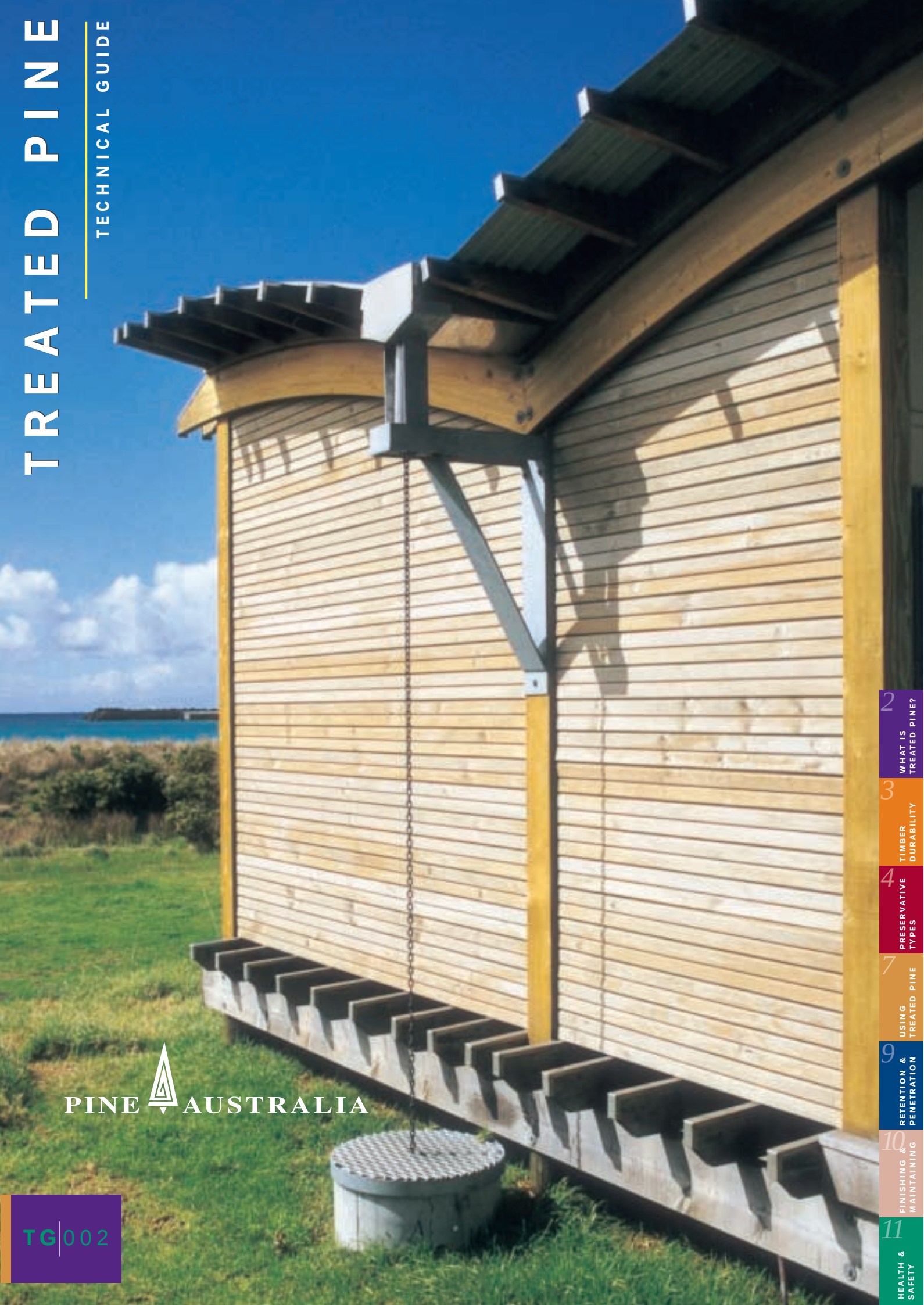
TREATED PINE

TECHNICAL GUIDE



PINE AUSTRALIA

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TECHNICAL GUIDE TO TREATED PINE

Timber in service can be subject to attack from natural enemies such as fungi, insects, and weathering. However, in most applications, timber protected from weather exposure will display adequate durability for the life of the structure. Where additional protection is required, timber durability can be enhanced through the addition of preservative chemicals.

WHAT IS TREATED PINE?

Preservative treated pine is timber that has been impregnated with a chemical solution containing two major components; fungicide and insecticide. Because the preservatives are forced deeply into the wood, treated pine has long term resistance to decay, insects and other wood destroying organisms, outliving many naturally durable timbers in exposed conditions.

This effective and lasting protection of pine enables it to be used in many applications where untreated pine is not suitable, such as pergolas, decks, cladding, retaining walls, posts and poles. As such, treated pine is a highly versatile material suitable for a wide range of applications.

TIMBER DURABILITY

Timber species exhibit a high degree of variation with respect to their structure and natural chemical constituents. Each softwood genus exhibits marked differences in cellular structure which determines its natural resistance to decay and its ability to take up preservative chemicals. Like many other commercially available timbers, untreated pine (especially the sapwood), may exhibit poor durability under exposed conditions, insect or fungal attack.

Pine† has a relatively large area of sapwood which is the younger, outer wood in a tree. This wood is less durable than the inner heartwood. One of the main reasons for this is that the sapwood cells are usually hollow with a high moisture and starch content which is conducive to decay. Heartwood cells have natural chemical deposits in them with a lower moisture content and no starch.

†*Pine is a generic term that refers to a number of Pinus species grown in commercial plantations in Australia. Pinus radiata, Pinus elliottii and Pinus caribaea are typical examples. The characteristics of some other species such as Cypress Pine and Hoop Pine are sufficiently different to be excluded from this publication.*

It is important to note that in general, the lower the moisture content of the timber, the less attractive it is to biological attack, notably by fungal organisms.

Decay is less likely to occur where the wood has a moisture content below 30 per cent. Seasoned pine (generally <15% moisture content) kept dry in service is therefore far less prone to fungal attack. It is also less attractive to insects, although there are some wood borers and termites that may attack seasoned timber.

Organisms responsible for damage to timber include decay-causing fungi and insects such as borers and termites. In sea water, immersed wood is readily attacked by marine borers. By keeping timber used in external applications protected from the weather by physical means, or through the application of water repellent coatings or paint, it is likely to display greater durability than unprotected timber - preservative treated or not!

The following table lists typical agents of timber fungal and insect attack:

Fungi	Borers	Termites
WOOD DECAYING FUNGI **Brown Rot** - attacks cellulose. **White Rot** - attacks cellulose and lignin. **Soft Rot** - usually in very moist areas. **WOOD DISFIGURING FUNGI** **Staining fungi** - e.g. blue stain, usually in areas of high temperature and humidity. Does not attack cellulose or lignin but may enable access for rot fungi. **Moulds** - coloured surface growth that may increase moisture permeability therefore enabling access for rot fungi.	**Lyctid borers** - female lyctid beetles lay their eggs under the surface of the timber and the young feed on the cellulose - not found in softwoods or the heartwood of hardwoods. **Anobiid borers** - common furniture beetles - they usually attack moist timber (18-26% m.c.) and commonly infest old furniture in both the heartwood and sapwood of softwoods. **Marine Borers** - molluscs and crustaceans found in all Australian waters but most active in warm, tropical zones.	**Subterranean termites** - living in nests in nearby trees or rotting wood, termites will forage in tunnels to find food and eat out susceptible wood. **Dry-wood termites** - only found in humid and coastal areas and do not need subterranean protection deriving their moisture requirements from the wood they ingest.

PRESERVATIVE TYPES

Three classes of preservatives are commonly used for the pressure treatment of pine timber.

1. Water-borne (Copper Chrome Arsenic [CCA], Alkaline Copper Quaternary [ACQ], Copper Azole [CuAz])

2. Solvent-borne (Light Organic Solvent Preservative [LOSP])

3. Oil-borne (Creosote, Pigment Emulsified Creosote [PEC])

Water-borne chemical solutions comprise a mixture of water soluble compounds of copper and other chemicals. In the treatment of rural fence posts, other chemicals can be included in the formulation to prevent glowing and smouldering of the wood after a fire.

Solvent based chemicals, such as LOSP, are solutions of fungicides, insecticides and in some cases water repellent chemicals. White spirit is the solvent commonly used for LOSP formulations.

Oil borne preservatives such as creosote and pigment emulsified creosote are a complex mixture of chemicals obtained from the distillation of coal tar. Being a liquid it is normally used without the addition of a solvent. Fuel oil however is sometimes added to facilitate the treatment of railway sleepers.

