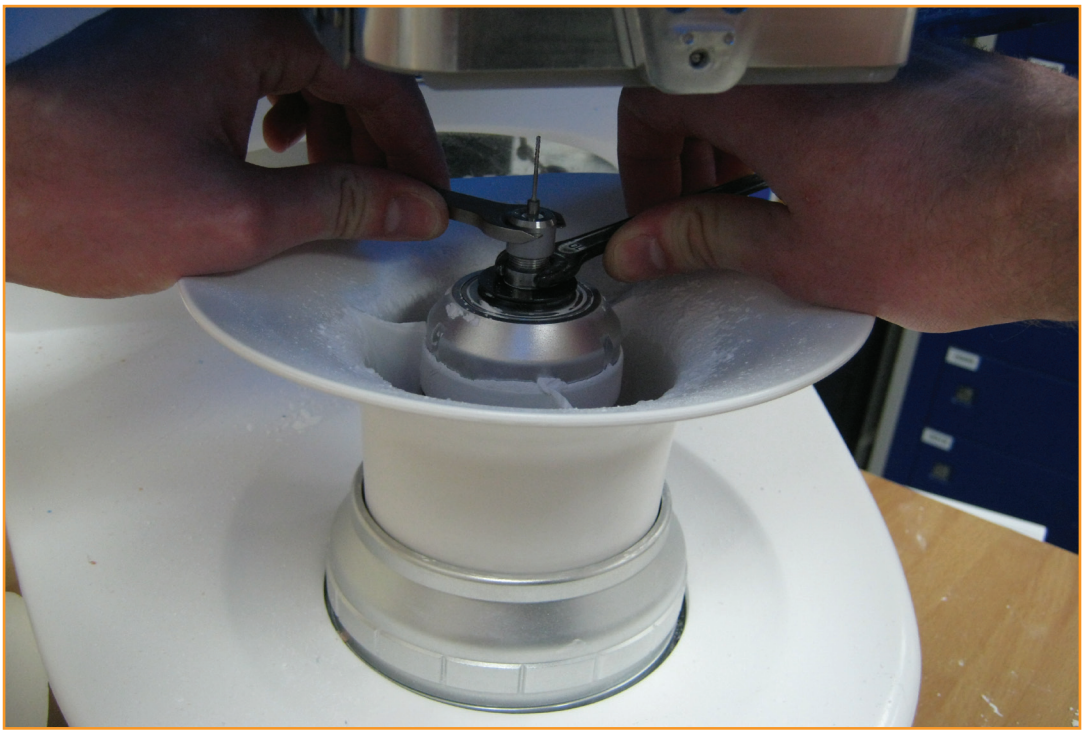
Loading a tool

A tool change is forced after machining 24 units. If a tool becomes blunt before this time, it can be changed after selecting the 'Mark tool as spent' button.

CAUTION

Do not drop the collet or tool down the spindle vents.

1. To loosen the collet, use two tool-change spanners as shown below.



2. Hold the spindle with the bottom spanner and slacken the collet with the top spanner until the tool is free to be removed.
3. Remove the collet and the collet nut and thoroughly clean with compressed air.
4. Clean the tapered hole in the spindle with a dry cotton bud and remove all trace of dust.
5. Replace the collet and the collet nut.
6. Insert the new tool fully into the collet and tighten it using the torque spanner to 4.75 Nm.

IMPORTANT: Do not tighten the collet nut until the tool is inserted.

Loading the probe

1. Hold the module with the stylus in the vertical position.
2. Move the probe module towards the machine module until the magnet pulls the module into position.
3. A correctly positioned module cannot be rotated. Gently try and rotate it to ensure a secure fit.

Machining icons

Billet machining

	**Start**	Start machining. This is possible only when the following conditions apply: • A billet is selected. • At least one framework is in the framework queue. • The machine status indicators are all green and credit units are available on the smartcard.
	**Abort**	Stop machining immediately. Note that the current framework will not be usable but will still count as a machined framework.
	**Abort at next step**	Stop machining after the current framework is complete.
	**Skip current**	Stop machining the current framework and start machining the next one. Note that the current framework will not be usable but will still count as a machined framework.

Framework queue

The buttons in this group are used to change the order of the frameworks waiting to be machined in the framework machining queue. Highlight a framework using the left mouse button before shifting.

	**Shift up**	This moves the highlighted framework up one place in the queue.
	**Shift down**	This moves the highlighted framework down one place in the queue.

