

# Technical Data Sheet

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## Prefere 4040

Liquid phenol-resorcinol adhesive for the wood industry

### Use

Prefere 4040 is a phenol-resorcinol adhesive that is mainly used in the manufacture of load bearing timber structures. It can also be used for products exposed to high humidity such as windows and outer doors, garden furniture, playground equipment etc.

When the gluing is carried out in accordance with the instructions in this Technical Data Sheet, Prefere 4040 gives waterproof and weatherproof bonds, conforming to Adhesive Type I of the European standards for adhesives for load-bearing timber structures (EN301:2023).

Prefere 4040, with hardeners Prefere 5835, Prefere 5839 and Prefere 5840 is tested by MPA, Otto-Graf-Institut, Stuttgart and NTI (Norsk Treteknisk Institutt) according to EN301:2023 and EN302-6, and fulfils the requirements for the gluing of load-bearing wooden structures, structural finger joints and cross-laminated timber (CLT) according to EN14080:2013, EN15497:2014 and EN16351:2021.

The adhesive system fulfils the requirements according to EN301:2023, and is classified as a general purpose and finger jointing adhesive for mix-in and separate application use, for the gluing of Norway spruce (*Picea abies*), Scots pine (*Pinus sylvestris*) and Silver fir (*Abies alba*), with the following class designations:

EN301-I-90-GP-0,6-M-w	(valid for all hardeners)
EN301-I-90-GP-0,3-S-w	(valid for hardener Prefere 5835 only)
EN301-I-90-FJ-0,1-M-w	(valid for all hardeners)

Prefere 4040 with hardener Prefere 5835 was tested positively according to EN302-2 with regard to the bonding of laminated veneer lumber (LVL) in beech with mix-in application. For details on gluing beech LVL, please contact our technical service department.

Prefere 4040 is approved with hardeners Prefere 5835, 5839 and 5840, according to JIS K 6802 and fulfils the requirement for production of glued laminated timber and finger jointing according to JAS MAFF.



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Prefere 4040 is approved for the use in production of load bearing timber structures by FCBA (France).

Provided that Prefere 4040 is used according to the instructions in this technical data sheet, the end-products will exhibit minimal emissions.

## Technical Data for the Adhesive

	<b>Prefere 4040</b>
<b>Appearance</b>	Reddish brown, viscous liquid
<b>Viscosity at 25°C (mPas)</b>	4000 – 10000
<b>Solids Content (%)</b>	57.0 – 59.0
<b>pH</b>	8.0 – 9.0
<b>Density at 25°C</b>	1.13 – 1.17
<b>Water dilutability</b>	indefinite

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

## Storage of the Adhesive

The storage stability of Prefere 4040 is temperature dependent. At 20°C it may be stored for 12 months from the date of production. The shelf live will be longer at lower temperatures. However, at lower temperatures the viscosity will be higher and may prove difficult to pump. The adhesive tolerates freezing but must be thawed out carefully to avoid overheating. Containers should be kept well sealed to prevent skin formation. Prefere 4040 is not flammable.

## Technical Data for the Hardener

	<b>Prefere 5835</b>	<b>Prefere 5839</b>	<b>Prefere 5840</b>
<b>Appearance</b>	Light brown liquid	Light brown liquid	Light brown liquid
<b>Viscosity at 25°C (mPas)</b>	2000 – 10000	3500 - 12000	3500 – 12000
<b>Density at 25°C</b>	1.19 – 1.23	1.18 – 1.22	1.22 – 1.26

\* Viscosity is measured by Brookfield, RVT, spindle 4 at 20 rpm. The hardener will change viscosity during storage, within the above specification, with the largest change occurring within the first 14 days after production.

## Storage of the Hardener

The hardeners may be stored for 6 months in the original containers. Optimum storage temperature is 20-25°C. Depending on storage conditions phase separation may occur. This is easily dispersed by stirring and will not affect their overall performance.



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## The Wood

The European production standards EN14080:2013, EN15497:2014 and EN16351:2021 dictate the material properties, the composition, and the moisture content of laminated timber structures. 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 4040 can be used for bonding a wide range of species and applications. For further details, please contact your TS Resins Ltd sales contact.

## Preparation of the Glue Mix

Prior to mixing, the mixing and application equipment must be clean.

The mixing ratios are given in the table below:

	Parts by Weight
<b>Prefere 4040</b>	100
<b>Prefere 5835, 5839 or 5840</b>	20

To obtain bonds of maximal water resistance it is essential that the correct hardener dosage is used. Heat is evolved from the reaction between adhesive and hardener. Therefore, it is recommended to prepare small batches with simultaneous cooling of the glue mix.

The use of automatic metering/mixing equipment is recommended for mixing Prefere 4040 with the hardeners.

## Pot Life

The adhesive and hardener will start reacting with each other once they are mixed, and the reaction will proceed until the glue is completely cured. How long this reaction takes depends on the temperature of the glue mix. Consequently, the temperature of the glue mix affects the pot life *ie* how long the glue mix remains usable. The higher the temperature, the shorter the pot life will be.

The table below gives the pot life of Prefere 4040 with the hardeners at various temperatures.

