

Technical Data Sheet

Wood & Specialty Adhesives

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Prefere 4535

Liquid melamine-urea resin adhesive for the wood industry.
Separate and mix-in application

Use

Prefere 4535 is a liquid melamine-urea resin adhesive, which is used together with the liquid hardeners Prefere 5035 or Prefere 5046 in the manufacture of glued laminated timber structures and for finger-jointing. When the gluing is carried out in accordance with the instructions in this Technical Data Sheet, Prefere 4535 gives water- and weatherproof, gap-filling bonds, conforming to Adhesive Type I of the European standards for adhesives for load-bearing wooden structures (EN 301 and EN 302). The glue lines are light-coloured and do not darken over time.

Nordisk Limtrememnd (The Nordic Glulam Committee) has approved Prefere 4535 with hardeners Prefere 5035 and Prefere 5046 for use in the manufacture of load-bearing wooden structures for climate class 1, 2 and 3 (interior and exterior use) from coniferous woods.

Prefere 4535 with hardener Prefere 5035 and Prefere 5046 has been tested according to the German Standard DIN 68 141 by the MPA, Otto-Graf-Institut Stuttgart in Germany and found to be suited for gluing load-bearing wooden structures for interior and exterior use in accordance with DIN 1052.

Prefere 4535 is approved for the use in production of load-bearing wooden structures by CTBA (France), KOMO (Holland) and BUTgb (Belgium). For details please contact our marketing department.

Prefere 4535 is also well suited for a number of other bonding operations. It can be used for hot and cold bonding and for bonding under radio frequency glue line heating conditions.

Prefere 4535 has low formaldehyde content and therefore offers the possibility to maintain a healthy working environment and at the same time achieve glue bonds exhibiting minimal formaldehyde emissions.

Finger joints

Prefere 4535 is a very well suited and flexible system that is extensively used for making finger joints. (Approved with 15 to 60 parts hardener with Prefere 5035 and 15-60 parts hardener with Prefere 5046) For more information on this subject please refer to a separate the Technical data sheet Prefere 4535-Fingerjoint.

Technical data for the resin

Appearance	Milky white liquid
Solids content	63-65 %
Viscosity at 25°C	3000-3500 mPa.s
pH at 25°C	9.5-10.0
Density at 25°C	1.22-1.24 g/cm ³

Storage of the resin

Depending on the storage temperature Prefere 4535 may be stored for up to 6 months. The table below shows the shelf life (from the date of production) for Prefere 4535 at different storage temperatures.

Storage temperature	Shelf life
5-10°C	Approx. 6 months
15°C	Approx. 5 months
20°C	Approx. 4 months
25°C	Approx. 3 months
30°C	Approx. 2 months

The optimal storage temperature is 10-15°C. Cold resin is high in viscosity and may be difficult to pump.

Customers who receive bulk supplies of Prefere 4535 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 4535 is not flammable.

Technical data for the hardeners

	Prefere 5035	Prefere 5046
Appearance	Greyish-white liquid	White liquid
Viscosity at 25°C	Approx. 3000 mPa.s	approx. 3000 mPa.s
pH at 25°C	Approx. 1.0	approx. 2.0
Density at 25°C	Approx. 1.3 g/cm ³	approx 1.1 g/cm ³

Hardener storage

Prefere 5035 may be stored for up to 6 months in the original containers. It must not be allowed to freeze. Prefere 5046 has a storage stability of approximately 4 months when stored in original containers at temperatures between 5 and 25°C.

The wood

The European standard EN 386 requires that only species or a mixture of species proven to be suitable for the production of laminated timber structures should be used. The timber shall be strength graded in conformity with EN 518 or EN 519. At assembly, the moisture content of each lamination shall be in the range of 8 % to 15 %. The range of moisture content of the laminations in a member shall not be greater than 4 %.

EN 386 also specifies that the major part of the curing shall take place in an area with a temperature of at least 20°C for an initial wood temperature above 18°C and at least 25°C for an initial wood temperature above 15°C. Colder wood than 15°C should not be bonded.

Glue mix preparation

The reactivity of the glue mixture can be adapted to the users production requirements (pot life, assembly time and pressing time). The following glue mixes are approved for laminated timber structures.

Prefere 4535 (pbw)	100
Hardener Prefere 5035 (pbw)	15-35
Hardener 5046 (pbw)	15-60

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.

Separate application of glue and hardener

Prefere 4535 and hardeners Prefere 5035 and 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 for the adhesive. Three ribbon spreaders, ECOTOP T350 from Oest, Type 30-2K-G from DWT (Both Dynea Washless System) and Type 2800 from Mixon have proven to work very well. These ribbon spreaders ensure correct ratio between adhesive and hardener and keep the application rate of the two components constant.

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

Mix-in application of a glue and hardener

These glue mixes are suited for automatic metering/mixing equipment. If resin and hardener are mixed by hand, one should be aware that the resin has a different specific gravity than the hardeners. In order to obtain a homogeneous glue mix it is therefore advisable to stir from the bottom.

Pot life

Heat is evolved when resin and hardener are mixed. More heat is evolved the higher the initial resin temperature is. Once resin and hardener are mixed, the curing reaction starts. This reaction will cause increased viscosity and proceeds until the resin is cured completely. The reaction rate will increase with temperature and amount of hardener. The pot life (the time to unusable viscosity) for the different glue mixes is given in the table below.

Glue :Hardener	Pot life in hours at			
	15°C	20°C	25°C	30°C
100:15	3 ¼	2 ¼	1 ⅓	¾
100:20	2 ½	1 ⅔	1	⅔
100:25	2 ¼	1 ⅓	¾	½
100:30	2	1 ¼	¾	⅓
100:35	1 ¾	1	½	¼

Glue spread

In the manufacture of laminated timber structures the adhesive should be applied to one surface only at a rate of 250-500 g/m² if a ribbon spreader is used, and at a rate of 125-250 g/m² coated surface (application to both surfaces) if a roller spreader is used. Application to both surfaces is advantageous when bonding difficult-to-bond wood species. 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.

