



Technical Data Sheet

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Prefere 4050

Liquid phenol-resorcinol adhesive for the wood industry

Use

Prefere 4050 is a phenol-resorcinol adhesive that is mainly used in the manufacture of load bearing timber structures. Furthermore, it can be used for a wide range of other, special applications, such as:

- High density wood species and chemically treated, or modified wood (eg acetylated wood or Accoya)
- Products exposed to high heat, such as heat resistant composite structures or fire resistant doors
- Products exposed to high humidity, such as windows and exterior doors, garden furniture, playground equipment *etc.*
- Boat building and marine constructions
- Improved or densified woods, such as “hydulignum”
- Gluing of wood, or wood based materials to mineral fibre reinforced boards, brick, concrete, unglazed porcelain, rigid expanded plastics such as expanded polystyrene, polyurethane and PVC, industrial and decorative laminates, leather, cork, linoleum, nylon, natural and synthetic rubber and sheet metals

When the gluing is carried out in accordance with the instructions in this Technical Data Sheet, Prefere 4050 gives waterproof and weatherproof bonds, conforming to Adhesive Type I of the European standards for adhesives for load-bearing timber structures (EN301:2013).

Prefere 4050, with liquid hardener Prefere 5750, is tested by MPA, Otto-Graf-Institut, Stuttgart, and fulfils the requirements for the gluing of load-bearing wooden structures, structural finger joints and cross-laminated timber (CLT) according to DIN1052, EN14080:2013, EN15497:2014 and EN16351:2015.



Technical Data Sheet

The adhesive system fulfils the requirements according to EN301:2013, and is classified as a general purpose and finger jointing adhesive for mix-in 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

EN301-I-90-FJ-0,1-M

Prefere 4050 is approved according to JIS K 6802 and fulfils the requirement for production of glued laminated timber and finger jointing according to JAS MAFF.

Prefere 4050 will meet the requirement according to EN314 – Class 3 (WBP) for the production of plywood for non-covered exterior use.

Prefere 4050 is resistant to acids, weak alkalis, solvents and boiling water.

Provided that Prefere 4050 is used according to the instructions in this technical data sheet, the end-products will exhibit minimal emissions.

Technical Data for the Adhesive

| | Prefere 4050 |
|---------------------------------|----------------------|
| Appearance | Reddish brown liquid |
| Viscosity at 25°C (mPas) | 400 – 1100 |
| Solids Content (%) | 52.0 – 58.0 |
| pH | 7.2 – 9.0 |
| Density at 25°C | 1.110 – 1.150 |
| Flashpoint (°C) | 31 |

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

Storage of the Adhesive

The storage stability of Prefere 4050 is temperature dependent. At 20°C it may be stored for at least 3 years. The shelf life 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.

Technical Data for the Hardener

| | Prefere 5750 |
|---------------------------------|---------------------|
| Appearance | Brown liquid |
| Viscosity at 25°C (mPas) | 13000 – 18000 |
| Solids Content (%) | 72 - 79 |
| pH | 6.7 – 8.0 |
| Density at 25°C | 1.140 – 1.180 |
| Flashpoint (°C) | 38 |

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

Storage of the Hardener

Optimum storage temperature for the hardener Prefere 5750 is between 5 – 20°C. Under these conditions the hardener may be stored for 18 months in the original containers. The hardener may show thixotropic behaviour upon standing. This tendency is worse at lower temperatures. In such cases, the material can usually be restored by shaking, stirring and/or gentle heating back to room temperature.

The Wood

All data for assembly times, pressing times and time to full water resistance refers to production using Norway spruce (*Picea abies*). However, Prefere 4050 can be used for bonding a wide range of species. For further details, please contact your TS Resins Ltd sales contact.

To ensure optimum bond quality when producing laminated timber structures, according to EN14080:2013, or for finger jointing, the lamellae should be freshly planed or profiled, and the moisture content of the wood should be between 6 – 15%, with a maximum difference in moisture content between lamellae of no more than 5%. For other gluing operations, satisfactory results may be obtained when the moisture content of the surfaces to be bonded is within the range 4 – 25%.

Preparation of the Glue Mix

Prefere 4050 must always be mixed with the hardener Prefere 5750 prior to use. To obtain bonds of maximal water resistance, it is essential that the correct hardener dosage is used.

It is essential that hardener Prefere 5750 is well stirred before pouring from the container, as the filler can occasionally separate.

Technical Data Sheet

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

Add the required amount of the hardener Prefere 5750 to the Prefere 4050 and mix thoroughly, until both are fully dispersed.

| | Parts by Weight |
|---------------------|------------------------|
| Prefere 4050 | 100 |
| Prefere 5750 | 100 |

Note The proportions may be measured by weight or volume. Since the resin and hardener have slightly different densities, but are supplied by weight, mixing by volume will result in uneven consumption of the components.

The use of automatic metering/mixing equipment is recommended for mixing Prefere 4050 with hardener Prefere 5750.

Use of Extenders

Wood flour or some mineral fillers may be added to increase the viscosity of the glue mix. However, this cannot be done for approved systems for load bearing components.

| | Lightly Filled Mix | Heavily Filled Mix |
|---------------------|---------------------------|---------------------------|
| Prefere 4050 | 100 | 100 |
| Prefere 5750 | 100 | 100 |
| China Clay | 40 | 200 |
| Water | - | ≤ 10 |

The lightly filled mix still complies with the requirements of EN 314 – Class 3 (WBP). It may be necessary to adjust the viscosity of the heavily filled mix with water, but the water addition must be kept to a minimum. This mix is suitable for bonding uneven-surfaced boards, such as mineral fibre reinforced boards, where maximum strength and full weatherproof properties are not required.

