



CIB #: 17-02

Date: 29 March 2017, updated 3 August 2017, 4 January 2018

Status: Non-confidential

Subject: Tips & Information for part building with Accura® HPC High Performance Composite material

1. **Software version:** It is best to use the most current appropriate software version for your system type, to ensure compatibility with newly-created build styles.
2. **ProX800 control and 3D Print software entries:** Each material on a SLA system uses a specific material entry. This is entered in the Control Code or 3DPrint software. See Users' Guide for details. Recommended starting parameters are shown below.

	SLA 7000 Systems	iPro™ 8000/9000	ProX® 800 Systems
Dp (mils)	5.0	5.0	-
Ec (mJ/cm2)	5.9	5.9	-
Default Scale Factors (x, y, z)	1.000, 1.000, 1.000	1.000, 1.000, 1.000	1.000, 1.000, 1.000
Default Linewidth	0.150 mm (0.006")	0.125 mm (0.005")	0.125 mm (0.005")
MDM temperature	28°C	28°C	28°C

3. **Loading resin:**
 - a) Before loading resin, carefully check the gap between the elevator legs and MDM rear wall. It needs minimum 5mm gap to avoid friction, which can cause overheating of resin. Proper alignment with the other mechanical systems must be maintained. Refer to the drawing at the end of this CIB.
 - b) When the material is first loaded in the system, bubbles may be created. Before building, make sure that the resin surface is free of all bubbles. It is especially important that the area enclosed by the baffle of the diode-leveling assembly is free of any bubbles. If there are bubbles inside this baffle, the leveling system cannot operate properly.
4. **MDM and vat maintenance:** Accura HPC is a filled material. While the formulation has been engineered to minimize settling, the material *MUST* be mixed regularly. Mixing must be performed between each build, and every 2 days, if the system is not building.
 - a) **Recirculation:** If your system is equipped with a ProX 800 Composite 750F MDM, use recirculation twice a week, for a minimum of 2 hours. Please follow instructions from your application or field engineer, if your MDM is being stored out of the system. **Note timing of build start after MDM circulation:** Circulation should be stopped 2 hours before starting a build. Circulation can have an adverse effect on mechanical properties. As long as circulation is halted for two hours before starting the next build, properties are unaffected.



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- b) **Between each build:** Use the platform to stir the resin for a minimum of one hour, using the full available z-stroke for your system. General stirring instructions are shown below. Please note that each system's stirring method varies slightly depending on software type and version, so only general instructions are provided:
- Position platform 0.200" below the current resin surface (no need to level the resin)
 - Set stirring velocity, normally 1 to 2 inches per second
 - Set the stirring stroke (negative z distance from stirring start position) to cover the full z-stroke for your MDM depth
 - Set stirring time
 - Start stirring
- c) **Whether idle or regularly building, once a week, stir using a squirrel-cage** (or similar) device attached to a drill motor, and stir for a minimum of 1 hour. You'll need to remove the platform before stirring, in order to access all the areas of the MDM. On large-frame systems, make sure to place the squirrel-cage in the bottom corners of the MDM, and in the bottom center, to properly stir the entire MDM. You should stir for a minimum of 1 hour total time.
- d) **If a large-frame MDM has been stored and idle** for more than 2 weeks, more significant stirring will be required. Please follow the procedure below. If possible, a high-shear mixer is recommended. If only a squirrel-cage mixer is available, longer stirring will be required.
1. Raise the platform and elevator arms out of the resin and remove the platform.
 2. Wipe the elevator arms dry, to prevent resin drips on the floor after MDM removal.
 3. Remove the MDM from the SLA system.
 4. Use a stiff scraper with a long handle to scrape the bottom of the MDM completely, in order to loosen any material that has settled to the bottom.
 5. Leave all the material that was scraped from the bottom in the MDM, so that it can be blended back into the resin.
 6. Obtain a mixer with 2 ten inch blades, and a variable speed ½ to ¾ HP motor.
 7. Lower mixer into MDM to about 1 inch above the bottom.
 8. Center the mixer in the MDM.
 9. Turn mixer on at a low speed and slowly increase the speed until the resin nears the point of splash out, and then lower the speed slightly.
 10. After about 45 minutes, move to mixer close to one end of the MDM, and continue mixing there for about 45 minutes.
 11. Move the mixer to the other end of the MDM and mix for 45 minutes.
 12. Remove the mixer from the MDM.
 13. Place the MDM back in the SLA system, and reinstall the build platform.



