Methods of applying Wood Preservatives

The degree of protection afforded by a wood preservative depends upon the quantity of preservative retained by the timber, the depth of penetration, and the permanence of the preservative in the wood.

The first two factors are largely determined by the method used to apply the preservative, although the penetration and retention given by any method in different species of wood can differ greatly.

The methods of applying preservatives in use include:

(a) brushing and spreading
(b) spraying, deluging and fogging
(c) immersion
(d) hot and cold steeping in open tanks
(e) diffusion
(f) pressure impregnation
(g) double vacuum

Each method may be more or less satisfactory in different circumstances, and the method of application should be chosen with due regard to the decay hazard to which the timber will be subjected, the service life required and the species of timber and health, safety and environmental protection.

Commercially, for each preservative only a few of these methods are used. Since the properties required of the treated wood may make it necessary to use a specific type of preservative, the choice of method of application is in practice limited.

In cases where the decay hazard is high, such as in outdoor timbers in ground contact (e.g. fence posts, transmission poles), or in timber permanently or intermittently immersed in sea or fresh water (e.g. marine and fresh water piling, cooling towers) a method of application which is capable of giving deep penetration of the preservative should be chosen. Generally speaking, pressure methods are to be preferred, although with small dimension timbers or where a shorter life is acceptable, less severe methods of treatment, such as hot and cold steeping in open tanks and long immersion have been found satisfactory.

In timbers where there is a high incidence of decay but where the hazard is less severe, such as in exterior timbers not in ground contact (e.g. fence panels, external joinery) immersion treatments have been found acceptable for small dimensional timbers, particularly where periodic retreatment by brushing or spraying is possible. With some timbers in this type of situation, cost and other requirements such as the need to overpaint the treated timber without delay mean that in practice organic solvent type preservatives are mainly used, and the methods of treatment are therefore those whch are appropriate to this type of preservative, e.g. double vacuum or immersion.

In some cases practical considerations limit the choice of techniques; for example, in the eradication of insect attack from timber in buildings the need to treat the timber in position limits the choice to spraying or fogging, which can be carried out with portable equipment and spreading of paste products.

In certain circumstances, Building Regulations or other ordinances lay down the methods of treatment which are permitted for the treatment of certain timbers. See the BWPDA Manual for guidance.

METHODS OF TREATMENT

Brushing

Brushing is the simplest and most readily available method of applying a wood preservative, and is particularly useful to the general public and for on-site treatments in building, particularly where working of pretreated timber exposes a fresh surface. It is mostly used with organic solvent type wood preservatives or with lower viscosity grades of creosote.

Paint brushes are commonly used but, with most preservatives, any soft bristled brush is satisfactory, and soft floor brushes can be used advantageously where large areas are involved.

Preservatives should be brushed on to clean and dry timber in flood coats, with the second and any subsequent coats being applied after the previous coat has soaked in but before it has dried. The preservative should not be brushed out to cover a large area, but sufficient flood application must be given to achieve the application rate recommended for the preservative being used; this usually necessitates two or three applications.

The preservative should be applied at the appropriate rate to all sides of the wood and must be flooded on to the end grain. When treating made-up components (e.g. furniture), the preservative should be flooded into joints. When used for woodworm eradication, it is beneficial to flood into old flight holes.

The life of superstructures, such as fencing and huts and sheds, will be extended by several years by brush application of a suitable preservative and may be prolonged almost indefinitely by applications of wood preservative at intervals of three or four years. Care must be taken to treat even the parts hidden from view as these are often more liable to disease.

Brush coating should not be used for timber situated in very vulnerable situations, e.g. in contact with the ground.

Spreading

Wood preservatives formulated as pastes are applied to wood surfaces using hand implements or mechanical application systems. Pastes are normally used for the treatment of embedded timbers or where access is difficult since the formulation is able to spread into areas away from the application site.

Spraying

Spray application of wood preservatives is generally comparable in its results to brush application, and can be carried out as an alternative to brush treatment under appropriate circumstances. Spray treatment is the most common and widely-used method of application of wood preservatives in the *in situ* eradication of woodworm and treatment of wet or dry rot.

Units giving a coarse spray with minimum atomisation are preferred, and it is particularly important to ensure good ventilation when spraying. Organic solvent type preservatives are most commonly used for this type of application.

