



**ELECTRICAL HAZARD:** Verify your facility's electrical service ratings before connecting power to any SLS equipment. Power must only be connected by a certified electrician.



**ELECTRICAL HAZARD:** Do not open the panel behind disconnect switch! Live voltage present. This should only be opened by qualified personnel after power is disconnected from the facility's power circuit/breaker panel.

All SLS equipment was designed to minimize operator exposure to electrical hazards during normal operations . All exposed electrical circuits are inside limited-access cabinets . This is to separate the operator from service and maintenance areas . When operating any SLS equipment, keep the following electrical safety points in mind:

- Only 3D Systems certified service personnel should operate SLS equipment with access panels or service doors open.
- Heed high voltage warning signs and labels.
- Take common-sense safety precautions when operating any electrical equipment.
- After any change to the electrical wiring, make sure the equipment is properly grounded.

## ENVIRONMENTAL ISSUES

The SLS system emits no toxic substances when using materials approved by 3D Systems .

### Emissions

**Material heating** – Analytical testing on 3D Systems materials indicates no detectable emissions outside acceptable limits from the SLS system . (See the materials' SDS .)

**Nitrogen** – The SLS system uses nitrogen, which is passively vented in the print chamber .



**NOTE: Do not install a fan in the exhaust port . The exhaust port in the print chamber must not be blocked . The nitrogen-inert atmosphere in the SLS system print chamber is at higher pressure than the outside atmosphere . The chamber will vent without a fan . Installing a fan in the exhaust port will draw nitrogen-rich air out of the print chamber too fast, raising the oxygen concentration in the chamber . This can keep the SLS system from reaching inert status, or cause an in-process print to abort .**

### Material Disposal

Refer to the DuraForm ProX® material SDS for disposal information . Follow any applicable local regulations .

## MATERIAL SAFETY

All materials certified by 3D Systems are safe during normal operation. However, you should be aware of the following issues:

- Any material, material-like substance, or airborne cloud of material has a remote chance of rapid combustion.
- Breathing some materials may cause certain people to experience respiratory irritation.
- Material safety hazards are minimized by good industrial housekeeping and ventilation practices.
- Spilled material can cause the floor to become very slippery.
- Material should be sifted in a well-ventilated room.

Refer to the SDS's and to 3D Systems material guides for information on specific materials.



**CAUTION: Using materials that have not been certified for use in the SLS equipment may cause health or safety hazards and may damage the equipment and void the warranty.**

### Material Ignition Information

Powdered materials can be flammable and can be ignited by static electricity in a non-inert environment. Refer to each material's SDS for specific information.



**CAUTION: The operator must use an approved vacuum cleaner to clean up excess material. 3D Systems recommends an ESD or explosion-proof model. Contact 3D Systems Customer Service for purchasing options.**

#### Finding Material Safety Information

Use the Material Safety Information table to locate references and contacts for information on important material safety topics .

Also check the SDS of the material used for the specific precautions to be observed.

#### Material Safety Information

TOPIC	REFERENCE / CONTACT		
Standard industrial ventilation practices	<b>US:</b> American Conference of Governmental Hygienists, Committee on Industrial Ventilation  <b>Europe:</b> Maximale Arbeitsplatz Konzentration, January 1990		
Housecleaning and prevention of accumulation of explosive dust concentrations	<b>US:</b> NFPA 654: Standard for the Prevention of Dust Explosions in the Plastics Industry; National Fire Protection Association, Volume 5 of the National Fire Codes <b>Europe:</b> Maximale Arbeitsplatz Konzentration, January 1990		
Material exposure	<b>US:</b> Code of Federal Regulations, 29 CFR, section 1900 .1000, available from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402  <b>Europe:</b> DIN EN 26184 Teil 1 /06 .91		
Specific materials	Material Safety Data Sheets (MSDS) from 3D Systems, Inc .		
	US/Canada:		Europe:
	Mfgr . Contact:	3D Systems Corporation 333 Three D Systems Circle Rock Hill, SC 29730 USA	3D Systems GmbH Guerickeweg 9 D-64291 Darmstadt, Germany
	Information	Phone: 803 .326 .3900 or Toll-free: 800 .739 .3669	Phone: (+49) 6151 357-0
	Emergency	1 .800 .262 .8200 - Chemtrec	1 .703 .741 .56100 - Chemtrec (U .S .)

