



# Technical Data Sheet

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Telephone: +44 (0)1352 757657  
Telefax: +44 (0)1352 758914  
Email: [sales@tsresins.co.uk](mailto:sales@tsresins.co.uk)

## Prefere 4535

Liquid melamine urea adhesive for the wood industry

### Use

Prefere 4535 is a liquid melamine urea adhesive which is used together with the liquid hardeners Prefere 5035 or Prefere 5046 in the manufacture of load bearing timber structures. Prefere 4535 is well suited for radio frequency curing as well as for hot and cold curing. The glue lines of this adhesive system are light-coloured and will not darken over time.

When the gluing is carried out in accordance with the instructions in this Technical Data Sheet, Prefere 4535 gives water- and weather-proof bonds, conforming to Adhesive Type 1 of the European standards for load-bearing wooden structures (EN301:2023).

Prefere 4535 has been tested by MPA (Otto-Graf-Institut, Stuttgart) as well as by NTI (Norsk Treteknisk Institutt, Oslo) according to DIN 68 141 and EN301:2023, and fulfils the requirements for the gluing of load-bearing wooden structures, structural finger jointing and cross-laminated timber (CLT) according to DIN 1052, EN14080:2013, EN15497:2014 and EN16351:2021.

The adhesive system fulfils herewith the requirements according to EN301:2023 and is classified as a general purpose and finger jointing adhesive for mixed in and separate application use, for the gluing of Norway Spruce (*Picea abies*/PCAB), Scots Pine (*Pinus sylvestris*/PNSY), Silver Fir (*Abies alba*/ABAL), European Larch (*Larix decidua*/LADC), Siberian Larch (*Larix sibirica*/LASI), Douglas Fir (*Pseudotsuga menziesii*/PSMN), Beech (*Fagus sylvatica*/FASY) and Birch (*Betula pendula*/BTXX) with the following class designations, as specified in the table overleaf:

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| Designation                         | Approved hardeners | Approved wood species <sup>1,2</sup>     |
|-------------------------------------|--------------------|------------------------------------------|
| EN 301-I-90-GP-0,6-M-w              | 5035               | PCAB, PNSY, ABAL, BTXX                   |
| EN 301-I-90-GP-0,3-S-w              |                    |                                          |
| EN 301-I-90-FJ-0,1-M-w              | 5046               | PCAB, PNSY, ABAL, LADC, LASI, PSMN, FASY |
| EN 301-I-90-GP-0,6-M-w <sup>3</sup> |                    |                                          |

<sup>1</sup> Nomenclature according to EN 13556:2003 "Round and sawn timber nomenclature of timbers used in Europe"

<sup>2</sup> For the gluing of wood species other than PCAB, PNSY or ABAL please contact your TS Resins Ltd sales contact.

<sup>3</sup> With the addition of colour in the hardener. For details, please see chapter "Glue mix preparation".

Prefere 4535 with hardener Prefere 5046 is approved for the gluing of load-bearing timber structures made of beech (Allgemeine bauaufsichtliche Zulassung nr Z-9.1-679). For detailed information about this process please contact your TS Resins Ltd sales contact.

Prefere 4535 with hardener Prefere 5035 is tested and approved by NTI for the gluing of load bearing timber structures made of birch (*Betula pendula*).

Prefere 4535 with hardeners Prefere 5035 and Prefere 5046 is tested and approved for the gluing of Wolmanit CX-8, Scanimp KF, Wolsit KD-10 and Permawood ACQ 1900 impregnated pine (*Pinus sylvestris*). For details about impregnation and suitable substances, please contact your TS Resins Ltd sales contact.

Provided that Prefere 4535 is used according to the instructions in this Technical Data Sheet, the end products will exhibit minimal emissions.

