

Air Abrasion Cavity Preparation Device

MODEL: DV-1
(115VAC 60 Hz)

OPERATOR'S MANUAL

Manual No.: 6040-1



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MANUFACTURED BY:

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Introduction and General Information

◆ Introduction

The Model DV-1 Air Abrasion Unit is a compact reliable dental instrument designed for various dental applications. It is designed as a means of removing tooth surface structure and composites in preparing teeth for restoration and as an adjunct to the high-speed dental handpiece and burr. This instrument was designed in conjunction with dentists in order to provide optimum performance, taking into consideration patient comfort and the time constraints faced by the modern dental office.

This manual should be thoroughly studied before using the equipment. Please feel free to call CRYSTALMARK Dental Systems, Inc. or your dealer if you need additional information regarding installation, procedures, etc.

◆ Purpose of this Manual

Information essential to the installation, operation and routine maintenance of the Model DV-1 Air Abrasion Unit is included in this manual. The instructions are written specifically for personnel who have been trained in restorative dentistry.

◆ General Information and Features

The Model DV-1 Air Abrasion Unit, by CRYSTALMARK Dental Systems, Inc., is designed to provide a controlled flow of an abrasive powder and air mixture through a very precise nozzle. Applications include, abrading, deburring, peening, texturing, polishing, and etching of tooth structures and restoration.

An increasing selection of abrasive powders and nozzles are available from CRYSTALMARK Dental Systems, Inc. See the listing of supplies in Chapter 10.

All user serviced components, such as pinch valves and hose connections are positioned for easy access through the front and rear panels of the instrument. A footswitch is provided for activating the abrasive flow to the handpiece.

Specifications

- Power Requirements: 115 volt, 60 Hz, 1 amp
- Air Requirements: Clean, 40 psi min. – 125 psi max.
1.5cfm @ 80 psi
- Approximate Size: 13" W x 11" D x 11" H
- Approximate Weight: 43 lbs.

◆ Functional Description

A Power Indicator Light is provided to indicate when the unit is on and ready for operation.

The Model DV-1 Air Abrasion Unit provides a controlled mixture of powder particles in a dry air stream and delivers this mixture to a nozzle.

The air supply provides pressurized air through an "ON" / "STANDBY" control valve and into two primary paths within the unit. One is to the pinch valve operating system. The other is through the Mixing Chamber and the Abrasive Pinch Valve Tube to the nozzle. In the Mixing Chamber, the stream of dry air is mixed with powder particles.

When the POWER switch is set to "ON", the Main Air Valve is energized and the path is open for airflow to the Mixing Chamber. With the footswitch depressed, the Abrasive Pinch Valve Tube (normally held closed by the air supply through the Pinch Valve Solenoid Valve) is opened as the Pinch

Valve Solenoid Valve is energized. This opens the path for the flow of powder particles from the Mixing Chamber through the Pinch Valve Tube to the nozzle. The air pressure regulator between the Main Air Valve and the Mixing Chamber is adjusted to provide optimum air pressure. The Powder Flow Rheostat is adjusted to provide optimum powder flow.

The air stream combined with abrasive powder has the ability to cut and etch tooth structure, composites, amalgams, porcelain, ceramic and most carious materials. It will not remove soft necrotic dentin. The abrasive powder/air stream is directed through a light, flexible delivery hose to the handpiece for precise cutting of defined cavity preparations. Five nozzles are available with specific orifice sizes, to enable the practitioner to accomplish particular tasks. In addition, a selection of abrasive powders is available to accommodate all desired uses. Nozzle and abrasive powder types are listed in Chapter 10.

When the POWER switch is set to "STANDBY" the unit automatically relieves the internal air pressure into a self-contained filter.

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Safety

◆ Warnings and Cautions

Always wear protective eye equipment in order to avoid corneal abrasion or irritation if particles are deflected or directed into the eye. This applies to all personnel including the patient.

When changing powder types, be absolutely sure that the chamber and hose has been completely cleared of all abrasive powders. Only use sodium bicarbonate in the chamber for prophylaxis procedures.

Never direct the nozzle of the Model DV-1 Air Abrasion Unit to an open pulp chamber or at pulpal exposures in order to reduce the risk of embolism. Also never place the handpiece in direct contact with the gingiva when the air stream is activated. While the abrasive stream will not readily cut the gingival tissue, it will irritate it.

The nozzle of the Model DV-1 Air Abrasion Unit should be directed precisely at surfaces and tooth structures, which are to be modified or removed. The nozzle tip should be placed directly above the tooth and angled toward the area to be removed or modified.

Be sure that your High Volume Evacuation system is operating properly when using the handpiece of the Model DV-1 Air Abrasion Unit. Have the dental assistant place the HVE in close proximity to the operative site.

Do not attempt to service the internal electrical system. If necessary, call CRYSTALMARK Dental Systems, Inc., your dealer, or distributor for advice.

Practice restorative preparations on extracted teeth and glass slides prior to use on patients. Consult CRYSTALMARK Dental Systems, Inc. for training assistance if you are not comfortable using in vivo.

Make sure that the air hose and the footswitch are connected to the Model DV-1 Air Abrasion Unit and the instrument is connected to a grounded electrical outlet. Make absolutely sure that the air line is connected to the house air supply, **if it is inadvertently connected to the water supply the unit will be damaged** and must be returned to CRYSTALMARK Dental Systems, Inc. Make sure that the air supply is turned on.

Use only abrasive powders supplied by CRYSTALMARK Dental Systems, Inc. Use of materials supplied by other manufacturers may result in damage to the unit and will void the factory warranty.

Make sure that your air compressor system utilizes an air dryer filter system and they are fully operational. Check to be sure that your air system produces a minimum of 80 psi. The air supply must be dry and clean, free of dirt, oil and water.

Sound clinical judgement and good common sense are essential to the successful use of the Model DV-1 Air Abrasion Unit in order to provide safe efficient patient care with air abrasive technology.




Always follow standard of care protocols in performing dental operative procedures. Air abrasive technology does not replace current accepted standards of care, rather it is a new technology designed to help accomplish them.

CAUTION: Federal law restricts this device for sale to or on the order of a dentist.