#### Material Handling Precautions

During normal operation of the SLS system using 3D Systems' materials, you are not required to wear a dust mask or special personal protection equipment unless specifically designated. Check the SDS of the material used for the specific precautions you should observe . Use the following table of precautions as a general guide:

## Safe Material Handling Guidelines

CATEGORY	PRECAUTION
FIRE/HEAT	<ul style="list-style-type: none"> <li>Never smoke or ignite anything around powdered materials.</li> <li>Maintain proper clearance from materials when using portable heating devices.</li> <li>Store flammable liquids away from materials.</li> <li>After removing a part from the print chamber, allow it to cool to room temperature in a well-ventilated area.</li> <li>Use anti-static mats in front of SLS equipment.</li> </ul>
INHALATION	<ul style="list-style-type: none"> <li>Avoid breathing powdered materials; when exposure to dust or fumes is likely, wear a NIOSH-approved respirator appropriate to the airborne concentration.</li> <li>Always provide adequate ventilation.</li> </ul>
SHOP SAFETY	<ul style="list-style-type: none"> <li>Train operators in SLS system procedures.</li> <li>Wear safety glasses.</li> <li>Use extreme care with all heated materials.</li> <li>Make sure that the room is well ventilated.</li> </ul>
AVOIDING SPILLS	<ul style="list-style-type: none"> <li>Keep containers closed when not in use.</li> <li>Have a fully-grounded internal non-ignition vacuum cleaner ready to use.</li> <li>Have any equipment specified in the SDS ready to use.</li> </ul>
SDS	<ul style="list-style-type: none"> <li>Give operators access to the SDS's that apply to materials they will be handling and ensure that they read them. If necessary, translate them.</li> <li>File SDS's in an easily accessible location for immediate reference.</li> <li>Strictly follow all the conditions in each SDS.</li> </ul>

### NITROGEN/OXYGEN SAFETY

The SLS system uses nitrogen to create an inert atmosphere in the print chamber . The nitrogen inhibits any potential rapid combustion of particulate matter during the SLS process .

The oxygen content of air is approximately 21 percent . Displacement of the normal atmosphere with an inert gas, such as nitrogen, can reduce the oxygen content in a room . In the remote chance that nitrogen leaks into the room during the sintering process, the situation can be hazardous .

Your site must have an oxygen alarm monitor installed in the room containing the SLS system . This monitor will alert you if the oxygen level drops below a designated point . It must be wired to trigger an immediate shutdown of the SLS system and nitrogen generator (if in use) .



**CAUTION: Exposure to an atmosphere containing 12 percent or less oxygen causes unconsciousness without any warning symptoms. This happens so quickly that you cannot help or protect yourself.**

The table of **Oxygen Deprivation Effects and Symptoms** explains the potential effects and symptoms that can occur at different concentrations of oxygen in the atmosphere .

When you work in an environment that may become oxygen-deficient, make sure you comply with the following items:

- If, at any time, you feel you are experiencing symptoms of oxygen deprivation, leave the area immediately.
- You have received oxygen/nitrogen safety training.
- The room is well-ventilated; at least 4 air exchanges per hour.
- Self-contained breathing apparatus is available and easily accessible.
- The room oxygen alarm monitor is functioning and audible.
- Leave the SLS system room/area immediately when you hear the oxygen alarm.