## Technical Data for the Adhesive

|                            | Prefere 4535                    |
|----------------------------|---------------------------------|
| Appearance                 | Light grey/white viscous liquid |
| Solids Content (%)         | 63.0 – 65.0                     |
| Viscosity at 25°C (mPas) * | 3000 – 10000                    |
| pH at 25°C                 | 8.5 – 10.0                      |
| Density at 25°C            | 1.240 – 1.280                   |

\* Viscosity is measured by Brookfield, RVT, spindle 4 at 20rpm

## Storage of the Adhesive

The storage stability of the adhesive is temperature dependent. The adhesive can be stored at a temperature of 10°C for up to 6 months.

| Temperature (°C) | Storage Stability (months) |
|------------------|----------------------------|
| 10               | 6                          |
| 15               | 5                          |
| 20               | 4                          |
| 25               | 3                          |
| 30               | 2                          |

Prefere 4535 is not flammable.

## Technical Data for the Hardeners

|                            | Prefere 5035         | Prefere 5046         |
|----------------------------|----------------------|----------------------|
| Appearance                 | White viscous liquid | White viscous liquid |
| Viscosity at 25°C (mPas) * | 2500 – 5000          | 2500 – 5000          |
| pH at 25°C                 | 0.7 – 1.3            | 1.5 – 2.5            |
| Density at 25°C            | 1.280 – 1.320        | 1.100 – 1.140        |

\* Viscosity is measured by Brookfield, RVT, spindle 4 at 20rpm

## Storage of the Hardeners

The optimal storage temperature is 10 – 25°C. At these temperatures Prefere 5035 may be stored for up to 6 months, and Prefere 5046 for up to 4 months. The hardeners must not be allowed to freeze.

## The Wood

The European production standards EN14080:2013, EN15497:2014 and EN16351:2021 dictate that laminated timber structures consist of one wood species only. The wood material must be strength graded in accordance with EN14081-1.

All data for assembly times, pressing times and time to full water resistance refers to production using Norway spruce (*Picea abies*). However, Prefere 4535 can be used for a wide range of species. For more details please contact your TS Resins Ltd sales contact.

To ensure optimum bond quality when producing laminated timber structures or finger jointing, the lamellas should be freshly planed or profiled, and the moisture content of the wood should be between 6 and 15%, with a maximum difference in moisture content between the lamellas of 5%.

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With Prefere 4535, the moisture content of the timber can be up to 23%, for special applications.

## Glue Mix Preparation

The reactivity of the glue mix can be adapted to the user's production requirements (pot life, assembly time and pressing time). The following glue mixes (in pbw) are approved for laminated timber structures <sup>3</sup>.

|                                                                                    | <b>Prefere 4535</b> | <b>Prefere 5035</b> | <b>Prefere 5046</b> | <b>Water</b> | <b>Colour</b>                      |
|------------------------------------------------------------------------------------|---------------------|---------------------|---------------------|--------------|------------------------------------|
| <b>EN 301-I-90-GP-0,6-M-w</b>                                                      | 100                 | 15 – 35             | 15 – 60             | -            | -                                  |
| <b>EN 301-I-90-GP-0,3-S-w</b>                                                      | 100                 | 25 – 35             | 25 – 60             | -            | -                                  |
| <b>EN 301-I-90-FJ-0,1-M-w</b>                                                      | 100                 | 15 – 60             | 15 – 60             | -            | -                                  |
| <b>Face gluing and finger jointing, mix-in application with addition of colour</b> | 100                 | 20                  | 30                  | -            | 2.2 <sup>1</sup> /2.0 <sup>2</sup> |

<sup>1</sup> 2.2 parts by weight of colour can be added to the hardener Prefere 5035 (related to the hardener amount) consisting of 2 pbw Pintosol Oxidrot E-WL41 and 0.2 Colanyl Schwarz PR130.

<sup>2</sup> 2 parts by weight of the colour Flexonyl-Gelb HR-LA01 can be added to the hardener Prefere 5046 (related to the hardener amount).

<sup>3</sup> For the gluing of wood species other than PCAB, PNSY and ABAL, please contact your TS Resins representative.

It must be demonstrated that automatic metering/mixing equipment to be used to mix Prefere 4535 and hardener is suitable for this special operation.

No fillers or extenders may be added to the glue mixes.

## Glue Application

### Separate Application of Glue and Hardener

Prefere 4535 and hardeners Prefere 5035 and Prefere 5046 are preferably applied with sequential ribbon spreaders especially suited to this purpose. The principle is that the first extruder is used for the hardener and the second extruder is used for the adhesive. The ribbon spreaders should ensure correct ratio between adhesive and hardener and should keep the application rate of the two components constant.