Status values

	**Generation in progress**	The cutting paths are being generated for this framework.
	**Ready for machining**	The cutting paths have been generated and the framework will be machined when it reaches the top of the queue in the machine tab. Note that the framework cannot be unlocked beyond this stage of the process.
	**Being machined**	The framework is currently being machined.
	**Machining complete**	The framework has been fully machined and is ready for cutting out.

Error states

	**Generation failed**	Cutting paths could not be generated for this framework. Contact Renishaw for assistance.
	**Machining failed**	The machining process failed. The framework machining process will need to be repeated.

Machine control

These buttons are used to control the milling machine outside the normal billet machining sequence.

	**Change tool**	A tool change is forced automatically after a certain number of framework units have been machined. If the tool breaks or becomes blunt prematurely, this button is used to force a tool change before the next framework is machined.
	**Disengage motors**	This disengages the motors. Note that the machine may move as power is removed from the motors, so care should be taken to ensure that the tool is not in contact with the job before this button is pressed.
	**Engage motors**	This engages the motors. Note that the machine may move as power is applied to the motors. Move the machine by hand if necessary to ensure that the tool is not in contact with the job before this button is pressed.
	**Move to front**	This moves the billet carrier and billet up and towards the front of the machine. This is useful if you want to inspect the billet.
	**Move to back**	This moves the billet carrier and billet up and towards the back of the machine. This is useful if you want to inspect the tool.

Cut out the framework

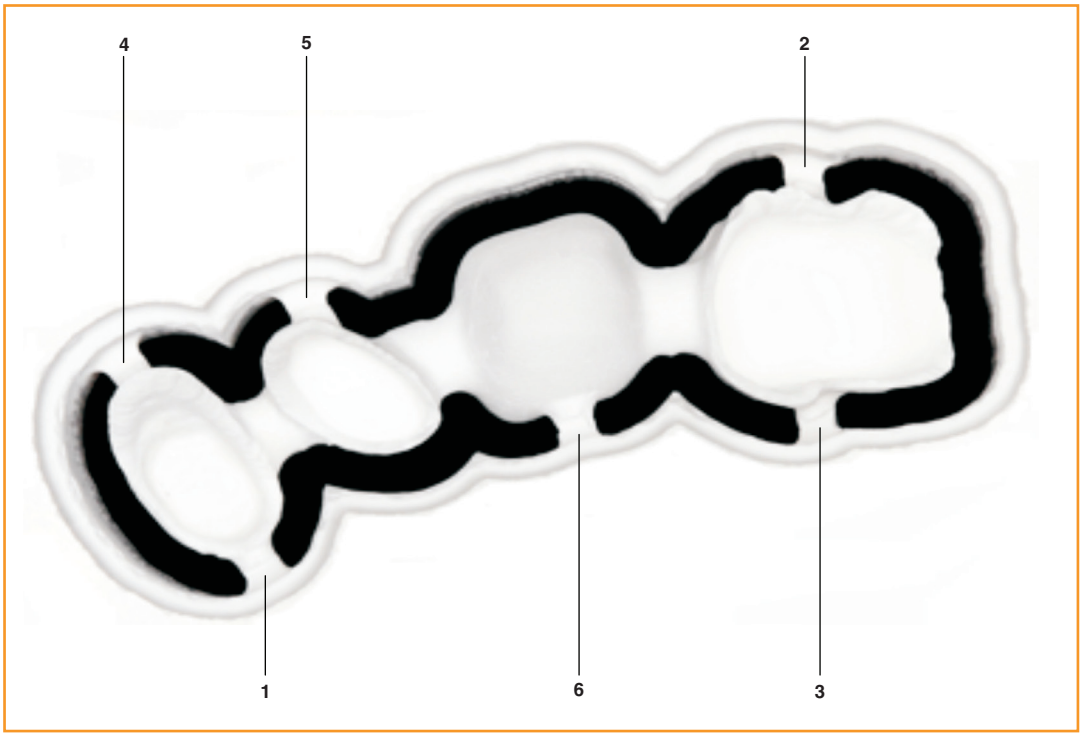
WARNING
Always wear safety glasses when cutting out frameworks.

Removing frameworks from a billet carrier (up to 4 units)

1. Remove the billet from the billet carrier.

2. Using an air line, blast the zirconia dust from the framework and billet. The pressure should be no more than 87 psi (6 bar) and the nozzle should be at least 150 mm from the framework.

