Microforge-Grinding Center

MF-5, MFG-5, MFG-5A

USER'S GUIDE

MDI

MicroData Instrument, Inc.

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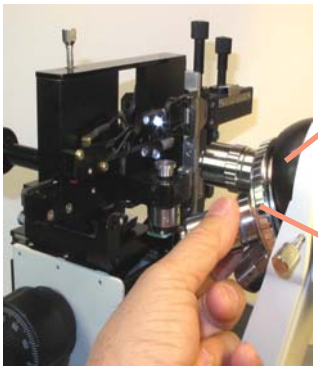
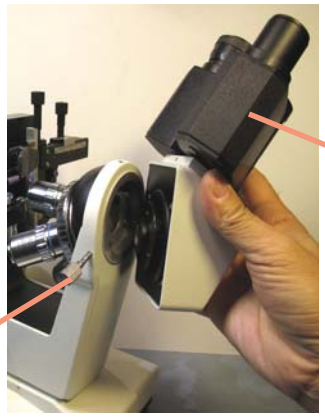
COMPONENTS AND INSTALLATION

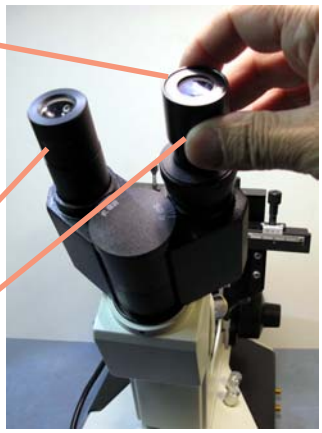
When the MFG-5 Microforge-Grinding Center packing box is opened, horizontal microscope platform must be installed before functions operating:



1. Install objectives to the nosepiece by 4x, 10x, 20x(optional) to 40x(optional) anti-clockwise.



2. Install binocular (or monocular, trinocular) to the base of nosepiece. Then tighten the tube holding screw.



3. Take out eyepiece hole covers from binocular (or monocular, trinocular). Then insert eyepieces.
If a scale eyepiece is installed, adjust the scale focus ring in the scale eyepiece to see scale division numbers clearly.

4. If a pipette or a needle is held in the pipette holder, observe the object with left eye on the left eyepiece, adjust coarse-fine focusing knob to image clearly. Then observe at the right eyepiece with right eye and adjust the diopter control to image clearly.
The interpupillary distance of two eyepiece tube can be adjusted for composing right-left fields to one view.

COMPONENTS AND INSTALLATION

The MFG-5A Precision Microforge-Grinding Center is composed of a horizontal binocular microscope, Combination of platinum microheater and microgrinder, two vertical and horizontal micromanipulators, 360 degree turnable pipette holder and side/rear high output LED lights . Foot switches, syringe and air input/output connector and tubing as accessories (Some components and accessories as optional for other model than the MFG-5A) . See Figure 1, 2:

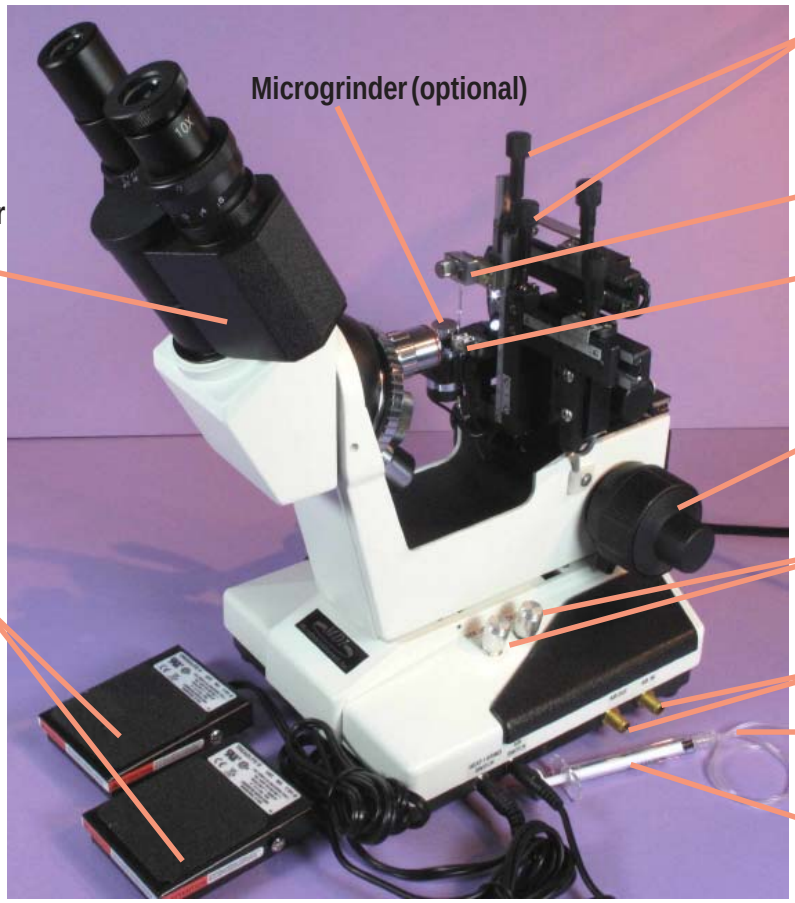


Fig. 1

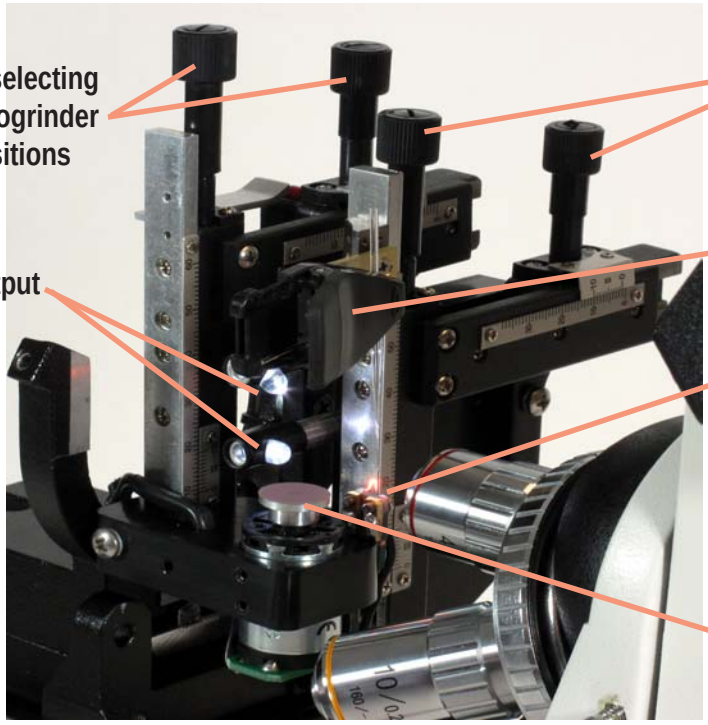


Fig. 2

After unpacking the microforge, install the binocular to the microscope body and set in the position. Put in the eyepieces. Screw objectives to nosepiece in clockwise order of x 40 (or x 25) x 10, x 4. Insert 10x or 20x eyepieces. If 10x scale eyepiece is used, each division is 25 um for objective x4, 10 um per division for objective 10x and 2.5 um/division for 40x objective. Position platinum microheater for microforge application or a microgrinder for grinding application by moving tools manipulator horizontally. Backward the Heater/Grinder. Let the heater or grinder wheel just front of the rear light center before installing a pipette in the pipette holder **(Figure 3)**. Plug in foot switch to connector on the side of the microscope platform **(Figure 5)**. If the microforge equipped with optional pressure air in/out connectors and extra foot switch, connect them to corespondent connectors. Connect power plug of the Microforge/Grinding Center to correct power outlet. Turn on the main power switch and adjust the heater level control dial wheel to minimum **(Figure 4)**. Adjust back light and focus the pipette tip first, then adjust tools forward/backward adjust knob to focus heater wire or grinder wheel edge just against the pipette tip **(Figure 6)**.

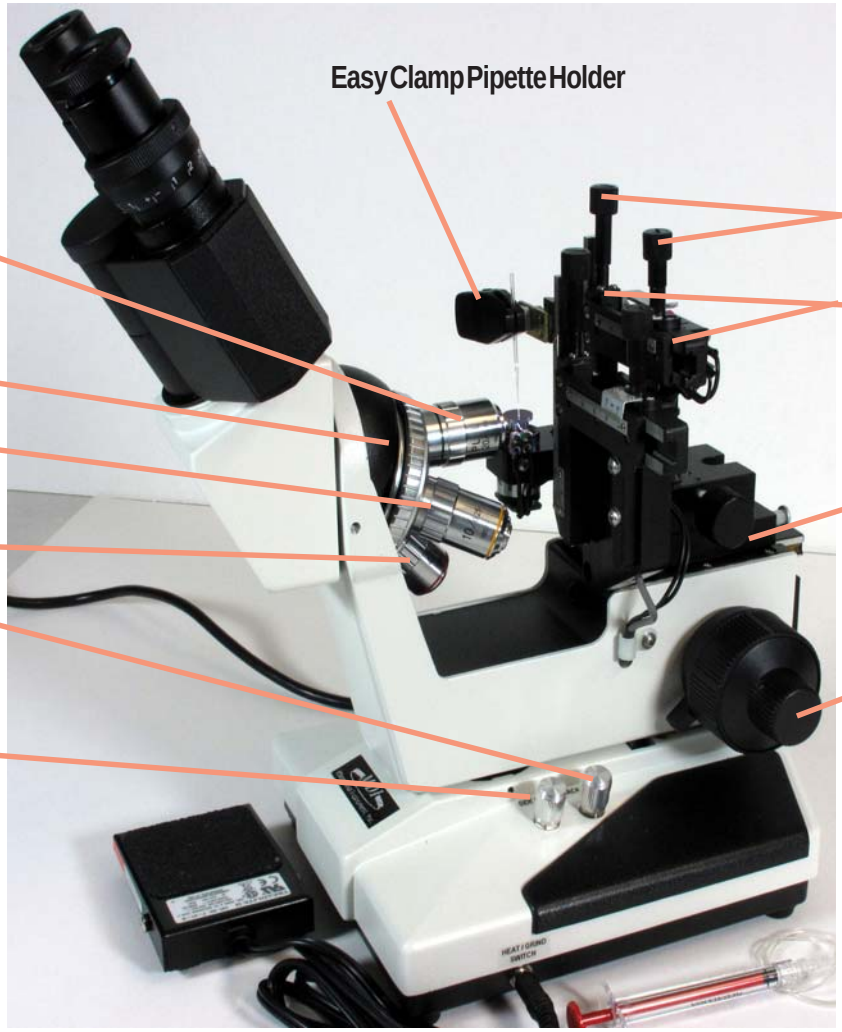


Fig. 3

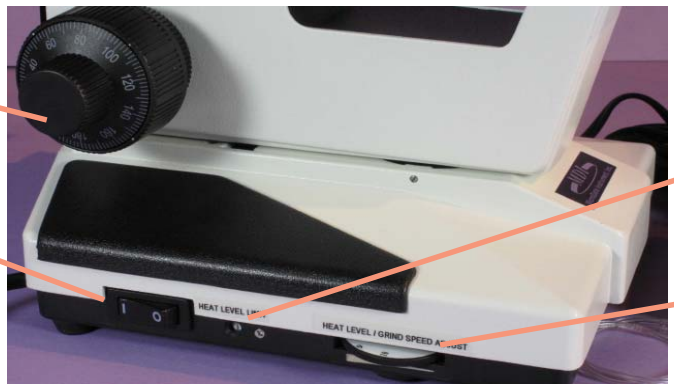


Fig. 4

Fig. 5

Side (contour) Light Power Adjustment Knob

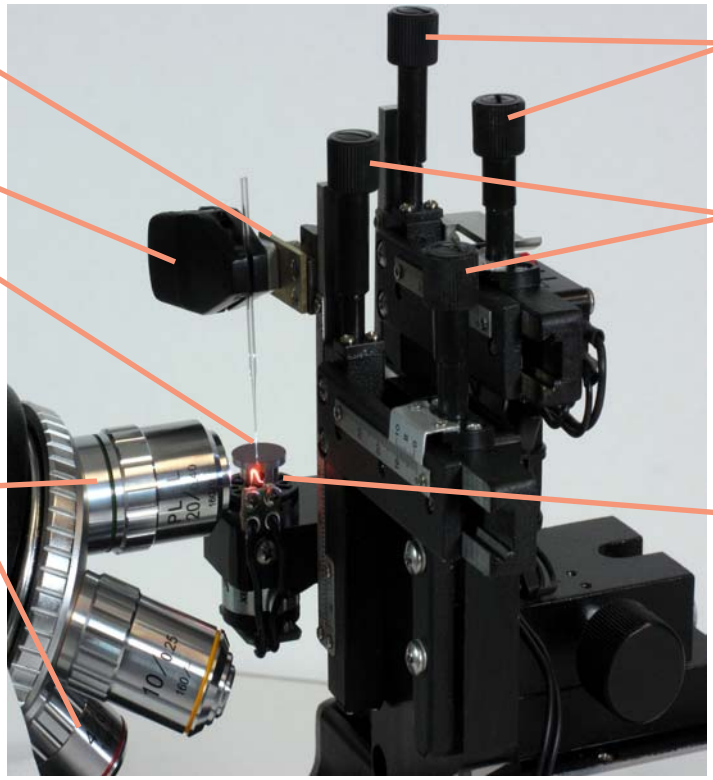
Back ground Light Power Adjustment Knob

Heater or Grinder Foot Switch Connector

Pressure Air Input Connector (only for MFG-5A)