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By use of the separate application technique, no glue mix is made. Consequently, the pot life issue is completely removed. As mixing and blending of the adhesive takes place on the surface of the lamellas, it is very important to have strict control of the planing quality (maximum glue line thickness 0,3mm), as well as the glue and hardener spread, the assembly time and the final pressure of the press.

## Mix-in Application of Glue and Hardener

It must be demonstrated that automatic metering/mixing equipment to be used is suitable for this special operation.

If adhesive and hardener are mixed by hand, one should be aware that the adhesive has a different specific gravity than the hardener. In order to obtain a homogeneous glue mix it is advisable to stir from the bottom.

## Pot Life

Heat is evolved when adhesive and hardener are mixed. The higher the initial adhesive temperature is, the more heat is evolved. As soon as the adhesive and hardener are mixed, the curing reaction starts. This reaction will cause increased viscosity and proceeds until the glue mix is completely cured. The reaction rate will increase with increased temperature and increased amount of hardener. The pot life (*ie* the time to unusable viscosity) for the different glue mixes and both hardeners is given in the table below.

| Dosage<br>(pbw) | Pot life in minutes |      |      |      |
|-----------------|---------------------|------|------|------|
|                 | 15°C                | 20°C | 25°C | 30°C |
| <b>100:15</b>   | 195                 | 135  | 80   | 45   |
| <b>100:20</b>   | 150                 | 100  | 60   | 40   |
| <b>100:25</b>   | 135                 | 80   | 45   | 30   |
| <b>100:30</b>   | 120                 | 75   | 45   | 20   |
| <b>100:35</b>   | 105                 | 60   | 30   | 15   |
| <b>100:60</b>   | -                   | 30   | -    | -    |

## Glue Spread

In the manufacture of laminated timber structures, the adhesive should be applied to one surface only at a rate of 200 – 500 g/m<sup>2</sup> if a ribbon spreader is used, and at a rate of 100 – 250 g/m<sup>2</sup> coated surface (application to both sides) if a roller spreader is used. Application to both surfaces is advantageous when bonding difficult-to-bond wood species. Lower glue spread can be sometimes be sufficient, depending on production technique, planing quality, required assembly time and pressing process. This should only be done after seeking technical advice from TS Resins Ltd.

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## Assembly Time

Assembly time is the time elapsing between glue application and pressure application. It can be subdivided into open (from glue application to assembly of adherents) and closed assembly time (from assembly to establishing pressure).

Open assembly time should be kept as short as possible, and should not exceed 5 minutes. On the other hand, 5 – 15 minutes closed assembly time is beneficial, especially when bonding dense wood.

Maximum closed assembly time depends on the glue spread rate and hardener dosage, as well as wood species, temperature and moisture content of the wood, air temperature, relative humidity and air circulation in the workshop. The lower the spread rate, the higher the temperature and the drier the air, the shorter the maximum allowed assembly time will be. Provided the lamellae are assembled immediately after glue application, the maximum assembly times for given hardener dosages are stated in the tables below.

| Dosage<br>(pbw) | Max Closed Assembly Time at 20°C for Separate Application (minutes) |                      |                      |                      |
|-----------------|---------------------------------------------------------------------|----------------------|----------------------|----------------------|
|                 | Prefere 5035                                                        |                      | Prefere 5046         |                      |
|                 | 250 g/m <sup>2</sup>                                                | 350 g/m <sup>2</sup> | 250 g/m <sup>2</sup> | 350 g/m <sup>2</sup> |
| <b>100:25</b>   | 60                                                                  | 90                   | 80                   | 120                  |
| <b>100:30</b>   | 60                                                                  | 80                   | 75                   | 110                  |
| <b>100:35</b>   | 45                                                                  | 75                   | 75                   | 110                  |
| <b>100:60</b>   | -                                                                   | -                    | 75                   | 110                  |