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Controls and Connectors

The diagram on page 10 illustrates the external controls, indicators and connectors for the Model DV-1 Air Abrasion Unit. The following describes their functions.

| TABLE OF SYMBOLS | |
|---|---|
| SYMBOL | DESCRIPTION |
|  | 'STANDBY' (Power Disconnected from the Secondary Side of the Mains Transformer) |
| | ON (Power Connection to the Mains) |
| ~ | Alternating Current |
|  | Protective Earth Ground |
|  | Type B Applied Part |

◆ Names and Functions
(refer to page 10)

#1. Power “STANDBY” / “ON” Switch:

In the “ON” position, this switch activates the Main Power and Air Valve, opening a path for input of the air supply and pressurizes the Pressure Relief Pinch Valve, closing the valve. In the “STANDBY” position, the Main Air Valve is closed and the input air supply is blocked. The Pressure Relief Valve is also depressurized, opening it to relieve (dump) unexpended and residual air.

#2. Power Green Pilot Light:

This light glows when the Power switch is in the “ON” position indicating that electrical power is available.

#3. Powder Flow Knob:

This knob adjusts a rheostat to obtain the desired rate of powder flow via a variable controlled vibrator. To operate, begin with minimum powder flow and increase until the desired amount of powder is available. (See powder flow to nozzle diameter ratio chart in Chapter 10)

#4. Air Pressure Gauge:

Indicates pounds per square inch (psi) of air pressure supplied to the Mixing Chamber. For normal operations, 60 - 80 psi is used. For certain operations, a lower or higher pressure may be desirable. The Model DV-1 Air Abrasion Unit can be adjusted from 0-125 psi.

#5. Air Pressure Regulator Knob:

Adjusts Mixing Chamber air pressure, which is indicated on the Air Pressure Gauge.

#6. Exhaust Filter:

Collects the spent abrasive powder when the Quick-Dump Pinch Valve is opened and from the Mixing Chamber during unit shut down.

#7. Pre-Filter:

The Model DV-1 Air Abrasion Unit is equipped with a membrane type air dryer and a pre-filter for the incoming air supply. This filter is designed to effectively remove oil, water, and particulate contamination from the air supply.

#8. Fuse Drawer:

Contains fuses wired in series with input electrical power. 250V 1 Amp fuses.

#9. Handpiece:

The handpiece holds the nozzle through which the powder/air flows.
Note: The handpiece assembly is fully autoclavable.

#10. Electrical Power Input Connector:

Input connector for electrical power cord.

#11. Footswitch:

When the footswitch is actuated, the flow of powder/air is continuous. The gray protective housing helps reduce the risk of accidental activation of the system and acts as a stirrup for easier mobility of the footswitch.

#12. Footswitch Connector:

Connector for Footswitch plug.

#13. Input Air Supply Connector:

Air-In connector for external air supply.

#14. Input Air Supply Hose:

This hose connects the external air supply to the unit. A quick release fitting is provided on one end, which connects to the unit (#13). The other end should be hooked up to a quick disconnect fitting of your choosing. Note: the air hose is a 1/4" OD poly hose with a 1/8" ID. The unit should be supplied with clean, dry air.

#15. Power Cord:

Connects electrical power to unit (#10).

#16. Abrasive Pinch Valve:

The Abrasive Pinch Valve controls the powder/air mixture flow to the nozzle. This pinch valve is normally closed or "pinched", blocking the flow of air/powder to the nozzle. When the Footswitch is depressed the pinch valve is opened, allowing the powder/air mixture to flow through the nozzle. When the Footswitch is released the pinch valve closes or "pinches" the pinch valve tube, stopping the powder/air flow to the nozzle.

#17. Quick-Dump Pinch Valve:

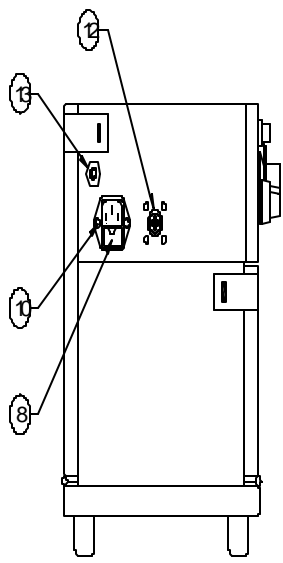
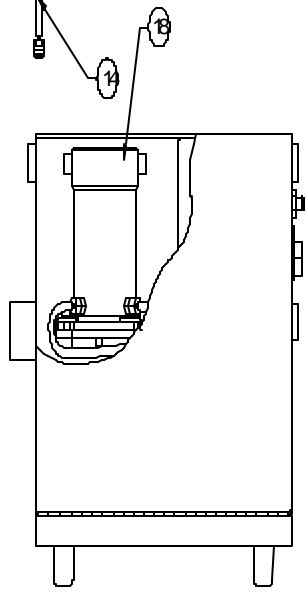
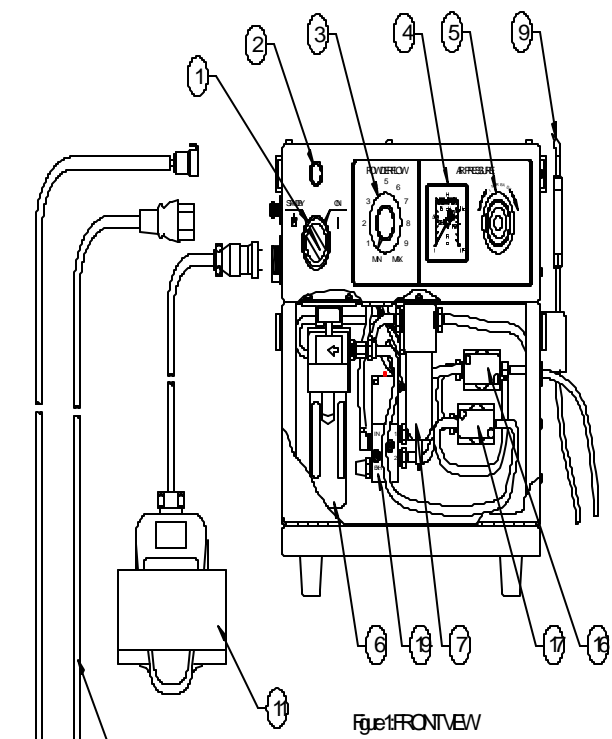
The Quick-Dump Pinch Valve provides an instant release of pressure entrapped in the abrasive air line between the Abrasive Pinch Valve and nozzle tip when the Footswitch is released to close the Abrasive Pinch Valve. When the Footswitch is again depressed to start the flow of the air/powder mixture to the nozzle, the Quick Dump Pinch Valve closes or "pinches" its pinch valve tube.

