
Prep Master®



Operating Manual
Eco/Prep 500



Eco/Prep™



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Please note: The following safety instructions must be followed as shown in this operating manual. Failure to do so may result in hazard to health or possible death.

1.0 Technical Data

- 1.1 Rating
- 1.2 Unit Specifications: ECO/PREP500
- 1.3 Operative Range and Correct Usage
- 1.4 Stand-by Power Supply
- 1.5 Advice for Operators of Grinding Machines
- 1.6 Machine Type Designation

1.1 Rating

Machine:	Prep/Master® Grinder
Machine-Types:	ECO/PREP500
Manufacturer:	Substrate Technology 1384 Bungalow Rd. Morris IL 60450 USA (815) 941-4800 www.substratetechnology.com

1.2 Unit Specifications: ECO/PREP500

Dimensions:

Length	41 in	104 cm
Width	20 in	51 cm
Height	42 in	107 cm
Weight	350 lbs.	157 Kg

Connected loads of the electrical system:

Power	5 HP
Electrical Connection	230V/60Hz-1 Phase

Wiring:

Yellow/Green Wire	Ground
Blue Wire	Line 1
Brown Wire	Line 2

1.3 Operative Range and Correct Usage



The Prep/Master® ECO/PREP500 is designed to be used on clean, dry or wet horizontal surfaces without obstacles. The machine can not be used for other purposes. The manufacturer will not be liable for damages resulting from such incorrect usage. In case of wrong usage the user is responsible for all risks.

1.4 Stand-by Power Supply (Generator)



If the Prep/Master® ECO/PREP500 is operated using a generator, the generator must be operated in accordance with the current local electrical directives (this applies in special to the protective ground conductor) in order to ensure that all safety devices are functioning and to be able to eliminate possible damage to electrical components.

1.5 Advice for Operators of Grinding Machines



During the operation of the Prep/Master® ECO/PREP500 it may be possible to exceed the acceptable noise level of 85 dB(A). This is dependent on the different locations and the local circumstances. When the noise level is 85 dB(A) or more, the machine operator and others working near the machine must wear sound-insulating devices.

1.6 Machine Type Designation

Machine Type:	Prep/Master® ECO/PREP500
Working Width:	20 in / 50 cm
Drive:	Manual
Grinding Capacity:	Variable
Dust Hose Connection:	2 in / 50mm

2.0 Safety Instructions

- 2.1 Explanation of Warnings and Symbols
- 2.2 Organizational Measures
- 2.3 Personnel Selection and Qualification
- 2.4 Safety Precautions Applicable to Different Operating Conditions
- 2.5 Repair Work, Maintenance Activities, and Default Repair on the Job Site
- 2.6 Definition of the Safety-off Position
- 2.7 Dangerous Aspects of the Machine
- 2.8 Electrical Engineering Regulations
- 2.9 Special Instructions



The following safety instructions must be followed as shown here. Failure to do so may result in hazard to health or possible death.

2.1 Explanation of Warnings and Symbols

The following symbols are used in the operating instructions to highlight areas of particular importance:



Operational Safety

This symbol will be shown in these Operating Instructions next to all safety precautions that are to be taken in order to ensure prevention of injury. Follow these instructions and take special care in these circumstances. In addition to these instructions, the general safety precautions and the local accident prevention guidelines are also to be followed. Please check, whether there are special regulations for the particular job site.



Safety Goggles/ Ear Protection

Information, instructions, and restrictions with regards to possible risks to persons or extensive material damages.



Electrical Warning

Warning against dangerous voltages.

2.2 Organizational Measures

The Operating Instructions are to be kept near the location where the machine is located and must be accessible all the time!

In addition to the Operating Instructions general and legal regulations regarding accident prevention and environmental protection must be with and indicated every time!

Such duties may for example relate to the handling of hazardous substances or to the provision and wearing of personal protection equipment as well as compliance with local traffic regulations.

The Operating Instructions must be supplemented by instructions including the duty to supervise and report relating to particular local working practices, for example work organization, work procedures, and personnel allocation.

Personnel entrusted with working with the machine must have read the Operating Instructions before starting the work; in particular the chapter about Safety Instructions. These have to be read before starting any work with the machine. This particularly applies to incidental activities such as setting up the machine, carrying out maintenance work, or training staff to work with the machine.

From time to time the working practices of the staff are to be checked regarding awareness of safety and hazards.

Personnel must tie back long hair and not wear loose clothing or jewelry and rings. There is a risk of injury through getting stuck or being drawn into moving machinery.



*Use personal protection equipment if necessary or required by regulations!
Take notice of all safety and hazard notices on the machine.*

All safety and hazard notices on the machine must be kept complete and legible.

If safety-critical changes occur to the machine or its performance, the machine must be shut down immediately! The cause of the fault has to be established immediately and has to be repaired before starting the work again.