| Dosage<br>(pbw) | Max Closed Assembly Time at 20°C for Mix-In Application (minutes) |                      |                      |                      |
|-----------------|-------------------------------------------------------------------|----------------------|----------------------|----------------------|
|                 | Prefere 5035                                                      |                      | Prefere 5046         |                      |
|                 | 250 g/m <sup>2</sup>                                              | 400 g/m <sup>2</sup> | 250 g/m <sup>2</sup> | 400 g/m <sup>2</sup> |
| <b>100:15</b>   | 90                                                                | 120                  | 80                   | 150                  |
| <b>100:20</b>   | 90                                                                | 120                  | 80                   | 150                  |
| <b>100:25</b>   | 60                                                                | 90                   | 75                   | 120                  |
| <b>100:30</b>   | 60                                                                | 90                   | 75                   | 105                  |
| <b>100:35</b>   | 45                                                                | 75                   | 70                   | 90                   |
| <b>100:60</b>   | -                                                                 | -                    | 45                   | 55                   |

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| Dosage<br>(pbw) | Max Closed Assembly Time at 25°C with 400g/m <sup>2</sup><br>for Mix-in Application (minutes) |
|-----------------|-----------------------------------------------------------------------------------------------|
|                 | Prefere 5046                                                                                  |
|                 | 25°C                                                                                          |
| 100:15          | 100                                                                                           |
| 100:20          | 100                                                                                           |
| 100:25          | 80                                                                                            |
| 100:30          | 75                                                                                            |
| 100:35          | 60                                                                                            |

Under all circumstances the adhesive must still be tacky when the pressure is applied. Adhesive being squeezed out of the glue line when the pressure is applied is an indication that the assembly time is not exceeded.

## Pressure

The pressure is dependent on the wood species (softwood or hardwood) and on the type of bonding operation.

In the manufacture of laminated timber structures, the pressure should be 0.6 – 1.0 N/mm<sup>2</sup> with softwoods and 0.8 – 1.2 N/mm<sup>2</sup> with hardwoods. In other bonding operations a lower pressure may be sufficient.

In finger jointing the end (longitudinal) pressure should be adapted to the joint profile, wood species, the moisture content and the cross section of the timber *etc*, and should be determined accordingly. For most softwoods an end pressure in the order of 5 – 8 N/mm<sup>2</sup> will be sufficient for finger joints over 25 mm in length. For shorter joints an end pressure of 8 – 12 N/mm<sup>2</sup> is necessary. If pre-heated wood is used, there is a risk that the pressure may cause compression fracture of the wood, in particular if the moisture content of the wood is high. In such cases the pressure must be reduced.

## Pressing Properties

### a) Laminated Timber Structures

#### Cold and Hot Bonding

In the table below, the minimum pressing times when manufacturing straight beams with a maximum glue line thickness of 0.1mm are given.

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| Dosage<br>(pbw)            | Pressing time with 0.1mm glue line (minutes) |                 |                 |                 |
|----------------------------|----------------------------------------------|-----------------|-----------------|-----------------|
|                            | 20°C                                         |                 | 30°C            |                 |
|                            | Prefere<br>5035                              | Prefere<br>5046 | Prefere<br>5035 | Prefere<br>5046 |
| <b>100:15</b> <sup>1</sup> | 735                                          | 345             | 240             | 150             |
| <b>100:25</b>              | 360                                          | 270             | 120             | 120             |
| <b>100:35</b>              | 240                                          | 180             | 105             | 90              |
| <b>100:60</b> <sup>2</sup> | -                                            | 180             | -               | 90              |

<sup>1</sup> Only for mix-in application

<sup>2</sup> Only valid for hardener Prefere 5046

| Dosage<br>(pbw)            | Pressing Time (minutes) <sup>3</sup> |      |      |      |      |       |
|----------------------------|--------------------------------------|------|------|------|------|-------|
|                            | 50°C                                 | 60°C | 70°C | 80°C | 90°C | 100°C |
| <b>100:15</b> <sup>1</sup> | 20                                   | 6    | 3    | 2½   | 1¼   | ½     |
| <b>100:20</b>              | 15                                   | 5    | 2½   | 2    | 1    | ½     |
| <b>100:25</b>              | 10                                   | 4    | 2    | 1½   | ¾    | ½     |
| <b>100:30</b>              | 8                                    | 3    | 2    | 1¼   | ¾    | ½     |
| <b>100:35</b>              | 6                                    | 2    | 1¾   | 1    | ¾    | ½     |
| <b>100:60</b> <sup>2</sup> | 6                                    | 2    | 1¾   | 1    | ¾    | ½     |

