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Code of practice for

Preservation of timber

Code de bonne pratique relatif à la protection du bois

Richtlinien für Holzkonservierung

British Standards Institution

BS 5589 : 1978

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This code of practice represents a standard of good practice but compliance with it does not confer immunity from statutory and legal requirements and bye-laws.			

Foreword

This British Standard code of practice, prepared under the direction of the Codes of Practice Committee for Building, deals with the preservative treatment of timber for various uses. It does not apply to wood based panel products but only to solid timber. The code was prepared from drafts produced by the British Wood Preserving Association. It is designed to supplement BS 5268 : Part 5 which deals primarily with the requirements for preservative treatment of timber used structurally in buildings.

A general introductory section is followed, in the present edition, by five sections, each of which deals with an area of use for timber. As the need arises, consideration will be given to the inclusion of further sections dealing with other specific end uses. For many of these uses there exist, or are planned, product specifications in which detailed attention is given to structural and manufacturing considerations but often only brief consideration can be given to requirements for durability or preservation. In most cases, the present code considers these latter requirements in more detail and has tried to obtain more uniformity between them. It is hoped that as new or revised product specifications are

prepared, they will make full reference to the appropriate sections of this code.

In this code, the concept of desired service life for a component has been introduced to enable a specifier or user to make a choice of performance requirement. Alternative treatments can then be selected to achieve the desired life on the basis of cost and availability. The figures used to categorize desired service life relate solely to protection against biodegradation and have to be considered together with the aspects of design, maintenance and service environment which all contribute to the actual service life of a component. Clause 4 of this code explains the basis on which service lives were selected. This basis sometimes differs from that used, either implicitly or explicitly, in certain other codes, e.g. for farm buildings where considerations such as building financing may be involved.

Reference is made in this code to a series of specifications published by the British Wood Preserving Association. These documents have been submitted to representative BSI committees with a view to using them as a basis for a corresponding series of British Standards.

British Standard Code of practice for Preservation of timber

Section one. General introduction

1. Scope

This code of practice gives recommendations for pre-treatment of timber for protection against biodegradation only, for certain specific uses in the United Kingdom. It recommends processes and treatment levels suited to the severity of the environment of use, and takes into account the natural durability and treatability of the timber employed. It does not deal with treatments primarily designed to influence the performance of timber in fire.

Uses at present covered in other sections of this code are:

Section two. External woodwork in buildings and out of contact with the ground

Section three. Agricultural and horticultural timbers

Section four. Timber for use permanently or intermittently in contact with sea or fresh water

Section five. Timber for use as packing in cooling towers

Section six. Fencing timber

Preservative treatments for structural timbers, particularly those in buildings, are recommended in BS 5268 : Part 5.

2. References

The titles of the standards publications referred to in this code are listed on the inside back cover.

3. Relationship to other codes and standards

This code is part of a group of British Standards dealing with preservative treatment of timber. BS 1282 forms an introductory document to the subject and gives general information on the biological hazards to which timber may be exposed, types of preservative and their properties, and the methods of treatment by which they can be applied.

This code has been written primarily for users and specifiers of treated timber, and is concerned only with those aspects of the preservative treatment over which they need to have control and which affect their use of the treated product. Section one covers matters common to all the uses dealt with in the other sections. In these other sections specific recommendations are given for the treatment for individual uses. In most cases a choice of treatment is offered and the level at which each should be applied is recommended.

Those aspects of preservative treatment which are principally the concern of the preservative manufacturer and treater are dealt with by a group of preservative and processing specifications. These cover the chemical compositions of

the preservatives and give details of the processes involved in their application. In most cases, however, they leave the specifier to choose the intensity of the treatment applied.* The following specifications are of this type and will be referred to in this code:

BS 144	Coal tar creosote for the preservation of timber
BS 913	Wood preservation by means of pressure creosoting
BS 3051	Coal tar creosotes for wood preservation (other than creosotes to BS 144)
BS 4072	Wood preservation by means of water-borne copper/chrome/arsenic compositions
BS 5056	Copper naphthenate wood preservatives
BWPA† 104	Pentachlorophenol-based wood preserving solutions and their application by non-pressure methods
BWPA 105	The preservation of softwood timber by means of disodium octaborate
BWPA 108	The preservation of timber by pentachlorophenol with gamma-hexachloro-cyclohexane
BWPA 109	The preservation of timber by tributyltin oxide
BWPA 110	The preservation of timber by tributyltin oxide with gamma-hexachloro-cyclohexane
BWPA 111	The preservation of timber by zinc naphthenate with pentachlorophenol
BWPA 112, 113, 114	Wood preservation by tributyltin oxide with gamma-hexachloro-cyclohexane by the double vacuum process
BWPA 115	Wood preservation by zinc naphthenate and pentachlorophenol with gamma-hexachloro-cyclohexane by the double vacuum process
BWPA 116	Wood preservation by pentachlorophenol and tributyltin oxide with gamma-hexachloro-cyclohexane by the double vacuum process
BWPA 117	Wood preservation by pentachlorophenol in heavy oil by a double vacuum process
BWPA 118	The preservation of timber by pentachlorophenol and tributyltin oxide with gamma-hexachloro-cyclohexane

To specify a treatment it is necessary only to cite the relevant preservative specification and to give certain parameters which define the intensity of the treatment. The appropriate values for the parameters k_1 , c_1 , t_1 , p_1 , etc., should be taken from the relevant British Standard or BWPA specification as indicated in table 1.

*In the past it was the usual practice to combine into a single British Standard the requirements for the composition of a type of preservative together with information on processing and recommended levels of treatment for specific uses. For an interim period recommended levels of treatment will be found both in these older standards and in the newer standards for particular commodities.

†British Wood Preserving Association. Reference should be made to the 1975 editions of these specifications. Copies have been deposited with the British Standards Institution. It is intended to publish British Standards for these processes.

Table 1. Parameters for specifying preservative treatments

Preservative process	Essential parameters for specification
Creosote (tar oil) pressure process	Creosote complying with the requirements of BS 144 or BS 3051 applied in accordance with the methods specified in BS 913 with a minimum net retention of k_1 kg/m ³ and a minimum extended pressure period of t_1 min.
Creosote immersion process	Creosote complying with the requirements of BS 3051 applied by complete submersion for a period of t_2 min.
Creosote hot and cold open tank process	Creosote complying with the requirements of BS 144 or BS 3051 applied in accordance with the methods specified in BS 144 with or without reheating.
Copper/chrome/arsenic (CCA) vacuum pressure process	CCA complying with the requirements of BS 4072 applied in accordance with the methods specified in BS 4072 using a minimum solution strength of c_1 % and a pressure period of t_3 min.
Organic solvent (OS) double vacuum process	OS preservative applied in accordance with the methods specified in BWPA 112 to BWPA 116 using an initial vacuum of minus p_1 bar* for a period of t_4 min and a pressure of p_2 bar for a period of t_5 min.
Organic solvent (OS) immersion process	OS preservative complying with the requirements of BS 5056, BWPA 104 or BWPA 108 to BWPA 111, or BWPA 118 applied by complete submersion for a period of t_6 min.
Pentachlorophenol (PCP) in heavy oil double vacuum process	PCP in heavy oil applied in accordance with the methods specified in BWPA 117 using an initial vacuum of minus p_3 bar for a period of t_7 min and a pressure of p_4 bar for a period of t_8 min.
Boron diffusion process	Timber treated at source with disodium octaborate in accordance with the methods specified in BWPA 105.

*1 bar = 100 kPa = 750 mmHg. All pressures quoted are 'gauge pressures', i.e. relative to normal atmospheric pressure as zero.

4. Performance ratings

The organisms that can attack wood, and the conditions under which the wood becomes degraded, are discussed in BS 1282. Here it is necessary only to consider the nature of the risk in relation to the service situation.

If timber becomes wet and remains wet (i.e. moisture content > 22 %), then it is likely to decay. The heartwood of some timber species is durable, i.e. possesses a natural resistance to decay which in some cases renders this process extremely slow†. In other species the heartwood possesses little resistance to decay, and the sapwood of all wood species is readily attacked: timber of this nature, with little natural durability of its own, needs preservative protection if used under wet conditions.