#18. Mixing Chamber:

Serves as the abrasive powder reservoir and also contains the powder feed orifices and powder/air mixing passages.

#19. Pinch Valve Solenoid:

Used to activate two different pinch valves.



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Unpacking and Setup

◆ General Information

The unit and the accessory equipment are shipped in a single container. When unpacking, check items against the list of contents packed with the unit. ***Do not discard*** the packing material. The shipping container and packing materials should be retained in the event that the unit has to be returned to the factory for service or repair. Check all items in the box against the “List of Contents” on the outside.

The following page is a list of standard equipment supplied with the unit.

In addition to the equipment supplied, the unit requires an external source of clean, dry, compressed air; carbon dioxide or nitrogen together with a single stage pressure regulator set below 125 psi. An external aerosol evacuation system is recommended in addition to your standard evacuator.

◆ List of Contents

Standard Equipment

| Part Number | Item | Quantity |
|---------------------|---|----------|
| 4362-1 (115V 60 Hz) | Model DV-1 Air Abrasion Unit | 1 |
| Includes: | | |
| 4399-1 | Hose Assy, Air In | 1 |
| 4413-1 | Footswitch Assembly with Guard | 1 |
| 3455-1 | Valve, Pinch (Spares) | 4 |
| | Assorted Nozzles | 5 |
| 4350-1 | Handpiece, Autoclavable | 1 |
| 8107-1 | Swivel Handpiece, Autoclavable | 1 |
| 6040-1 | Operator's Manual | 1 |
| 500-003-9 | Power Cord | 1 |
| 500-37-5 | Tubing, Black Super Hose (Spare) (Pinch Valve to Mixing Chamber) | 18" |
| 600-007-87 | Powder, Aluminum Oxide, #16 W | 1 lb. |
| 500-005-21 | Fuse, 250V, 1 Amp | 2 |
| 550-096-3 | Goggles, Safety | 3 pair |
| 850-105-1 | Glass Slides | 3 |
| 850-094-1 | L Hex Wrench | 1 |

◆ Unpacking and Setup

Remove the unit from the shipping container and proceed as follows:

- Open the front and rear cover by releasing the latches.
- Remove the foam insert from the mixing chamber. The foam insert should be retained with the shipping box and packing materials. In the event that the unit has to be shipped, the foam insert must be reinstalled to prevent damage to the vibrator and its mounts.

CAUTION: Failure to remove the foam insert will result in improper vibrator operation and powder flow.

◆ Supply Requirements

- ✱ **Air supply:** A filtered compressed air line or a cylinder of regulated CO₂, or nitrogen may be used as the gas supply for the unit.

***Warning:** The use of compressed oxygen as a gas supply for the unit presents the possibility of an explosion occurring.
Under *no* circumstances should it be used.

The normal air supply to the unit should be about 80 psi but can range from a minimum of 40 psi to a maximum 125 psi. The air source must deliver a minimum of 1.5 cfm at 80 psi. Since many dental office compressed air lines can be contaminated with moisture, oil and dirt, which are detrimental to the performance and operation of the unit, a pre-filter and membrane air dryer are incorporated into the Model DV-1 Air Abrasion Unit.

•• Electrical Requirements

The electrical requirements for this unit are 115 VAC, 60 Hz single phase. The cord set supplied is three prongs, polarized, providing an earth ground.

NOTE: The unit is fused. If at any time during operation a fuse blows, immediately unplug the power supply cord, and check for possible shorts or malfunction prior to replacing the fuses. If the fuses continue to blow, contact CRYSTALMARK Dental Systems, Inc. to return for repair.

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Installation and Unit Checkout

After removing the unit from the shipping container, following the instructions on page 13, proceed as follows:

**** Unit Checkout**

- Connect the end of the air supply hose with the quick disconnect fitting to the Input Air Supply Connector on the left side of the unit. Connect the other end of the supply hose to an external air supply.
- Set the POWER switch on the front panel to “STANDBY”, and the POWDER FLOW knob completely counter-clockwise to the "min" position.
- Plug the female end of the power supply cord into the Model DV-1 Air Abrasion Unit power connector located on the left-hand side of the unit. Then plug the male end of the cord into an electrical outlet.
- Set the POWER switch to “ON”. The green pilot light should go on.

NOTE: If the green pilot light does not go on, it indicates absence of electrical power. Check unit fuse and if OK, check the input power source and power cord connections and air pressure.

- Check the reading on the AIR PRESSURE gauge. Set the Main Air Pressure Regulator as follows:
 - 1) Pull the black knob out and rotate knob to desired pressure.
 - 2) Push the black knob forward to lock the pressure setting.
- Attach a Handpiece and nozzle to the handpiece connector on the delivery hose.
- Plug in the Footswitch. Actuate the Footswitch. Air should flow from the nozzle.

CAUTION: Some residual powder may be in the unit from factory testing. Always use goggles or protective eyewear when using the Model DV-1 Air Abrasion Unit and do not direct the nozzle towards the face when operating the footswitch.

- Set the POWER switch to “STANDBY”. This depressurizes any residual air remaining in the chamber and air lines.

CAUTION: After turning the Power Switch to the “STANDBY” position. Allow a Pressure Relief time of 20 to 25 seconds before removing the Mixing Chamber cover, or performing other services. Verify that the pressure regulator reads 0 psi.

- Select the desired powder for the operation to be performed and proceed to fill the Mixing Chamber as described on page 16.
- Place the POWER switch to “ON” and set the POWDER FLOW knob to obtain the desired amount of powder flow for the operation to be performed. Powder flow is at a minimum in the counterclockwise "min" position and gradually increases to the clockwise or "max" position. Consult the powder flow to nozzle diameter ratio guide on page 42.
- Actuate Footswitch to obtain powder flow through the nozzle.

You can now practice operative procedures on extracted teeth as described in Chapter 2, *Safety*.

•• Unit Shutdown

- Set the POWER switch to “STANDBY”.

•• Filling the Mixing Chamber

Observe the following procedures when filling the Mixing Chamber. (See pages 35 & 36 for drawing).