The preservative should be flooded on to

TREATMENT CYCLES FOR PRESSURE AND VACUUM PROCESS[1]

	PRESSURE				DOUBLE VACUUM	
	FULL CELL		EMPTY CELL		Pine	Spruce and Hemlock
	COLD PRESSURE	BETHELL	LOWRY	RUEPING		
CHARGE TIMBER						
Initial Treatment (timber in closed cylinder)	None	Vacuum applied typically 635mm mercury for half hour	None	Air pressure applied, typically 4×10^5 N/m^2	-0.67 bar for 20 mins	up to -0.83 bar for 20 mins
FLOOD TIMBER WITH PRESERVATIVE WHILE MAINTAINING VACUUM OR PRESSURE						
Impregnation Stage	Pressure 10×10^5 N/m^2 until retention achieved	Pressure applied, typically 12×10^5 N/m^2 for 2 hours			(a) Atmospheric pressure for 3-5 minutes or (b) Pressure below atmospheric but not less than 250mm mercury above initial vacuum	Pressure applied typically 10×10^4 N/m^2 for 60 mins
PRESERVATIVE PUMPED OUT OF TREATING CYLINDER						
Final stage	None	Vacuum applied typically 635mm mercury for 10 minutes	Vacuum applied, typically 650mm mercury for 2-12 hours		Vacuum applied, typically 600mm mercury for 20 minutes	
ATMOSPHERIC PRESSURE-DISCHARGE TIMBER						
Principal type of preservative[2]	Creosote low viscosity to BS 144	Creosote to BS 144 or waterborne to BS 4072:Part 1	Creosote to BS 144	Creosote to BS 144	Organic solvent preservatives to BS 5707: Part 1[3]	

[1] See the BWPDA Manual for guidance on the selection of processes for various timber components.
[2] a list of BWPDA approved preservations is given in the BWPDA Manual.
[3] currently out of date (September 1993) - see BWPDA Manual for up to date specification.

the surface until a slight run-off occurs. If the resultant absorption is less than that recommended for the preservative being used, further applications should be made after the initial treatment has soaked in but before it has dried.

For pre-treatment, the preservative should be applied to all sides of the timber, and for *in situ* eradication to all accessible sides. Particular regard should be paid to flooding on to end grain and into joints.

Fogging
Fogging is a technique used in professional remedial treatment requiring special equipment. A liquid preservative formulation is heated and dispersed through a nozzle as a 'fog' of fine droplets which deposit preservative on surfaces throughout the treated area. Typically used to treat roof voids and under-floor areas.

Deluging
In deluging the timber is passed through an enclosed tunnel in which preservative is applied to it from various types of jet; in different makes of deluge tunnel these vary from spray jets similar to those used in normal spray application to a number of small jets or a single jet from a large diameter pipe.

Deluging is mostly used for application of organic solvent preservatives, but tar oils, creosote and certain types of water-borne preservatives may also be applied by this method.

Deluge treatments can be used for the pre-treatment of timber in situations where a brush or spray treatment could also be considered, but they offer greater throughput and more uniform application for industrial use.

Immersion
Immersion treatment is used with timbers which are to be subjected to a wide variety of hazards but, because the preservative absorption and therefore the effectiveness of the treatment is related to the time for which the timber is immersed, it is most important that a suitable immersion period is specified and adhered to. With many of the preservatives prepared for immersion treatments, recommended immersion times range from three minutes for many building timbers to several hours for timbers in ground contact or other hazardous situations.

The clean and dry timbers are totally immersed in a tank of preservative fluid. Immersion treatment is used for all types of wood preservatives but it is most usual with organic solvent or low viscosity Creosote. For the treatment of seasoned timber, immersion is carried out at ambient temperatures, provided these are above freezing.

An exception to total immersion is the butt treatment of fence and other posts where an effective economical treatment can be

given by soaking the butt end only to about 300mm above ground level in preservative for several hours and treating the remainder by a much shorter immersion or by brush or spray.

In industrial practice immersion treatments are increasingly carried out in mechanical plant in which several cubic metres of timber are treated at a time and in which the immersion time is fixed by a timing device controlling the immersion mechanism.

Hot and Cold Steeping in Open Tanks
There are several variations of this method of applying preservatives. In all cases the timber is first heated to expel air and subsequently allowed to cool in preservative solution, when the solution is drawn into the wood.

Most commonly, the timber is immersed in cold preservative and the bath and timber are heated up together to around 80^{0}C until the timber is hot throughout, and the whole then allowed to cool down together. Treatments may be carried out more rapidly by using two baths, one hot and one cold. Timber is put into the hot bath until it is heated throughout and then transferred quickly to the cold bath.

This method of treatment is mostly used for the treatment of fence posts, hurdles and similar items with creosote on estates. It is important to guard against fire.

Better penetration is obtained by the hot and cold steeping method than by brushing, spraying or cold steeping.

