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TECHNICAL DATA SHEET

Resorcinol: R15 Resin
Resorcinol: RP51H Hardener

ADHESIVE DESCRIPTION:

RESORCINOL R15 RESIN is a resorcinol formaldehyde resin designed to be used in conjunction with the powder hardener **RESORCINOL RP51H** and is recommended for use in laminating and finger jointing soft wood lumber as well as some hard wood species.

The **RESORCINOL R15 RESIN / RESORCINOL RP51H** system is recommended for interior or exterior applications where a durable, strong, waterproof wood to wood bond is required. The bond formed with **RESORCINOL R15 RESIN / RESORCINOL RP51H** is capable of with-standing continuous or intermittent exposure to cold or boiling water, elevated temperature, mould and fungus attack, and common organic solvents.

RESORCINOL R15 RESIN / RESORCINOL RP51H can be cured at elevated or room temperature (above 15°C), or by radio frequency energy.

SAFETY PRECAUTIONS:

RESORCINOL R15 RESIN is manufactured from resorcinol and formaldehyde. Avoid contact with skin as it can potentially cause dermatitis in allergic persons. Hot pressing of this adhesive may release some formaldehyde emissions. Ensure there is sufficient ventilation as exposure can cause irritation to the eyes and mucous membranes.

RESORCINOL RP51H contains paraformaldehyde. Avoid contact with skin as it can irritate. Keep in a tightly closed container and do not smell the product as formaldehyde vapours will be present which may be irritating to the mucous membranes and respiratory tract.

Adequate ventilation should be provided. Rubber gloves and safety goggles should be worn during mixing, gluing and cleaning up of the glue. Wash thoroughly with water if any glue is spilt onto skin.

Material Safety Data Sheets for **RESORCINOL R15 RESIN** and **RESORCINOL RP51H** should be read before using these products.

TYPICAL ADHESIVE PROPERTIES:

The physical properties listed below are typical.

TYPICAL PROPERTIES OF RESORCINOL R15 RESIN (AT MANUFACTURE):-

Appearance: Deep red-brown liquid
Viscosity: 4.2 – 6.0 P at 25 °C (using cone and plate)
Solids: 55 – 59%
pH: 7.5 – 8.5
Flash Point: 31 °C

Dangerous Goods Class: 3 (flammable liquid)
UN Number: 1992
Hazchem Code: 3WE
Subsidiary Risk 1: 6.1 (toxic)

TYPICAL PROPERTIES OF RESORCINOL RP51H (AT MANUFACTURE):-

Appearance: Brown powder

Dangerous Goods Class: 4.1 (flammable solid)
UN Number: 2213
Hazchem Code: 1Z

TESTING STANDARDS:

RESORCINOL R15 RESIN is routinely tested to the requirements of British Standard 1204 ' Synthetic Resin Adhesives (Phenolic and Aminoplastic) for Wood' (BS 1204 Part 1 and 2 : 1979) Clauses 7 and 8 for both gap-filling and close-contact joints. **RESORCINOL R15 RESIN / RESORCINOL RP51H** meets the requirements for weather and boil resistant (WBP) grade (clauses 7 and 8).

STORAGE LIFE:

RESORCINO R15 RESIN has a shelf life of 12 months from date of manufacture at 20 °C. At temperatures greater than 20 °C the shelf life will be shortened. **RESORCINOL R15 RESIN** should be stored between 10 - 20 °C.

RESORCINOL RP51H has a shelf life of 12 months from date of manufacture at 20 °C. It must be stored in a sealed container in a dry environment.

Always use the oldest product first by rotating stock regularly.

PREPARATION OF GLUE MIX:

The **RESORCINOL R15 RESIN / RESORCINOL RP51H** system is a two part system with fillers incorporated.

	RATIO BY WEIGHT
RESORCINOL R15 RESIN	100 parts
RESORCINOL RP51H HARDENER	25 parts

TABLE 1 : Mixing ratios of resin:hardener

The recommended ratio of resin:hardener is 4:1 by weight with an allowable range of 3.9 – 4.1 parts resin to 1 part powder hardener by weight. This ratio is critical to the performance of the adhesive and must be checked quantitatively during production. It is important that the resin and hardener quantities are determined by weight not volume.