- Place the POWER switch of the unit to “STANDBY”. This actuates the Pressure Relief valve to ensure that the pressure to the Mixing Chamber is released.
- After turning the Power Switch to the “STANDBY” position. Allow 20 to 25 seconds of Pressure Relief time before opening the Mixing Chamber. Verify that the pressure gauge reads 0 psi.
- Open back panel of the Model DV-1 Air Abrasion Unit to access mixing chamber/vibrator assembly.
- Clean off any dust or debris from the Mixing Chamber lid and nut then loosen the nut and remove the lid.
- Squeeze abrasive powder bottle and carefully pour abrasive powder into the Mixing Chamber until it is 3/4 full.
- Replace the Chamber lid and nut and tighten.

CAUTION: Make certain that no lint, or other foreign substances enter the chamber. They can clog the orifices in the Mixing Chamber's Orifice Plate and cause poor powder flow performance.

•• Mixing Chamber Powder Unloading

See Mixing Chamber Cleaning and Orifice Plate Replacement on page 33 or powder unloading instructions.

6

Sterilization

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| <p>WARNING: All Model DV-1 Air Abrasion Unit accessories which come into contact with the patient must be sterilized prior to each use.</p> |
|--|

**** Sterilization Procedures:**

Disinfecting and Isolation Procedure

The Model DV-1 Air Abrasion Unit can be cleaned with conventional surface disinfectants as specified by your local authorities requirements for inoperatory counter tops, dental units, etc. It is worth noting that the long-term use of these agents could lead to a change in color of the Model DV-1 Air Abrasion Unit. It is therefore suggested that the controls of the Model DV-1 Air Abrasion Unit, namely the "ON" / "STANDBY" switch, the power flow control and the air pressure control and the gauge be wrapped with plastic wrap material before and after each patient treated. In this way, the operator's hands will not come in direct contact with these surfaces. The implementation of this tactic negates the need to continually disinfect these controls.

The office staff can also cover the upper and lateral surfaces of the Model DV-1 Air Abrasion Unit with plastic wrap material to prevent any abrasive powder overspray from depositing itself on these surfaces. This strategy allows for easy clean up of the machine at the end of a workday. This also reduces the need for disinfectant wiping of these surfaces during the

everyday use of this machine.

Handpiece

Sterilization of the handpiece/nozzle can be accomplished by utilizing any conventional dental autoclave. The handpiece/nozzle is fully autoclavable in a dry heat, steam, or chemical autoclave. This is mandatory prior to each use and ensures that the handpiece cannot become a source for cross contamination disease or infection.

NOTE: Always confirm that the handpiece/nozzle assembly is completely dry inside and outside prior to use.

Accessories

The handpiece hose connector and hose assembly of the Model DV-1 Air Abrasion Unit which will be in close proximity to the patient or other sources of contamination should be sheathed or wiped down in accordance with standard disinfecting procedures.

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Operating Instructions

As previously stated, you should practice on extracted teeth and glass slides prior to in vivo use in order to appreciate the variably unique cutting ability of the Model DV-1 Air Abrasion Unit.

Below is a list of indications for the use of the Model DV-1 Air Abrasion Unit:

•• Intra-Oral Applications

- Cavity preparations for composite restorations and small amalgam fillings. Preparations for aesthetic composite procedures.
- Removal of composite and small amalgam restorations.
- Partial removal of composite restoration and repair or re-bonding at failure sites.
- Etching of enamel, dentin and porcelain bonding.
- Preparations for pit and fissure sealant.
- Prophylaxis. CAUTION: Only use soda bicarbonate for this procedure.
- Removal of stains from teeth.
- Etch teeth prior to bonding restorations.
- Clean pit and fissures prior to placing sealant resins.

- Prepare teeth for veneer/facing restorations.
- Etch metal/porcelain/composite restorations prior to repairing them.
- Prepare teeth for cavity preparations, remove decay, Class I, II, III, IV, V & VI restorations.
- Polish metallic restoration margins.
- Satinize metallic restorations to check occlusion.
- Prepare metal and porcelain to bond orthodontic brackets.
- Remove and modify enamel, dentin, composite, porcelain and metal restorations.
- Carve occlusal anatomy in restorations.
- Remove residual amalgam stains from enamel and dentin.

•• Extra-Oral Applications:

- Clean cement from a displaced crown prior to recementation.
- Satinize metallic restoration to locate occlusal interference prior to cementation.
- Etch internal surfaces of restorations prior to bonding or cementation.
- Carve occlusal anatomy in porcelain restorations prior to bonding or cementation.
- Etching stainless steel crown to bond composite material to facial or buccal surface.
- Satinize restorations to check for interference.
- Clean restorations prior to recementation.
- Etch restorations prior to bonding or cementation.
- Carve occlusal anatomy in porcelain restorations.

CAUTION: Clinical use of the Model DV-1 Air Abrasion Unit for procedures not included or suggested in this instruction guide is not advised. Similarly, the Model DV-1 Air Abrasion Unit should only be used by dentists who have practiced on extracted teeth and who are thoroughly familiar with this manual as well as proper air abrasion procedures.

The use of the Model DV-1 Air Abrasion Unit as described can generally be well tolerated by patients without local anesthesia. If a patient reports discomfort, the air pressure and/or powder flow can be adjusted or an

anesthetic may be called for.

In general, cutting speed increases with increased air pressure, increased nozzle diameter, increased powder flow and decreased distance to the tooth structure. Cutting speed decreases with decreased air pressure, decreased nozzle diameter, decreased powder flow and increased distance to the tooth. Enamel cuts slower than dentin, thus while it may take 1-2 minutes to complete a Class I preparation on a molar, it may take 5 seconds to complete a Class V preparation on a premolar. Increased powder flow and air pressure will increase cutting speed, but also will deliver more powder to the operative site that must be controlled with the high volume evacuation (HVE). You will find a comfortable balance between cutting speed and controlling the powder flow in the mouth. Most preparation procedures can be easily accomplished with about 60 - 80 psi and proper powder flow ratio set to the nozzle diameter used. Use larger nozzle sizes such as .66 mm (0.026") for rapid reduction or removal and the finer tip .28 mm (0.011") for finely controlled and precise preparations. Refer to nozzle chart on page 42.

**** General Operating Procedures**

The Cutting Process

The unit performs a cutting action by impinging sharp-edged powder particles to a surface. A cylindrical powder/air stream emerges from the nozzle for a short distance (approximately 0.079") and then diverges into a cone shape, with a seven degree included angle. With a close nozzle tip distance small holes and cuts with straight walls are made. As the nozzle moves away from the work, the hole diameter or width of cut increases, with the walls becoming angular. With a large nozzle tip distance one wall can be kept normal to the surface by holding or setting the nozzle at an angle. The angle can be determined with a few trials. To obtain sharp definition (as in precise cutting) the nozzle tip distance should be kept to a minimum of 1mm, and use the smallest diameter .28 mm (0.011") nozzle.