3. Using a pencil grit blaster set to 29 psi (2 bar), with 50 µm aluminium oxide grit and a 0.75 mm nozzle, gently cut away the spigots at the thinned down sections. A suggested order in which to cut the spigots on a bridge is shown below. Take great care when performing this task.



4. Clean the framework once more with an air blast.

5. Dressing can be performed in the pre-sintered state. Carefully remove the spigot ends from the framework using a fine carbide or diamond impregnated rotary tool and a standard hand-held driver.

Removing frameworks from a billet carrier (5 units or more)

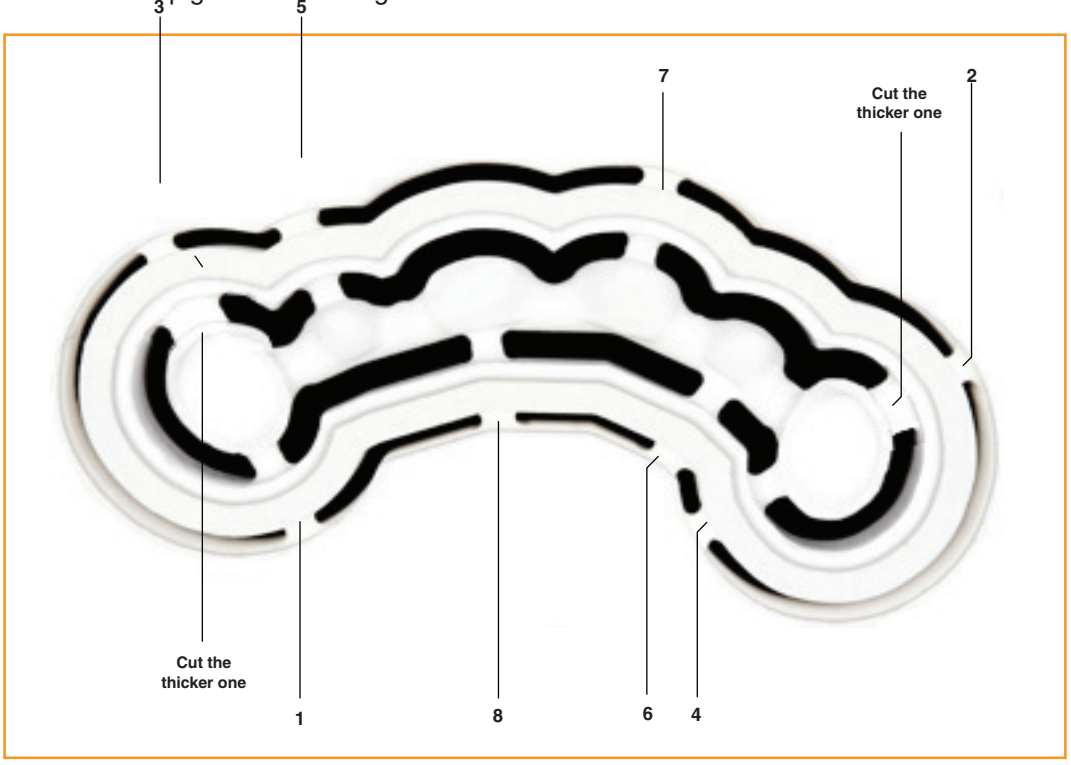
A sintering frame is automatically generated for bridges of five units and more. This constrains the bridge so that it does not warp in the sintering furnace. To remove the sintering frame and bridge from the billet:

1. Cut all the spigots that hold the sintering frame into the billet.

2. Each end unit on the bridge has two spigots – the thicker of the two in each case must be cut prior to sintering. All other spigots between the bridge and the sintering frame must remain intact.