Air Output Foot Switch Connector (only for MFG-5A)

Pressure Air Output Connector (only for MFG-5A)



Holder turning fix thumb screw

Heater or Grinder X/Y Position Adjustment

Easy-Clamp Pipette Holder

Micropipette X/Y Position Adjustment

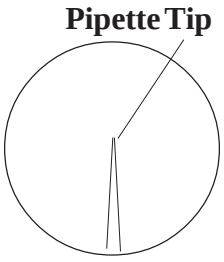
Grinder

Objective 4x, 10x, Optional 20x, 40x

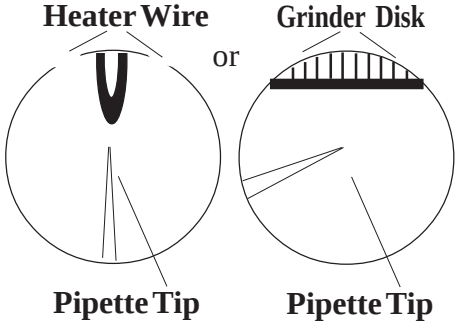
Heater

Fig. 6

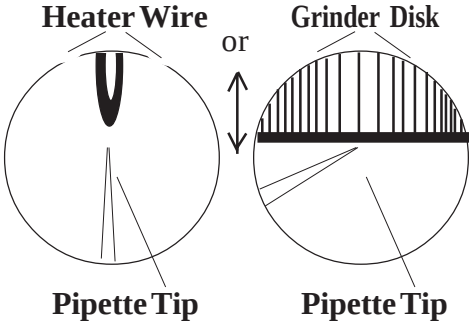
1. Adjust pipette manipulator and main focus adjust knobs to focus pipette tip first.



2. Adjust tool horizontal position and adjust the fine up/down position set the heater or grinder in the lower portion of the view.



3. Use heater/grinder coarse Y position knob or adjust the fine up/down position knob to move the heater or grinder up and down to polish or grind the pipette tip.



SETTING THE MICROFORGE

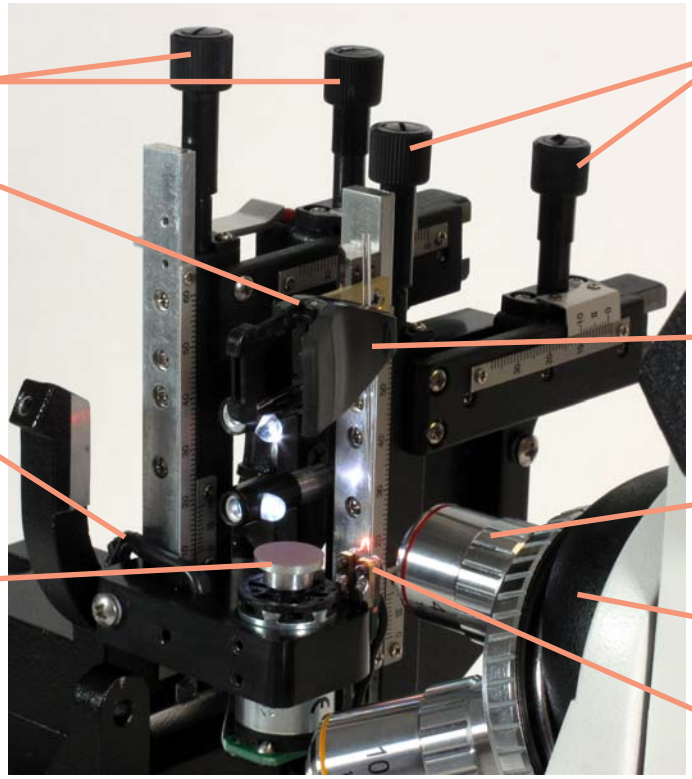
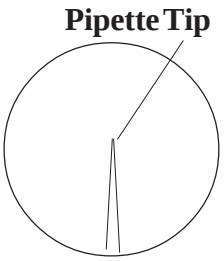


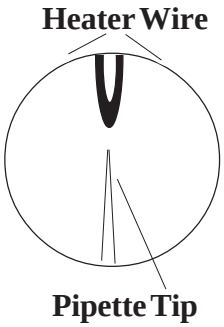
Fig. 7

Refer Fig.7 and Fig.8:

A. Turn on the microforge main power switch. The side light (contour light) should be on. Turn the nosepiece to use lowest magnification 4x objective. The two lights angles have been set right by manufactory before shipping. Only adjust the background light by turning the background light power adjustment knob to get suitable background brightness.



B. A pipette can be clamped by pipette holder in vertical position if polishing is needed, in horizontal position if bending is needed. Adjust the pipette manipulator left/right and up/down position knobs as well as the main coarse/fine focusing knobs to find and focus the pipette tip in the center of view. Then turn heater tool manipulator X/Y position knobs and heater forward/ backward knob to find the heater coil in the position of against pipette tip and focus the heater, adjust the heater coil up or down apart the pipette tip for some distance. Please note: Using microscope focus knobs to focus pipette first, then using heater forward/ backward knob only to focus heat coil. Please see Fig. 8 .