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.



Technical Data Sheet

The table below gives the pot life of Prefere 4050 with Prefere 5750 at various temperatures.

| Temperature of mix | 15°C | 20°C | 25°C | 30°C |
|--------------------|------|------|------|------|
| Pot life (hours) | 5½ | 3 | 2 | 1 |

Preparation of Materials for Bonding

Surface Preparation

The surfaces to be bonded should be free from dust or other deposits. Wood panels, laminates etc should be of uniform thickness. Solid timber should be freshly machined, but does not usually require sanding. Materials with smooth, dense surfaces, except expanded plastics and mineral fibre reinforced boards, should also be thoroughly sanded.

Metal surfaces should be abraded, degreased and coated with suitable primer before bonding to porous materials (such as wood).

Effect of Preservative Treatment

Before bonding timber that has been treated with a preservative it is necessary to machine or sand the surfaces. Also the joint moisture content should be checked since this can be increased beyond acceptable level by water borne preservatives and may need to be reduced before gluing. For gluing of load-bearing timber structures with preservative treated wood, a special approval is required. Further advice on the gluing of preservative treated timber is available on request.

Note Where preservative treatment is applied after bonding, beams and components should be conditioned for at least 7 days, at not less than 15°C before being subjected to water borne preservative treatment in pressure cylinders.

Fire Retardant Treated Wood Based Materials

When bonding FR grades of wood based materials such as MDF or particleboard it is possible that the treatment will affect the cure of the adhesive. Advice on the bonding of fire retardant timber is available on request.

Glue Spread

In the manufacture of laminated timber structures the adhesive should be applied to one surface only at an application rate of 200 – 500g/m² if a ribbon spreader is used, and at an application rate of 100 – 250 g/m² (applied to both surfaces) if a roller

Technical Data Sheet

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, 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 softwood are stated in the table below.

| Maximum Closed Assembly Time (minutes) | | |
|--|----------------------|----------------------|
| Temperature (°C) | 350 g/m ² | 450 g/m ² |
| 15 | 60 | 90 |
| 20 | 40 | 60 |
| 25 | 30 | 45 |
| 30 | 20 | 30 |

** According to EN14080:2013, the minimum allowed temperature during gluing is 18°C*

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/mm² for softwoods and 0.8 – 1.2 N/mm² 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/mm² will be sufficient for finger joints over 25mm in length. For shorter joints an end pressure of 8 – 12 N/mm² 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 Times

a) Cold and Hot Bonding

The minimum pressing times for gluing of softwood are given in the table below.

| Glue Line Temperature | 15°C | 20°C | 25°C | 30°C | 40°C |
|-----------------------|------|------|------|------|------|
| Pressing Time (hours) | 15 | 8½ | 6½ | 3 | 1 |

| Glue Line Temperature | 50°C | 60°C | 70°C | 80°C | 90°C | 100°C |
|-------------------------|------|------|------|------|------|-------|
| Pressing Time (minutes) | 30 | 12 | 6 | 3 | 2 | 1 |

For dense or high moisture content woods, or panel products such as MDF and moisture resistant particle board, where a component is impermeable, or if the joint is likely to be strained immediately after removal of pressure (eg as in the manufacture of curved laminated beams), the above times should be increased.

Preferre 4050 will continue to gain strength after pressing, but full water resistant properties are developed only after several days.

Technical Data Sheet

b) Heat Penetration

The pressing times stated above refer to glue-line temperatures only and allowance must be made for the heat to travel from the press platen to the glue line. Heat penetration time will vary according to the density of the wood, moisture content, and distance to the furthest glue line. The table below is a guide to the additional time required for low and medium density timbers.

| Distance to Glue Line (mm) | Heat Penetration Time in minutes per mm to Furthest Glue Line | | | | |
|----------------------------|---|------|-------|-------|-------|
| | 80°C | 90°C | 100°C | 110°C | 120°C |
| < 5 | 1.2 | 1.0 | 0.9 | 0.8 | 0.8 |
| 5 – 10 | 1.7 | 1.4 | 1.2 | 1.1 | 1.0 |
| > 10 | 2.0 | 1.7 | 1.4 | 1.3 | 1.2 |

c) Radio Frequency (RF) Heating

Preferre 4050 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 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, but this can be higher or lower, depending on the type and settings of the press.

Resorcinol adhesives heat up more slowly under glue line or stray field heating than amino resins, but curing can be accelerated by the addition of common salt (sodium chloride) at a rate of 1-2 parts by weight of salt to 100 parts by weight of resin. Precautions should be taken against arcing, which may lead to tracking and burning in the glue line. Arcing can be minimised by low spread, low moisture content and good jig design to ensure no gaps between the electrode and glue line, and sufficient and even pressure on the joint during curing.

Staining on Absorbent Boards

Light coloured absorbent boards eg mineral fibre reinforced cement boards, bonded with resorcinol phenol adhesives may tend to show signs of staining when subjected to exposure to weather or very wet conditions. This is because certain soluble materials in the uncured resin are absorbed and retained by the board and may subsequently be leached out by soaking. These materials appear as dark stains on the surface of the board, but disappear with further weathering.

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 4050 and hardener Prefere 5750.

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.



Technical Data Sheet

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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PdW 11.2017