

How to Use Powdered Urea Resin Adhesive

Intro:

Urea resins are a truly versatile adhesive, capable of most assembly gluing, face and edge gluing, laminating and veneering. Urea resin adhesives are available as either liquid resins with powder catalysts, or as pre-formulated, pre-catalyzed powders. Both will produce similar glue line characteristics: strong, rigid, thermoset, Type II water resistance, and excellent heat resistance.

Powder ureas are preferred where production runs are infrequent, where the ambient temperature is high, and where longer storage life is needed. Powdered ureas have a one-year shelf life. They are pre-formulated, complete with required fillers, additives and catalyst to meet a wide range of process requirements. CPI's Powdered Plastic Resin (PPR) product may be hot pressed, cold pressed, or radio frequency (RF) cured.

Mix:

Water is all that is necessary to reconstitute the powder resin. Amount of water used should be 50-65% of the weight of the dry powder to be mixed.

- 65% is the ideal level of water.
- With the amount of required water determined, first add 2/3 of that amount of water to the mixing vessel.
- Slowly add the powder, while stirring the mix on slow RPM's (<2,000) with a mechanical agitator.
- Continue mixing for 3-5 minutes, using a spatula to scrape powder from the sides back into the liquid. Mix should be creamy and virtually lump-free at this point.
- Add the remaining 1/3 water and mix for an additional minute. Mix should be smooth, creamy, and lump-free.
- ****Note:** If powder won't easily and readily dissolve into the water, or if the mix appears sandy and/or grainy, the product should not be used. These working characteristics provide a built-in safety check signaling the powder has passed its shelf life.
- ****Note:** Keep in mind, the rated shelf life pertains to unopened containers stored in a cool (60°-70°F) and dry place. Higher temperatures will severely reduce the shelf life (only 6 months @ 90°F), and exposure to high humidity may cause severe lumping or actual catalyzation of the powder resin.

Spread:

Spread rate will largely depend on the nature of the work being done and the method of cure employed. Rates are normally defined by lbs. of glue required per 1,000' sq. of board surface (MSGSL) to be glued. In many instances it may be more practical to drop one zero from each side of the equation and talk in terms of lbs. per 100'sq. E.g., You are veneering a 4 x 6 surface area, and are looking for a spread of 30#/1,000 MSGSL, then figure 3#/100'sq.. With a board area of 24'sq., you can deduce you will need .5# of glue.

- Spread rates will range from 25# to 50# / MSGSL, depending on the nature of the work, time constraints of the glue-up, and method of cure.
- Generally, higher spreads (40-50#) are used for solid lumber gluing than for veneer work.
- RF curing, spread rates are lower (32-36#) than normal to prevent interference with equipment operation. This spread rate should be sufficient to show a slight bead of squeeze-out when the pressure is applied. A lighter spread of a heavy mix is normally preferred to a heavier spread of a thin mix.
- Spreading one surface is all that is required, however, pushing the limits of the rated assembly time may require coating both surfaces. Similarly, working with harder to wet woods (e.g. hard maple, ash, hickory) may also require two sided coverage.
- Thin spreads are critical when working with raw veneer in order to reduce the effect of bleed through. Bleed through is the occurrence of glue seeping through the pores of the wood to show up on the face of the panel. Be aware of the thickness of your veneer and relative porosity of the species you're working with, and adjust the spread accordingly. In many instances, a thin spread coupled with mandatory open assembly time (perhaps up to 10 minutes) will be necessary to prevent excessive bleed-through. Take care not to let the glue dry-out if allowing open assembly time. It must still be wet enough to transfer to the mating surface.
- Lower spread rates are also the norm for pressing high pressure laminate (HPL) to board, due in part to the good consistency of the surfaces being glued.
- Press pressure also has great bearing on the spread rate. Lower pressures should have less glue in the glue line, as thick glue lines will take longer to cure and be a weak point in the glue line.
- All of this is relegated, of course, to the ability to measure and control spread. Spreading can be accomplished very crudely with brushes or paint rollers, or can be done in a sophisticated manner with automated gluing equipment. The more accurately spread can be controlled, the better your success will be. Although the adhesive is somewhat forgiving, reducing variables yields better results. If much gluing is being done, upgrading to better spreading equipment is recommended. With cruder equipment, distinction between spread rates is normally not possible.
- Measuring spread rates is normally done by weight or by film measurement. When measuring thickness of the wet film, a wet film gauge is used to give a mil reading, and although not as precise a measurement as #/MSGSL, it can be converted to give an accurate reading. Formulas and directions are also available to figure weighted measurement, though it is more involved. Working with glue spread over time usually results in a good feel for what spread level is necessary, without the use of measuring. However, if you are new to gluing, or haven't checked yourself in a while, a closer look at measuring your spread may be worthwhile.
- The amount of glue squeezed out while under pressure is still a good determinant as to how your spread level is. Remember, it's not