Changes, add-ons, or conversions of the machine which might have an influence to the safety of the machine must not be undertaken without the permission of the manufacturer.

This applies in particular to the fitting and adjustment of safety devices and to welding on major and load bearing parts.

Spare parts must always comply with the technical requirements and the specifications of the manufacturer. This is always guaranteed with original spare parts of the manufacturer.

Inspection intervals and intervals for recurring checks specified in these Operating Instructions must be complied with. At the same time it is necessary to meet the legal requirements.

To perform maintenance work correctly it is important to be equipped with proper tools for the task in question.

The location and the operation of fire extinguishers must be made known on each building site!

Take note of the facilities for fire reporting and fighting fires!

2.3 Personnel Selection and Qualification

Fundamental duties:

Only reliable personnel are allowed to work on the machine

Only trained personnel can be used to operate the machine. Note the statutory minimum age! Specify clearly the responsibilities of personnel for operation, setting up, servicing and maintenance work!

Make sure that only authorized personnel operate or work on the machine.

Select clearly the machine operator. Define his/her responsibilities also with regard to traffic safety regulations and empower him/her to decline instructions from third parties which are not complying with the safety requirements.

Personnel being trained or made acquainted with the equipment may only be deployed under constant supervision of an experienced person.



Work on the electrical parts of the equipment may only be undertaken by a skilled electrician or by a trained person under the guidance and supervision of a skilled electrician as well as in accordance with the electrical engineering regulations.

2.4 Safety Precautions Applicable to Different Operating Conditions

Avoid any method of working that impairs safety!

All precautions have to be taken, that the machine will only be used in a safe and functional status.



Only operate the machine when all safety devices and related safety equipment, e.g. detachable safety devices, emergency stops, and suction devices are present and operational!

The machine has to be checked visually at least once a day for any damage and defects.

In the event of operational malfunctions the machine must be shut down immediately and secured. The fault must be rectified before starting the machine again!



Secure the work area around the machine in public areas providing a safety distance of at least 10 feet around the machine.

Fault must be rectified immediately!

Start up and switch off operations and control devices have to be handled in accordance with the Operating Instructions.



All persons in the proximity of the machine must wear safety glasses with lateral protection as well as safety shoes. Ear protection may be required. The operator is obliged to wear close fitting protective clothing.

Use only extension cables for extending the main cable that are sized and marked in accordance with the overall power consumption of the machine and the valid local guidelines..

Before starting the machine make sure that nobody can be endangered when the machines starts running.



Do not switch off or remove the exhaust and ventilation devices when the machine is running!

2.5 Repair Work, Maintenance Activities, and Default Repair on the Job Site



Before starting any servicing work on the machine, put the machine in the Safety off position as described in chapter 2.6 in order to prevent the machine from being switched on accidentally.

Please follow any special safety instructions in the various chapters on servicing the machine. (See chapter 7.)

Adjustments, servicing, and inspection work and inspection intervals specified in these Operating Instructions as well as any information on the replacement on parts and systems of the machine must be undertaken and / or complied with.

These activities can only be undertaken by qualified personnel.

Before starting any maintenance or repair work the operator of the machine has to be informed about it.

During all work related to the use, the re-erection or the adjustment of the machine and of the safety devices as well as inspection, maintenance and repair, the start up and shut off procedures have to be done in accordance with the Operating Instructions.

For the machine to be shut off completely for repair or maintenance work the plug has to be disconnected in order to prevent the machine from being switched on accidentally.

The dust bin of a connected dust collector has to be emptied before transportation. Please handle in accordance with the regulation how to dispose the dust and make sure that you meet the local regulations.

Do not use any aggressive cleaning materials!

Use lint-free cleaning cloths.

Always tighten any screw connection that is undone during servicing and maintenance work.

If safety devices need to be dismantled during setting up, servicing and repair work, these safety devices must be reinstalled and inspected immediately after completion of the servicing and repair work.

Make sure that process materials and replacement parts are disposed of safely and in an environmentally-friendly manner!



Work on the electrical parts of the equipment may only be undertaken by a skilled electrician or by a trained person under the guidance and supervision of a skilled electrician as well as in accordance with the electrical engineering regulations.

Make sure that electrical components used for replacement purpose comply with the original parts and are correctly adjusted if necessary.

2.6 Definition of the Safety-off Position

Definition:

The safety off position is the position of the machine when it cannot generate any hazard.

Putting the machine in the safety-off position means:

- Switch off the grinder.
- Switch off the dust collector.
- Wait for standstill of all drives.
- Pull out main plugs.
- Secure the machine against unintended start up.

2.7 Dangerous Aspects of the Machine



Every machine, if it is not used according to the regulations, may be hazardous for operating, setting-up and service personnel. The operating authority is responsible for compliance with the safety regulations during operation and maintenance of safety devices supplied with the machine as well as the provision of appropriate additional safety devices.