Cutting Speed

The cutting speed, (removal of material), increases up to a certain nozzle distance. Adjusting the powder flow, using different pressure settings, powders and special type nozzles, may also vary the cutting rate. Etching or removing broad areas of metallized film or coatings can be accomplished by increasing the nozzle tip distance and nozzle diameter and diverting the air stream at an acute angle.

Adjustment of Powder Flow

Depressing the Footswitch causes a mixture of powder and air to be discharged from the nozzle. The mixture richness is controlled by the

Powder Flow Knob, which adjusts the vibrator voltage. A suggested starting point is at the "two" position. See Optimal Powder Flow to Nozzle Diameter Ratio chart on page 42.

Pressure Behind the Nozzle

Air pressure settings may vary depending on the material being cut, the type of cut or abrading process desired, and the powder being used. A suggested starting point is 80 psi.

Check the Progress of the Cavity Preparation

Stop frequently, every few seconds, and make a visual inspection of the progress. Early in the use of the Model DV-1 Air Abrasion Unit it is suggested that you use only short bursts of air/powder mixture. You should not continue for more than 5 seconds without stopping to make a visual inspection. For Class V restorations you should not continue for more than 2 seconds without stopping to examine the results. It is strongly recommended that all procedures performed with the air abrasion unit be done under magnification.

Use a Saliva Ejector

As with any other cavity preparation procedure, your conventional saliva ejector should be normally positioned in the patient's mouth, to collect saliva and rinse water.

Use Your High Volume Evacuation System

This is an important part of the use of the Model DV-1 Air Abrasion Unit for cavity preparation or cutting procedures. Place the HVE about .5 or 1 cm from the operative site to collect the abrasive powder.

Stopping to Rinse

Most cavity preparations will take between 30 seconds and 1½ minutes. On longer procedures some patients will experience discomfort from dryness and may wish to have their mouth rinsed with the water syringe and evacuated with the saliva ejector.

**** Step by Step Operating Instructions**

NOTE: Prior to the procedure pre-load the Mixing Chamber with the appropriate abrasive powder for the procedure to be performed. Make sure that the air source is connected to the input air supply hose and that the power cord is connected to a properly grounded receptacle.

1. Remove a Handpiece/nozzle from its package and connect it to the fitting on the "white" flexible delivery hose.

2. Make sure that your patient is prepared just as you would for traditional procedures and all participants are wearing protective eyewear.
3. Always do procedures with high power magnification.
4. Turn the Model DV-1 Air Abrasion Unit "ON"/"STANDBY" switch to "ON", the green light should be lit.
5. Adjust the air pressure and powder flow to the rates needed for the procedure.
6. With the nozzle pointed into a receptacle, such as a sink or extended aerosol evacuator, press the footswitch to check that the air/powder mixture is flowing from the nozzle.
7. Direct the tip at the desired target, and with the HVE in place begin the procedure, observing the progress carefully.
8. When the desired result has been accomplished, release the footswitch; flow from the nozzle will stop.

8

Maintenance

EXHAUST FILTER (ITEM 6)

(Refer to pages 26 & 27)

The Exhaust Filter collects the spent abrasive powder drawn out of the Handpiece hose when the Quick-Dump Pinch Valve is opened during operation of the Model DV-1 Air Abrasion Unit and from the Mixing Chamber during unit shut down.

FILTER MAINTENANCE

The Exhaust Filter must be cleaned frequently to assure proper operation.

The Filter is located inside the unit, behind the front door, on the left side.

To remove and disassemble the Filter:

- 1) Switch the Model DV-1 Air Abrasion Unit to “STANDBY” mode.
- 2) Slide the Filter Assembly out of its track. The hoses do not need to be disconnected.
- 3) Hold the top housing with one hand and with the other hand, slide down the black plastic bowl lock and rotate the bowl and its metal guard in either direction until they separate from the assembly (approx. 30 degrees).

- 4) Empty powder out of bowl and clean Filter Element with a soft brush, vacuum dust collection system or compressed air. Removal of the element is unnecessary except for replacement. To remove element, unscrew the black plastic Baffle at the bottom of the element. When re-installing the Filter element and Baffle; clean any powder from the threads of both the Baffle and the threaded retainer rod. When screwing the Baffle back onto the rod, care must be taken to prevent damaging the threads of the plastic Baffle.
- 5) After cleaning the filter, reverse the removal procedure to re-assemble and replace the filter assembly. It is sometimes easier to separate the plastic bowl from its guard and install them into the filter housing one at a time. First the bowl, turning as you push up and in. Then slide the guard over the bowl aligning the bayonet mounting tabs of the guard with the openings in the filter housing. The guard will not seat completely if the boss on the bottom of the bowl does not protrude into the hole in the bottom of the guard. After the bowl and guard are fully seated in the housing, rotate the guard in either direction until it locks in place (approx. 30 degree).

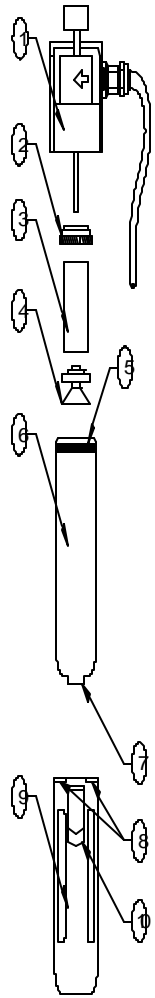
WARNING: Do not expose filter assemblies to solvents, alcohol's, or glycol's. Exposure to these materials could cause failure of the housing.

DRAINING THE PRE-FILTER (ITEM 7)

The moisture should be drained from the bowl about once a week. To drain the bowl, (located inside the front door) be sure the compressed air supply is connected to the Model DV-1 Air Abrasion Unit. At the bottom of the pre-filter is a spring-loaded plunger. Depress the plunger, by pushing it into the bowl until you hear air escaping. Leave plunger depressed for a few seconds, then release the plunger.

Exhaust Filter Assembly

| Item Number | Description |
|--------------------|------------------------|
| 1 | Housing |
| 2 | Deflector |
| 3 | Filter Element |
| 4 | Baffle |
| 5 | O-Ring |
| 6 | Bowl |
| 7 | Boss on bottom of bowl |
| 8 | Bayonet Mounting Tabs |
| 9 | Bowl Guard |
| 10 | Bowl Lock |



PINCH VALVES

The Model DV-1 Air Abrasion Unit contains 2 Pinch Valves, which control the flow and direction of the air/powder mixture inside of the unit and to the nozzle.