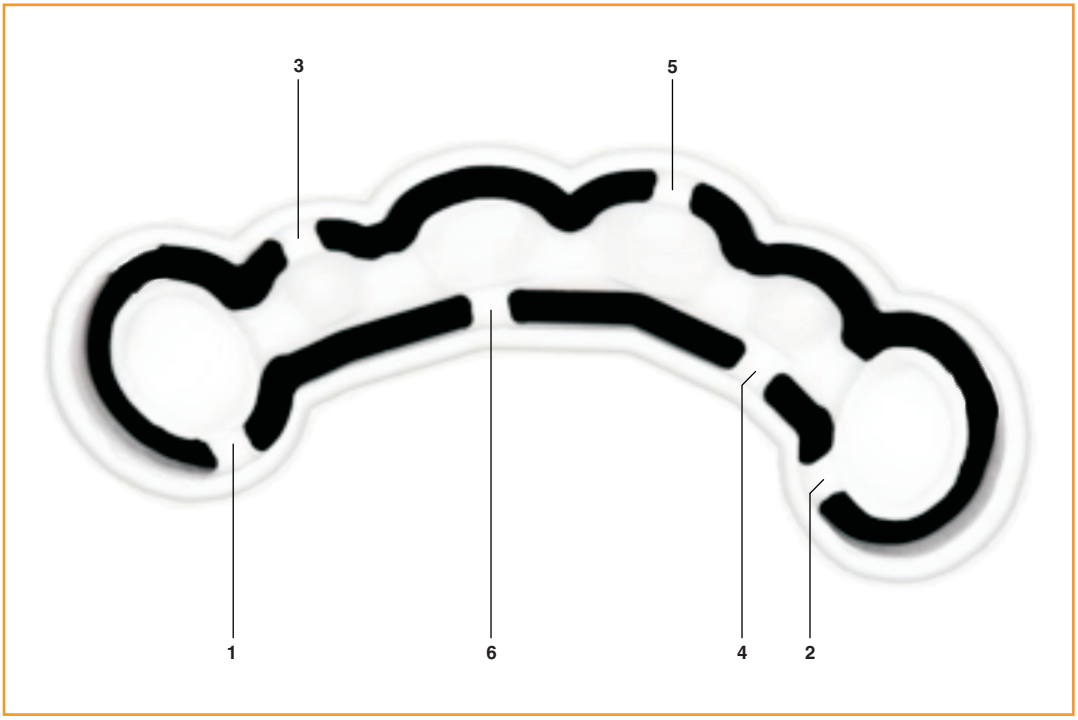
3. Cut the sintering frame spigots with a pencil grit blaster set to approximately 87 psi (6 bar), with 50 – 100 µm alumina blasting medium.

4. Cut the thick spigots on the bridge end units with a fine carbide lab bur.



5. When the sintering frame is removed from the billet, the flat surfaces of the sintering frame must be cleaned before placing the job on a furnace tile. The tile will keep the sintering frame flat, ensuring the bridge does not distort in the furnace. Ensure the surface of the tile is also clean of all dust (see page 23 for more information on the furnace tile).

6. After the bridge has been sintered, cut the spigots that hold the bridge to the sintering frame to release the framework. Do this using a coarse or super-coarse diamond bur. Burs of diameter 0.5 mm to 1.2 mm are suitable. Take care to avoid excessively heating the bridge and apply only a light pressure. If required, apply water cooling.



7. When the bridge is released from the sintering frame, dress back the spigots on the bridge using a diamond-impregnated rubber wheel. Apply only a light pressure to avoid overheating the framework. If required, apply water cooling.

8. Finally, grit-blast the whole framework at a pressure of 87 psi (6 bar) with 50 µm alumina blasting medium.

Stain the framework

If required, the framework should be stained following the cutting out and before firing.

Fire the framework

Use the operating instructions supplied with the furnace along with the guidelines below.