<sup>1</sup> Only for mix-in application

<sup>2</sup> Only valid for hardener Prefere 5046

<sup>3</sup> At pressing temperatures above 50°C the hardeners 5035 and 5046 can be considered equal in reactivity

If the bonding is accomplished at elevated temperature in curing chambers, the time to reach the desired temperature in the glue line must be added to the pressing times above. This additional time depends on the chamber temperature, the initial temperature of the wood and, in particular, on the width of the laminations. Our Technical Service department can assist in calculating the necessary pressing times.

In the case of thicker glue lines, additional pressing time is required. Curved structures require extended pressing times. The smaller the radius of the curvature, the longer pressing times are required.

## Radio Frequency Curing

Prefere 4535 is very well suited for curing under radio frequency heating conditions.

Since the necessary pressing times depend on a number of factors, such as the shape of the adherents, the position of the electrodes, the effect of the generator *etc*, it is recommended to optimise the pressing times by trials in the customer's workshop.

Our Technical Service department can advise on establishing press times and how to make glue line temperature measurements when radio frequency heating is used. A typical glue line temperature will be in the range 65 – 80°C in combination

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with a wood temperature of 35 – 40°C. It can be higher or lower depending on the type and settings of the press.

## Post Curing

After pressing using the above pressing times, the adhesive is sufficiently cured to allow for machining. However, full water resistance of the bonds will only be achieved after post curing. The necessary time for post curing depends on the glue mix, glue line thickness, pressing time and the temperature during pressing and post curing. The following table shows minimum post curing times for glue line thickness of 0.1mm, at an application amount of 250 g/m<sup>2</sup> and at a storage temperature of 20°C.

| <b>Dosage<br/>(pbw)</b> | <b>Time to Water Resistance at 20°C<br/>(hours)</b> |
|-------------------------|-----------------------------------------------------|
| <b>100:15</b>           | 72                                                  |
| <b>100:35</b>           | 36                                                  |
| <b>100:60</b>           | 12                                                  |

If the curing takes place by means of radio frequency curing, in curing chambers at elevated temperatures or by hot curing, the post curing time will be reduced. Our Technical Service department can assist in establishing the necessary post curing times. During the post curing period, the structures should not be exposed to strains which may weaken the glue bond.

## b) Finger Jointing

Finger joints can either be cured in a heated workshop, or the curing can be accelerated by means of hot dies, radio frequency heating or by pre-heating the wood. The curing is dependent on the achieved temperature of the glue line. The following table shows the time to full bending strength.

| <b>Glue Line<br/>Temperature<br/>(°C)</b> | <b>Curing Time to Full Bending Strength<br/>(hours)</b> |                        |
|-------------------------------------------|---------------------------------------------------------|------------------------|
|                                           | <b>20 pbw hardener</b>                                  | <b>50 pbw hardener</b> |
| <b>20</b>                                 | 16                                                      | 5                      |
| <b>25</b>                                 | 6½                                                      | 2½                     |
| <b>30</b>                                 | 3½                                                      | 1                      |

At higher curing temperatures the time to full bending strength and time to full water resistance can be considered equal. The following table shows the time to full water resistance from 20 to 80°C.

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| Glue Line Temperature (°C) | Curing Time to Full Water Resistance |                 |
|----------------------------|--------------------------------------|-----------------|
|                            | 20 pbw Hardener                      | 50 pbw Hardener |
| 20                         | 72 hours                             | 12 hours        |
| 25                         | 15 hours                             | 4 hours         |
| 30                         | 7 hours                              | 2 hours         |
| 35                         | 210 mins                             | 1 hour          |
| 40                         | 90 mins                              | 30 mins         |
| 45                         | 50 mins                              | 18 mins         |
| 50                         | 30 mins                              | 12 mins         |
| 55                         | 17 mins                              | 8 mins          |
| 60                         | 10 mins                              | 5 mins          |
| 65                         | 7 mins                               | 4 mins          |
| 70                         | 5 mins                               | 210 secs        |
| 75                         | 210 secs                             | 150 secs        |
| 80                         | 150 secs                             | 105 secs        |