2.8 Electrical Engineering Regulations



Never start machine in the tilted position. The machine must only be started when all guards and dust collection parts are attached and machine is standing flat on work surface.



Work on the electrical parts of the equipment may only be undertaken by a skilled electrician or by a trained person under the guidance and supervision of a skilled electrician as well as in accordance with the electrical engineering regulations.



Use only extension cables for extending the main cable that are sized and marked in accordance with the overall power consumption of the machine and the valid VDE guidelines. In case there is any question ask the manufacturer or a skilled electrician.

If work on electrified parts is necessary, a second person must be deployed who can pull out the plug in an emergency. The working area must be sealed with a red and white safety chain and a danger sign. Use tools that are insulated against voltages.

Only start work, once you are familiar with the electrical engineering regulations that apply to your area.

Only use voltage testers that comply with the regulations when troubleshooting. From time to time check voltage tester to ensure that they are operationally efficient.

2.9 Special Instructions

Use only proper and default free tools for your work. Damaged tools have to be repaired immediately or to be replaced.

Use during your work for your own safety the required safety equipment and safety clothes (e.g. safety glasses, safety shoes, safety gloves).

Please instruct your operators and the repair personnel about the following points:

- Cleaning and repair work are only allowed if the machine is shut off (safety off position).
- During work on the machine, be certain that the machine cannot be started.
- Opening or removing safety devices while the machine is running are not allowed.
- Replace all safety covers and devices after cleaning, repair, and maintenance work.
- Do not touch moving parts and do not walk into the working path of the machine.
- Before restarting machine, make sure all personnel are a safe distance away from the work area after initial start up.

3.0 General Information

- 3.1 Operative Range
- 3.2 Scope of Supply
- 3.3 Exploded Diagram
- 3.4 Operating Features
- 3.5 Electric Motor
- 3.6 Cutting Area
- 3.7 Couplers & Tool Plates
- 3.8 Variable Speed Drive
- 3.9 Tool Change
- 3.10 Care & Maintenance

3.1 Operative Range

The STI Prep/Master® ECO/PREP500 is a grinding machine with counter rotating heads that is used for preparation and polishing of horizontal surfaces. Grinding the surface according to STI specifications thoroughly removes surface contaminants, coats of paint, sealants, and thin coatings.

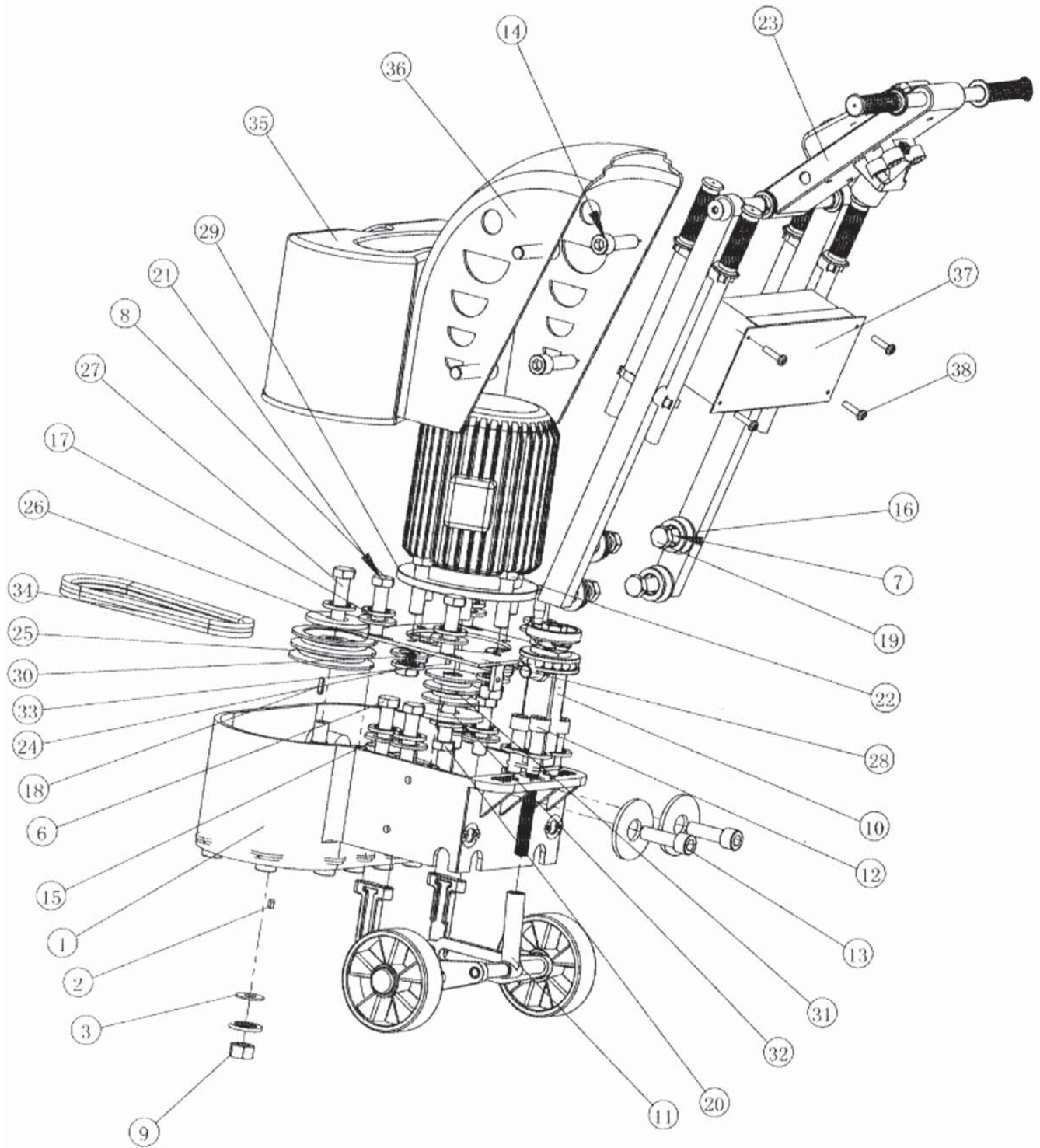
A suitable filter unit must be connected to the machine in order to thoroughly collect the dust being produced by the grinding process. The proper dust collection system ensures dust-free operation of the machine and clean air at the workspace.

