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**Preserving Cultural  
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Article: Heat- and Solvent-Set Repair Tissues

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## Heat- and Solvent-Set Repair Tissues

Precoated heat- and solvent-set tissue has a long history of use at the Library of Congress (LC) and the National Archives and Records Administration (NARA). It is the preferred method for mending certain types of library and archival materials due to its translucency and ability to be applied with ease, speed, and consistency. Because it does not require moisture for activation, it is useful for mending tracing paper, brittle wood pulp paper, mold-damaged paper, and other water-sensitive items.

In 2013, LC was informed that adhesives used for many years to make the “Library of Congress Heat Set Tissue” were no longer available. LC and NARA began collaboration on a joint research project to identify replacements. Initial research results were presented in the 2015 AIC presentation, “Heat-Set Tissue: Finding a Practical Solution of Adhesives.” Mixtures of Avanse MV-100 and Plextol B500 were identified as possible replacements that would continue to be tested at both institutions. Concerns were raised when it was later discovered that some of the adhesives had turned brown after being stored at ambient conditions. The history of conservation adhesives is unfortunately plagued with discontinued products and changing formulas. Finding the correct combination and dilution of adhesives is a tricky balancing act: the adhesives must remain flexible and strong enough to ensure good adhesion, yet they must be readily reversible, not cause blocking, and pass analytical testing.

NARA and LC performed joint testing of a variety of precoated tissues made with Lascaux 498 HV, Lascaux 303 HV, Avanse MV-100, Plextol B500, Aquazol 200, and Aquazol 500. Prepared tissues were applied to substrates using both solvent- and heat-set methods. Testing assessed color change and reversibility after artificial aging, blocking of mends and fills after natural aging under pressure, and the adhesives’ interaction with silver-based photographic materials. The method of application—heat or solvent—did not affect results. The Avanse-Plextol tissues failed the color change tests and exhibited some other concerning characteristics. The six successfully tested mixtures were 1:4 Lascaux 498 HV: water (L1:4); 1:1:2 Lascaux 498 HV : 0.25% methylcellulose: water (Lm1:1:2); 1:1:1:1 Lascaux 498 HV : 0.25% Klucel G: 0.25% methylcellulose : water (Lkm1:1:1:1); 3:2:8 Lascaux 498 HV : Lascaux 303

HV : water (LL3:2:8); 10% solution of Aquazol 200 in water; and 5% solution of Aquazol 500 in water.

Based on these results, both institutions have begun to use the new and modified adhesive mixtures while discontinuing their use of Avanse-Plextol. Several case studies were presented involving L1:4, LL3:2:8, and the two Aquazol solutions, and recommendations were given for ongoing quality assurance testing.

This report was presented as two presentations, “Analytical Testing of Heat and Solvent Set Repair Tissues” in the Photographic Materials Group Session and “Use of Heat and Solvent Set Repair Tissues” in the Book and Paper Group Session, at AIC’s 47th Annual Meeting, May 13–17, 2019, in Uncasville, Connecticut. The authors intend to submit the two presentations as a single paper to the *Journal of the American Institute for Conservation* in the near future.

*Handout from “Use of Heat and Solvent Set Repair Tissues”  
National Archives and Records Administration and Library of  
Congress Adhesives Research Team  
Book and Paper Group Session, AIC’s 47th Annual Meeting,  
May 17, 2019, Uncasville, Connecticut*

### **Lascaux 498 HV Tissue (1:4 in water)**

#### *Materials and Tools*

- Lascaux 498 HV
- Deionized water
- Silicone-release Mylar
- Kozo tissue, 5–9 gsm
- 3-in. Hake brush

*Prepare adhesive mixture:* A 1:4 volume-to-volume mixture of Lascaux 498 HV to water was found to produce a good precoated tissue for mending paper. Use the displacement method for measuring the thick, viscous Lascaux 498 HV: Fill a 250 mL beaker with 200 mL of deionized water, then add Lascaux 498 HV to bring the contents up to the 250 mL mark. Mixing the solution for 10 to 15 minutes using a magnetic stirrer gives the best results, but stirring slowly with a glass rod is fine. Avoid shaking, as this will introduce bubbles.

*Precoating:* Precut tissue to be 2 in. smaller than silicone-release Mylar. Label with formula, tissue, and date made. Work on a dark surface. Lay tissue on silicone-release Mylar and gently brush adhesive mixture through the tissue with the “Union Jack pattern” followed by parallel stripes. Let dry thoroughly.

The silicone-release Mylar is reusable if excess adhesive is cleaned up with blotter while it is still wet. Tissue can be stored on the silicone-release Mylar until ready to use, or removed and stored between sheets of silicone-release paper.

*Applying with heat:* Cut out pieces with scissors or a scalpel. Apply the tissue to the tear adhesive side down. Lightly touch the tissue with the bare iron to position and secure it. Place silicone-release paper over the mend. Apply heat for about 5 seconds, through silicone-release paper, using a tacking iron set to about 110°C to 120°C. Set under weight, such as a small Plexiglas square, until cool.

*Applying with ethanol:* Saturate a 3 × 5 in. piece of thick blotter with ethanol and place in a polyester sleeve. Cut piece of coated tissue for mend. Pick up tissue with tweezers, lift cover of polyester sleeve, and gently touch the adhesive side of tissue to blotter. Quickly close the polyester cover over the tissue and gently apply pressure over length of mend. Remove tissue from ethanol/blotter packet. Using too much solvent washes the adhesive away. Apply the tissue to the tear adhesive side down. Place polyester webbing on top of the mend and press with Teflon folder. Let dry under blotter and weight.