ABRASIVE PINCH VALVE ASSEMBLY

The Abrasive Pinch Valve controls the powder/air mixture flow to the nozzle. When the Model DV-1 Air Abrasion Unit's Power Switch is in the "ON" position the pinch valve is pressurized and its valve tube is closed or "pinched" preventing the flow of powder/air to the nozzle.

When the footswitch is depressed the pinch valve is de-pressurized, opening the valve tube and allowing the flow of powder/air to the nozzle. When the footswitch is released, the pinch valve is again pressurized, closing the valve tube and shutting off the flow of powder/air to the nozzle.

When the Power Switch is turned to the "STANDBY" position the pinch valve remains closed to allow any remaining air pressure in the system to depressurize through the Depressurization Pinch Valve and into the Exhaust Filter.

QUICK-DUMP PINCH VALVE ASSEMBLY

The Quick-Dump Pinch Valve opens a path for pressurized air/powder entrapped in the handpiece hose, to quickly drain off when the footswitch is released. Thus, eliminating any overspray at the nozzle. Its opening and closing is inverse to that of the Abrasive Pinch Valve.

When the Footswitch is depressed to start the flow of air/powder through the handpiece, the Quick-Dump Pinch Valve is pressurized to close or "pinch" its valve tube. Thus preventing the air/powder flowing to the handpiece from escaping through the Quick-Dump Pinch Valve.

When the Footswitch is released, the Quick-Dump Pinch Valve is de-pressurized to open its valve tube. The open valve tube creates a path for the pressurized air/powder in the handpiece hose to quickly drain off through the Quick-Dump Pinch Valve and into the Exhaust Filter.

PINCH VALVE TUBE REPLACEMENT

(refer to pages 31 & 32)

The rubber pinch valve tubes wear and will eventually leak. The Pinch Valve Assembly is not removed from the Unit for tube replacement. The procedure for replacing the tubes is the same for all of the Pinch Valves. All tubes should be replaced at the same time.

- 1) Set POWER Switch to the "STANDBY" position. Allow 20 to

25 seconds of depressurization time before performing the service. In order for the depressor in the Abrasive Pinch Valve to retract, the residual air pressure within the pinch valve has to be exhausted. To relieve this pressure, disconnect Air In Hose from Unit. Turn Power Switch to "ON", depress Footswitch several times and then turn Power Switch back to "STANDBY". Depress the red button on the solenoid valve until air is relieved (*refer to pages 8-10*).

- 2) Remove top block from assembly by removing the two knurled screws. Remove worn pinch valve tube and fittings from bottom block. Remove tube from fittings and carefully insert the new pinch valve tube between the fittings. Insert the new pinch valve and fittings into the bottom block indentation.

Note: You must align the pinch valve's seam to the side of the block when installing.

- 3) Carefully replace top block, making certain that the tube and fittings align with the indentations in the top block. Secure top block in place with knurled screws. Finger tighten only.
- 4) Turn POWER Switch "ON" and check for proper operation and air leaks.

REPLACING THE PINCH VALVE BLOCKS

If the Model DV-1 Air Abrasion Unit is operated for an extended period of time with a leaking pinch valve tube, the top and bottom blocks that hold the pinch valve tube may become excessively worn by the leaking abrasive powder and their replacement will be required. The pinch tube depressor may also become worn by the leaking of abrasive powder.

- 1) Disassemble and remove pinch valve as outlined above in the Pinch Valve Tube Replacement instructions.
- 2) Be sure the depressor is retracted into the pinch valve body prior to proceeding to step 3. (See Pinch Valve Tube Replacement instructions step 1)
- 3) Remove the bottom block by removing the 2 small locating screws, which secure it to the pinch valve body.

CAUTION: When the bottom block is removed, the internal parts of the pinch valve can fall out if the unit is jarred or moved.

- 4) If the depressor's end is worn it must be replaced. Remove the Spring and Depressor. Install a new depressor and then the spring.
- 5) Install the new bottom block being sure that it sits flat on the

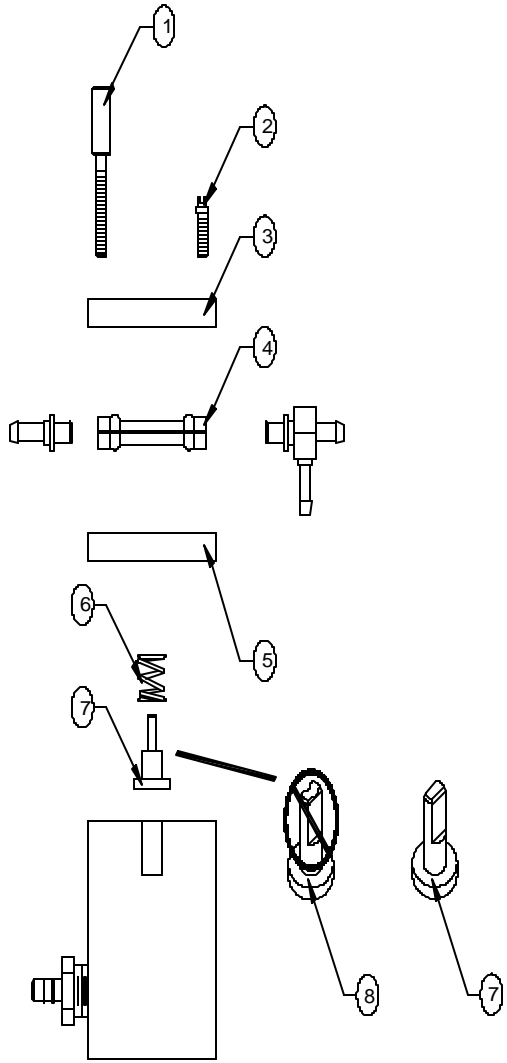
pinch valve's top surface.

Note: The bottom block is the block with the rectangular hole through its center.

- 6) Re-assemble with a new valve tube and top block as outlined in the Pinch Valve Tube Replacement instructions.