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. On the other hand, 10-15 minutes closed assembly is beneficial, in particular when dense wood is being bonded.

Maximum closed assembly time depends first of all on the glue spread rate and hardener dosage, further on 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 given hardener dosages are in the table below.

Separate application		Maximum closed assembly time in minutes			
		25 pbw	30 pbw	35 pbw	60 pbw
Prefere 5035	20°C 250 g/m ²	60	60	45	-
Prefere 5035	20 °C 350 g/m ²	90	80	75	-
Prefere 5046	20°C 250 g/m ²	80	75	75	75
Prefere 5046	20°C 350 g/m ²	120	110	110	110

Mix-in application		Maximum closed assembly time in minutes				
		15 pbw	20 pbw	25 pbw	30 pbw	35 pbw
Prefere 5035/5046	20°C 400 g/m ²	150	150	120	105	90
Prefere 5035/5046	25 °C 400 g/m ²	100	100	80	75	60

The times apply to softwood when the relative humidity of the air is approx. 65 %.

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/mm² with softwoods and 0.8-1.2 N/mm² with hardwoods. In other bonding operations a lower pressure may be sufficient.

Pressing times

The pressing times table can be used for Prefere 5035 and Prefere 5046.

a) *Laminated timber structures*

In the table below, the minimum pressing times when manufacturing straight beams according to EN 386 are given. Curved structures require extended pressing times. The smaller the radius of curvature, the longer pressing times are required.

Glue :Hardener	Pressing time in hours at different glue line temperatures			
	20°C	25°C	30°C	40°C
100:15	12	5 ½	3 ¼	1
100:20	9	4 ½	2 ½	¾
100:25	6 ½	3 ½	1 ¾	½
100:30	5 ¼	2 ¾	1 ½	½
100:35	4 ½	2 ½	1 ¼	½
100:60*	4 ½	2 ½	1 ¼	½

*Only valid with hardener Prefere 5046.

If the process always gives a thin glue line (Approx. 0,1 mm), the pressing times in the table below which will give enough strength for handling the beams, can be used.

Pressing time in hours at 20°C with 0,1 mm glue line				
Prefere 5035		Prefere 5046		
100:25	100:35	100:25	100:35	100:60
6	4	4 ½	3	3

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. Norsk Treteknisk Institutt (The Norwegian Institute of Wood Technology, NTI) has developed a model for calculating the degree of curing of the adhesive in the manufacture of laminated timber structures. The model is based on the assumption that the curing of the adhesive proceeds during the heating-up in the curing chamber, but the rate of curing increases as the temperature at the glue line increases. The model calculates the degree of curing for each °C temperature increase at the glue line and adds these contributions to the curing. In this way a measure is obtained of the degree of curing which can be used to determine when the adhesive is sufficiently cured that the pressure can be released. It is assumed that the adhesive does not necessarily have to be fully cured over the total cross section when the pressure is released. The adhesive in the outer part of the structure will be sufficiently well cured that the laminations are held together while the glue in

the core continues to cure even after the pressure is released. Our Marketing Department will assist in calculating the necessary pressing time.

After expiration of the above pressing times the adhesive is sufficiently cured to allow for machining. Full water resistance of the bonds will, however, only be reached after some time. The necessary time for post-curing depends on the glue mix, pressing time and the temperature during pressing and post-curing. The following table shows after curing times with pressing and storage at 20°C

Glue: Hardener ratio	Time to water resistance at 20°C
100:15	72 hours
100:35	36 hours
100:60	12 hours

If the glue is cured by means of radio frequency, a post-curing time of a few hours may be sufficient. If the curing takes place in heated chambers at 40-60°C air temperature, the post-curing time be reduced. Our Marketing Department will 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) Hot-bonding

Glue :Hardener	Pressing time in minutes at different glue line temperatures					
	50°C	60°C	70°C	80°C	90°C	100°C
100:15	20	6	3	2 ½	1 ¼	½
100:20	15	5	2 ½	2	1	½
100:25	10	4	2	1 ½	¾	½
100:30	8	3	2	1 ¼	¾	½
100:35	6	2	1 ¾	1	¾	½

The pressing times (basic times) stated refer to glue line temperatures only and allowance must be made for the heat to travel from the press platens. Heat penetration will vary according to the density and the moisture content of the wood and the distance to the farthest glue line. The table below gives a guide to the additional time required for low and medium density woods:

Press temperature	Additional time per mm distance to the farthest glue line
50-60°C	3 minutes
70-80°C	2 minutes
90-100°C	1 minute

c) *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.

Our Marketing Department can advice 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, but it can be both higher and lower depending on the type and settings of the press.

Cleaning

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.

With mixed application systems, the mixing and application equipment must be cleaned at the end of each working day. If the glue mix thickens in the application equipment, the equipment must be immediately emptied and cleaned because otherwise there is a risk that the glue will cure. Cured glue is insoluble and must be scraped off.

Cleaning is most easily done with warm water (40-60°C). However, as this glue has very good washability, fresh glue mix can be washed with water with temperatures down to 25°C. Before flushing of the equipment is started, the water pipes should be drained of cold water.

Melamine-urea resins are potential water pollutants. 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".

Safety precautions

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

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 for the adhesive will be reduced. The acid/salt concentration of the hardener will be diluted.

When handling the adhesive, the hardener and the gluemix, 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 underarms 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 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.

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 that may result from the use of our products.