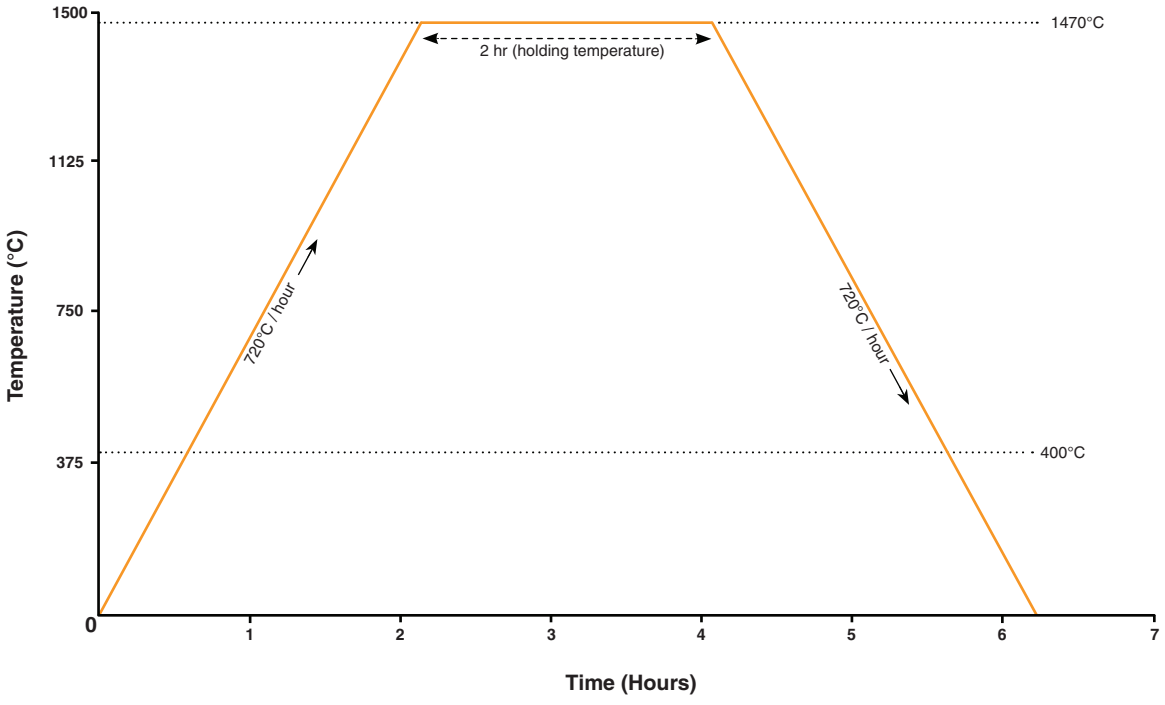
Firing

WARNING:
During this operation the temperature of the furnace will exceed 400 °C. The door of the furnace may be opened during the cooling stage of the cycle when the temperature is below 400 °C. However, it is recommended that the furnace cools to room temperature before being opened it to help maximise the heating element life-span.
If you do remove the frameworks early, you must use the protective gloves and tongs supplied and eye protection must be worn.
Place the hot crucible onto the heat-proof mat supplied.

IMPORTANT:
If you are firing bridges with five units or more, they must be fired within a sintering frame. The frame should be placed on a furnace tile.
The furnace tile is an additional item and can be purchased from Renishaw (part no. M-5495-0221).
It is a precision-ground alumina ceramic disc which is made to a high degree of flatness.
The tile supports the sintering frame that is produced around longer span bridges of 5 units and more.
It is extremely important that the tile is used for these frameworks because without it the surfaces of the sintering frame will distort and the accuracy of the bridge will be compromised. The sintering tile is designed to remain extremely flat even at very high temperatures, for this reason it should only ever be placed flat on the furnace floor and should have nothing but sintering frame bridges placed upon it.
Never load a crucible onto a tile or suspend the it over a crucible.

Sintering of frameworks

1. Clean the framework with an air blast.
2. Ensure the crucible has a layering of 250 µm alumina grit in the bottom 10 mm deep.
3. Place the framework(s) into the crucible. Ensure that adjacent frameworks do not contact one another.
4. Sinter the framework(s) to the profile shown below.



Framework loading guidelines

- Before loading each coping or bridge, break up the aluminium oxide sand to a smooth, fine texture with no large clumps to ensure fluidity.
- The depth of the sand in the crucible must not exceed 10 mm.
- Before loading any crucible into the furnace, check that no sand particles are trapped inside the copings, as this can affect the fit of the final product.

	✓	**Correct** The crucibles must be stacked one above the other in the furnace.
	✗	**Incorrect** The crucibles must be stacked one above the other, not at an angle.
	✗	**Incorrect** A crucible should not be balanced on the sintering frame. Additionally, the sintering tile must rest directly on the furnace floor – not above any crucibles.

Coping guidelines – single units

	✓	**Correct** A single unit coping can be buried up to half of its depth for support.
	✓	**Correct** A single unit coping can be laid flat and slightly pressed into the sand to provide support from underneath.
	✗	**Incorrect** The coping is balanced on top of the sand and subsequently not supported.
	✗	**Incorrect** The coping is balanced upside down on top of the sand and subsequently not supported. This position also means that sand may become trapped within the coping. There is a high chance of distorting the margins.