If batch mixing the hardener should be added to the resin and stirred for 5 - 8 minutes until a smooth mix is obtained. Mixing can be carried out in containers of steel, glass, wood or in galvanized or tinned vessels. Copper and brass must not be used. On NO account should leftover glue be incorporated into the next mix.

NOTE: If it is intended to cure the adhesive at temperatures above 90°C it is advisable to add up to 5% walnut shell flour (300 – 350 mesh) as this will prevent excessive penetration due to lowered viscosity.

VISCOSITY:

The viscosity of **RESORCINOL R15 RESIN, RESORCINOL RP51H** and the resulting glue mix is predominantly dependent upon temperature. At high temperatures the adhesives have a much lower viscosity and consequently are thin and will run. At low temperatures the viscosity is much higher causing the adhesive to thicken. This can result in pumping and application problems. It is generally recommended that **RESORCINOL R15 RESIN** and the resulting glue mix be maintained at 20°C to allow consistent and efficient gluing. Note that it is **crucial** that temperatures are recorded for viscosity measurements.

PREPARATION OF WOOD:

For efficient gluing the moisture content of the wood should be in the range 10 - 16% (note that this is the minimum and maximum that is acceptable and not an average). For radio frequency gluing this moisture range should be closely controlled at 12 - 15%.

Moisture contents above 16% may lead to starved glue joints due to over penetration of the adhesive whilst moisture contents below 8% can prevent penetration of the adhesive at all and also limit the permissible assembly period, particularly at temperatures above 26°C. Moisture contents of adjacent laminations should not vary by more than 3% and the range of moisture contents of all laminations in a beam should not exceed 5%.

Moisture contents outside the range specified may cause dimensional changes both during the curing process and when the laminate is in service. It is desirable to use timber having a lower equilibrium moisture content than that likely to be attained in service.

This system is not designed or recommended for use at moisture contents outside of the above recommended range.

Wood surfaces must be free of dust, dirt, wax, grease and other foreign materials. The best bonding is obtained when final surfacing of the timber has been performed immediately prior to gluing so that smooth, clean accurately fitting surfaces are provided. Surfaces should be free from raised or torn grain, skips, burns, glaze or any other imperfections, which will prevent good contact. Timber which is cupped or warped so that it will not straighten when pressure is applied should not be used.

In accordance with the Australia / New Zealand Standard Specification for the Manufacture of Glue Laminated Timber AS/NZS 1328 : 1998, laminations should not be sanded but should be planed within 72 hours preceding gluing. Whilst this 72 hour period is usually satisfactory please note that in some situations shorter time periods may be required, for example with oil-borne preservative treatment, some wood species and different production methods. The planer should provide a clean cut without bruising or damaging the wood fibres.

MANUFACTURE:

GEL TIME / POTLIFE

After mixing **RESORCINOL R15 RESIN / RESORCINOL RP51H** remains liquid for a limited period after which it gels and become unusable.

Table 2 below shows the importance of keeping the glue-mix cool to achieve a longer working life.

Pot Life: The estimated working life of the glue mix. Usually defined as two thirds of the gel time.

Gel Time: The time it takes for the glue-mix to gel. This is **not** the cure time.

GLUE MIX TEMPERATURE (°C)	15	20	25	30
POT LIFE (HOURS)	3 ¼ - 4	2 - 2 ½	1 - 1 ½	½ - ¾

TABLE 2 : Glue mix temperature and pot life of adhesive

Note that pot life is also dependent on factors such as the revolving action of roller type glue spreaders. This tends to prematurely thicken a glue mix by constantly exposing the mix to the atmosphere and encouraging evaporation of water. Use of pressure pots also shortens the pot life of a glue mix significantly.

Equipment and containers should be emptied and thoroughly cleaned with hot water when the glue mix becomes too thick to spread or no longer has sufficient working life for the assembly time being used.