With radio-frequency pre-heating of the ends, the temperature in the glue-line will drop at 5 – 10°C/minute depending on the temperature of the materials and the achieved glue-line temperature. Experiments have shown that with a glue-line temperature of 75 – 80°C when pressure is applied, the time to 100% water resistance will be 10 minutes. At 55 – 60°C, the time to full water resistance will be 2 hours.

With radio-frequency pre-heating of the ends, the lowest recommended temperature when pressure is applied is 55°C. With radio-frequency curing, the glue-line temperature should be at least 60 – 70°C after the press.

## Cleaning

With mixed application systems, the mixing and application equipment must be cleaned at the end of each working day. The application equipment can be easily cleaned with warm water (40 – 60°C). If the glue mix thickens in the application equipment, the equipment must be immediately emptied and cleaned, otherwise there is a risk that the glue will cure. Cured glue is insoluble and must be scraped off. Before flushing of the equipment with warm water is started, the water pipes must be drained of cold water, as the thickened glue is insoluble in cold water.

Advice on safe handling of glue remainders and wash water can be found in our Technical Information leaflet No. 2E “Waste handling”.



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## Safety Precautions

Reference is made to the Safety Data Sheet for Prefere 4535 and hardeners Prefere 5035 and Prefere 5046.

When the adhesive and the hardener are mixed a chemical reaction will start. The pH of the mixture will be in between the values for the adhesive and hardener. The free formaldehyde content for the adhesive will be reduced. The acid/salt concentration of the hardener will be diluted.

When handling the adhesive, the hardener and the glue mix, it is recommended that certain precautions normally taken when handling chemicals is observed. Skin contact with the uncured glue should be avoided, since people with particularly sensitive skin may be affected. It is recommended to wear protective gloves, likewise eye protection where there is a risk of splashes. Hands and forearms should be thoroughly washed with soap and warm water at the end of the working day.

Adequate ventilation of the workshops should be maintained.

## Notice

The use of these products and trademarks for the purposes of research and in scientific and academic publications is not permitted without prior consent. For details, please contact our technical services department.

The manufacture of laminated timber structures is normally subject to control procedures implemented by the authorities or other regulatory bodies. To satisfy these requirements certain guidelines have to be followed in the production. These guidelines vary from country to country. They may, on some points, differ from the instruction given in this Data Sheet. In such cases the manufacturer must obey the applicable regulations.



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## Caution

TS Resins adhesives and hardeners are generally quite harmless to handle provided that certain precautions normally taken when handling chemicals are observed. The uncured materials must not, for instance, be allowed to come into contact with foodstuffs or food utensils, and measures should be taken to prevent the uncured materials from coming into contact with the skin, since people with particularly sensitive skin may be affected. The wearing of impervious rubber or plastic gloves will normally be necessary; likewise the use of eye protection. The skin should be thoroughly cleansed at the end of each working period by washing with soap and warm water. The use of solvents is to be avoided. Disposable paper – non cloth – towels should be used to dry the skin. Adequate ventilation of the working area is recommended. These precautions are described in greater detail in Material Safety Data sheets for the individual product. These are available on request and should be referred to for fuller information.

*The suggestions given in these notes are based on data gained from experience and tests. However, since operating conditions in the user's plant is beyond our control, we cannot assume responsibility for any risks or liabilities, which may result from the use of our products. The information provided were believed by TS Resins Ltd. to be accurate at the time of preparation, or obtained from sources believed to be generally reliable. TS Resins Ltd. makes no warranty concerning their accuracy, and TS Resins Ltd. will not be liable for claims relating to any party's use of or reliance on information or recommendations contained herein, regardless of whether it is claimed that the information or recommendations are inaccurate, incomplete or otherwise misleading. Further, TS Resins Ltd. makes no warranty concerning any product, except that the product shall conform to contracted specifications.*

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