Comprehensive testing has established that these preservatives are highly toxic to decay-causing fungi and insects and remain active in the wood indefinitely. CCA and creosote or PEC are also extremely effective against marine borers. Treatment preservatives do not protect pine against weathering. The application of suitable surface finishes is necessary for weather protection (see Finishing and Maintaining).

However, some products may include a wax or oil additive which acts as a water repellent and aims to increase the timber's resistance to weathering. Contact your supplier.

WATER-BORNE CHEMICALS

1. Copper Chrome Arsenic [CCA]

CCA

CCA water-borne preservative is by far the most widely used preservative for the treatment of pine timber. The copper acts as a fungicide while the arsenic is also an insecticide. Chrome is included to fix the copper and arsenic to prevent them being leached from the timber. Wood treated with CCA is clean, odourless, has a slight green colour and is able to be glued and painted when dry.

Variations in the shade and intensity of the green colour of CCA treated wood are due to varying degrees of exposure to sunlight immediately after treatment. Colour therefore, cannot be used as a reliable guide to the level of preservative treatment. Also, the absence of colour in some areas of treated timber is no indication that they are untreated; use of a standard chemical indicator is the only sure way of establishing the presence of preservative.

'Fixing' of CCA preservatives occurs by a complex series of reactions. A white powder which sometimes appears on the surface of CCA treated wood up to 6 weeks after treatment is a harmless by-product of the process. These deposits are known as Glauber's Salt. They are water soluble and are easily washed or hosed off.

Pine which has been pressure treated with CCA preservative and re-seasoned **after** treatment to between 8 and 15 per cent moisture content, can be supplied as MGP or F-grade structural timber. (Specific re-drying and grading requirements should be met to ensure products are fit-for-purpose.)

2. Alkaline Copper Quaternary [ACQ]

Alkaline Copper Quaternary (ACQ) uses copper as an agent against fungal and insect attack and quaternary ammonium compounds as an added defence against fungi, termites and wood boring insects. ACQ also has a green to brown appearance that quickly weathers to brown with sun exposure. ACQ treatment is a similar process to CCA.

3. Copper Azole

Copper Azole uses copper as a fungicide and azole as a biocide/insecticide.

Copper Azole has a green colour after treatment and will gradually weather to a honey brown.

Presently, Copper Azole is only available as the proprietary brand, Tanalith E, however, other formulations of this chemical may become available.

SOLVENT-BORNE CHEMICALS

LOSP refers more to the solvent carrier in the treatment process than the actual preservatives, which comprise various solutions of organic fungicides and insecticides (such as copper naphthenates and synthetic pyrethroids). LOSP treated pine provides long lasting protection against decay and insect attack in above-ground applications.

LOSP can be used for treating appearance or structural pine timber which has been sawn or profiled. LOSP is usually clear, leaving the light coloured appearance of pine virtually unchanged, however LOSP treatment with colour pigment is also available.

OIL-BORNE CHEMICALS

Creosote treated wood is highly water repellent and resistant to weathering and so, can be used in many highly hazardous situations. Maintenance is not necessary.
At pressures of about 1400 kPa creosote provides deep and permanent treatment of pine. Because it is non-aqueous, drying of treated wood is not required. It also does not alter the timber dimensions during treatment.

The surface of creosote treated timber is generally oily and black. It cannot be painted or glued. It remains oily to handle for some months after treatment and gives off a strong odour which many people dislike. It also has a tendency to ‘bleed’ preservative on the wood surface.
For these reasons the material is seldom used in buildings.

A more recently developed variation of creosote is Pigment Emulsified Creosote (PEC). This is an emulsion of water and creosote with the same preservation abilities as creosote, but with lower volatility and mobility (less ‘bleeding’). The timber has a dry, dark brown finish after treatment.

THE TREATMENT PROCESS

Prior to treatment, all timber is seasoned (air or kiln-dried) to remove moisture that would otherwise inhibit the uptake of the preservative chemicals. For water-borne and oil-borne treatments the wood is usually dried to a moisture content of about 20 per cent (where structural timber is to be machine stress graded prior to treatment, it is dried to a level not exceeding 15%). Timber to be LOSP treated is machined to its final size and as far as practicable, all drilling, notching and end-trimming completed. LOSP treatment uses relatively low pressures. Timber distortion is minimised because the treatment is solvent based.