Pinch Valve Assembly

| Item Number | Part Number | Description |
|-------------|-------------|--|
| 1 | | Knurled Screw |
| 2 | | Locating Screw |
| 3 | | 3453-1 Top Block |
| 4 | | 3455-1 Pinch Tube (Align pinch tube seam as shown) |
| 5 | | 3453-2 Bottom Block |
| 6 | | Spring |
| 7 | | 3416-1 Depressor |
| 8 | | (Worn Depressor) |



Pinch Valve Assembly

MIXING CHAMBER AND ORIFICE PLATE

The Mixing Chamber serves as the abrasive powder reservoir and also contains the powder feed orifice plate and powder/air mixing passages.

The pressurized airflow into the chamber is mixed with the abrasive powder as it is vibrated into the air stream through the passages in the orifice plate. The resulting mixture is carried through the Abrasive Pinch Valve to the nozzle.

The Powder flow rate is determined by the air pressure level (set by the AIR PRESSURE Regulator) and the vibration amplitude imparted on the Mixing Chamber by the Vibrator (controlled by the POWDER FLOW control knob).

MIXING CHAMBER CLEANING AND ORIFICE PLATE REPLACEMENT.

Occasionally the Mixing Chamber may have to be removed and disassembled for cleaning or replacement of the Orifice Plate Assembly.

To disassemble and clean the Mixing Chamber (*refer to page 35-38*):

- 1) Set POWER Switch to the "STANDBY" position. Allow 20 to 25 seconds for the unit to depressurize before performing and service.
- 2) Firmly hold the chamber and vibrator and loosen the Mixing Chamber Cap by turning it counter clockwise. Completely unscrew the Cap Nut and remove from the chamber along with the Cap and Gasket.
- 3) Loosen the two cap screws that hold the large cleat with a 3/16 Allen key wrench and remove the small cleat and its cap screw.
- 4) Remove the Chamber from the Mounting Plate.
- 5) Pour powder into its original container or any other clean, dry container.
- 6) Invert the chamber, remove the three base screws and remove the Base Cap and gasket.

Note: If the Base Cap is difficult to remove. One of the Cap screws can be screwed into the threaded center hole of the Cap and used to pull it out.

- 7) Turn the chamber upright. Reach into the chamber and grasp the tube portion of the Orifice Plate Assembly and push the assembly out through the base.
- 8) Clean holes in the orifice plate by using a fine wire brush and low-pressure compressed air.
- 9) Clean interior of chamber with low pressure compressed air.
- 10) Reverse above procedure for re-assembly. Replace any worn or damaged gaskets.

Note: Prior to replacing Cap and Cap Nut be sure the cap threads are free of powder and the cap gasket is properly seated.

- 11) After chamber is clamped into position with the two cleats, hand tighten the Cap Nut.

Caution!! An improperly tightened cap nut will cause powder to enter the chamber and cap threads and make future removal of the cap difficult.

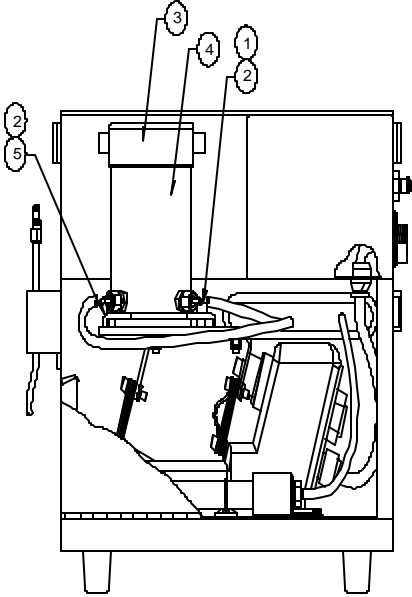
- 12) Check the two air hoses that attach to the Mixing Chamber to assure that they are not kinked and that they make a large free loop.

Mixing Chamber Removal

| Item Number | Description |
|-------------|------------------|
| 1 | Small Cleat |
| 2 | Screw, ¼-20 SHCS |
| 3 | Cap |
| 4 | Mixing Chamber |
| 5 | Large Cleat |

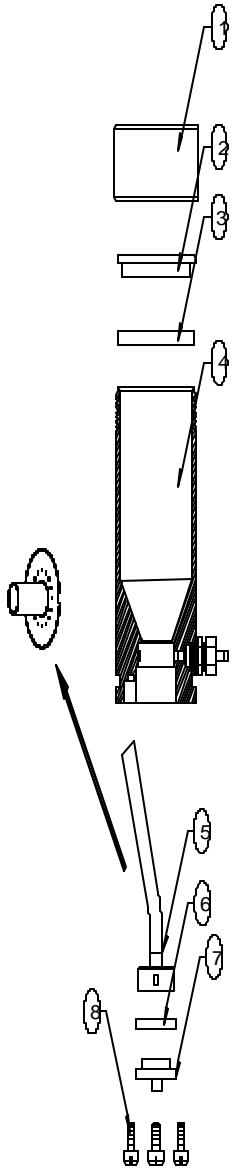
Note: Hoses shown disconnected from chamber fitting for clarity only. They do not need to be disconnected for normal chamber cleaning and orifice plate removal. See page 36 for drawing.

Mixing Chamber Removal



Mixing Chamber Assembly

| <u>Item Number</u> | <u>Description</u> |
|--------------------|--------------------|
| 1 | Cap Nut |
| 2 | Cap |
| 3 | Gasket, Cap |
| 4 | Mixing Chamber |
| 5 | Orifice Plate Assy |
| 6 | Gasket, Base Cap |
| 7 | Base Cap |
| 8 | Base Cap Screws |



Mixing Chamber Assembly

9

Troubleshooting

| PROBLEM | PROBABLE CAUSE | REMEDY |
|---|---|--|
| No power: | ◆ Instrument not plugged in | Check power cord connection. |
| | ◆ Main switch at "STANDBY" | Check switch |
| | ◆ Blown fuse(s) | Check fuse(s) |
| | ◆ Main switch bad | Call service rep. |
| No powder flow when footswitch is depressed: | ◆ Footswitch not plugged in | Check connection |
| | ◆ Powder flow not selected | Check powder flow control knob |
| | ◆ Nozzle clogged | Check for clog |
| | ◆ Tubing pinched | Check tubing |
| | ◆ Pinch Valve problem | Call service rep. |
| | ◆ Mixing Chamber empty | Refill Mixing Chamber with Abrasive powder |
| | ◆ Clogged orifice in Chamber | Disassemble & clean chamber |
| | ◆ Vibrator inoperative | Call service rep. |
| ◆ Moisture in air line | Check desiccant in air dryer | |
| Air flow from nozzle when footswitch not depressed: | ◆ Pinch tube rupture | Replace pinch tube |
| | ◆ Defective footswitch | Call service rep. |
| | ◆ Loss of air pressure from Abrasive pinch valve or pinch valve regulator | Call service rep. |
| Erratic powder flow: | ◆ Moisture in air line | Change desiccant in air dryer |
| | ◆ Powder caking in Chamber | Replace powder and check air dryer |
| | ◆ Chamber empty | Check powder level |