only the amount of glue, but also how consistently it was applied, and squeeze out can give you indications of each.

Pot Life:

Once mixed with water, the resin will advance in its cure stage until it is unusable. The amount of time between first mixed until it reaches the unusable point is termed pot life. As with most directions for gluing, this is a dynamic value. It will change, primarily due to temperature. Hotter temperatures yield a shorter pot life, and vice versa with colder temperatures. There is no problem putting mixed resin in the refrigerator to extend its pot life; however, it should not reach below 55°F, as it will thicken to the point where it won't spread well. Do not freeze the adhesive!

- At 70°F pot life will be 5-1/2 hours, and @ 90°F will be 3 hours.
- The adhesive will continue to cure until it is rock hard—generally within 24 hours.
- Only experience and a careful eye will tell you the point when the mix is unusable, so err on the side of performance rather than yield. When it has thickened to the point that it is not spreading well, consider the mix unusable.
- Before it gets too heavy, a small amount of water (up to 3%) may be added to keep the glue thin enough to be used. Additionally, a new glue mix can be added to a small amount of thicker product, and after being stirred, will yield a new full pot life.

Assembly Times:

The time you have after spreading the glue, before full press pressure is applied, is referred to as assembly time. Urea resins offer very generous assembly times, making them ideal for intricate work requiring longer lay-up time.

- Open assembly is after the glue is applied to the work piece, but before it is put together with the mating surface.
- Closed assembly is after the surfaces have been placed together, but before full press/clamp pressure is applied.
- Open and closed assembly times are interrelated: the max. closed assembly time is only reached when virtually no open time is given, and is reduced about 2 minutes for every minute of open assembly time.
- Once again, these are dynamic, dependent on spread rate, substrate porosity, moisture content, and temperature—both ambient and stock temp.
- Maximum spreads are necessary to obtain maximum assembly times.
- As temperature increases, allowable assembly times decrease. Max. assembly time @ 70°F is 40 minutes, and @ 90°F is 20 minutes.
- More important than just measuring the time is being sure that the spread glue is wet enough to transfer to the mating surface, and once again, this is indicated by a slight bead of squeeze-out.

Stock Preparation:

The best results are obtained with the best stock preparation. The closer these conditions are adhered to, the better the results.

- Equilibrium moisture content (EMC) should be 8-10%, max of 12% for cold pressing, and 6-8%, maximum of 10% for hot pressing. It is critical to know the destination of the end piece, so moisture content change will not be extreme.
- Wood should be freshly machined—within 12 hours is ideal.
- Surfaces should be free of dust, dirt, grease or other contaminants.