#### Oxygen Deprivation Effects and Symptoms

OXYGEN CONTENT (% BY VOLUME)	EFFECTS AND SYMPTOMS AT ATMOSPHERIC PRESSURE <sup>a</sup>
15 – 19 %	Decreased ability to work strenuously . May impair your coordination or may induce early symptoms in persons with coronary, pulmonary, or circulatory problems .
12 – 14 %	Increases respiration during exertion . Pulse rate goes up . May experience impaired coordination, perception, and judgment .
10 – 12 %	Respiration continues to increase in rate and depth . Lips become blue . May lose consciousness at this point .
8 – 10 %	Mental failure . Fainting and unconsciousness . Face becomes ashen, lips become blue . Nausea and vomiting may occur .
6 – 8 %	100% fatal after 8 minutes of exposure . 50% fatal within 6 minutes . Recovery with treatment within 4 to 5 minutes .
4 – 6 %	Coma within 40 seconds; convulsions, respiration ceases, death occurs .

a . From Safety Bulletin SB-2 - 1983—"1983 by the Compressed Gas Association, Inc . 1235 Jefferson Davis Highway, Arlington, VA 22202

## 4 PROX® MQC SINGLE USE SYSTEM OPERATIONS

Follow the instructions in this section to use ProX® MQC Single Use System safely . The instructions tell you how to load fresh material, blend material, and breakout parts from the print cake .

### HOW THE PROX® MQC SINGLE USE SYSTEM WORKS

The ProX MQC Single Use System regulates the material usage for the ProX® SLS 6100 . It stores and mixes fresh, blended, and recycled powder and can supply material for one ProX® SLS 6100 printer. The printer sends a separate refill request to the ProX® MQC Single Use System when its feed hopper is low .

## Receiving and Storing Material

Fresh material and blended material are stored in separate bins on the ProX® MQC Single Use System . Recycled powder is reclaimed through the sifter . To feed recycled material into the system, the Sifter Switch must be turned on during breakout .

**Fresh bin** – receives and stores fresh material input by the user . The fresh material is loaded from the material containers . The container's tag (on top of the lid) must be scanned by the reader on the interface of the ProX® MQC Single Use System before it can be fed into the system .

**Blended bin** – receives, blends, and stores material from the sifter and fresh bin for use in the printer .

## Blending and Sending Material

The ProX MQC Single Use System automatically initiates a blend cycle when the sifter is activated . The amount of recycled and fresh powder required for a blend depends upon the blend ratio



**NOTE: A load cell under the bin read the material weight and level . Do not place objects on top of the bin . This will give an incorrect reading of the material weight .**

## BASIC OPERATIONS

### Turning on the ProX® MQC Single Use System:

3D Systems designed the ProX® MQC Single Use System to remain with the power on at all times . You seldom need to powerup the machine. If you ever find the power off, this subsection describes how to turn on the system.

1. Make sure the facility power to the system is turned on.
2. Turn on the dust collector by pressing the power switch.
3. On the user interface, flip the power switch to the ON position.



Power Switch

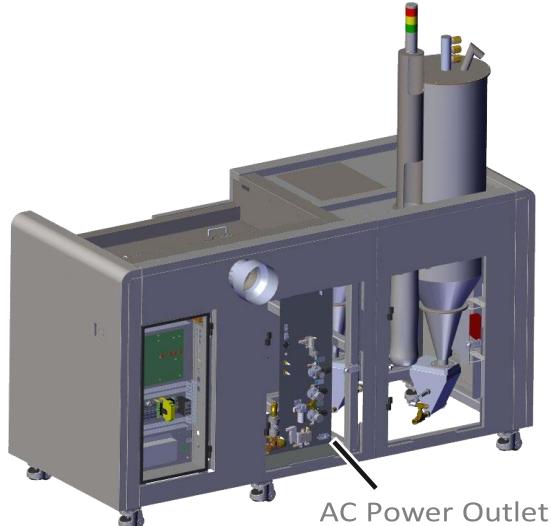
### Shutting Down the ProX® MQC Single Use System Completely

3D Systems designed the ProX® MQC Single Use System to remain with the power on at all times . You seldom need to power-down the system, unless:

- You are shutting down the entire system .
- The system requires service .
- The system loses facility power and does not regain it immediately .
- The system will be idle over an extended period of time .