Coping guidelines – bridges

	✓	**Correct** In this position, the bridge is fully supported from underneath.
	✗	**Incorrect** If the bridge is buried more than 1/3 deep in the sand, sand may become trapped between the units and cause distortion when the zirconia contracts and the sand does not.
	✗	**Incorrect** Sand can become trapped within the framework cavity as the framework shrinks, this can lead to margin distortion.
	✓	**Correct** Whilst this method would be incorrect for bridges which are relatively straight (the method shown above is preferred), it is correct for bridges with significant curvature. For high curvature bridges, facing the occlusal surfaces vertically downwards is recommended.
The sand must be contacting all occlusal surfaces. The gaps between units must not be heavily packed with sand and the bridge should not be buried any deeper than indicated in the image.		

Coping guidelines – span bridges

	✓	**Correct** The sintering frame must be placed on a sintering tile and the units should not be removed from the support structure. The larger of the two spigots on the end units of each bridge should be cut prior to sintering. This will leave each unit supported by one 2 mm diameter spigot.
Both the tile and the sintering frame surfaces should be cleaned to avoid grit particles becoming trapped between the frame and the tile. These surfaces are accurately flat and must mate together so that the bridge does not distort during firing. The sintering tile may be used for more than one framework if space allows. The framework must not be placed on the tile surface marked with an X as this surface is not actually flat.		
	✗	**Incorrect** The sintering frame must be placed on the sintering tile, not in the sand. This introduces a high risk of distortion.

Completing the framework

Final dress-back and grit-blast

A final cleaning operation using the grit-blaster should be done to remove any foreign substances and sintering residues from the surface. Grit blasting should be done with 50 µm aluminium oxide grit and a 0.75 mm nozzle and at a pressure of 87 psi (6 bar).

Using an LED light, inspect each unit to ensure no cracks are present. Inspect by placing an LED light inside each unit and outside each unit.

The framework is now ready for porcelain application.

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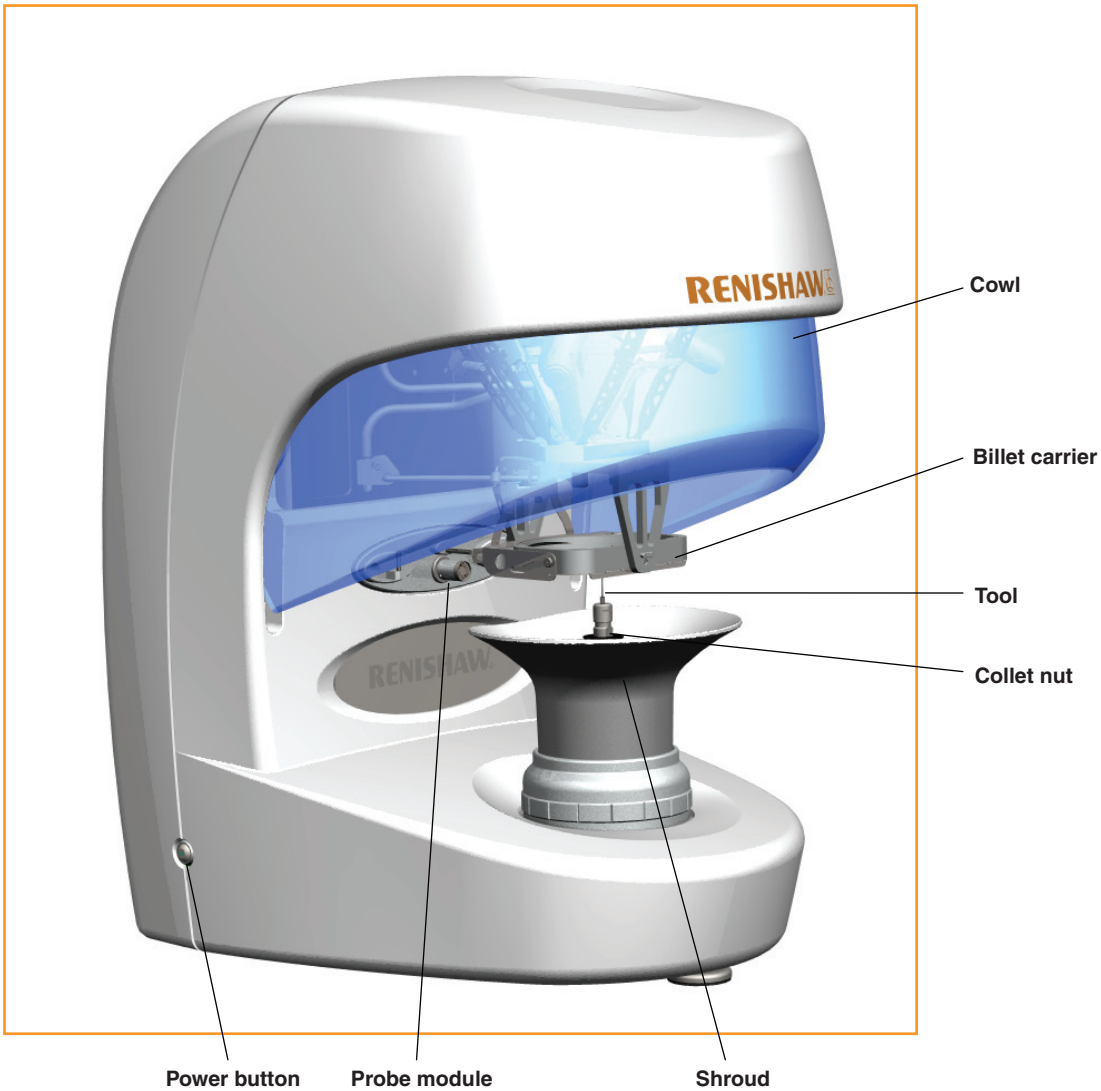
Machine maintenance