TREATMENT METHODS

The effectiveness of any timber treatment is dependent upon chemical penetration and retention (see page 9).

Commercial scale preservative chemical treatment is carried out by vacuum-pressure methods in large specially designed treatment cylinders. This is the most common and has proven to be the most effective treatment method.

Initially a vacuum is applied to the cylinder to remove as much air as possible from the timber so that maximum absorption can be achieved. With the vacuum maintained, the preservative is pumped into the cylinder from a holding tank. Pressure is then applied until the required uptake of preservative has occurred. At this stage the unused solution is pumped from the cylinder and the cycle completed by application of a final vacuum to remove excess preservative.

Creosote is impregnated by a method in which no initial vacuum is applied and the air trapped in the wood under pressure is utilised to expel surplus preservative when the final vacuum is drawn. Treatment is carried out with the creosote heated to about 95°C. The vacuum-pressure method can be controlled to achieve the required preservative loading and degree of wood penetration for any specified end use.

WHERE TO USE TREATED RADIATA PINE

Preservative treated pine is intended for use wherever the wood is permanently or regularly exposed externally to weather, in contact with the ground, or subjected to high moisture conditions. This applies to both structural and non-structural applications.

Treatment is also recommended for pine used internally in buildings where humid or other continuously wet conditions exist such as indoor swimming centres, 'wet' factories and greenhouses.

Preservative treatment can be used for general framing in areas of high termite risk in lieu of, or in addition to, other physical and/or chemical barriers. The following are some of the more common uses for the available types of preservative treatments.

Water-borne preservative treated pine (CCA, ACQ, CuAz): exterior wall cladding, fascia and joinery, underfloor timbers, stumps, piles and posts, roof beams exposed to the weather or interior humid conditions, pergolas, decks, retaining walls and landscaping timbers, playground equipment, fencing, farm buildings, vineyards and hop vine poles, glass house framing, cooling tower slats and marine structures.

Solvent-borne treated pine (LOSP): exterior cladding, joinery, fascia, elevated decks, pergolas, garden furniture and glue laminated components; also interior linings in bathrooms and laundries, and structural components in areas of high humidity such as indoor swimming pools.

Oil-borne treated pine (creosote, PEC): rural fencing, vineyard trellising and heavy duty uses such as marine piles, utility building poles, railway sleepers and bridge beams and decking.

Note: Because of its high electrical resistance oil-borne treated pine is also suitable for use in transmission towers and electric fences. Creosote treated pine is more difficult to ignite than untreated wood and on ignition tends to self extinguish after a short burning period. These properties are utilised in treated fence posts which are highly effective in resisting grassfires.

LIFE EXPECTANCY

The service life of preservative treated pine products is dependent upon the level of treatment given and the degree of hazard presented by the conditions of use. Please consult product suppliers for further information.

QUALITY

Many treated pine products are produced by licensed members of the Pine Australia Quality Certification Scheme (PAQCS) and bear the Pine Australia Quality Certification mark. Products marked in this way are audited by Pine Australia staff ensuring that they meet all relevant standards and codes.

The PAQCS is a national third-party quality certification scheme. For further information and a complete list of PAQCS member producers, please contact Pine Australia.

EXPOSURE HAZARD

The best indicator for appropriate use of treated pine is "hazard class" as outlined in *AS1604 - Timber-Preservative-treated-Sawn and round.* The type and degree of attack to which timber may be exposed in service is known as the "hazard". Suitable treatments are defined for each hazard class.

The Hazard Class assigned depends on a number of factors other than insect attack, including temperature, the amount of moisture prevailing in service and the nature and geographical location of the exposure environment. Higher Hazard Class numbers are indicative of a more severe hazard.

Table 1: Hazard Classes

Hazard Class	Hazard	Exposure	Suitable chemicals*	Typical Uses
H1	Insects other than termites - Lyctid and Anobiid attack	Inside, above ground	CCA, LOSP	Flooring, furniture, interior joinery
H2	Termites and Borers	Inside, above ground	CCA, ACQ, LOSP	Framing, flooring and similar used in dry situations
H3	Moderate decay, borers and termites	Outside, above ground	CCA, ACQ, CuAz , LOSP	Cladding, fascia, pergolas (above ground), joinery, framing, decking
H4	Severe decay, borers and termites	Outside, in-ground	CCA, ACQ, CuAz, Creosote	Fence posts, greenhouses, pergolas (in-ground), landscaping
H5	Very severe decay, borers and termites	Outside, in-ground, fresh water contact	CCA, ACQ, PEC, Creosote	Retaining walls, piling, House stumps, building poles, cooling tower fill
H6 or H6SW	Marine Borer attack and decay	Marine waters, northern and southern	CCA, Creosote, PEC	Boat hulls, marine piles, jetty cross bracing, landing steps & similar