C. Plug in the foot switch to the Foot Switch Connector. Before step on the foot switch to turn on heater power , move the pipette tip away from the heater coil for some distance, because the heater will move forward when the heater is on. **Caution! The heater wire can not be moved closer than the focus distance to the objective lens, otherwise the objective lens will be damaged during heating. The heating time should not be longer than 60 second for each turn on the heater, otherwise the objective lens will be damaged during heating. Always use 4x or 10x (for very fine tip) objectives only, when heater is on. The 40x or higher power objective can only be used for post-heating inspection. The 40x objective can not be turned to used when the heater is on, because the 40x objective working distance may be too short to close the heater and will be damaged by heating!**

OPERATING THE MICROFORGE

After connecting the foot switches and focusing both heater and pipette tip, turn the objective 4x in the view position. The objective 4x is suggested to use for viewing the position of setting the heater wire and pipette tip during the heater polishing, bending and tipping, since it can provide wider viewing field and longer working distance. The objective 10x is suggested to use for viewing breaking tips or very fine tip polishing and tipping. The objective 40x or higher, which the working distance is shorter than 10x and much shorter than the 4x, is suggested to use for inspection only while the heating is stop.

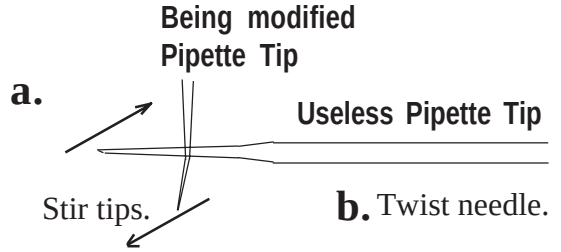
Turn on the main power switch. The back and side lights should be on. Adjust the lights angle or level to get suitable back ground brightness if they are needed (manufacture preset). Make sure the heat level about 8-9. Heat level higher than 9 will burn out the heat coil faster. If the heat wire is burn out, see Maintenance page to replace a new heat wire .

Before step on the heater, adjust focus for the pipette tip then adjust the heater forward/backward knob on the right hand side to make sure the top of heater wire can be focused, adjust the Heat/Speed Control knob to minimum. Then press the foot switch to turn on the heater and slowly to increasing the Heat/Speed Control knob to see the micro-platinum heat wire become red hot. Do not adjust the heat wire to bright light, otherwise, the heat wire will be burn out easily . **Caution! The heater wire can not be moved to the objective lens closer than the focus distance, otherwise the objective lens will be damaged during heating. The heating time should not be longer than 60 seconds for each turn on the heater, otherwise the objective lens may be damaged during heating.**

1. BREAKING: Breaking a pipette tip can change tip opening to bigger. There are two methods to break a pipette tip:

a. Using another useless (or broken) pulled pipette tip stir the being modified pipette tip until the pipette tip breaking (Fig. 8a).

b. Install a fine tip pipette to the vertical pipette clamp (Fig. 8c). Turn off the heater. Slowly move the tip to hit the heater coil to break the tip to desirous opening. Hitting the cool heater wire can make about 1-20 um tip opening. Opening larger than 25 um tip can be made by hitting the heater fixture block either by hand holding pipette (press to turn) or pipette holder holding pipette. The larger tip opening made from method "a." may not be flat, which can be flatten by hitting the tip to the block and move the block left and right to grind the tip. If the tip edge is still not be ideal as you need, grinding may be needed. Measure the tip opening with an optional scaled 10x eyepiece.



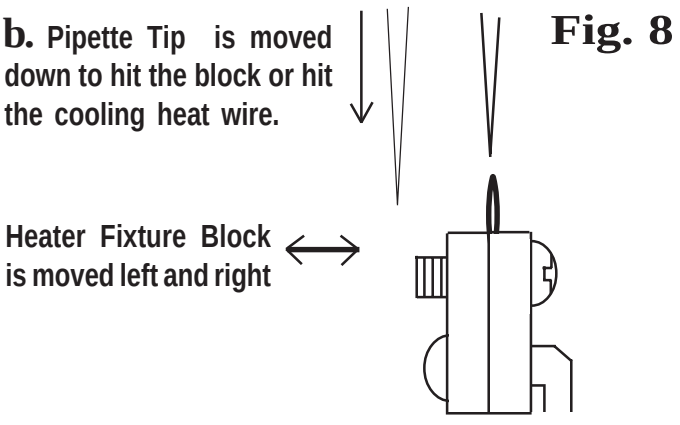
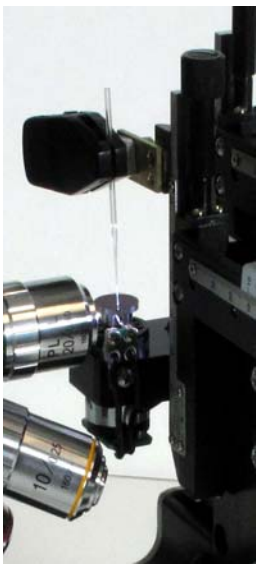
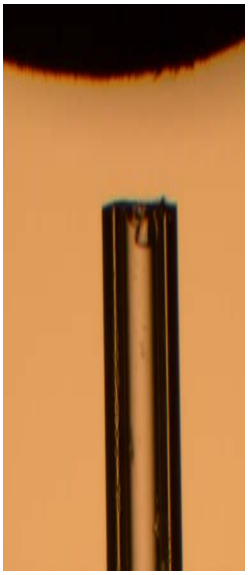


Fig. 8

Fig. 9 **BREAKING**





2. POLISHING : Polished pipette tip can be used for cell holding or patch clamping. Install an open tip pipette to pipette holder clamp in vertical position (Fig. 10). Step on the heater, slowly move the tip close to the heater or swing the heater back and forward until the tip is polished. If the opening is melt to almost close, stop heat foot switch immediately or (optional) press on the pressure air to blow air by connected air output tubing to the pipette, to keep the tip opened. When the tip polishing is finished, inspect and measure the polished tip by using higher magnification objectives (Fig. 10).