3.2 Scope of Supply

Provided with machine:

- Prep/Master® ECO/PREP500
- 40 ft. electrical cord
- Manual (1)

3.3 Exploded Diagram



3.4 Operating Features

The Variable Speed Drive displays all controls and instruments used for supervision and control of the machine.

Key Button Controls Start/ Stop

Pushing the top green button will start the motor. Pushing the top green Button will stop the motor running.

Adjusting Motor Speed

While powered but with motor stopped, adjust motor speed by turning black dial clockwise to increase running speed/counter-clockwise to decrease running speed. Push top green button and motor will begin turning. Speed can also be adjusted with black dial while motor is running.

All Other Control Keys/Buttons

These buttons are used for drive diagnostics and programming and are not used.

3.5 Electric Motor

The power plant of the Prep/Master® ECO/PREP500 grinder is the electric motor. The motor is responsible for turning the gears which turn the abrasive tools on the floor. The motor is controlled exclusively by the Variable Speed Drive which inputs specific power to generate a given RPM.

3.6 Cutting Area

The area inside the shroud and directly beneath the gear deck is the cutting area. This is the area in which the tools turn to produce the grinding action. It is also the area that keeps the dust from grinding contained and subsequently evacuated through the dust collection port.

3.7 Couplers & Tool Plates

The grinder is outfitted with couplers and tool plates. The couplers attach to the tool plates and provide flexibility for smooth operation of the diamond tools. The tool plate holds the tools in place for the grinding application.

3.8 Variable Speed Drive

The variable speed drive is responsible for monitoring incoming power as well as changing the electronic frequency to allow the motor to run at different speeds. This unit is a closed panel that is intended to be operated only with the dial.

3.9 Tool Change

In order to change the tools, the operator must first ensure that the grinder is switched off and disconnected from the electrical source. Then, push machine down by the handle in a controlled manner until the grinder is resting on its handle. The operator then taps the abrasive tools free by forcing toward center of plate and re-installs with preferred abrasive tool.

Machine must only be tilted back on firm, level surface. There is danger of machine falling if all weights are not used and surface is not level.

3.10 Care & Maintenance

Special attendance and regular maintenance of the machine and its parts are imperative for functioning and safety.

In order to prevent unnecessary downtimes it is recommended to keep original spare and wear parts on stock.

The following maintenance should take place before and after every operation of machine:

1. Clean all surfaces with a dry, lint free cloth.
2. Inspect all electrical cables/wires for cuts and replace damaged cords.
3. Check all electrical connections are secure and snug.
4. Inspect gear box for any signs of oil leakage and repair as required.



All persons in the proximity of the machine in operation must wear safety glasses with lateral protection and safety shoes. The machine operator must wear close-fitting protective clothing.

4.0 Transportation Instructions

- 4.1 General Notes
- 4.2 Transportation
- 4.3 Transportation by Vehicle
- 4.4 Operation Conditions

4.1 General Notes

Before the machine used for the first time, STI authorized dealers offer a course to familiarize maintenance and operating personnel with all elements of the machine. We are not liable for damage caused by incorrect use of the machine by personnel not trained by STI.