The exposure of timber to adverse conditions may be such that:

- the timber is constantly exposed to the adverse conditions;
- the exposure to adverse conditions is intermittent or only occurs fortuitously.

Timber in the ground (e.g. fence posts, poles) and timber in water quickly acquire and retain a high moisture content, and are thus constantly at risk. Additionally, timber used in sea or brackish water is liable to attack by marine organisms; timbers which have a natural resistance to fungal decay are not necessarily also resistant to marine borers. Timber used in environments of this kind is constantly exposed to adverse conditions and there is a high risk of early failure of

susceptible species unless preventive measures are taken. In these circumstances it is sensible to describe the adequacy of these measures in terms of a performance requirement (i.e. desired life) for the commodity‡. In some cases it has been possible to lay down conditions suited to two levels of performance (e.g. fencing timber with desired lives of 20 and 40 years). The performance requirements in the individual commodity specifications are based on timbers, and levels of preservation, readily available commercially. In special cases where longer lives are required a higher standard of treatment may be achieved by more severe processing of a restricted number of timbers.

In addition to the situations where timber is exposed continuously to hazardous conditions, there are others where these may or may not develop in service. This is particularly true for timber used in buildings where wood can become wet through design faults, condensation, failure of other materials, workmanship errors or lack of maintenance. Additionally, the incidence of insect attack is sporadic in character, despite the fact that all exposed sapwood is vulnerable. In these circumstances the performance concept for the treated timber has less meaning since the hazard may or may not present itself, and its severity is unlikely to be known in advance. Treatments for commodities in this category are rated, therefore, in terms of period of effectiveness (i.e. the time during which the preservative can be expected to remain in sufficient quantity to provide effective protection).

†Technical Note no. 40, 1975, 'The natural durability classification of timber' published by the Princes Risborough Laboratory of the Building Research Establishment.

‡e.g. door, window frame, barn, marine piling, packing timber in water cooling tower, fencing and gate post.

It is essential to realize that the life cited in a 'performance' clause of this code is not a guarantee of performance but simply indicates the service life against which the specifications for timber treatment were drawn up, assuming normal conditions of use. It relates solely to the resistance of the timber to biodegradation and it has to be borne in mind that other factors, such as mechanical damage or failure of other elements of the construction, may limit the life of the complete commodity. The lives predicted have in some cases not been established by direct service evidence and therefore may be subject to revision as more experience is gained.

5. Design considerations

This standard is not a design code for timber components or structures. However, detailed design has such an important influence on timber durability that it is essential that it be considered in conjunction with the possible need for preservative treatment.

In some cases, the risk of timber degradation by biological agents can be eliminated by designs which prevent the timber from becoming wet. Where such a design solution to provide acceptable immunity is impracticable or too expensive, it may have to be reinforced by the use of naturally durable timbers or those treated with preservative. Even if design precautions have been employed, experience has shown that there are some situations where it is wiser not to rely entirely on design. In other situations, such as timber in contact with the ground, or in dock and harbour work, design can do little to reduce the hazard; in these circumstances the use of naturally durable timbers or appropriate preservative treatment is essential if adequate service life is to be achieved.

It should not be assumed that the use of a naturally durable or preservative treated timber obviates the need for good design and workmanship. The preservative treatments recommended for the various commodities in subsequent sections are complementary to good design and workmanship, not a substitute for it. Where possible, reference has been made in these sections to other standards dealing with details of construction which constitute good design. Examples of design features to consider are provision of adequate moisture barriers, throating of ledges and cills, adequate ventilation of cavities, provision of damp-proof courses and vapour barriers, attention to the sealing of end grain and joints and avoidance of unweathered horizontal exposed surfaces and water traps.