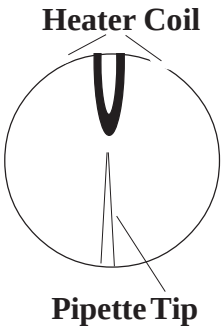
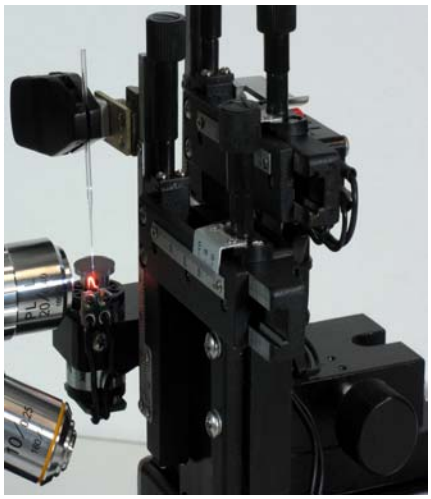
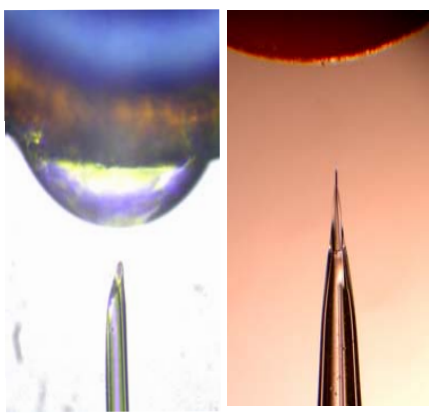


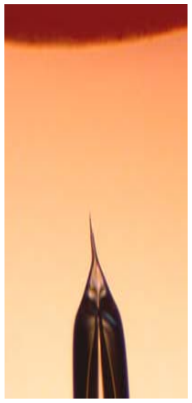
Fig. 10



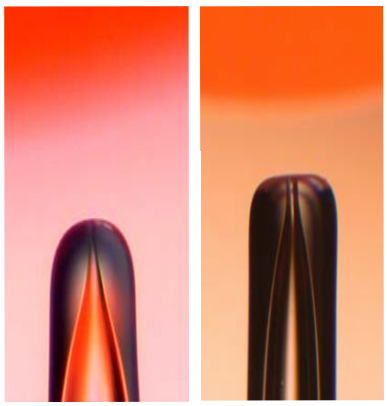
3. SHARPENING AND TIPPING : Sharpening or tipping a pipette can give a bigger opening tip with a sharp tip to penetrate a target. Install a fine tip pipette to the vertical pipette clamp (Fig. 10). Turn on the heater with higher heat level. Move the tip to the heater and touch the heat coil with the glass tip side, then rapid move out the pipette tip from the heat coil. A sharp tip can be produced .



SHARPENING



TIPPING



POLISHING

4. BENDING: A good hold cell pipette, special an egg (embryo) holding pipette needs not only polishing but also bending to some degree for required handling under a microscope. Install a longer tip pipette to the horizontal pipette clamp (See Fig.11). Turn on the heater with higher heat level. Move the tip above the heater coil when bending the tip is needed (Under the heat coil is viewed from the microscope. See Fig. 12). Controlling properly on closing the heat wire and gradually move out from the heat coil when the tip is bent.

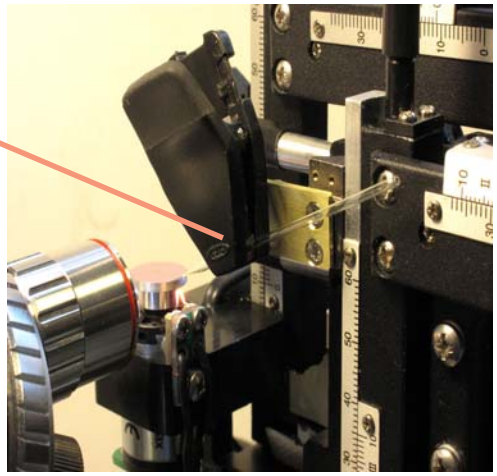


Fig.12

Fig.11

SETTING THE MICROGRINDER (For MFG-5 or MFG-5A)

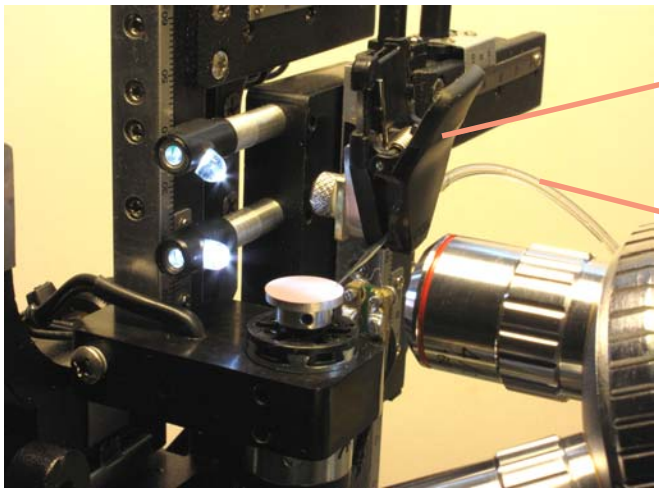


Fig. 13A

Fig. 13B

A. Insert foot switch plug to foot switch connector. Turn on main power switch. Turn the nosepiece to use lowest magnification 4x objective. Adjust the back light to get suitable back ground brightness. The side light should be adjusted to high light. Adjust the tool manipulator to move microgrinder to the center front of back light (Fig. 13A).

B. If a pipette needs wet grinding, fill syringe with clean water. Insert syringe output Tygon tubing to the end of pipette before clamping the pipette to the pipette holder. Then clamp the pipette by the pipette holder (Fig.13B). Turn the pipette holder with required angle to the grinder wheel (Fig.13A). Focus the pipette tip in the center view first, then move the tip up for some distance. Adjust the grinding wheel position so that the center tangent position alignment with the pipette tip (Fig.14). Then move the grinding wheel forward to focus the grinder front edge and move further a little distance just under the pipette tip.

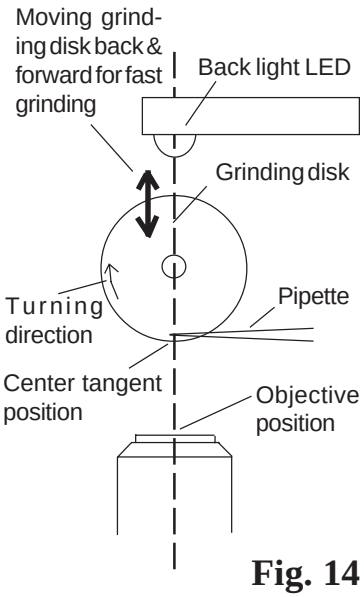


Fig. 14

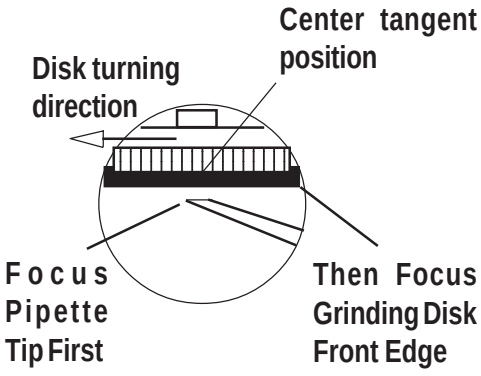
OPERATING THE MICROGRINDER (For MFG-5 or MFG-5A)

1. Grinding a micropipette needs patient and careful operating skill. The grinding results will be very different with different operators even working on the same grinder.

