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## Advanced Materials

# Resin XB 9721
# Hardeners XB 3473 / Aradur® 917 /Accelerator DY 070*

HOT CURING SYTEM FOR INDUSTRIAL COMPOSITE

| | | | |
|---|---|---|---|
| **APPLICATIONS** | High performance composite parts | | |
| **PROPERTIES** | High Tg system | | |
| **PROCESSING** | Filament Winding<br>Pultrusion<br>Pressure Moulding | | |
| **CHEMICAL DESCRIPTON** | XB 9721 is a multifunctional epoxy resin<br>XB 3473 is a formulated amine hardener<br>Aradur 917 is an anhydride hardener<br>Accelerator DY 070 is an imidazole accelerator | | |
| **KEY DATA** | **Resin XB 9721** | | |
| | Aspect (visual) | clear, brown liquid | |
| | Epoxy Index (ISO 3001) | 8.5 - 9.5 | [eq/kg] |
| | Epoxy Equivalent (ISO 3001) | 105 - 118 | [g/eq] |
| | Viscosity at 50°C (ISO 12058-1) | 3000 - 7000 | [mPa s] |
| | Density at 25°C (ISO 1675) | 1.15 - 1.18 | [g/cm$^3$] |
| | Flash point (ISO 2719) | > 149 | [°C] |
| | Storage temperature<br>(see expiry date on original container) | < 8 | [°C] |
| | **Hardener XB 3473** | | |
| | Aspect (visual) | clear yellow to brown liquid | |
| | Viscosity at 25 °C (ISO 12058-1) | 95 - 145 | [mPa s] |
| | Density at 25 °C (ISO 1675) | 0.99 - 1.02 | [g/cm$^3$] |
| | Flash point (ISO 2719) | 121 | [°C] |
| | Storage temperature<br>(see expiry date on original container) | 2 - 40 | [°C] |
| | **Aradur 917** | | |
| | Aspect (visual) | clear liquid | |
| | Colour (Gardner, ISO 4630) | ≤ 2 | |
| | Viscosity at 25 °C (ISO 12058-1) | 50 - 100 | [mPa s] |
| | Density at 25 °C (ISO 1675) | 1.20 - 1.25 | [g/cm$^3$] |
| | Flash point (ISO 2719) | 195 | [°C] |
| | Storage temperature<br>(see expiry date on original container) | 2 - 40 | [°C] |
| | **Accelerator DY 070** | | |
| | Aspect (visual) | clear liquid | |
| | Colour (Gardner, ISO 4630) | ≤ 9 | |
| | Viscosity at 25 °C (ISO 12058-1) | ≤ 50 | [mPa s] |
| | Density at 25 °C (ISO 1675) | 0.95 - 1.05 | [g/cm$^3$] |
| | Flash point (ISO 2719) | 92 | [°C] |
| | Storage tempereratur<br>(see expiry date on original container) | 2 - 40 °C | [°C] |

* *In addition to the brand name product denomination may show different appendices, which allows us to differentiate between our production sites: e.g. BD = Germany, US = United States, IN = India, CI = China, etc. These appendices are in use on packaging, transport and invoicing documents. Generally the same specifications apply for all versions. Please address any additional need for clarification to the appropriate Huntsman contact.*

**STORAGE**

Provided that the products described above are stored in a dry place in their original, properly closed containers at the above mentioned storage temperatures they will have the shelf lives indicated on the labels. The resin should be stored below < 8°C.

Partly emptied containers should be closed immediately after use. Because Aradur 917 is sensitive to moisture, storage containers should be ventilated with dry air only.

## PROCESSING DATA

**INITIAL MIX RATIO**

| *Components* | *Parts by weight* | *Parts by volume* |
|---|---|---|
| Resin XB 9721 | 100 | 100 |
| Hardener XB 3473 | 38 | 44 |
| | | |
| Resin XB 9721 | 100 | 100 |
| Aradur 917 | 141 | 134 |
| Accelerator DY 070 | 0.5 - 2 | 0.6 - 2.3 |

We recommend that the components are weighed with an accurate balance to prevent mixing inaccuracies which can affect the properties of the matrix system. The components should be mixed thoroughly to ensure homogeneity. It is important that the side and the bottom of the vessel are incorporated into the mixing process.

| *Components [pbw]* | *System 1* | *System 2* | *System 3* |
|---|---|---|---|
| Resin XB 9721 | 100 | 100 | 100 |
| Hardener XB 3473 | 38 | - | - |
| Aradur 917 | - | 141 | 141 |
| Accelerator DY 070 | - | 1 | 2 |

**INITIAL MIX VISCOSITY** (Cone Plate viscosimeter)

| *[°C]* | | | | |
|---|---|---|---|---|
| at 25 | *[mPa s]* | 14000 - 17000 | 550 - 750 | 550 - 750 |
| at 40 | *[mPa s]* | 1800 - 2200 | 100 - 250 | 100 - 250 |

**POT LIFE** (Tecam, 100 ml, 65 % RH)

| *[°C]* | | | | |
|---|---|---|---|---|
| at 23 | *[h]* | 80 - 95 | 110 - 130 | 70 - 80 |

**GEL TIME** (Hot plate)

| *[°C]* | | | | |
|---|---|---|---|---|
| at 120 | *[min]* | 80 - 100 | 6 - 9 | 4 - 7 |
| at 140 | *[min]* | 35 - 45 | 2 - 4 | 1 - 3 |
| at 160 | *[min]* | 18 - 21 | 1 - 2 | - |
| at 180 | *[min]* | 8 - 11 | - | - |

The values shown are for small amounts of pure resin/hardener mix. In composite structures the gel time can differ significantly from the given values depending on the fibre content and the laminate thickness.

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## PROPERTIES OF THE CURED, NEAT FORMULATION

**TYPICAL CURE CYCLE** 2 h 120 °C + 2 h 140 °C + 2 h 180 °C + 2 h 220 °C

The optimum cure cycle has to be determined case by case depending on the processing and the economic requirements.

| *Components [pbw]* | *System 1* | *System 2* |
|---|---|---|
| Resin XB 9721 | 100 | 100 |
| Hardener XB 3473 | 38 | - |
| Aradur 917 | - | 141 |
| Accelerator DY 070 | - | 1 |

**GLASS TRANSITION TEMPERATURE**
(IEC 1006,
DSC, 10 K/min)

| *Cure:* | $T_G$ [°C] | $T_G$ [°C] |
|---|---|---|
| 2 h 120 °C + 4 h 180 °C | 215 - 225 | 198 - 208 |
| 2 h 120 °C + 2 h 160 °C + 2 h 200 °C + 4 h 220°C | 232 - 238 | 205 - 215 |

**GLASS TRANSITION TEMPERATURE**
(IEC 1006,
TMA, 10 K/min)

| *Cure:* | *System 1* | *System 2* |
|---|---|---|
| | $T_GO$ [°C] | $T_GO$[°C] |
| 4 h 80 °C + 4 h 160 °C | 170 - 180 | 178 - 188 |
| 2 h 120 °C + 4 h 180 °C | 195 - 205 | 190 - 200 |
| 2 h 120 °C + 2 h 160 °C + 2 h 200 °C | 200 - 210 | 195 - 205 |
| 2 h 120 °C + 2 h 160 °C + 2 h 200 °C + 4 h 220°C | 218 - 228 | 185 - 195 |

**TORSIONAL TEST**
(ISO 6721
DMA, 2 K/min)

| *Cure:* 2 h 120 °C + 2 h 160 °C + 2 h 200 °C + 4 h 220°C | | *System 1* | *System 2* |
|---|---|---|---|
| $T_G$ | [°C] | 245 - 255 | 205 - 215 |

**FLEXURAL TEST**
(ISO 178)

| *Cure:* 2 h 120 °C + 2 h 160 °C + 2 h 200 ° 4 h 220°C | | *System 1* | *System 2* |
|---|---|---|---|
| Flexural strength | [MPa] | 105 - 125 | 85 - 100 |
| Ultimate elongation | [%] | 3.0 - 4.2 | 2.5 - 3.0 |
| Flexural modulus | [MPa] | 3450 - 3650 | 3200 - 3500 |

**FRACTURE PROPERTIES BEND NOTCH TEST**
(PM 258-0/90)

| *Cure:* 2 h 120 °C + 2 h 160 °C + 2 h 200 °C + 4 h 220°C | | *System 1* | *System 2* |
|---|---|---|---|
| Fracture toughness $K_{1C}$ | [MPa√m] | 0.61 - 0.67 | 0.43 - 0.50 |
| Fracture energy $G_{1C}$ | [J/m$^2$] | 95 - 100 | 45 - 60 |

**HANDLING PRECAUTIONS**

Mandatory and recommended industrial hygiene procedures should be followed whenever our products are being handled and processed. For additional information please consult the corresponding product safety data sheets and the brochure "Hygienic precautions for handling plastics products" (Publ. No. 24264/e).

**Personal hygiene**

| | |
|---|---|
| *Safety precautions at workplace* | |
| protective clothing | yes |
| gloves | essential |
| arm protectors | recommended when skin contact likely |
| goggles/safety glasses | yes |
| *Skin protection* | |
| before starting work | Apply barrier cream to exposed skin |
| after washing | Apply barrier or nourishing cream |
| *Cleansing of contaminated skin* | |
| | Dab off with absorbent paper, wash with warm water and alkali-free soap, then dry with disposable towels. Do not use solvents |
| *Disposal of spillage* | |
| | Soak up with sawdust or cotton waste and deposit in plastic-lined bin |
| *Ventilation* | |
| of workshop | Renew air 3 to 5 times an hour |
| of workplaces | Exhaust fans. Operatives should avoid inhaling vapours |

**FIRST AID**

Contamination of the *eyes* by resin, hardener or mix should be treated immediately by flushing with clean, running water for 10 to 15 minutes. A doctor should then be consulted.
Material smeared or splashed on the *skin* should be dabbed off, and the contaminated area then washed and treated with a cleansing cream (see above). A doctor should be consulted in the event of severe irritation or burns. Contaminated clothing should be changed immediately.
Anyone taken ill after *inhaling* vapours should be moved out of doors immediately.
In all cases of doubt call for medical assistance.

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Main Office :
**Huntsman Advanced Materials (Switzerland) GmbH**
Klybeckstrasse 200
CH-4057 BASEL
Switzerland
+41 61 966 3333