Diffusion
This process is used to treat unseasoned timber, particularly Canadian hemlock, Baltic redwood and home-grown spruce, the preserved timber being used in building.

After sawing, the green timber is immersed in a strong solution of a water-borne preservative - usually boron salts - for a short period. Timber is then close-piled under cover to restrict drying for several weeks while the preservative diffuses into the timber. Less concentrated solutions of such preservatives may also be applied by a combination of pressure process (see below) and subsequent diffusion. In such cases the diffusion period may be much shorter than that used with the immersion process.

Since the preservative salts remain water-soluble, wood treated by the process is unsuitable for use under wet conditions such as ground contact or exterior timbers not protected by paint.

Pressure and Vacuum Treatments
In most of the simpler treatments so far described - (i.e. brush, spray, deluge and immersion) - the absorption of preservative fluid is mainly by capillary attraction under atmospheric pressure.

By increasing the driving force either by reducing the pressure in the wood cells, by increasing the pressure above the preservative or by a combination of these effects, more rapid and complete penetration of the timber can be achieved. A number of processes in which the pressure is manipulated have been developed and are briefly described below. Such treatments cannot normally be carried out by the timber user; they require special plant, including treatment cylinders capable of withstanding the vacuum or pressure conditions, storage tanks, valves, pumps and measuring instruments and are generally carried out by specialist treatment firms.

Because of the much greater degree of protection resulting from the higher loadings and deeper penetrations which these processes can give, they are widely used for the pretreatment of commercial timber and are the only really satisfactory way of protecting by a single treatment, timbers which are to be exposed to the high decay hazard of outdoor use in ground contact or used in sea or fresh water.

As commonly used, the terms vacuum pressure or pressure treatments refer to those processes using a high pressure with or without use of vacuum, and double vacuum or vacuum to those primarily depending on vacuum, but in some variation of double vacuum a low positive pressure may be involved.

Pressure Processes
The timber, usually on bogies, is loaded into a treating cylinder which is then closed. The cylinder is flooded with the preservative and pressure applied to force it into the timber. In variations of this process (see table) a vacuum may be drawn on the cylinder or an air pressure applied before the preservative is admitted. These variations affect the final retention of preservative, it being greatest within an initial vacuum (full cell) and least when air pressure is applied (Rueping).

After the end of the pressure period, or when liquid gauges on the plant show that the required amount of preservative as been absorbed, pressure is released and the preservative pumped out of the treating cylinder. A short final vacuum is applied to remove excess preservative from the outer layer of the timber.

All the pressure processes are used to apply Creosote. Creosote to BS144 is applied hot (65-100^{0}C) since the reduction in viscosity thus obtained allows readier penetration but cold Creosote to BS144 is sometimes used in farm and estate plants. Application of water-borne preservative is almost entirely by the full cell method. After treatment with water-borne preservative the timber must usually be allowed to dry.

All three techniques will achieve full impregnation of the sapwood of permeable timbers but penetration into heartwood or impermeable sapwood is more limited. The amount of preservative solution left in the wood is greatest in the full cell method since, in the empty cell process, part of the preservative absorbed is expelled by the expansion of air within the wood on release of the pressure.

Double Vacuum
This process depends primarily on creating a vacuum inside the timber and then using this to draw preservative fluid into the timber; the impregnation period is usually at atmospheric pressure, although in some variations it may still be under vacuum. With refractory timbers, or to obtain high preservative loading, a positive pressure may also be used, usually around 1 x 10^5 N/m^2.

A final vacuum serves to remove excess preservative from within the wood, thus timber can be painted a very short interval after treatment. Complete penetration of permeable sapwood is achieved, but retentions are controlled at a low level since the double vacuum technique is used with organic solvent preservatives for treatment of window frames and other building timbers.

Condition of Timber before Treatment
For all methods of treatment described above the timbers must be in a suitable condition for treatment.

For all preservatives it should be free from bark and surface coating. For treatment with organic solvent type preservatives or with tar oils by any method, and for treatment with water-borne preservatives under pressure, the timber should be air dry.

For treatment by diffusion with boron compounds the timber must not have lost its original green moisture content.

Safe Use of Preservatives
In all treatments close regard should be paid to manufacturer's instructions covering the safe use of preservatives. In the UK all wood preservatives must be approved under the Control of Pesticides Regulations procedures. Statutory conditions of use must be observed and those who use preservatives professionally must have been trained and be competent in their use. The Control of Substances Hazardous to Health (COSHH) Regulations apply to the use of wood preservatives at work.

The use of preservatives and the disposal of waste arising must be carried out without prejudice to protection of the environment. Statutory controls apply in all cases.

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