2. The grinding wheel comes with a grinding disk attached on the top. The grinding disk is changeable with different grade. Grinding a pipette tip from 1-2 um needs 0.1 um grade disk. Grinding 5-10 um needs 0.5 -1.0 um grade disk. MDI supplies grade 0.1um disk (color green) , grade 0.5 um disk (color grey) and grade 1.0 um (color violet). It is easy to peer out the grinding disk with a pair of tweezers and replace another adhesive grind disk.

3. After setting up the grinder, step on the foot switch to turn on the grinder and adjust the speed, then carefully and slowly up the microgrinder to touch the tip (or down the pipette tip to touch the turning grinding disk surface), lightly up and down the grinder (or tip) and forward /backward the grinding wheel to grinding the tip. Pull up the tip before turn off the turning wheel.

4. For faster grinding, the grinding disk can be moved back and forward repeatedly during the pipette tip touching the turning grind disk. If sharper tip is need, after grinding a pipette on one side, slowly turn the pipette little bit to grind the edge again to make it sharper **(Fig. 15)**. It is easier to turn the pipette with the Tygon tubing connect to the end of pipette. Don't clamp the pipette too tight in the pipette holder.



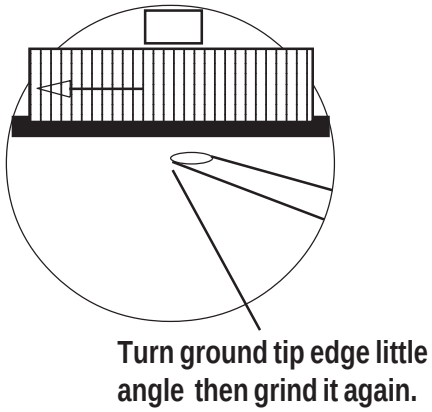
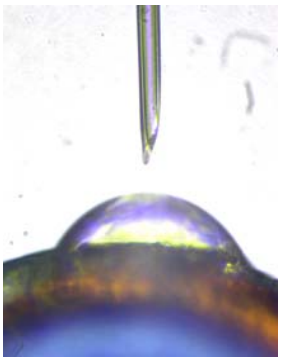
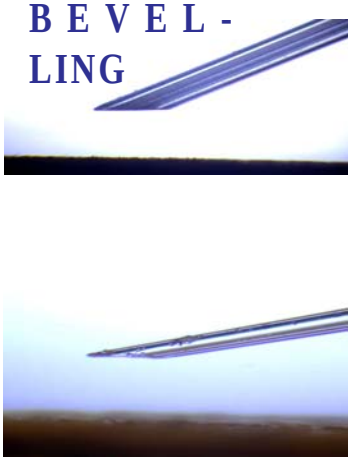
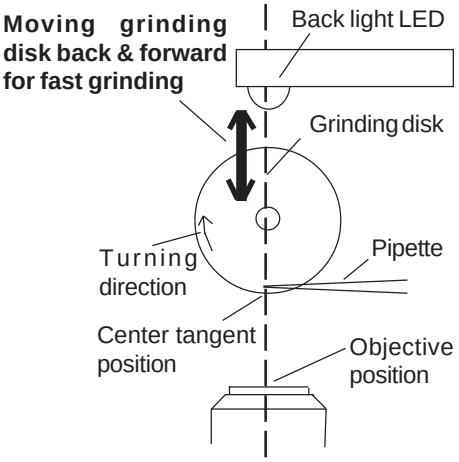


Fig. 15

Polishing after grinding to a 5 um opening with sharpen edge.







4. Grinding a micropipette may use wet grinding with dropping water from inside or outside the ground pipette by using a syringe with Tygon tubing connector. For dropping water from inside a pipette, connect the Tygon tubing to the no tip end of the pipette before putting the pipette in the pipette holder, fill a syringe with water then connect the syringe to the Tygon tubing. Control to pump or hold water to the tip during grinding. Dropping water from inside of pipette is good only for tip opening larger than 8 um.

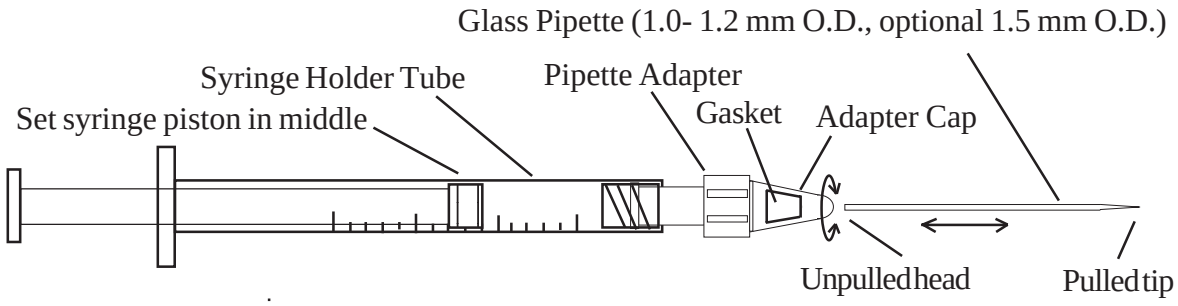
6. The grinding is better for tip opening larger than 5 um. Pipette tip opening modification between 0.1 to 2 um should be used pipette tip breaking method by apply tip hitting on the non-power heater wire or heater fixture block. Larger than 10 um tip may be wet ground by plumping water through a connected tubing from a syringe. After grinding a pipette tip as required size and angle, there is some glass dust touching on the tip. Use air blow inside and outside or use cool heater wire to kick the dust carefully then polishing the tip at a quick and very careful control. The pipette tip can be cleaned, blunt and thinned by dipping in 25% hydrofluoric acid and clear by pure water.

7. Wet grinding will be better for cleaning tip dust during grinding. Fill the syringe with clean water, connect Tygon tubing to the pipette unpulled head and connect tubing another side to syringe before putting the pipette to the holder. Inject water to the pipette tip before grinding. If tip opening is too small to inject water reach the tip, keep pressure on the syringe during initial grinding until water can be dropped from the tip.

8. Using an optional accessory **HOLD-S** Syringe Pipette Holder can test or clean a pipette after grinding Install a ground pipette to the **HOLD-S** as following picture. Immerse the pipette tip to the clean steam water or medical alcohol, then flash by sucking water for cleaning and injecting air to see bubble for checking through output.