Source: AS1604 - Timber-Preservative-treated-Sawn and round

** Suitable chemicals - these are subject to change based on preservative manufacturers' recommendations for product treatment and use.*
Note: "Non-structural uses" include fence posts and palings, low cost garden retaining walls and roadside barriers. "Structural uses" include poles and piles for buildings and other applications where long life is required and timber would be difficult and/or costly to replace.

RETENTION AND PENETRATION

The ability of treated pine to withstand biological attack in service is correlated with the loading of preservative and the depth and pattern of its penetration.

The preservative loading is more commonly referred to as the "retention". This is the quantity of preservative remaining in the timber after treatment and is measured as the mass of preservative chemical per unit mass of penetrated wood. Higher retentions are required for service conditions where the hazard is increased such as ground contact and in marine environments.

For all treated wood, whatever the end use, it is desirable that the preservative penetrates the cross-section as uniformly as possible from all outside surfaces in accordance with penetration levels expressed in *AS 1604-Timber-Preservative-treated-Sawn and round.*

In common with all other species, uniform penetration of preservatives is not always easily achieved with pine, because wood to be treated often contains both sapwood and heartwood which have different permeabilities. Pine sapwood is highly absorbent and readily and fully penetrated by preservative solutions under pressure. Heartwood is less permeable and more difficult to penetrate.

In practice a proportion of the timber cross section may not be completely treated despite the use of vacuum-pressure treatment methods. Sawn sections for example often show a narrow treated region on the outside of heartwood. However, treatment in accordance with the penetration requirements of Australian Standards is intended to provide sufficient protection to ensure a long service life.

If un-treated wood is exposed by cutting after treatment, an appropriate re-sealing/treatment product should be applied. For details of these products, contact your treated timber supplier.

In New South Wales and Queensland the penetration and retention of preservatives for all treated wood are required to conform with regulations under the Timber Marketing Act (1977) and Timber Utilisation and Marketing Act (1987) respectively.

These regulations are based on research and experience with treated timber in those States. Detailed information about the regulations may be obtained from State Forests of NSW and QLD Department of Primary Industries.

FINISHING AND MAINTAINING

The following information is provided to assist users in selecting the most appropriate finish for their project. Refer to product data available from the manufacturer or supplier for specific performance information.

Exposed to the weather, all timber soon changes in appearance unless it has been finished with some form of protective coating or treatment. Wood colour gradually fades to a silver grey and "checks" or cracks develop as the wood is alternately exposed to rain and sun. Colour fading can be uneven depending on exposure conditions. Surfaces remaining moist for long periods can suffer a dark grey discolouration due to weathering.
Exterior finishes suitable for pine include paints and acrylics, water repellent preparations and exterior wood stains.

Exterior paints are broadly classified into **oil based (alkyd) and water based (acrylic).** Both types can be used effectively on treated pine, although experience has shown that acrylic paints are more durable and maintain greater flexibility. An added practical advantage with the acrylics is their short re-coating time which allows additional coats to be applied in the one day, provided quality procedures and products are used.

Several clear finishes are available for exterior use including water based finishes. Consult the supplier of the type of treated timber you have selected for advice on the appropriate paint system to achieve maximum durability and U.V. resistance.

Dark paint colours on timber may also cause excess moisture content fluctuations as these colours will absorb heat into the timber. This may decrease its durability and also result in 'bleeding' from the timber.

It is also important to note that some treated pine products, particularly cladding, can be supplied with a thin coating of 'pink' primer (which may also be a 'cream' colour). This is a protective coating for storage and transport only and is not substantial enough to be considered a substitute for undercoat.

Water repellent preparations are clear or coloured and can be used alone as a natural, penetrating finish. These easy-to-use finishes contain waxes and resins which help protect wood against the effects of moisture and small amounts of preservatives to control the growth of surface mould. Used alone, water repellent preparations are suitable for closely maintaining the original appearance of treated pine, although during the first few years, surfaces given this treatment need more frequent maintenance than either stained or painted wood. Some variation in wood colour may occur depending on exposure conditions.