4.2 Transportation

When transporting the machine with hoisting equipment like a crane or a lift, check the total weight permitted. (See Chapter 1 — dimensions)

Please use only appropriate, allowed, and qualified hoisting equipment as well as ropes and chains. You will find the weight of the equipment in chapter 1 or on the serial plate on the machine.

Do not fix any rope or chain to the handle. The machine must be placed on a pallet or platform designed to hold the weight of the machine and the platform or pallet can then be lifted or hoisted from the appropriate points.

4.3 Transportation by Vehicle

When transporting the machine with vehicle, proceed in such a manner that damage due to the effects of use of force or incorrect loading and unloading is avoided. Use straps to tighten the machine to the cabin of the vehicle.

Use at least two straps, or tighten the machine with one strap to the cabin wall of the vehicle. Make sure, that all parts of the machine are fixed.

4.4 Operation Conditions

Check the surface to be treated for loose parts (stones, screws, etc.). The surface must be swept if necessary. Make sure that the machine can travel over all inequalities on the surface. Small inequalities like floor joints less than $\frac{1}{4}$ inch are no barriers for the machine.

The machine must be operated in accordance with instructions given in Chapter 5—Initial Operation.

5.0 Start Up

5.1 Preparing for Initial Operation

5.2 Initial Operation

5.1 Preparing for Initial Operation

Before start up ensure all existing protective housings are fitted and the filter unit is connected correctly.



All persons in the proximity of the machine must wear safety glasses with lateral protection as well as safety shoes. The operator is obliged to wear close-fitting protective clothing.

Work on the electrical system have to be done only by qualified specialists.

Check the surface to be treated; it should be free of for loose parts (stones, screws, etc.). The surface needs sweeping if necessary. Ensure that the machine can run over all inequalities on the surface. Small inequalities like floor joints aren't a barrier for the machine.

In order to avoid downtimes a regular inspection is essential. Carry out the following checks before any start-up:

- Check whether all machine parts are assembled safely and correctly.
- Check all screws and other fasteners for tight seat.
- Check the tool holders to ensure that the proper tools are in place and secure.
- Check the tightness of the hose connections and the condition of the hose to the filter.
- Make sure the dust container of the filter unit is empty. Please comply with the local waste treatment regulations considering the removed material.
- Check the electrical connections for dirt and foreign body deposits.
- Check the motor for dirt and other contaminants.



Before start-up operators and other personnel must be familiar with the safety regulations given in this manual.

5. Place the grinder in the area where work is to begin.
6. Place weight in tank pocket if needed.
7. Check the main power cable and the dust hose for damage. Replace or repair all damaged parts before starting the machine.
8. Connect the grinder and the filter unit with the dust hose. Use hose clamps at the connections.

5.2 Initial Operation



All persons near the machine must wear safety glasses with lateral protection, ear protection as well as safety shoes. The operator is obliged to wear close fitted protective clothing.

Before start-up the operating personnel must be familiar with the safety regulations given in this manual.



Attention! Before you plug the equipment to a power supply make sure the power supply is equivalent to the data shown on the machine label.

The start of the grinder and the filter unit is affected in the following sequence:

1. Switching on the filter unit

Initial operation of the grinding machine:

2. Assure the plug is connected correctly to the power source.
3. Assure the dust hose is connected correctly to filter and machine.
4. Check that the main switch is turned on.
5. Press the top green start button.
6. Immediately begin moving the machine from side to side to prevent the tools from digging into the concrete surface and creating an uneven profile. For the operation of the running machine, it is necessary to move the machine from side-to-side to create an even profile that is consistent in flatness and profile.
7. When grinding in work area is complete, push the top green button to stop the grinding motor.
8. The dustbin of the filter unit needs regular dumping.



Do not overfill the bin to avoid dust exposure when opening the bin. Comply with the local waste treatment regulations considering the removed material.

6.0 Operation

- 6.1 Daily Operation
- 6.2 Failure
- 6.3 Safety Switch Off
- 6.4 Restart

6.1 Daily Operation

Normal start-up and operation of the Grinder is not different as has been described in Chapter 5—Initial operation.

Carry out grinding operation in parallel tracks in a way that the dust hose and electric cable do not become twisted.

The speed of moving the grinding machine over the work surface will influence the final finish and production.

In the case that the surface shows different characteristics, means different hardness or different coating thicknesses, a uniform grinding result will be achieved by varying the speed of movement over the surface.

6.2 Failure

Irrespective of the following information, the local safety regulations are valid in any case for the operation of the machine.

Assure all turning machine parts have come to standstill before inspection or maintenance work starts. Always arrange the Safety Off as described in Chapter 2.

6.3 Safety Switch Off



The machine must be set into its “Safety Off Position” before starting any kind of maintenance or repair work.

See Chapter 2—Safety Instructions.