Part descriptions



Cleaning the collet

CAUTION:
Failure to remove all dust from inside the spindle, collet and cap can result in the tool not being loaded correctly and will affect the accuracy of the copings.

1. Clean around the spindle rotation area.

2. Remove the collet and tool holder. Clean the dust out of the collet and the spindle.

3. Fit the collet back into place and secure.

IMPORTANT: Do not tighten the collet nut until the tool is inserted.

Cleaning the shroud

1. Using the brush supplied, clean away any dust from around the neck of the shroud.

2. Clean inside the shroud until you reach the bottom of the tube which will be approximately the full length of the brush. This process is required to ensure that the build up of zirconia dust does not become excessive and prevent effective dust extraction.

MAU unit checks

Emptying the extraction unit

WARNING:
A face mask, eye protection and protective gloves should be worn when emptying the extraction unit.

1. Switch off the mobile ancillary unit (MAU) and disconnect the power lead from the unit.
2. On the MAU, open the door at the front of the unit by turning the two catches by a quarter turn.
3. Swing down the filter bag retaining arm.
4. Seal the bag with the attached plug.
5. Slide out the bag from the retaining arm and dispose of it.
6. Fit a new bag. These are available to order from Renishaw, part number P-AD99-0022.
7. Lift the retaining arm until it clicks into place in the ball catch.
8. Close the door.
9. Reconnect the electrical supply.

Planned maintenance schedule

To minimise the risk of any potential problems with the MAU, Renishaw advises that the maintenance schedule is adhered to and signed each time upon completion. Note that the bag replacement is only required every 8 weeks.

Week no. / Task	1	2	3	4	5	6	7	8	9	10	11	12	13
Clean shroud													
Replace MAU bag													

Week no. / Task	14	15	16	17	18	19	20	21	22	23	24	25	26
Clean shroud													
Replace MAU bag													

Week no. / Task	27	28	29	30	31	32	33	34	35	36	37	38	39
Clean shroud													
Replace MAU bag													

Week no. / Task	40	41	42	43	44	45	46	47	48	49	50	51	52
Clean shroud													
Replace MAU bag													

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System specification

Renishaw Dental Milling Machine

Dimensions	Width Depth Height	300 mm (11.81 in) 424 mm (16.69 in) 535 mm (21.06 in)
Weight	20 kg (maximum)	
Operating environment	Temperature Relative humidity Altitude	15 °C to 26 °C (maximum temperature change of 2 °C per hour) 20% to 80% 2000 m maximum
Billet size	Diameter Thickness	98 mm (3.86 in) 14 mm (0.63 in), 20 mm (0.79 in)
Billet Mounting	Manually operated without tools	
End stops	Hard stops limit the travel of the machine	
Voltage for power supply (ac to dc adaptor)	100 V to 240 V ac	
Frequency range	50 Hz to 60 Hz	
Voltage for milling machine	18 V dc	
Power supply rating	70 W	
Communications to PC	USB	
Connectors on milling machine	USB, power, multi-way D-plug (to the MAU)	
Switch	On / off power	
Motor drives	DC PWM with direct digital control and tacho feedback	
Encoders	Optical, providing feedback for motor speed and position	
Encoder resolution	Sub-micrometre	
Spindle	High-frequency spindle, 60,000 r/min, 240 V	