*Handout from “Use of Heat and Solvent Set Repair Tissues” National Archives and Records Administration and Library of Congress Adhesives Research Team Book and Paper Group Session, AIC’s 47th Annual Meeting, May 17, 2019, Uncasville, Connecticut*

### **Lascaux 498 HV : Lascaux 303 HV Tissue (3:2:8 in water)**

#### *Materials and Tools*

- Lascaux 498 HV (60 mL)
- Lascaux 303 HV (40 mL)
- Deionized water (160 mL)
- Silicone-release Mylar
- Kozo tissue, 5–9 gsm
- 3 in. Hake brush

*Prepare adhesive mixture:* A 3:2:8 volume-to-volume mixture of Lascaux 498 HV, Lascaux 303 HV, and water was found to produce a good precoated tissue for mending paper. Use the displacement method for measuring the thick, viscous Lascaux 303 and 498: Fill one beaker with 80 mL of deionized water, then add Lascaux 498 to bring the contents up to the 140 mL mark. Fill another beaker with 80 mL of deionized water and add Lascaux

303 to bring the contents up to 120 mL. Combine both beakers into one jar and mix the solution for 10 to 15 minutes using a magnetic stirrer for best results, but stirring slowly with a glass rod is fine. Avoid shaking, as this will introduce bubbles.

*Precoating:* Precut tissue to be 2 in. smaller than silicone-release Mylar. Label with formula, tissue, and date made. Work on a dark surface. Lay tissue on silicone-release Mylar and gently brush adhesive mixture through the tissue with the “Union Jack pattern” followed by parallel stripes. Let dry thoroughly.

The silicone-release Mylar is reusable if excess adhesive is cleaned up with blotter while it is still wet. Tissue can be stored on the silicone-release Mylar until ready to use, or removed and stored between sheets of silicone-release paper.

*Applying with heat:* Cut out pieces with scissors or a scalpel. Apply the tissue to the tear adhesive side down. Lightly touch the tissue with the bare iron to position and secure it. Place silicone-release paper over the mend. Apply heat for about 5 seconds, through silicone-release paper, using a tacking iron set to about 110°C to 120°C. Set under weight, such as a small Plexiglas square, until cool.

*Applying with ethanol:* Saturate a 3 × 5 in. piece of thick blotter with ethanol and place in a polyester sleeve. Cut piece of coated tissue for mend. Pick up tissue with tweezers, lift cover of polyester sleeve, and gently touch the adhesive side of tissue to blotter. Quickly close the polyester cover over the tissue and gently apply pressure over length of mend. Remove tissue from ethanol/blotter packet. Using too much solvent washes the adhesive away. Apply the tissue to the tear adhesive side down. Place polyester webbing on top of the mend and press with Teflon folder. Let dry under blotter and weight.

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### **Aquazol 200 / Aquazol 500 Tissue**

#### *Materials and Tools*

- Aquazol 200 or Aquazol 500
- Deionized water
- Silicone-release Mylar
- Kozo tissue, 5–9 gsm
- 3 in. Hake brush

*Prepare adhesive mixture:* Aquazol comes as white to yellow chunks of crystal. It dissolves in water, but slowly. Aquazol 500 is a larger molecule and produces a more viscous solution in

water than Aquazol 200 at the same proportion. A 10% solution of Aquazol 200 and a 5% solution of Aquazol 500 were both found to produce a good precoated tissue for mending paper:

- Aquazol 200, 10% (w/v) solution in water: Place 10 g of the crystals into ~60 mL of deionized water.
- Aquazol 500, 5% (w/v) solution in water: Place 5 g of the crystals into ~60 mL of deionized water.

Allow to dissolve and then increase the volume of water until the total volume of the solution is 100 mL. Agitation helps, but it is best to prepare the solution a day or two before preparing the tissue.

*Precoating:* Precut tissue to be 2 in. smaller than silicone-release Mylar. Label with formula, tissue, and date made. Work on a dark surface. Lay tissue on silicone-release Mylar and gently brush adhesive mixture through the tissue with the “Union Jack pattern” followed by parallel stripes. Let dry thoroughly.

The silicone-release Mylar is reusable if excess adhesive is cleaned up with blotter while it is still wet. Tissue can be stored on the silicone-release Mylar until ready to use, or removed and stored between sheets of silicone-release paper.

*Applying with heat:* Cut out pieces with scissors or a scalpel. Apply the tissue to the tear adhesive side down. Lightly touch the tissue with the bare iron to position and secure it. Place silicone-release paper over the mend. Apply heat for about 5 seconds, through silicone-release paper, using a tacking iron set to about 95°C. Set under weight, such as a small Plexiglas square, until cool.

*Applying with ethanol:* Saturate a 3 × 5 in. piece of thick blotter with ethanol and place in a polyester sleeve. Cut piece of coated tissue for mend. Pick up tissue with tweezers, lift cover of polyester sleeve, and gently touch the adhesive side of tissue to blotter. Quickly close the polyester cover over the tissue and gently apply pressure over length of mend. Remove tissue from ethanol/blotter packet. Using too much solvent washes the adhesive away. Apply the tissue to the tear adhesive side down. Place polyester webbing on top of the mend and press with Teflon folder. Let dry under blotter and weight.

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