	Pot life in minutes		
	15°C	20°C	25°C
<b>Prefere 5835</b>	330	195	90
<b>Prefere 5839</b>	150	105	70
<b>Prefere 5840</b>	105	60	45



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If the glue mix becomes too viscous to be used, the mixing and application equipment should be emptied and cleaned immediately.

## Glue Spread

In the manufacture of laminated timber structures the adhesive should be applied to one surface only at an application rate of 250 – 500g/m<sup>2</sup> if a ribbon spreader is used, and at an application rate of 125 – 250 g/m<sup>2</sup> (applied to both surfaces) if a roller spreader is used. Application to both surfaces is advantageous when bonding difficult to bond woods, or for other special applications.

A lower glue spread can be sufficient, depending on production technique, planing quality, assembly time required and press method. This should only be done after seeking technical advice from TS Resins Ltd.

EN14080:2013 requires that the application method used in finger jointing shall ensure that all finger surfaces are covered with adhesive. To ensure satisfactory glue coverage, application of glue to both members to be bonded is recommended. The glue spread may be one member only, if it is documented that the requirement is fulfilled.

## Assembly Time

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

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 when bonding softwood. For the gluing of hardwood and dense materials, longer closed assembly times may be required.

Maximum closed assembly time depends on the glue spread rate, 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 assembly time will be. Provided the lamellae are assembled immediately after glue application, the maximum assembly times for softwoods with the different hardeners at 20°C and 65% relative humidity are stated in the table below.



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	Maximum Closed Assembly Time (minutes)		
	Temperature (°C)	350 g/m <sup>2</sup>	450 g/m <sup>2</sup>
<b>Prefere 5835*</b>	<b>20</b>	150	180
	<b>25</b>	100	120
	<b>30</b>	45	60

\* With separate application it is important to avoid dry out of the hardener.

	Maximum Closed Assembly Time (minutes)	
	Temperature (°C)	350 g/m <sup>2</sup>
<b>Prefere 5839</b>	<b>20</b>	70
<b>Prefere 5840</b>	<b>20</b>	50

Under all circumstances the glue must still be tacky when the pressure is applied. Glue being squeezed out of the glue line when the pressure is applied indicates that the assembly time was 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> for softwoods and 0.8 – 1.2 N/mm<sup>2</sup> for 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, thus it should be therefore determined accordingly. For most softwood an end pressure of the order of 5 – 8 N/mm<sup>2</sup> will be sufficient for finger joints over 25mm 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.



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## Pressing Times

### a) Cold Bonding

The minimum pressing times when manufacturing straight beams with a maximum glueline thickness of 0.1mm are given in the table below. For thicker gluelines, additional pressing time is required.

	Pressing time in minutes			
	20°C	25°C	30°C	40°C
<b>Prefere 5835</b>	285	210	95	40
<b>Prefere 5839</b>	165	105	60	20
<b>Prefere 5840</b>	150	90	50	10

The above stated times are the shortest pressing times when laminating straight softwood beams. When bonding curved structures, the times must be extended depending on the radius of curvature.

When bonding hardwoods or preservative treated wood, longer pressing times might be necessary and/or higher workshop air temperatures than those mentioned above may be required.

When bonding at elevated temperatures in curing chambers, the time required to reach the desired temperature in the glue line must be added to the pressing times in the table. The additional time depends on the chamber temperature, on the initial temperature of the wood and on the width of the lamination.

### b) Radio Frequency (RF) Heating

Prefere 4040 is 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 required pressing times using trials

TS Resins Ltd Technical Services department can advise on establishing suitable pressing times and how to conduct glue line temperature measurements when radio frequency heating is employed. A typical glue line temperature will be in the range 60 – 80°C in combination with a wood temperature of 35 – 40°C, but this can be higher or lower, depending on the type and settings of the press.

### c) Post Curing

After expiration of the pressing time the adhesive is sufficiently cured to allow for machining. Full water resistance of the bonds will be reached after 2 days, when using hardener Prefere 5835, and after 1 day when used with hardeners Prefere 5839 or Prefere 5840, when bonded and cured at 20°C. During this post-curing period, the structures should not be exposed to strains that may weaken the glue bond.



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## d) Finger Jointing

Finger joints can either be cured at room temperature, by means of heat or radio frequency heating. It is recommended to establish the minimum curing time by running trials on the production line.

## Cleaning

The mixing and spreading equipment must be cleaned at the end of the working day. If the glue 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. Warm water (50 – 60°C) is recommended for cleaning.

Phenol-resorcinol glue is a potential water pollutant. Glue remainders and untreated wash water may not be discharged into public drains or watercourses unless a permit has been obtained from the appropriate authorities. Advice of safe handling of glue remainders and wash water can be found in our Technical information Leaflet No. 2E “Glue Waste Disposal – Prevention of Pollution”.

## Safety Precautions

Reference is made to the Safety Data Sheets for Prefere 4040 and hardeners Prefere 5835, 5839 and 5840.

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 the hardener. The free formaldehyde content for the hardener and the free phenol and resorcinol contents of the adhesive will be reduced.

When handling the adhesive, hardener and the glue mix it is recommended that certain precautions normally taken when handling chemicals are 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 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 instructions given above. 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 use of TS Resin's products for the purpose of research and in scientific and academic publications is not permitted without prior consent. For details, please contact you TS Resins Ltd sales contact.*

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