6.4 Restart



All persons in the proximity of the machine must wear safety glasses with lateral protection as well as safety shoes. Ear protection may be required. The operator is obliged to wear close fitting protective clothing.

See Chapter 5—Initial Operation.

7.0 Maintenance

7.1 Recommendations

7.2 Maintenance and Inspection

7.3 Maintenance

7.4 Regular Wear Parts

7.1 Recommendations



Prior to any repair work on the machine and its drives, secure the machine against unintentional switch-on. Put the machine to its Safety Off Position as described in chapter 2.

Failures due to inadequate or incorrect maintenance may generate very high repair costs and long stoppage periods of the machine. Regular maintenance is essential.

Safety and service life of the machine depend, among other things, on proper maintenance.

The following table will show recommendations about time, inspection and maintenance for the normal use of the machine.

The time indications are based on uninterrupted operation. When the indicated number of working hours is not achieved during the corresponding period, the period can be extended.

Due to different working conditions it cannot be foreseen how frequently inspections for wear checks, inspection, maintenance and repair works ought to be carried out. Prepare a suitable inspection schedule considering your own working conditions. Our specialists would be glad to give you advice.

7.2 Maintenance and Inspection

Operating Hours / Time Period	Inspection Points / Maintenance Instructions
Daily — Prior to Operation	<ul style="list-style-type: none"> • Check all cables/wires for cuts or damage • Check the hose connections for tightness and fixed seat. • Check the hose to the filter for damages. • Make sure that the dustbin of the filter has been dumped. • Check Coupler, tool plate, and diamond tooling for wear and damage. • Check that shroud and rubber seal are in good working condition. • Check the electric connections for sediments of dirt or foreign bodies. • Check the electric motor/propane tank for dirt and other contaminants. • Check gearbox assembly for any leaks of oil from motor and top and bottom of gear box.
Daily — After Operation	<ul style="list-style-type: none"> • Check for debris, if any, in the dust ports under gear box as well as at handle. • Check for dirt build up on variable speed drive and electric motor.

7.3 Maintenance

Only those repair works are described which occur within the context of maintenance or which are required to replace wear parts. If you replace parts yourself for specific reasons, the instructions in section 7.4 and work sequence have to be observed.

You should also stock all spare or wear parts that cannot be supplied quickly. As a rule, production standstill periods are more expensive than the cost for the corresponding spare part. Screws that have been removed must be replaced with those of the same quality (strength, material) and design.



Prior to any repair work on the machine and its drives, secure the machine against unintentional switching-on. Pull out the main plug in order to do this. Store the plug near the machine to avoid accidents.

7.4 Regular Wear Parts

Regular wear parts consist of the Coupler.

To replace a worn or damaged Coupler, perform the following:

1. Remove the three socket head cap screws from drive plate using Allen key.
2. Then remove hex head bolts from tool plate
3. Replace coupler and reassemble
4. Upon fixing assembly to machine, be sure that socket head cap screws are equally seated.

** When replacing bolts, be sure to hand start bolts BEFORE using any impact wrench to tighten down. This minimizes the risk of stripping the threads by tightening an unseated bolt.*

8.0 Troubleshooting / Diagnostics

8.1 Diagnosis of Failures

8.2 Diagnosis of Electrical Failure

8.1 Diagnosis of Failures



Prior to any repair work on the machine or drives, the machine must be secured against unintentional start-up. Put the machine in its Safety-off position.

Failure	Possible Reasons for the Failure	Corrective Actions
Unusual Vibrations	Uneven or loose surface being ground	Verify suitability of substrate being ground.
	Loose or damaged tooling	Inspect tooling to make sure that all connecting hardware is tight and tool is firmly seated to holder.
Unusual Noise	Uneven or loose surface being ground	Verify suitability of substrate being ground.
	Loose or damaged tooling	Inspect tooling to make sure that all connecting hardware is tight and tool is firmly seated to holder.
	Shroud is dragging on the floor	Adjust shroud and tighten to no more than ¼ inch above floor
Reduced performance or no performance	Diamond tooling is worn or damaged	Inspect diamond tooling for remaining abrasive. If depleted, replace with new tooling.
Dust being produced	Shroud is out of adjustment	Adjust shroud and tighten to no more than 2 mm above floor.
	Dust hose is clogged	Inspect dust hose and ports for debris that may be clogging hose.
	Dust collector malfunction	Verify dust collector is operating properly

8.2 Diagnosis of Electrical Failure



Prior to any repair work on the machine or drives, the machine must be secured against unintentional start-up. Put the machine in its Safety-off position.



Work on electrical equipment or operating materials may only be undertaken by a skilled electrician or by trained persons under the guidance and supervision of a skilled electrician in accordance with the electrical engineering regulations.