- ◆ Nozzle partially clogged Check nozzle and clean.
- ◆ Vibrator inoperative Call service rep.

| PROBLEM | PROBABLE CAUSE | REMEDY |
|--|---------------------------------------|---|
| Powder spray loses definition: | ◆ Worn nozzle tip | Replace nozzle |
| Poor cutting performance from nozzle: | ◆ Worn nozzle tip | Replace nozzle |
| | ◆ Low powder flow | Turn powder flow up to proper nozzle to powder flow ratio |
| | ◆ Too much powder in abrasive pathway | Remove nozzle and purge excess powder from abrasive pathway, adjust powder flow to proper powder to nozzle ratio. |
| | ◆ Improper cutting technique used | Reattach nozzle. Consult with CRYSTALMARK Dental Systems, Inc. for referral to trainer. |
| Air Pressure Drop when using the Model DV-1 Air Abrasion Unit: | ◆ Not enough cfm to unit | Hook up air line to a larger air supply. |
| | ◆ Worn Nozzle | Replace nozzle |
| | ◆ Air Leak | Check for leaks and fix or consult CRYSTALMARK Dental Systems, Inc. |

10

Nozzles and Abrasives

**** Nozzles**

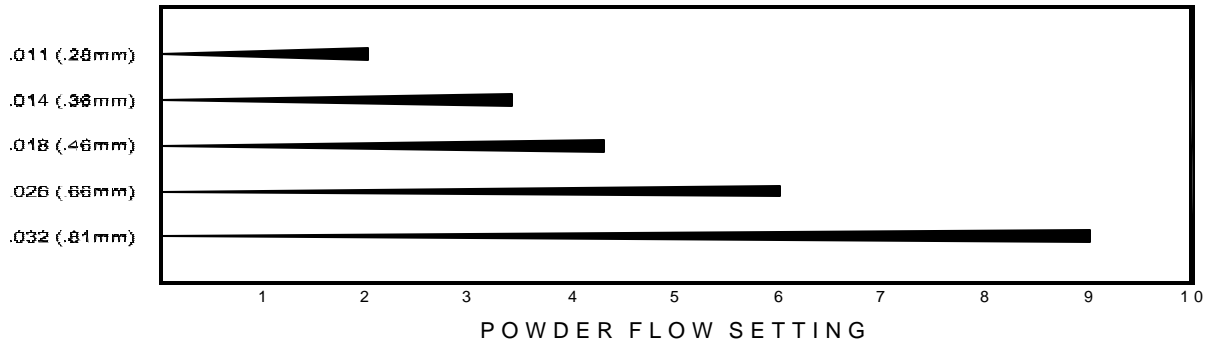
Nozzles available for the Model DV-1 Air Abrasion Unit, feature straight, 45° angle, or 90° angle, in the following sizes (see nozzle chart, page 42).

- .28mm (.011") ID
- .36mm (.014") ID
- .46mm (.018") ID
- .66mm (.026") ID
- .81mm (.032") ID




**** Abrasives**

- #16W (27 micron Aluminum Oxide), white color. Also available in Dark color. Other sizes are 35m and 50m. Custom requests are available. Please contact your representative
- 44 micron Soda Bicarbonate

Z



NOZZLE SELECTION CHART

| NOZZLE STYLE | |  90° |  45° |  |
|------------------------------|-------|--|--|--|
| ORIFICE SIZE COLOR ID(MM) | | STANDARD | | HOOK NOZZLE |
| GOLD | .28mm | 3591-2 | 3744-2 | |
| RED | .36mm | 4326-2 | 4329-2 | 8120-1 |
| BLUE | .46mm | 5599-2 | 5599-2 | 8120-2 |
| WHITE | .53mm | | | 8120-3 |
| GREEN | .66mm | 3594-2 | 3585-2 | |
| BLACK | .81mm | 3595-2 | 3586-2 | |

Optimal Powder Flow to Nozzle Diameter Ratio

11

Warranty, Returns and Adjustments

**** Returns and Adjustments**

Warranty claims must be made promptly and received by CRYSTALMARK Dental Systems, Inc., during the warranty period. If it is necessary to return a product for repair or adjustment, authorization for the return must first be obtained from CRYSTALMARK Dental Systems, Inc. A return materials authorization (RMA) number will be issued after consultation with the service department.

All products returned for examination or warranty repair must be sent insured via a means of transportation specified by CRYSTALMARK Dental Systems, Inc.

CRYSTALMARK Dental Systems, Inc. claims the sole responsibility for determining the cause of any instrument failure and the adjustments are subject to CRYSTALMARK Dental Systems, Inc.'s final approval.

**** Limited Warranty**

The Model DV-1 Air Abrasion Unit is warranted to be free from defects and workmanship for a period of **36 months from the date of shipment**. Accessories such as handpieces, hoses, etc., have a limited life expectancy

based on use and are warranted to be free from defects and workmanship. The warranty applies *only* to the original end user of the equipment.

The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, or implied, and shall be the purchasers sole remedy and CRYSTALMARK Dental Systems, Inc.'s sole liability under contract or otherwise for the product.

CRYSTALMARK Dental Systems, Inc. will not be liable for any incidental consequential damages arising out of or in connection with the use or performance of the product delivered hereunder. CRYSTALMARK Dental Systems, Inc. disclaims any implied warranty or merchantability or fitness for particular purposes.

**** Storage and Shipment**

The Model DV-1 Air Abrasion Unit has been designed for long term usage in normal dental office environments. If it is to be stored for any reason for a long period, it should be covered to protect it from elements and the Mixing Chamber should be emptied. Ideally it should be packed in its original carton for storage.

The unit has been designed for shipment by normal commercial carriers. Protective packaging should be used and the foam inserts described in the unpacking and setup section on page 13 must be reinstalled for shipment. Shipping instructions from CRYSTALMARK Dental Systems, Inc. are to be followed closely.