Water-borne acrylic timber finishes are sometimes not compatible with LOSP treated wood, but can be effectively used for weather protection provided they are applied over an oil-based primer.

Because creosote treated pine is highly resistant to weathering, checking and splitting are rare. Additional surface finishing of this material is therefore unnecessary.

Both oil based and water based exterior wood stains are available. These stains may contain water repellents, fungicides and algaecides for longer life. Generally service life is proportional to the level of pigment contained in the stain.

Remember, the aesthetic service life of treated pine is dependent on the level of maintenance and the expectations of the owner.

FASTENERS

Metal fasteners in contact with some types of treated timber may exhibit a propensity to corrode. The presence of excessive moisture in the timber aids formation of an electrochemical cell (or electrical circuit) which sets off a corrosive reaction.

Moisture presence is the important factor. The natural electrical insulation of seasoned wood (moisture content of 12% or less) is high enough to restrict corrosion. Please consult your treated timber supplier and/or fastener suppliers for more specific information related to each product.

The following recommendations may prevent corrosion;

- Design connections and detail the structure to shed water
- Ensure that timber has been allowed to cure for up to 6 weeks before using fasteners, particularly with CCA treated timber
- Plastic gaskets, washers and coatings are recommended for electrical insulation between metal and treated timber
- Oversizing bolt holes and coating bolts with grease will resist corrosion
- Use fasteners which are compatible with the treatment type and the method of connection required. Hot-dipped galvanised fixings are most often specified, however in severe environments such as in close proximity to the coast, stainless steel or other fixings may be required to provide an adequate service life.

MARKING

AS 1604 - Timber-Preservative-treated-Sawn and round requires that each piece of treated timber, claimed to conform with the standard, must be labelled on one end with the treatment plant number, the preservative code number and the hazard class. This form of branding is designed to enable easy identification in one location on the timber. The only exceptions for marking are fence battens, palings and timber of less than 15mm thickness or 1500mm^2 in cross section.

HEALTH AND SAFETY

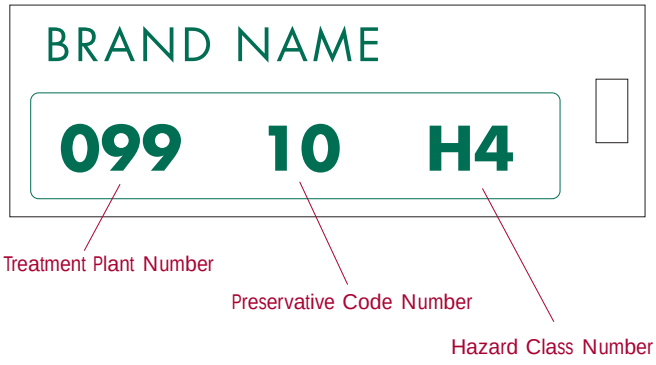
Exposure to freshly treated timber should be avoided irrespective of which treatment chemical was used. Timber should only be supplied after a suitable period of time has been allowed for the chemicals to permanently fix in the wood.

Importantly, treated pine timber should not be burnt as a method of disposal. It should definitely not be used as fuel for barbecues. The safest and recommended method of disposal is by burial. The following are a few simple safety precautions that should be adhered to when working with treated timber.

- Always wear a filter mask and eye protection when sawing, machining or sanding treated pine,
- Wear gloves at all times and wash hands before eating and
- Brush or wash sawdust off skin and clothes immediately.

Merchants, treaters and preservative manufacturers can supply material safety data sheets which fully detail any possible hazards related to handling, cutting and disposal of treated timber products.

Label requirement of AS 1604



AVAILABILITY

Many pine timber products are available in treated form, however, availability of types of treatment should be checked with your supplier. Similarly, availability of treated structural grades should be checked before specifying.

The maximum length of treated structural pine is generally 6.0m. Finger-jointed and glue-laminated components normally range up to 7.5m. Large cross-section; longer length glue-laminated products are sometimes possible with special arrangements for manufacture and transport. Round posts are available in small end diameters of 75mm to 200mm, at increments of 25mm and lengths from 1.2m to 3.6m in 0.3m increments.

Poles and piles range in diameter from 200mm up to 600mm, with a maximum standard length of 6.0m. Longer lengths, up to 12.0m, are obtainable on special order.

For further information, please consult your local timber supplier.

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