Do not use RESORCINOL R15 RESIN / RESORCINOL RP51H at temperatures below 15°C as the adhesive may not cure properly.

Do **NOT** adjust the resin:hardener ratio in an attempt to lengthen or shorten the gel time as this can pose a significant risk to the bond quality.

SPREAD:

Generally a spread of 240 - 420 g/m² of double glue line is required. If hardwood substrates are used glue spreads of 240 – 350 g/m² are acceptable however for softwoods the range is typically 350 - 420 g/m² based on a double mean glue line. Usually the glue-spread is sufficient if a small and regular amount of squeeze out is formed after pressure is applied. It is important that the glue is applied evenly.

The complete package should be put under pressure before the spread surface dries out. Slight squeeze out or beading of adhesive along the edge of all the joints when pressure is applied is usually a good indication of adequate spread and that total assembly time has not been exceeded. On the other hand, excessive squeeze out may indicate that the assembly time was too short, the glue spread was too heavy or the pressure too high – or combinations of these three factors.

Spreading of only one surface is acceptable in applications where adequate production controls exist to ensure that the assembly time, adhesive spread and application of pressure are selected to ensure that good transfer of adhesive from the spread to the un-spread surface is obtained when the assembly is made. When single spreading is used the open assembly time should be reduced by about 10% at 25 °C and 15 – 20% at 30 °C. If the described production controls do not exist to guarantee this transfer then adhesive should be applied to both surfaces being bonded.

Heavier spreads should be used when long assembly times are required. They should also be used when wood and room temperatures are above 25 °C or the relative humidity is less than 50%. Lighter spreads should be used on cold timber.

ASSEMBLY TIME:

Open Assembly Time: The time period during which the glue line is exposed to the air and subject to evaporation (causing dry out).

Closed Assembly Time: The time period during which the joint is closed but not under pressure.

Total Assembly Time: The time period from the spreading of the first surface until the system is under full pressure.

The assembly time for the **RESORCINOL R15 RESIN / RESORCINOL RP51H** system varies with the amount of adhesive applied, the moisture content of the wood and other variables involved. Optimum results are usually obtained when the open assembly time is kept as short as possible (5 mins is the maximum allowed) and the closed assembly time is a minimum of 10 minutes. Total assembly time must **not** exceed the pot life of the glue mix and final pressure must be applied whilst the glue line is still wet. Table 3 below specifies the maximum allowable assembly times at various ambient temperatures.

GLUE LINE TEMPERATURE (°C)	15	20	25
MAXIMUM ALLOWABLE ASSEMBLY TIME (MINS)	60	45	30

TABLE 3 : Assembly Times Versus Temperature for RESORCINOL R15 RESIN / RESORCINOL RP51H

PRESSURE:

The pressure applied must be adequate to bring all surfaces to be bonded into intimate contact. The normal pressure range for softwood is 700 - 1400 kPa. For hardwoods pressures between 1000 - 1400 kPa are required.

Clamps should be spaced close enough to give a uniform applied pressure whilst bolts should be checked with a torque wrench to ensure that sufficient and uniform pressure is applied. If a large assembly is placed in a heated chamber for curing, the pressure should be checked several times during the first hour of heating and should be adjusted if necessary. A glue line thickness of 0.05 – 0.18 mm is recommended.

CLAMPING TEMPERATURES:

Glue line temperature determines the time that any assembly to be bonded with formaldehyde based adhesives should be kept under pressure to effect a complete cure. The rate of chemical reaction which takes place between **RESORCINOL R15 RESIN** and **RESORCINOL RP51H** Powder Hardener increases at higher temperatures. Conversely, the reaction rate is slower at lower temperatures. The rate of reaction before the adhesive is applied can be somewhat controlled by cooling the adhesive mixture to obtain a longer pot life. After the adhesive has been applied the cure rate can be speeded up by heating the glue line and/or the clamped assembly, which may allow the pressure period to be shortened. This must be monitored very carefully however.