Pressing/ Curing:

- As with pot life, both press pressure and cure time are dynamic, depending on the conditions at hand.
- Pressure required to develop sufficient bond strength is dependent upon the construction and the wood species used, with the guiding rule that surfaces must be in intimate contact with one another for a long enough cure time to develop sufficient strength for removal from press/clamps.
- Solid wood glue-ups will require from 150 psi for low-density species up to 250 psi for high-density species.
- Cold pressing panels @ 70°F will require from 4 hours press time on low density species to 6 hours on high density species. At 90°F this range will be from 2 hours to 4 hours.
- Cold pressing HPL to board can be accomplished with 40-70 psi, with the above press times.
- Hot pressing panels will require from 100-200 psi, and dependent on the depth to the deepest glue line, will require from 1 to 3.5 minutes @ 250°F.
- After cold pressing, panels should be dead stacked with the top weighted for a period of 24- 48 hours prior to machining or sanding.
- After hot pressing, panels should be dead stacked with top weight for 18-24 hours before machining or sanding.

- Ureas cure by chemical action in which the presence of water is necessary. If the water leaves the glue line prior to the complete chemical reaction, the resulting bond will be weak.
- As seen above, rate of cure is dependent on temperature, with higher temperatures yielding faster cures.

Clean-Up:

- Ureas are water-based products and therefore can be cleaned up with water. Warm water is preferred, as either cold or hot water will make clean-up more difficult.
- Eliminate as much of the adhesive from surfaces to be cleaned as possible, prior to adding water. The straight adhesive should be collected in a bucket and allowed to sit until cured completely, which leaves a solid plug of urea. This can be discarded as solid waste in a dumpster.
- Cured adhesive on the work pieces can be removed by either sanding or machining. Ureas are considered easier to sand than most adhesives, not loading sanding belts and not softening from the heat. They are considered harder on tooled surfaces.

Safety:

As with the use of any industrial chemical, proper care should be taken when handling urea adhesives. These are specifically outlined in the MSDS, which is available for this and any product you purchase and use.

Troubleshooting:

Please consult with CP industries for a complete troubleshooting list if problems with the mix or bond quality are encountered.

Mixing Chart:

Mixing recipes for PPR based on square footage needs. Spread rate based on 35# per 1000 square feet. Please read the section on mixing for further clarification.

Sq Ft	Unit equals ounces			Unit equals pounds		
	ttl mix (ounces)	PPR (ounces)	Water at 65% (ounces)	ttl mix (pounds)	PPR (pounds)	Water at 65% (pounds)
10	5.6	3.4	2.1	0.35	0.21	0.13
25	14	8.5	5.1	0.88	0.53	0.32
50	28	17.0	10.3	1.75	1.06	0.64
75	42	25.5	15.4	2.63	1.59	0.96
100	56	33.9	20.6	3.50	2.12	1.29
125	70	42.4	25.7	4.38	2.65	1.61
150	84	50.9	30.9	5.25	3.18	1.93
175	98	59.4	36.0	6.13	3.71	2.25
200	112	67.9	41.1	7.00	4.24	2.57
225	126	76.4	46.3	7.88	4.77	2.89
250	140	84.8	51.4	8.75	5.30	3.21
300	168	101.8	61.7	10.50	6.36	3.86
350	196	110.0	72.0	12.25	7.42	4.50
400	224	135.8	82.3	14.00	8.48	5.14
450	252	152.7	92.6	15.75	9.55	5.79
475	266	161.2	97.7	16.63	10.08	6.11
525	294	178.2	108.0	18.38	11.14	6.75
550	308	186.7	113.1	19.25	11.67	7.07
600	336	203.6	123.4	21.00	12.73	7.71
650	364	220.6	133.7	22.75	13.79	8.36
700	392	237.6	144.0	24.50	14.85	9.00
750	420	254.5	154.3	26.25	15.91	9.64
800	448	271.5	164.6	28.00	16.97	10.28
850	476	288.5	174.8	29.75	18.03	10.93
900	504	305.5	185.1	31.50	19.09	11.57
950	532	322.4	195.4	33.25	20.15	12.21
1000	560	339.4	205.7	35.00	21.21	12.86