Failure	Possible Reasons for the Failure	Corrective Actions
Motor does not start up	Missing Phase/ Battery Failure	Check power supply or battery power
	Faulty Switch or relays	Get diagnosis and replacement by a skilled electrician
Motor stops during operation	Current power is too high / Low or no fuel	Disconnect plug / check fuel supply
	Supply circuit breaker is disengaged.	Reset circuit breaker or replace fuse.
	Motor is damaged.	Inspect motor.

Call your local dealer if you can't solve the problem.

9.0 STI Reference Guide & Procedures

- 9.1 Introduction
- 9.2 Why a Diamond Cuts
- 9.3 Why a Diamond Doesn't Cut
- 9.4 Heat & Diamonds
- 9.5 Super-Abrasive Applications
- 9.6 Acceptable Cost per Square Foot
- 9.7 Segment Attachment
- 9.8 Importance of Concrete Densifiers
- 9.9 Choosing the Right Diamond Tool for the Application
- 9.10 Diamond Tooling Offered by STI

9.1 Introduction

Now that you own the most versatile and reliable surface preparation and polishing machine on the market, you need to understand the way it gets the job done. Diamond tooling provided by Substrate Technology has been designed and tested for use with the Prep/Master® line of machinery exclusively. We have assembled a system that takes the guess work out of the industry that is Concrete Surface Preparation and Polishing. These products are proprietary, original creations that are made to work consistently so that you have success on your first and every concrete grinding or polishing project thereafter.

9.2 Why a Diamond Cuts

A diamond's ability to cut is directly influenced by weight, speed, and diamond size. As any one of those factors are reduced or increased the remaining two need to be modified to accommodate that change without affecting performance. Diamond tooling cuts by using the aggressive characteristics of synthetic or natural diamonds. As the diamond chip is moved across the work surface, its inherent strength causes a scratch in the material equal to the amount which the diamond chip is protruding from the matrix.

The matrix that holds the diamond is very important to the diamond chip's ability to cut as well as be retained so that the diamond can be held in place for as long as possible to keep lifespan at an acceptable level. During the grinding process, the matrix holds the diamond

by eroding away only at the leading edge of the diamond as a function of abrasion, but the matrix attached to the trailing edge of the diamond stays intact and provides support to the diamond as it is pushed through the work-piece.

As the diamond chip wears down from abrasion so does the matrix that is supporting it until the matrix support is reduced so much that the remaining diamond chip falls out of the matrix. After a diamond chip falls out, the wearing of matrix repeats to expose a new diamond chip and the process continues until no matrix or diamond remains.

9.3 Why a Diamond Doesn't Cut

The easiest way to explain why a diamond doesn't cut is to say that a given material is harder than what the diamond was created to grind. The reason why the design is flawed for a specific material hardness is not so easy to explain.

Possible Causes:

1. Diamond make-up, that is the individual diamond chip's mechanical makeup, may be the culprit in a material being too hard to cut. The diamond chip design may not allow the diamond to fracture fast enough to maintain an aggressive edge when working on a hard material.
2. The concentration of diamond chips in a given tool may be too great or too little; the more diamond chips touching the floor the less the pressure on each chip and vice-versa.
3. The matrix strength may be too strong to release the diamonds at a consistent rate to always allow a fresh diamond chip to become exposed to the work-piece.
4. The speed at which the diamond tool is being moved across the surface may be too fast or too slow for its design thereby causing excess heat.
5. The weight may be more or less than what the diamond tool was designed to handle and without the proper amount of pressure the diamond tool is being run outside of its designed operating limits.
6. The diamond chip size may be too small or large for the given work-piece and its inherent hardness characteristics.

Whatever the reason the diamond tool is failing, correcting the problem is usually as easy as adding water to the equation; because heat, in most cases, inhibits the cutting ability of the diamond tool.

9.4 Heat and Diamonds

Heat plays a crucial role in the life and cutting characteristics of any diamond tool because just like a metal cutting tool there is an optimal temperature at which it is designed to operate. When a diamond is moved across a surface, heat is being produced by the friction caused by the tool movement and therefore it is impossible to prevent some heat being created.

With regard to acceptable heat levels, diamond tools are designed to dissipate heat by transferring heat at a given rate so the cutting ability or lifespan is not compromised. The diamond tool transfers heat into the metal that holds the diamonds and matrix and eventually into the tool holder.

The diamond tool also transfers heat as a function of cutting the concrete or stone into small chips that then carry the resultant heat with them away from the diamond tool (i.e. Chip Clearance). When one or both of these temperature regulators are not performing in the way they were designed, the diamond tool stops cutting or keeps cutting but lifespan is reduced drastically. The best indicator that a diamond tool is operating outside its required temperature range is when the diamond tool cannot be held in a bare hand.

9.5 Super-Abrasive Applications

When a diamond tool is used on a surface that is softer than that which it was created to cut, the productivity will be high but so will the diamond cost per square foot.

