

## 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 water- and weather proof bonds, conforming to Adhesive Type 1 of the European standards for adhesives for load bearing timber structures (EN 301:2013).

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 EN 301:2013 and DIN 68141:1995-08 and fulfils the requirements for the gluing of load-bearing wooden structures, structural finger jointing and Cross laminated timber (CLT) according to DIN 1052, EN 14080:2013, EN 15497:2014 and EN 16351:2015.

The adhesive system fulfils herewith the requirements according to EN 301:2013 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:

EN 301-I-90-GP-0,6-M	(valid for all hardeners)
EN 301-I-90-GP-0,3-S	(valid for hardener Prefere 5835 only)
EN 301-I-90-FJ-0,1-M	(valid for all hardeners)

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.

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

Appearance	Brownish, viscous liquid
Solids content (2 h at 120°C)	55-57%
Viscosity at 25°C	4000-10000 mPa.s *
pH at 25°C	8-9
Density at 25°C/4°C	1,15±0,02 g/cm <sup>3</sup>
Water dilutability	Indefinite

\*The viscosity is measured by Brookfield, RVT, spindle 4 at 20 rpm.

## Storage of the adhesive

The storage stability of the adhesive is temperature dependent. At 20°C it may be stored for 12 months from the date of production. The shelf life is longer at lower temperatures but the viscosity will be higher and the adhesive might be difficult to pump. The adhesive tolerates freezing but must be thawed out carefully to avoid overheating. Containers should be kept well closed to prevent skin formation.

Customers who receive bulk supplies of Prefere 4040 to their own storage tank are referred to our Technical Information Leaflet No. 5E "Bulk storage and handling of liquid resins" which contains useful advice on storage of resins and operation of storage tanks. Prefere 4040 is not flammable.

## Technical data for the hardeners

	Prefere 5835	Prefere 5839	Prefere 5840
Appearance	Light brown liquid	Light brown liquid	Light brown liquid
Viscosity at 25°C	2000-10000 mPa.s	3500-12000 mPa.s	3500-12000 mPa.s
Density at 25°C/4°C	1,21±0,02 g/cm <sup>3</sup>	1,20±0,02 g/cm <sup>3</sup>	1,24±0,02 g/cm <sup>3</sup>

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

## Storage of the hardeners

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.

## The wood

All data for assembly time, pressing time and time to full water resistance refers to production using Norway Spruce (*Picea abies*). However, Prefere 4040 can be used for a wide range of species. For details, please contact Dynea's Technical Service Department.

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

For other applications higher or lower moisture contents might be suitable.

## Glue mix preparation

Prior to mixing, the mixing and application equipment must be clean. The mixing ratios are given in the table below.

Prefere 4040	100 pbw
Prefere 5835, 5839 or 5840	20 pbw

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 hardener.

### Pot life

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

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

If the glue mix becomes too viscous to be usable the mixing and application equipment must be emptied and cleaned immediately.

### 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 surfaces) if a roller spreader is used. Application to both surfaces is advantageous when bonding difficult-to-bond woods. 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 Dynea.

EN 14080:2013 requires that the application method used in finger jointing shall ensure that all finger surfaces are covered with the adhesive. To ensure satisfactory glue coverage, application of glue to both members to be jointed is recommended. The glue spread may be to only one member 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 in open (from glue application until assembly of the adherents) and closed assembly time (from assembly until pressure is established).

Open assembly time should be kept as short as possible and should not exceed 5 min. On the other hand, 5 -15 minutes closed assembly is beneficial, in particular when dense wood is being bonded.

Maximum closed assembly time depends on the glue spread rate, wood species, temperature and moisture content of the wood, 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 will the assembly time be. Provided the lamellas are assembled immediately after glue application the maximum assembly times for the different hardeners at 20°C and 65 % relative humidity are stated in the tables below.

	Temp. in °C	Assembly time in minutes with 350 g/m <sup>2</sup>	Assembly time in minutes with 450 g/m <sup>2</sup>
Prefere 5835*	20	150	180
	25	100	120
	30	45	60

	Temp. in °C	Assembly time in minutes with 350 g/m <sup>2</sup>
Prefere 5839	20	70
Prefere 5840	20	50

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

This applies to softwood. 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> 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, thus it should therefore be determined accordingly. For most softwoods an end pressure of 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 curing

The pressing times depend mainly on the type of hardener used and the glue line temperature and are stated in the table below.

	Pressing time in minutes at temperature			
	20°C	25°C	30°C	40°C
Prefere 5835	330	240	105	40
Prefere 5839	240	150	90	20
Prefere 5840	180	105	60	10

The above stated times are the shortest pressing times when laminating straight softwood beams. When bonding curved structures the times have to 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 the above mentioned minimum temperature of 20°C 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.

### **Radio frequency curing**

Prefere 4040 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.

Our Technical services Department can advise on establishing press times and how to make 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. It can be either higher or lower depending on the type and settings of the press.

### **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 2-3 days when bonding at room temperature. During this post-curing period the structures should not be exposed to strains that may weaken the glue bond.

#### **b) 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 times by trials in 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. Cured glue is insoluble and must be scraped off. Warm water (50-60°C) is recommended for cleaning.

For separate application with Dynea Washless System the need for cleaning is reduced significantly compared to mixed application systems since there is no glue-mix and the system is protected from dry-out.

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 on safe handling of glue remainders and wash water can be found in our Technical Information Leaflet No. 2E "Glue waste disposal - Prevention of pollution".

Dynea AS has developed a special method for the treatment of spillage and wash water containing phenol-resorcinol glue and delivers complete treating units utilizing this method.

## Safety precautions

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

When the adhesive and the hardener are mixed a chemical reaction will start. The pH of the mixture will be in between the value for the adhesive and the hardener. The free formaldehyde content of the hardener and free Phenol content of the adhesive will be reduced.

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 Dynea's 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 service department.*

The manufacture of laminated timber structures normally is 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 regulations applicable.

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Replaces Technical data-sheet for Prefere 4040 dated 04.2016

RB/TS 01.2018