6. Means of protection

The recommendations of the individual sections of this code provide, in most cases, an option of choosing a timber* with sufficient natural durability (or resistance to insect attack) or a less durable timber which requires preservative protection. If reliance is placed on natural durability alone it should be realized that this is a property of the heartwood only of the timber concerned. The sapwood of all timber is susceptible to decay and, with certain exceptions (notably spruce and other timbers in which heartwood is not distinct), it is only the sapwood which is attacked by wood-boring insects. On the other hand, marine borers can, in general, attack heartwood. For many softwoods, and certain hardwoods, the exclusion of sapwood is not a practical proposition. If a significant amount of sapwood is present, consideration should be given to the need for preservation, dependent upon the proposed end use despite the durability rating of the heartwood.

*Timbers have been named throughout according to their standard names listed in BS 881, 589.

The preservative treatments recommended are restricted to those for which there is a suitable British Standard or BWA specification and which are available commercially in the United Kingdom. The recommendations take into account both the natural durability of the timbers concerned and their permeability (i.e. resistance to impregnation). Hazards in other countries (e.g. where termites occur) may be different from those in the United Kingdom and should be taken into account in treating timber for export.

7. Preparation of timber for treatment and post-treatment handling

7.1 Preparation. Before carrying out any preservative treatment of timber it is important to ensure that the timber is in a suitable condition as follows.

- The timber should be free from all signs of attack by wood-destroying fungi or insects; however, timber showing signs of attack by sap-stain fungi or pinhole borers is acceptable, subject to agreement between the treater and the customer.
- It is essential that the surface of the timber is free from extraneous water, mud, dirt and inner and outer bark. It should also be free from any paint, polish, or other surface finish.
- It is essential that the moisture content of the timber is below 28 % throughout the zone to be treated, except when it is to be treated by the boron diffusion process. Preservative solutions cannot penetrate capillaries blocked by free water. For some commodities it may be preferable to treat at a lower moisture content nearer that required for the finished product. Methods for determining moisture content are detailed in the treatment specifications.
- Timbers for which different schedules are appropriate should not be treated in the same charge, unless the most intense schedule can be applied without detriment to the more easily treatable timbers.
- All cutting, drilling, profiling and sanding of the timber should be carried out, as far as possible, before treatment. If further cutting after treatment is unavoidable, the freshly exposed surfaces should be liberally treated with preservative as required by the relevant commodity specification. Failure to do this can negate the value of the treatment.

Boron diffusion treatment is carried out on green timber at source and treated timber is supplied already seasoned. For most purposes timber treated in this way can be machined or worked on site without re-treatment of cut surfaces, except longitudinal conversion of timber more than 50 mm thick, which is not recommended.

7.2 Handling. After treatment the following considerations apply.

- Timber treated by copper/chrome/arsenic preservatives becomes wet during processing and a period of re-drying is normally required after treatment. Even where the nature of the commodity does not require re-drying after treatment, a holding period of seven days before use should be allowed for the preservative salts to fix (i.e. become non-leachable). It is essential to stack timber carefully during this holding period because wetting and drying will cause timber movement and, in some cases, may cause distortion.

(b) The moisture content of timber is not increased by treatment with creosote or organic solvent preservatives and the product can be used immediately after treatment. However, with organic solvent preservatives, time should be allowed for the carrier solvent to evaporate if a finishing system or adhesive is to be applied.

8. Safety

All preservatives are toxic and should be handled with care and in accordance with the extended Pesticides Safety Precautions Scheme*, the BWPA safety code† and manufacturers' specific instructions. Bodily contact and ingestion should be avoided, and appropriate precautions taken in using solutions on site.

When handling timber after treatment, protective gloves should be worn if the timber is still wet or contains solvent. No special precautions are necessary in handling timber treated with water-borne salts or organic solvent preservatives once the timber has dried, but it is essential to observe the normal practice of washing hands before handling food or smoking. Timber treated with creosote or PCP in heavy oil does not dry out in the same way as that treated with salt or organic solvent preservatives, and continued precautions may be necessary if the surface is oily.

Machining of treated timber should be kept to a minimum as this removes some of the protective treatment. However, if it is necessary to machine or sand the treated timber, an efficient dust extraction system should be used.

9. Properties of treated timber

9.1 General. The main types of preservative employed (creosote, water-borne and organic solvent) have widely different secondary properties, which influence the field in which each has a particular value. Where these properties impose a limitation on their use for a particular commodity this is noted in the appropriate section. Some general comments on the utilization of treated wood are given in this clause.