The glue line can be heated in many ways. For example pre-heating of the timber to 20 °C or above, placing the assembly in a heated chamber, hot pressing or using resistance heaters placed adjacent to the glue line. The rate of temperature rise in the glue line will vary with each type of heat application, size of assembly and production facility. The pressure periods detailed in this document assume that the entire glue line is at the specified temperature.

CLAMPING TIMES:

This is the period under which the joint is held under pressure (it does not apply for fingerjointing). The glue line core temperature governs the rate of resin cure therefore clamp times and glue line strength development.

ROOM TEMPERATURE CLAMPING:

Minimum pressure periods of three times the pot life should be used. Although full strength will not develop during this time it is generally adequate for all normal handling.

GLUE LINE TEMPERATURE (°C)	15	20	25	30
MINIMUM CLAMP TIME (HOURS)	14	9	6	3.5

TABLE 3 : Clamp times of RESORCINOL R15 RESIN / RESORCINOL RP51H at relative glue line temperature

It is crucial that each entire glue line is maintained at temperatures of at least 15 °C throughout the clamping period.

HIGH TEMPERATURE CLAMPING:

The following minimum press times are needed to achieve a sufficient strength for the joint to be moved.

GLUE LINE TEMPERATURE (°C)	40	60	80
MINIMUM CLAMP TIME (MINUTES)	100	20	10

TABLE 4 : Press times of RESORCINOL R15 RESIN / RESORCINOL RP51H at relative glue line temperature

This adhesive system can be pressed with glue line temperatures from 15 – 100 °C. If the glue line temperature exceeds 100 °C however some problems may be encountered as the water leaves the glue line as steam. This causes the glue to bubble before it cures reducing the glue line strength.

RADIO FREQUENCY CURE:

An adjustment to the standard **RESORCINOL R15 RESIN / RESORCINOL RP51H** glue mix may be required for cure by radio frequency energy. Usually this is a simple matter of adding salt to increase the conductivity. The final bond formed is in no way inferior to that formed by cold curing. Details of a suitable glue mix are available on request.

The moisture content of wood used in radio frequency cured joints should be carefully controlled between 12 - 15% for parallel RF heating and below 10% for bulk heating. Below 12% moisture the wood cells tend to collapse and finger joint cutters can overheat. Above 15% moisture the radio frequency energy tends to pass through or across the timber in preference to the glue line. This leads to arcing of the electrical energy and burning of the wood.

CONDITIONING OF JOINTS:

During clamping the glue will gel however full strength is not obtained. Joints need to be conditioned for 2 - 3 days before further processing. The conditioning period will need to be longer at temperatures below 20 °C or if treated timber is being used. If treated timber is being glued (especially CCA) then the joints should be heated to 30 – 40 °C for 6 – 8 hours so that full cure may be achieved. If joints are machined too early there is a much higher probability that they will be broken or poor wood failure of the final bonds will result. Maximum bond strengths are reached 5 - 8 days after gluing at 20 °C.

Studies of the curing characteristics of **RESORCINOL R15 RESIN / RESORCINOL RP51H** show that this system should **not** be cured at temperatures below 15 °C. Below this temperature maximum strength is never obtained.

CLEAN UP:

Equipment should be cleaned with hot water while the adhesive is still liquid. Use of a dilute caustic solution may aid clean up (safety glasses, gloves and an apron are required when handling caustic soda as it is highly corrosive).

The use of a glue release agent on machinery will help to stop the build up of adhesive on the machinery.

TESTING:

Product made using **RESORCINOL R15 RESIN / RESORCINOL RP51H** should be routinely tested to ensure that the bonds produced meet the required standards and are suitable for the end use of the product. Nightingale Supply recommend a regular testing regime with **at least** two samples tested from each production shift.

Nightingale Supply recommend that glue log books are maintained which record at least the following measurements and information:

- batch numbers of resin and hardener
- glue gel time (specified temperature)
- ambient mill temperature
- glue mix ratio
- timber moisture
- timber temperature
- joint/surface condition
- squeeze out
- glue spread rates and evenness
- assembly times
- time under pressure (clamp time)
- any problems, abnormalities
- bond results (eg proof loader results, cleavage tests, delamination tests)