Technical Data Sheet

Aerodux 185

Liquid phenol resorcinol adhesive for the wood industry

Use

Aerodux 185 is a phenol-resorcinol adhesive that is mainly used in the manufacture of load bearing timer 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 such as acetylated (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 outer 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 or 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, Aerodux 185 gives water- and weather proof bonds, conforming to Adhesive Type 1 of the European standards for adhesives for load-bearing timber structures (EN 301:2006).

Aerodux 185 with powder hardener HRP 150 or HRP 155 is tested by MPA, Otto-Graf-Institut, Stuttgart and NTI (Norsk Treteknisk Institutt) according to EN 301:2006 and DIN 68141:1995-08 and fulfils the requirements for the gluing of load-bearing timber structures for interior and exterior use in accordance with DIN 1052 and EN 14080:2005.
Aerodux 185 will meet the requirement according to EN 314 – Class 3 (WBP) for production of plywood for non-covered exterior use.

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 use with the following class designations:

EN 301-I-90-GP-0,6-M
EN 301-I-90-FJ-0,1-M

Aerodux 185 with Hardener HRP 150 and HRP 155 is also approved by Luftfahrt-Bundesamt for the production of glued wood products to be used in airplanes.

Aerodux 185 with HRP hardeners is resistant to acids, weak alkalis, solvents and boiling water.

Technical data for the adhesive

Appearance ***	Reddish liquid
Viscosity (25°C) *	400-1500 mPa.s
Density at 25°C/4°C	1,15±0,02 g/cm^3
Solids content (2h, 120°C)	55,0-61,0 (% w/W)
pH	7-9
Flashpoint	37°C (CC)

*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 18 months, at 25°C Aerodux 185 has a storage stability of 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.

Aerodux 185 may form a skin which should be removed before use. Depending on storage conditions phase separation may occur. This is easily dispersed by stirring and will not affect their overall performance of the adhesive.

Storage of the hardeners

The powder hardeners HRP 150 and HRP 155 have a storage stability of at least 3 years when stored cool and dry in sealed bags.

Choice of hardener

Aerodux 185 must always be mixed with a hardener prior to use. To obtain bonds of maximal water resistance it is essential that the correct hardener dosage is used.
Hardener HRP 150 gives a high-viscosity glue mix (8000-10000 mPa.s at 20°C) that dries out faster than mixes containing HRP 155. Recommended use is for joints where a viscous mix is required to limit flow, e.g. for thick glue lines, uneven surfaces, etc.

Hardener HRP 155 provides a medium-viscosity glue mix (4500-6000 mPa.s at 20°C), suitable for most gluing applications especially timber structures. This glue mix tolerates longer assembly times than a mix using HRP 150.

The wood

The European standard EN 386 specifies requirements on wood to be used for laminated timber structures. The moisture content shall be 8-15 %. The maximum allowable difference in moisture content between two adherents to be bonded together is 4 %.

EN 386 also deals with the temperature during the curing of the glue mix. Most of the curing should take place at a temperature of at least 20°C if the wood temperature is above 18°C and at a temperature of at least 25°C if the wood temperature is above 15°C. Colder wood than 15°C may not be bonded. The wood should be planed less than 24 hours before bonding.

EN 385 specifies that the timber to be finger-jointed shall have moisture content between 8% and 18%. The difference of moisture content between two ends of timber to be jointed shall not exceed 5 %.

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.

	pbw
Aerodux 185	100
Hardener HRP 150 or HRP 155	20

Add the hardener to the adhesive and mix until the hardener is fully dispersed. Then, if required add the filler, stirring it thoroughly into the adhesive-hardener mixture.
The use of automatic metering/mixing equipment is recommended for mixing Aerodux 185 with the hardeners.

Use of extenders

Wood flour or some mineral fillers may be added according to the table below to increase the viscosity.

	Lightly filled mix	Heavily filled mix
Aerodux 185	100	100
HRP hardener	20	20
China clay	20	100

The lightly filled mix with HRP 155 still complies with the requirements of EN 314 – Class 3 (WBP) and EN 301. It may be necessary to adjust the viscosity of the heavily filled mix with water but the water addition should be kept to a minimum. This mix is suitable for bonding uneven-surfaced boards such as mineral fibre re-reinforced boards and where maximum strength and full weatherproof properties are not required.

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.

The below table shows the pot lifes with HRP 155. For HRP 150 the pot lifes will be somewhat shorter.

Temperature of mixture	10°C	15°C	20°C	25°C	30°C
Pot life (time in hours)	8	5	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. Smooth dense surfaces to be bonded, except expanded plastics and mineral fibre reinforced boards should also be thoroughly sanded.

Moisture content

Satisfactory results may be obtained when the moisture content of the surfaces to be bonded is within the range 4 - 25% but for best results 12 - 16% is recommended. The European standard EN 386 specifies requirements on wood to be used for laminated timber structures. The moisture content shall be 8-15 %. The maximum allowable difference in moisture content between two adherents to be bonded together is 4 %.

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.

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 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 Aerodux 185 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 a rate of 200-500 g/m² if a ribbon spreader is used, and at a rate of 100-250 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 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 Dynea.

EN 385 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 with hardener HRP 155 are stated in the table below.

	Temp.	Assembly time with **350** g/m²	Assembly time with **450** g/m²
HRP 155	**10**°C/65% RH	120 minutes	150 minutes
	15°C/65% RH	60 minutes	90 minutes
	20°C/65% RH	45 minutes	60 minutes
	25°C/65% RH	20 minutes	30 minutes
	30°C/65% RH	10 minutes	15 minutes

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/mm² with softwoods and 0.8-1.2 N/mm² 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/mm² will be sufficient for finger joints over 25 mm 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 times for application of pressure is as follows for softwood.

Glue line temperature	10°C	15°C	20°C	25°C	30°C	40°C
Pressing time in minutes	720	360	240	180	135	60

Glue line temperature	50°C	60°C	70°C	80°C	90°C	100°C
Pressing time in minutes	30	10	6	3	2	1

For dense or high moisture content woods or panel products such as MDF and moisture resistant particleboard where a component is impermeable or if the joint is liable to be strained immediately after removal of pressure (e.g. as in the manufacture of curved laminated beams) the above times should be increased. Aerodux 185 will continue to gain strength but full water resistant properties are developed only after several days.
The above pressing times should be used as a guideline.

Heat penetration

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

Distance to the glue line	Heat penetration time in minutes per mm distance to the glue line at				
	80°C	90°C	100°C	110°C	120°C
Less than 5 mm	1.2	1.0	0.9	0.8	0.8
5 - 10 mm	1.7	1.4	1.2	1.1	1.0
More than 10 mm	2.0	1.7	1.4	1.3	1.2

b) Radio frequency heating

Aerodux 185 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 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, but it can be both higher and lower depending on the type and settings of the press.

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.
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 Aerodux 185 and hardeners HRP 150 and HRP 155.

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.

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

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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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