To turn the system off,

- 1 . Check the ProX® MQC Single Use System user interface screen to see what mode it is in .
- 2 . If the cycle is stopped, skip the next step .
- 3 . If the cycle is in **Full** or **Local** mode, navigate to the **Operation Mode** menu, and select "**Stop Cycle** ."
- 4 . Navigate to the **Setup/Service** menu and then the **Setup** submenu. Select "**System Shutdown**" .
- 5 . At the operator panel, turn the power switch off .
- 6 . Go to the back side of the ProX® MQC System and open the reject powder door .
- 7 . Pull out the power plug from the AC inlet .  **WARNING (for ATEX): Use socket cap when unplugged .**



### Cleaning the ProX® MQC Single Use System Before Breakout

Follow these procedures to clean the system before you print parts with your ProX® SLS 6100 printer .

- 1 . Debris and loose powder from the ProX® MQC Single Use System can be cleaned using a non-ignition vacuum cleaner .
2. A clean, dry cloth can be used to wipe off excess material from any area of the machine where it is present .

### Verifying Material Quantity

The approximate amount of powder required for a print job can be found using 3D Sprint Estimate menu .

To verify that there is sufficient material for the print job, you can use either of the two following methods:

1. In **Sinter**, check the **ProX® MQC Single Use window** in the **Man Ops** screen . This displays the MQC Single Use System's status, including the amount of available powder .
2. Check the **ProX® MQC Single Use status** in the **Sinter Status** window which also displays the amount of available powder .

## REMOVING THE PRINT CAKE FROM THE PRINT CHAMBER

The print cake can be removed from the print chamber either before or after it has finished cooling.



**CAUTION: Do not begin breakout of the parts from the print cake until the cooldown stage is complete . The temperature must be no higher than 85 °C . The print cake can remain extremely hot for hours after a build . To prevent burns, allow sufficient time for cool down (up to 24 hours without the nitrogen lid) before removing parts from the print cake . The temperature of the print cake can be tested using the thermocouples in the breakout area of the ProX® MQC system .**

### Where to Cool Down the Print Cake

If you cool down the print cake inside the print chamber, wait until the print cake reaches its final cooldown temperature of no more than 85 °C . If you choose to let the print cake cool down outside the print chamber, you can take it to the MQC Single Use System and either let it cool down normally or use the nitrogen lid on the side of the MQC Single Use System .

To use the nitrogen lid, do the following:

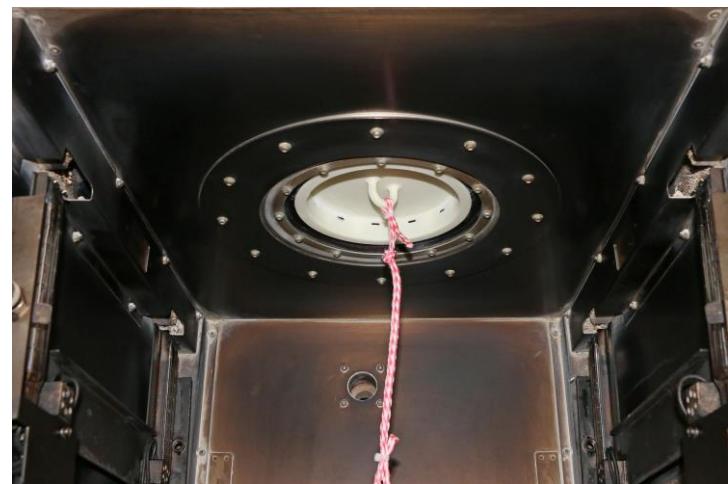
- Immediately after placing the hot print cake in the breakout area of the MQC Single Use System, place the nitrogen lid onto the print cake cylinder . Then . . .
- use the lid to do a controlled cooldown for a programmed amount of time (the default is 3 hours), or until a programmed temperature is reached .
- let the print cake cool down without the nitrogen flow.