9. Switch to the micro-heater, forge the clean ground pipette tip and make a more sharp but smooth tip.

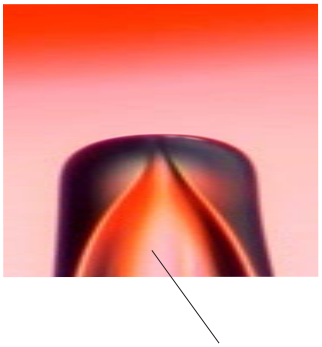
HOLD-S Syringe Pipette Holder Connection:



Set syringe piston in the middle of syringe tube. Connect pipette adapter female connector to the syringe male connector. Insert glass pipette to the adapter cap and completely go through the gasket. Then turn the adapter cap clockwise to tighten the glass pipette. To take out the glass pipette, loose the adapter cap by turning anti-clockwise, then pull out the glass pipette.

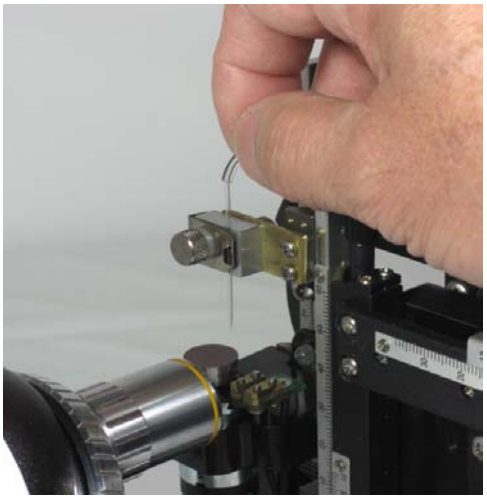
USING AIR OUTPUT (For MFG-5A only)

Input an out side pressure air (30-80 psi) to the air input port in the MFG-5A and connect an output tubing to the air output port in the MFG-5A. Connect the Tygon tubing side of output air tubing to the tail of the clamped pipette (Fig.16). Pressing the output air foot switch to blow air into the pipette during polishing can keep the tip opened, even can expand cavity inside pipette. Without the heater on, blowing air can clean inside pipette dust which after grinding (Fig. 17), or clean out side of the pipette tip (Fig.18). **Do not input an air pressure higher than 95 psi. Do not input any flammable gas as pressure source.**



Pipette cavity expanded by air pressure

Fig.16



Clean Pipette Internal

Fig. 17

Clean Pipette Tip Outside

Fig. 18

MAINTENANCE

1. During polishing, do not move the heater to the objective closer than the focus distance, do not turn on the heater longer than 30 seconds each time. When using objective 10x for polishing , turn on the heater less than 10 seconds. When using long working distance objective 40x for polishing , turn on the heater less than 1 second.

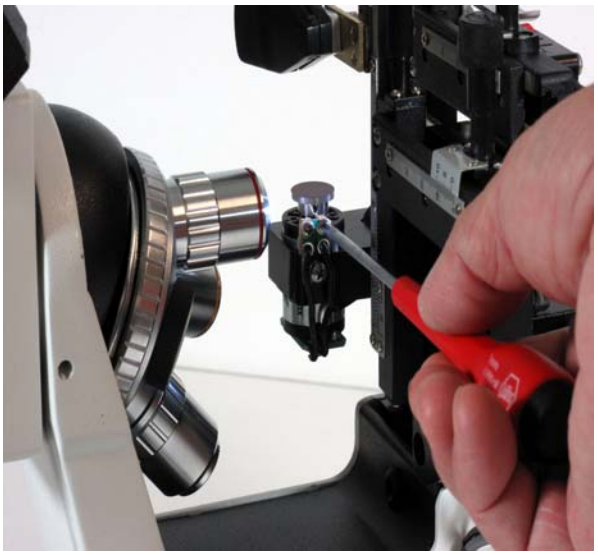
2. Do not set the heat level too high. Higher heating level will lower the heat coil life and jeopardize the lens of objective.

3. Sweep the lens only by lens tissue or soft fabric immersed with mixed liquid of alcohol/ether or blow air to clean dust. Do not use organic solvents for cleaning the paint parts or plastic components.

4. When the microforge is not used, unplug the power, cover unit and place it to where is dry and clean. Store all objectives and eyepieces in closed container with drying agent when the unit will not be used for long time.

5. **Replacing a heat wire:** If replacing the heat wire is needed, turn off the main power first. There are few screws in the heat wire clamp block (**Fig.19**). Only loose (don't take them out) two small heat wire fixing screws which just hold the heat wire terminals. Don't turn the other screw in the heat wire clamp block fixture. Then take out the broken heat wire. Replace a new Platinum heat wire (total length about 5 mm) with a pair of tweezers. Then fix the heat wire clamp block by tighten back two small fixing screws. Then use pair of tweezers to shape the heat wire as position as **Fig.20** in the 4x objective view.
   After replacing a new heat wire, the limited power level may be needed to readjust for enough high power but not burn out the heat wire :
   A. Reinstall the microheater follow the microforge set up procedure. Turn the Heat level/Grinder Speed Control dial wheel to minimum, then turn on the power.
   B. Press on the foot switch. Slowly increase heat level by turning the control dial wheel until to see the enough bright on the heat wire but don't burn out the heat wire. Then check the dial wheel if it is the maximum number 10. If it is less than 10, lower heater limit power adjustment is needed. If even turn to 10, but the heat wire is still not getting enough heating power, higher heater limit power is needed. The heater limit power setting pot hole is located between the power switch and heat / speed control wheel in left side of the microscope (**Fig. 22**). Using a small screw driver turns slowly to clockwise for decrease the power, anti-clockwise for increasing the power to get the best power result on dial wheel maximum number 10. The function of pot hole adjustment will give enough heating power and protect the heat wire not being burned out when the control dial wheel is turned to the maximum number 10.

6. **Replacing a grinding disk:** If replacing the grinding disk is needed, turn off the main power first. The grinding wheel comes with a grinding disk attached on the top. The grinding disk is changeable with different grade. Grinding a pipette tip from 1-2 um needs 0.1 um grade disk. Grinding 5-10 um needs 0.5 -1.0 um grade disk. MDI supplies grade 0.1um disk (color green) , grade 0.5 um disk (color grey) and grade 1.0 um (color violet). It is easy to peel out the grinding disk with a pair of tweezers (**Fig.21**). Peel out the cover of a new grinding disk then adhere to the grinding wheel with fitting position. It is tolerable for little uneven grinding surface.