Examples of super-abrasive applications – thin-set mortar, cementitious, or gypsum based underlayment, epoxy coatings containing silica, soft concrete (carbonized or rain slab) and soft natural stone such as limestone.

9.6 Acceptable Cost per Square Foot

Diamond tooling should be costing the equipment owner between \$.03 & \$.05 per square foot for each type of diamond tool being used. So if there is a project that requires 4 polishing steps, the diamond cost should be \$.12 - \$.20 per square foot (\$.03 - \$.05 per square foot/per diamond type x 4 total types) overall. This is a general guideline, but it is important to always strive for tool choices that yield close to this amount to keep cost at an acceptable level.

9.7 Segment Attachment

When attaching the diamond segment to the tool plate ensure that the hardware is tight to keep tool from loosening. Also make sure that the tool plate, as well as the diamond segment, is clean where they meet to ensure the flattest possible cut. If the surfaces have build up, the diamond tool will cut at an angle that will essentially be gouging the surface of the concrete rather than grinding across it.

9.8 Importance of Concrete Densifiers

Whether an unsealed concrete surface is polished or unpolished, that surface will deteriorate if a densifier is not used. Concrete densifiers offer protection to a concrete floor by a chemical process in which the densifier reacts with the Calcium Hydroxide (Free Lime) present in all cured concrete.

During hydration, the process by which cement dries, the compound Calcium Hydroxide is formed. This compound is a weak by-product of hydration and contributes nothing to the abrasion resistance or overall strength of the concrete. This weak material can be very easily abraded from the surface of the concrete which leads to small voids as the particles are pulled out.

Over time, these voids collapse which make them larger and lead to dulling of the concrete surface or in extreme cases de-lamination. The chemical densifier fills the voids with crystal growth created by its reaction with the Calcium Hydroxide and essentially 'glues' the cement particles together.

The result is a surface that exhibits increased abrasion resistance which prevents dusting, de-lamination or loss of shine if polished. We think it's important to mention densifiers here, because if a densifier is omitted from a polishing process, that surface will NOT be permanent.

9.9 Choosing the Right Diamond Tool for the Application

Using the correct diamond tooling for a specific application is the most important part of ensuring productivity and an acceptable cost per square foot (lifespan) for the specific tool. With that said, predicting which tool to use is probably the most difficult thing to do because concrete surfaces are so variable from one pour to the next and depending on the surface strength or the strength and composition of topical materials (thin-set, patch, adhesive, etc.) the variation from one material to the next can cause the diamond tooling to be affected in any number of ways.

Prep Tools - Quick Change Applications

- ***Thin-set covered concrete, patch covered concrete, rain slabs:*** 2 Segment Diamond 30 Grit (57SQ302) or EG Double PCD (57PCDR & 57PCDL)
- ***Epoxy or adhesive covered concrete:*** EG Double PCD (57PCDR & 57PCDL)
- ***New Concrete (well finished and unsealed):*** ECO-#3 Wet

Note: There are many different conditions that will be encountered when preparing a concrete slab, the above is a general list of those conditions. There is no substitute for experience and observation when it comes to determining exactly which diamond design will work in a given application.

9.10 Diamond Tooling Offered by STI

Substrate Technology offers diamond tooling for any phase of the grinding or polishing process. Below is a list of those tools and their applications:

Concrete Applications:

Metal Bonded Tooling

1. EG Double PCD

The EG Double PCD is used for the aggressive removal of adhesives and epoxy coatings. This tool can also be useful for removal of patching material and thin-set. The profile produced by this tool is the roughest of all metal bond tooling offered for the ECO/PREP500. Usually the use of this tool is a last resort when polishing is to be the final product. This is true because in most cases a 30-grit Super Seg will be required to remove profile left by the EG Double PCD.

- Grits – N/A
- Life – 20,000 SF / 2,000 m²
- Speed – Variable depending on coating

2. Segment Diamond — Super Seg

The 2-Segment diamond is a versatile surface prep tool used to remove many different coatings and or profiles. This tool is available in three grits and the proper grit is determined by coating/contamination and surface hardness.

- Grits – 30, 50 & 80
- Life – 15,000 SF / 1,500 m²
- Speed – Medium to High speed on dial

Resin Bonded Tooling – ECO Pads 3"

The ECO Polishing Pads have been created specifically for the ECO/PREP500 machine to accommodate it's lighter weight and head speed. This system is numbered using the designation #3, #4, #5, #6, #7, #8 & #LUX. This system is designed to be run in order starting with #3 and finishing with whatever grit is necessary to meet project requirements. The ECO Polishing Pads can be run wet, but the best results come from dry operation.

- Grits – #3 to #LUX
- Life – 10,000 SF / 1,000 m²
- Speed – Medium to High speed on dial



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