Mobile ancillary unit (MAU)

Dimensions	Width Depth Height	450 mm (17.72 in) 660 mm (25.98 in) 770 mm (30.31 in)
Weight	50 kg	
Capacity	120 m^3 per hour	
Exhauster	Side channel blower	
Output	0.37 kW	
Electrical supply	230 V, single phase, 50 Hz	
Noise level	Less than 63 dBA	
Filter efficiency	95% at 0.3 micrometres	
Filter volume	20 litres	

Minimum PC specification

Processor	Intel Pentium 4, 3.0 GHz (or equivalent)
Hard drive	100 MB minimum free space is required for installation. Additional hard disk space is required to store frameworks as they are created. A minimum of 200 GB is recommended.
Memory	1 GB RAM (for Windows XP SP3) 2 GB RAM (for Windows Vista SP1 and Windows 7)
Graphics adaptor	Fully DirectX 9 compatible graphics adaptor, 256 MB (minimum) video RAM
Colour display resolution	1024 × 768 capable
Mouse	3-button mouse or pointing device
CD-ROM drive	Required for software installation
USB	Three USB ports are required
Broadband internet connection	2 Mb/s, operational
PC operating system	Microsoft Windows XP SP3 (x32 Edition only) Windows Vista (x32 and x64) Windows 7 (x32 and x34)

Parts list

Part number	Description
A-5000-7806	Cutting tool
A-EA02-0020	PSU
A-EA06-0049	Smartcard reader
P-TL01-1003	MS nut wrench
P-TL02-0036	Single end open spanner
P-TL04-0015	Ultra-precision collet
P-TL04-0016	High speed clamping nut
M-5495-0108	Cutting tool
P-AD99-0022	Replacement MAU bag
A-5495-3001	Packaging kit
A-5495-0042	Crucible kit
M-5495-0221	Furnace tile
A-5495-4140	14 mm zirconia billet in shade LL0
A-5495-4141	14 mm zirconia billet in shade LL1
A-5495-4142	14 mm zirconia billet in shade LL2
A-5495-4143	14 mm zirconia billet in shade LL3
A-5495-4144	14 mm zirconia billet in shade LL4
A-5495-4145	14 mm zirconia billet in shade LL5
A-5495-4026	20 mm zirconia billet in shade LL0
A-5495-4021	20 mm zirconia billet in shade LL1
A-5495-4022	20 mm zirconia billet in shade LL2
A-5495-4023	20 mm zirconia billet in shade LL3
A-5495-4024	20 mm zirconia billet in shade LL4
A-5495-4025	20 mm zirconia billet in shade LL5
A-5495-4216	16 mm wax billet

NOTE: Spare parts can be ordered from the sales department using the contact details as listed on the back cover.

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Proprietary information

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Warranty

Equipment requiring attention under warranty must be returned to your equipment supplier. No claims will be considered where Renishaw equipment has been misused, or where repairs or adjustments have been attempted by unauthorised persons. Prior consent must be obtained in instances where Renishaw equipment is to be substituted or omitted. Failure to comply with this requirement will invalidate the warranty.

Changes to equipment

Renishaw reserves the right to change equipment specifications without notice.

Patents

Features of Renishaw products supplied as part of the incise™ system are the subject of one or more of the following patents and patent applications:

US 4,926,566
US 4,974,962
US 5,088,209
US 5,302,820
US 5,323,540
US 5,327,657
US 5,339,535
US 5,404, 649
US 5,505,005
US 5,813,287
US 5,861,953
US 6,145,405
US 6.336,375 B1
US 6,430,833 B1
US 6,588,333
US 7,141,780B2
US 7,146,741B2
US 7,241,070B2
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US 2007-0145265 A1
US 2007-0231061
US 2008-0021672 A1

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EP 0674969
EP 0748436
EP 1147377
EP 1360461
EP 1407152
EP 1468242
EP 1505362
EP 1585903
EP 1695028
EP 1730465
EP 1777423
EP 548328 B

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JP 2005-515,458
JP 2006-130654
JP 2006-513380
JP 2007-183294
JP 2007-510921
JP 2007-101061

CN1620596A
CN1738978A
CN1934409A
CN100402873

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