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14. Stir resin in the MDM with the platform, using the stir function in the 3D Print software until bubbles are all gone from the resin surface (this may take an hour or two).
 15. Ready to build again.
- e) SLA-7000 systems: Follow items (b) (c) and (d) in this section. The stir option for this system is unique in a few ways, as noted below.
1. In the stir option, stirring is allowed a maximum value of 1440 minutes (24 hours). If you desire to stir more than 24 hours, the option will have to be re-selected and stirring re-started.
 2. If the system has been idle more than 24 hours, an additional step must be taken to avoid issues caused by sedimentation of resin within the leveling baffle area.
 - i) Move the resin level down, to make sure the resin surface is lower than the bottom rim of the baffle. Make sure there is an air-gap in between the resin surface and the bottom of the baffle.
 - ii) Stir the resin using the stir option for at least 1 hour, or as long as possible.
 - iii) Move the resin level back to the start position, and wait until there are no bubbles on the resin surface, or within the baffle area.
 - iv) Ready to build.
5. **Refill material:** Upon opening new containers of Accura HPC material, stir the contents for about 1 hour with a mechanical stirrer (such as is used for mixing paint). Also, resin containers should be stirred for at least 30 minutes on subsequent additions.
6. **Support preparation:** Careful preparation of supports is critical for success with Accura HPC material. Supports that are too close together may limit the flow of resin and result in mounding on the tops of supports. Mounding that occurs during support building, prior to sweeping, can become cured and thus result in a blade collision. To minimize this mounding, the following items should be observed:
- Excess supports should be deleted in part preparation, so that there is sufficient spacing between support vectors. Because the resin is more viscous than other resins, without this space the resin will not have sufficient space to flow, and will not form a flat surface during the z-wait interval. This is only a problem when lots of supports get generated in a small area. Care should be to delete supports that are not required.
 - Users should take care to make sure that excessive bubbles are not accumulated during the support building process. Efforts should be made to remove any bubbles that might get created during support building and are not eliminated by recoating. In addition, any bubbles present prior to starting a build should be removed. Bubbles can be removed by either blotting the resin surface with a paper towel, or by using a hairdryer or very low pressure compressed air.



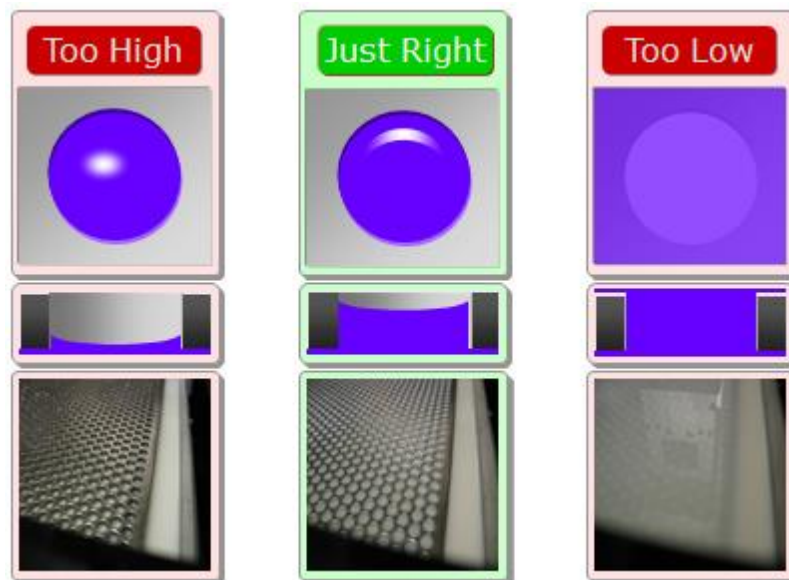
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- If you notice bubbles building up during a build, the build should be paused and you should manually remove the bubbles using the two processes listed above.
 - Accura HPC supports have been described as “hard and crisp.” The default parameters are optimum for successful part building. Modifying supports may cause the build to crash, so proceed with caution if you change support parameters.
6. **Setting build start position:** The build start position is particularly important for Accura HPC. At the beginning of the build, the top surface of platform must be very close to the resin surface. The resin should fill the holes on the platform, but not cover the top surface of it. This is to allow for proper adhesion of cured supports to the build platform, but at the same time to eliminate supports getting cured deep within the holes, which can prevent free flow of material.



7. **Hatch Overcure:** Hatch overcure has been optimized to maximize both part accuracy and mechanical properties. It is highly recommended that the hatch overcure values not be reduced from default. However, you can decrease hatch overcure to increase build speed. This increase in speed does come at the cost of part accuracy and reduction in mechanical properties in both green and post-cured parts.



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8. **Part cleaning:** When cleaning Accura HPC parts, an undesirable white residue may remain. This residue can be easily removed by scrubbing the parts with a soft bristle brush and/or beadblasting the parts **prior to UV postcure**. Parts treated in this way will have a nice white satin appearance. The recommended cleaning procedure is as follows:
- Place the parts on the platform in the TPM dip tank for 25 minutes, or in the isopropyl alcohol tank for 10 minutes.
 - Brush the parts with a soft bristle brush quite vigorously, being careful not to apply so much force that it would damage the part.
 - If using TPM, rinse the part with water. No water rinse if using isopropyl alcohol.
 - If beadblasting, bead blast the part.
 - Use compressed air to dry the part and inspect for excess powder remaining on the surface of the part.
 - Repeat brushing, rinsing, beadblasting, and drying parts as many times as necessary until the majority of the powder has been removed from the part. In most cases this will take about 3 cycles with brushing or 1 cycle with beadblasting.
 - **Cleaning trapped volumes from long builds:** We have noticed some settling into the surfaces of trapped volumes during long build periods (e.g, a weekend build). During part cleaning, this build up would require scraping and removal of the soft layer that is deposited.
11. **Support removal:** It is preferable that supports are removed prior to UV post cure, to avoid damaging the part surface when supports are removed.



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Reference drawing for elevator leg clearance on ProX and iPro systems:

