

## Advanced Materials

# Araldite® LY 1564\* / Aradur® 3486\* / Aradur® 3487\*

## WARM CURING EPOXY SYSTEM

Araldite® LY 1564

Aradur® 3486 (formulated amine hardener)

Aradur® 3487 (formulated amine hardener)

|                     |                                                                                                                                                                                                                                                                                                                         |                                            |                      |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------|
| <b>APPLICATIONS</b> | Industrial composites                                                                                                                                                                                                                                                                                                   |                                            |                      |
| <b>PROPERTIES</b>   | Laminating system with low viscosity and high flexibility. The reactivity may easily be adjusted to demands through the combination of both hardeners. The long pot life of XB 3486 facilitates the production of very large industrial parts. The systems are qualified by Germanischer Lloyd.                         |                                            |                      |
| <b>PROCESSING</b>   | <ul style="list-style-type: none"> <li>• Resin Transfer Moulding (RTM, SCRIMP)</li> <li>• Wet lay-up</li> <li>• Filament Winding</li> </ul>                                                                                                                                                                             |                                            |                      |
| <b>PRODUCT DATA</b> | <b>Araldite® LY 1564</b>                                                                                                                                                                                                                                                                                                |                                            |                      |
|                     | Aspect (visual)                                                                                                                                                                                                                                                                                                         | clear liquid                               |                      |
|                     | Viscosity at 25 °C (ISO 12058-1)                                                                                                                                                                                                                                                                                        | 1200 - 1400**                              | [mPa s]              |
|                     | Density at 25 °C (ISO 1675)                                                                                                                                                                                                                                                                                             | 1.1 - 1.2                                  | [g/cm <sup>3</sup> ] |
|                     | Epoxy index (ISO 3001)                                                                                                                                                                                                                                                                                                  | 5.8 - 6.05**                               | [Eq/kg]              |
|                     | <b>Aradur® 3486</b>                                                                                                                                                                                                                                                                                                     |                                            |                      |
|                     | Aspect (visual)                                                                                                                                                                                                                                                                                                         | clear colourless to slightly yellow liquid |                      |
|                     | Viscosity at 25 °C (ISO 12058-1)                                                                                                                                                                                                                                                                                        | 10 - 20                                    | [mPa s]              |
|                     | Density at 25 °C (ISO 1675)                                                                                                                                                                                                                                                                                             | 0.94 - 0.95                                | [g/cm <sup>3</sup> ] |
|                     | Amine value (ISO 9702)**                                                                                                                                                                                                                                                                                                | 8.55 - 9.30                                | [Eq/kg]              |
|                     | <b>Aradur® 3487</b>                                                                                                                                                                                                                                                                                                     |                                            |                      |
|                     | Aspect (visual)                                                                                                                                                                                                                                                                                                         | clear colourless to slightly yellow liquid |                      |
|                     | Viscosity at 25 °C (ISO 12058-1B)                                                                                                                                                                                                                                                                                       | 30 - 70                                    | [mPa s]              |
|                     | Density at 25 °C (ISO 1675)                                                                                                                                                                                                                                                                                             | 0.98 - 1.0                                 | [g/cm <sup>3</sup> ] |
|                     | Amine value (ISO 9702)**                                                                                                                                                                                                                                                                                                | 9.30 - 10.20                               | [Eq/kg]              |
| <b>STORAGE</b>      | Provided that Araldite® LY 1564 SP and Aradur® 3486 or Aradur® 3487 are stored in a dry place in their original, properly closed containers at the storage temperatures mentioned in the MSDS they will have the shelf lives indicated on the labels. Partly emptied containers should be closed immediately after use. |                                            |                      |

\*\* Specified data are on a regular basis analysed. Data which is described in this document as 'typical' is not analysed on a regular basis and is given for information purposes only. Data values are not guaranteed or warranted unless if specifically mentioned.

\* 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.

## TYPICAL SYSTEM DATA

### PROCESSING DATA

| MIX RATIO | Components        | Parts by weight | Parts by volume |
|-----------|-------------------|-----------------|-----------------|
|           | Araldite® LY 1564 | 100             | 100             |
|           | Aradur® 3486      | 34              | 41              |
|           | Araldite® LY 1564 | 100             | 100             |
|           | Aradur® 3487      | 34              | 41              |

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.

When processing large quantities of mixture the pot life will decrease due to exothermic reaction. It is advisable to divide large mixes into several smaller containers.

| INITIAL MIX VISCOSITY<br>(HOEPLER, ISO 12058-1B) |                        | [°C]  | [mPa s]   |
|--------------------------------------------------|------------------------|-------|-----------|
|                                                  | LY 1564 / Aradur® 3486 | at 25 | 200 - 300 |
|                                                  | LY 1564 / Aradur® 3487 | at 25 | 220 - 320 |

| POT LIFE<br>(TECAM, 23 °C, 65 % RH) |                        | [g]  | [min]     |
|-------------------------------------|------------------------|------|-----------|
|                                     | LY 1564 / Aradur® 3486 | 100  | 560 - 620 |
|                                     |                        | 1000 | 180 - 230 |
|                                     | LY 1564 / Aradur® 3487 | 100  | 130 - 160 |
|                                     |                        | 1000 | 75 - 100  |

| GEL TIME<br>(HOT PLATE) |                        | [°C]   | [min]     |
|-------------------------|------------------------|--------|-----------|
|                         | LY 1564 / Aradur® 3486 | at 60  | 110 - 130 |
|                         |                        | at 80  | 33 - 43   |
|                         |                        | at 100 | 13 - 17   |
|                         |                        | at 120 | 5 - 9     |
|                         | LY 1564 / Aradur® 3487 | at 60  | 65 - 85   |
|                         |                        | at 80  | 18 - 25   |
|                         |                        | at 100 | 6 - 10    |
|                         |                        | at 120 | 2 - 5     |

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.

### COMBINATION OF THE HARDENERS

|                           |           |           |           |           |           |
|---------------------------|-----------|-----------|-----------|-----------|-----------|
| Araldite® LY 1564         | 100       | 100       | 100       | 100       | 100       |
| Aradur® 3486              |           | 8.5       | 17        | 25.5      | 34        |
| Aradur® 3487              | 34        | 25.5      | 17        | 8.5       |           |
| Pot Life (Tecam at 23 °C) | [min]     | [min]     | [min]     | [min]     | [min]     |
| 100g                      | 130 - 170 | 290 - 340 | 380 - 430 | 530 - 590 | 560 - 620 |
| Gel time (Hot plate)      | [min]     | [min]     | [min]     | [min]     | [min]     |
| at 80 °C                  | 18 - 25   | 20 - 27   | 25 - 33   | 30 - 39   | 33 - 43   |
| at 100 °C                 | 6 - 10    | 7 - 11    | 9 - 13    | 11 - 15   | 13 - 17   |

## PROPERTIES OF THE CURED, NEAT FORMULATION

| <b>GLASS TRANSITION TEMPERATURE</b> |                                 | <i>Cure:</i>                | $T_g$       | LY 1564<br>Aradur® 3487      | LY 1564<br>Aradur® 3486    |
|-------------------------------------|---------------------------------|-----------------------------|-------------|------------------------------|----------------------------|
| (ISO 11357-2<br>DSC, 10 K/MIN)      |                                 | 2 days 23 °C                | [°C]        | 42 - 48                      | 33 - 37                    |
|                                     |                                 | 8 days 23 °C                | [°C]        | 54 - 59                      | 49 - 53                    |
|                                     |                                 | 20 h 40 °C                  | [°C]        | 63 - 68                      | 52 - 56                    |
|                                     |                                 | 15 h 50 °C                  | [°C]        | 68 - 73                      | 66 - 70                    |
|                                     |                                 | 24 h 50 °C                  | [°C]        | 71 - 75                      | 66 - 70                    |
|                                     |                                 | 10 h 60 °C                  | [°C]        | 72 - 76                      | 67 - 71                    |
|                                     |                                 | 16 h 60 °C                  | [°C]        | 75 - 80                      | 68 - 72                    |
|                                     |                                 | 4 h 80 °C                   | [°C]        | 81 - 86                      | 77 - 81                    |
|                                     |                                 | 8 h 80 °C                   | [°C]        | 81 - 86                      | 80 - 84                    |
|                                     |                                 | 2 h 100 °C                  | [°C]        | 81 - 86                      | 78 - 82                    |
|                                     |                                 | 5 h 100 °C                  | [°C]        | 82 - 86                      | 80 - 84                    |
| <b>TENSILE TEST</b>                 |                                 | LY 1564 / Aradur® 3487      |             | <i>Cure:</i><br>15 h 50 °C   | <i>Cure:</i><br>8 h 80 °C  |
| (ISO 527)                           | Tensile strength                | [MPa]                       | 77 - 81     | 72 - 76                      |                            |
|                                     | Elongation at tensile strength  | [%]                         | 3.9 - 4.1   | 4.5 - 4.9                    |                            |
|                                     | Ultimate strength               | [MPa]                       | 58 - 64     | 63 - 68                      |                            |
|                                     | Ultimate elongation             | [%]                         | 7.2 - 8.0   | 8.0 - 9.0                    |                            |
|                                     | Tensile modulus                 | [MPa]                       | 3200 - 3350 | 2940 - 3100                  |                            |
| <b>TENSILE TEST</b>                 |                                 | LY 1564 / Aradur® 3486      |             | <i>Cure:</i><br>15 h 50 °C   | <i>Cure:</i><br>8 h 80 °C  |
| (ISO 527)                           | Tensile strength                | [MPa]                       | 74 - 78     | 70 - 74                      |                            |
|                                     | Elongation at tensile strength  | [%]                         | 4.0 - 4.2   | 4.6 - 5.0                    |                            |
|                                     | Ultimate strength               | [MPa]                       | 62 - 68     | 60 - 64                      |                            |
|                                     | Ultimate elongation             | [%]                         | 5.8 - 6.2   | 8.0 - 8.5                    |                            |
|                                     | Tensile modulus                 | [MPa]                       | 3100 - 3250 | 2860 - 3000                  |                            |
| <b>FLEXURAL TEST</b>                |                                 | LY 1564 / Aradur® 3487      |             | <i>Cure:</i><br>7 days 23 °C | <i>Cure:</i><br>15 h 50 °C |
| (ISO 178)                           | Flexural strength               | [MPa]                       | 98 - 112    | 125 - 138                    | 118 - 130                  |
|                                     | Elongation at flexural strength | [%]                         | 2.7 - 3.6   | 5.0 - 5.4                    | 5.5 - 6.5                  |
|                                     | Ultimate strength               | [MPa]                       | 98 - 112    | 88 - 95                      | 88 - 100                   |
|                                     | Ultimate elongation             | [%]                         | 2.7 - 3.6   | 8.2 - 10.0                   | 10.0 - 12.0                |
|                                     | Flexural modulus                | [MPa]                       | 3460 - 3660 | 3200 - 3400                  | 2950 - 3100                |
| <b>FLEXURAL TEST</b>                |                                 | LY 1564 / Aradur® 3486      |             | <i>Cure:</i><br>7 days 23 °C | <i>Cure:</i><br>15 h 50 °C |
| (ISO 178)                           | Flexural strength               | [MPa]                       | 80 - 90     | 120 - 135                    | 118 - 130                  |
|                                     | Elongation at flexural strength | [%]                         | 2.1 - 2.5   | 5.2 - 5.6                    | 5.5 - 6.5                  |
|                                     | Ultimate strength               | [MPa]                       | 80 - 90     | 78 - 85                      | 88 - 100                   |
|                                     | Ultimate elongation             | [%]                         | 2.1 - 2.5   | 9.0 - 11.5                   | 10.5 - 12.5                |
|                                     | Flexural modulus                | [MPa]                       | 3500 - 3700 | 3100 - 3300                  | 2900 - 3050                |
| <b>FRACTURE PROPERTIES</b>          |                                 | <i>Cure: 5 h<br/>100 °C</i> |             | LY 1564<br>Aradur® 3487      | LY 1564<br>Aradur® 3486    |
| <b>BEND NOTCH TEST</b>              |                                 |                             |             |                              |                            |
| (ISO 13586)                         | Fracture toughness $K_{1C}$     | [MPa√m]                     | 0.95 - 1.05 | 0.95 - 1.05                  |                            |
|                                     | Fracture energy $G_{1C}$        | [J/m²]                      | 255 - 305   | 260 - 310                    |                            |

## PROPERTIES OF THE CURED, REINFORCED FORMULATION

|                                |  |                                                                                                                                                                |       |                         |                         |
|--------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------------|-------------------------|
| <b>INTERLAMINAR SHEAR TEST</b> |  | Short beam: Laminate comprising 12 layers unidirectional E-glass fabric (425 g/m²)<br>Laminate thickness $t = 3.0 - 3.2$ mm<br>Fibre volume content: 63 - 65 % |       |                         |                         |
| (ASTM D 2344)                  |  | <i>Cure: 1.5 h 80 °C<br/>+ 5 h 100 °C</i>                                                                                                                      |       | LY 1564<br>Aradur® 3487 | LY 1564<br>Aradur® 3486 |
|                                |  | Shear strength                                                                                                                                                 | [MPa] | 53 - 58                 | 53 - 58                 |

## HANDLING PRECAUTIONS

### 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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