Heater Wire Clamp Block

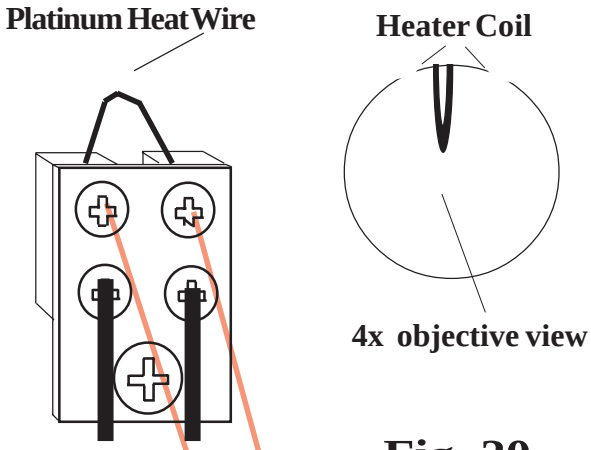


Fig. 20

Only loose upper two Heater Wire Fix Screws to change heat wire.

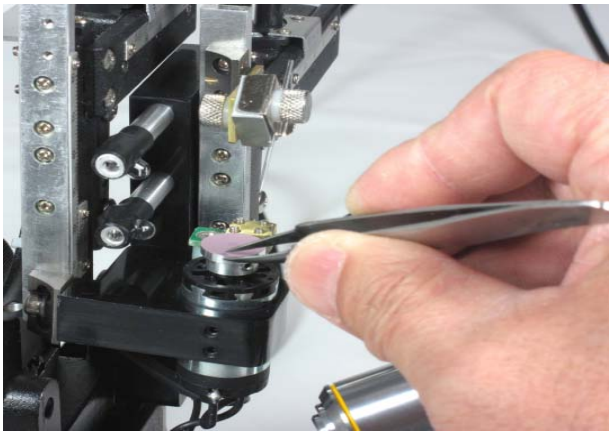


Fig. 21

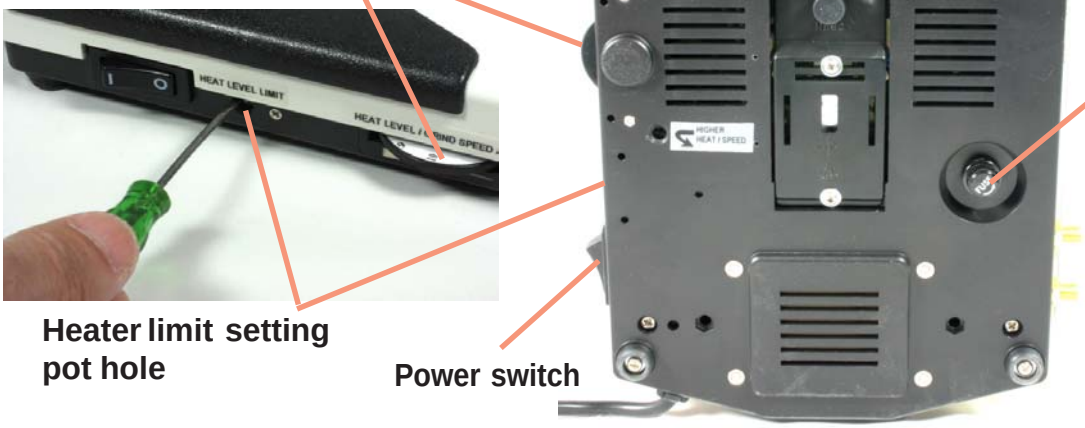


Fig. 22

Microscope Platform Bottom

Specifications of MFG-5 Microforge-Grinding Center :

Pipette movement	Two-axial manipulator and coarse-fine focusing adjustment.
Heater movement	Three-dimension tool manipulator.
Pipette holder	360 degree turnable for single to multipipette holding..
Body	Horizontal Binocular microscope.
Eyepiece	10x, 20xWF. Optional 10x Scaled.
Objective lenses	4x, 10x/0.25, Optional: 20x, 40x/0.6 Long Working Distance.
Heater	Platinum heat wire (0.005"OD).
Light	Two super bright white LEDs for background and contour image.
Air in/output	Optional air jet foot switch, in/output tubing and connector.
Microgrinder	combination of microgrinder with 0.1/0.5/1.0 um grade disks.
Accessory	One foot switch. Optional one more.
Power Supply	20W, 120/240VAC
Output Voltage	<10V for micro switch and heat element connector.

Model Selection:

	Platinum Wire Heater	Microgrinder	Pressure In/output
MF-5	V		
MF-5A	V		V
MG-5		coarse/fine	
MG-5A		coarse/fine	V
MFG-5	V	V	
MFG-5A	V	V	V

Warranty

The following warranty is in place of all other warranties, expressed or implied, and all other warranties, including warranties as to merchantability or fitness, are expressly excluded.

1. SYSTEM, PARTS AND LABOR. MDI (MicroData Instrument, Inc.) warrants purchased equipment to be free of defects in material and workmanship under normal use and maintenance from the date of shipment for a period of one year (90 days in the case of (a) fuses, heating elements, light emitting diodes, and (b) separately purchased replacement parts). Consumable supplies and cables are warranted to be free of defects in material and workmanship at the time of shipment. Labor invoiced in connection with repairs performed at MDI's facility is warranted for a period of 90 days from the day of shipment of the repaired equipment.

2. LIMITATION OF REMEDY. MDI shall have no liability for any direct, incidental or consequential damages resulting from breach of warranty, from the breach of nonperformance of any term. This limited warranty does not include service to repair damage from improper installation, improper connections with peripherals, external electrical fault, accident, disaster, misuse, abuse or modifications to the equipment not approved in writing by MDI.

3. GEOGRAPHICAL LIMITATION, NONTRANSFERABILITY AND INCONSISTENT LANGUAGE. In the case of equipment located outside of the 50 states, the District of Columbia and the Commonwealth of Puerto Rico which is returned (in whole or in part) to MDI for warranty service, the transportation costs incurred in such return shall be at buyer's expense. This warranty is not transferrable and may not be supplemented or amended except in writing referring specifically hereto and signed by buyer and MDI. Without limiting the generality of the foregoing, any inconsistent language contained in requests for quotation, buyer's purchase orders, shipping instructions or similar documents is specifically rejected by MDI.

MDI

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