### Unloading the Print Cake After a Print

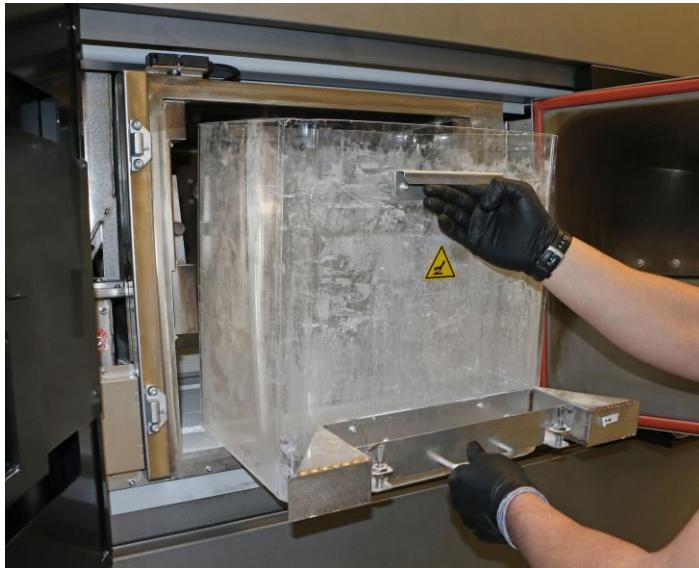
After a print and before part breakout, you must remove the print cake from the print chamber and transport it to the ProX® MQC Single Use System .

To remove the print cake:

- 1 . Turn off the chamber lights .
- 2 . Open the outer door of the print chamber .
- 3 . Unlatch and open the inner print chamber door .
- 4 . Raise heaters .
- 5 . Remove the Laser Window by turning it counterclockwise  $\frac{1}{4}$ -turn and pulling it out of the top of the chamber . Put it in a safe, clean location and clean it before reinstalling it into the print chamber .
- 6 . Press the Laser Window Baffle Plug into the top of the chamber (see photo).



7. With the handle facing towards you, fully insert the print cake cylinder into the print chamber, placing it over the print bed.



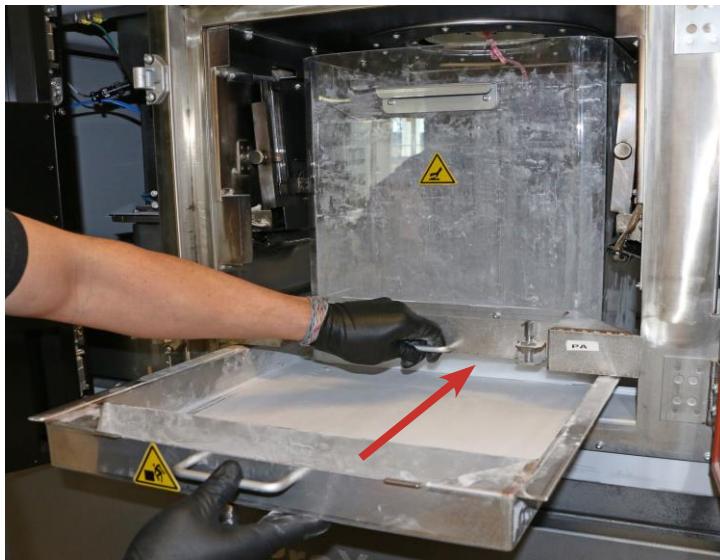
Full insert print cake cylinder into chamber



**Make sure the outer tabs of the cylinder catch on the rim of the print chamber door.**

- 8 . Close and latch the inner print chamber door .
- 9 . Close the outer print chamber door .
- 10 . In Build Setup, open the Piston Control and press the Start Piston button to raise the print cake into the cylinder .

11. Once the piston has finished raising the print cake, open the outer and inner print chamber doors.
- 12 . Slide the Print Cake Tray underneath the cylinder, as shown, and latch the tray with the pull pins on the cylinder .



Slide print cake tray underneath cylinder

- 13 . If the print cake is light enough, it can be moved manually to the ProX® MQC Single Use System . Otherwise, use the Part Transfer Cart .
- 14 . Move and align the cart to the print chamber .



Align cart with print chamber



Slide tray and cylinder onto cart

- 15 . Slide the cylinder and tray out of the chamber and onto the cart .

16 . Move the transfer cart to the MQC System .

#### **BREAKING OUT PARTS**

When a print completes, you need to remove the sintered parts from the print cake and clean them . Removing parts from the print cake is called “breakout.” This section describes the procedures you follow when you break out parts.