9.2 Strength. Preservative treatments may, in some cases, have a small effect on the strength properties of timber, but these are generally regarded as not being of practical significance.

9.3 Metal fastenings and fittings. Under some conditions, metal fastenings may become corroded through contact with treated timber, and the preservative manufacturer should be consulted about any possible interactions of this kind.

In general, provided the timber remains dry there is little risk of interaction of treated wood with ferrous metal fittings. Under damp conditions, corrosion of steel or galvanized steel will occur even with untreated timber; this may be aggravated with timber which is treated with copper/chrome/arsenic preservative. It is important not to apply any metal fittings until the period of fixation of the preservative is complete.

There is very little service evidence on which to base advice on the interaction of preservative-treated wood with other metals. Precautions are usually taken to avoid contact of aluminium with copper-containing preservatives, but there are no suspected interactions with other preservatives.

NOTE. Interaction between metal fittings and timber treated with salt-type fire retardants presents a more serious corrosion problem.

*Operated by the Health and Safety Executive.

†'The safe use of wood preservatives in Great Britain'; extract from BWPA news sheet 105 December 1965.

‡British Standard Methods for the identification of preservatives are being prepared.

9.4 Adhesives and sealants. The interaction of adhesives and sealants with preservatives is complex and the subject cannot be adequately covered in general terms. Treatment of glued assemblies and gluing of preservative-treated timber should not be undertaken without first having sought advice from both the adhesive and the preservative manufacturer.

9.5 Paint. In general, timber treated with a water-borne preservative or with an organic solvent preservative, which is formulated for use under paint, can be painted normally. However, it is important that an adequate drying period should be left between preservative treatment and painting. This can vary for different preservative types, and the manufacturer's advice should be followed.

However, highly porous zones are sometimes encountered, particularly in redwood, which can rapidly absorb excessive amounts of preservative solution. Such timber can give rise to painting problems, particularly if treated with organic solvent preservatives.

Some pigmented organic solvent preservatives are formulated as combined preservative treatment and finish and are not intended to be overpainted. These materials are designed primarily as finishes and are not generally suitable for the pre-treatment uses covered in sections two to six.

Timber treated with creosote or PCP in heavy oil is not suitable for overpainting.

9.6 Flammability. The solvents commonly used for applying OS preservatives are flammable and it is essential that care be exercised in applying such materials. However, once the solvent has evaporated from treated wood the timber is no more flammable than untreated wood.

When the surface of creosoted timber has dried, the timber is no easier to ignite than untreated timber, but treated timber has different burning characteristics to those of untreated timber.

10. Checking of treatment

10.1 General. There are two aspects of preservative treatment which the user commonly wishes to check. The first is whether the treatment has been carried out at all, and the second is whether it has been carried out according to the specified procedure. The former is more easily verified than the latter.

10.2 Detection of preservative‡. The chemicals used in wood preservation comprise a diverse range of substances differing in the ease with which they can be detected in wood in situ. They can all be identified after isolation in the laboratory.

Creosote is recognizable by its odour and colour, and copper-containing preservatives such as CCA and copper naphthenate colour the wood green. In cases of doubt (e.g. on darker timbers), these latter preservatives can be made more visible by spray reagents (see BS 4072 and BS 5056).

Other preservatives are usually colourless. Boron salts (BWPA 105) and zinc compounds can be detected in wood by sprays, but tributyltin oxide, pentachlorophenol and the insecticides require special laboratory methods to detect their presence with certainty.

10.3 Quantitative requirements. Most preservative specifications give a chemical procedure whereby it is possible to estimate the amount of preservative in a sample of treated

wood. However, in most cases this information does not allow a conclusion to be drawn as to whether or not the treatment requirements have been met. This is largely due to the variable nature of wood and the range of absorptions obtained in a charge.

The only way to be sure that the process has been carried out as required is to witness the treatment, and some large users already operate an inspection system of this kind. If this is not done, it is necessary to accept the assurances of the treater embodied in the certificate of treatment which should be provided with each treated charge. Some pressure plants and double vacuum plants have automatic control systems, and certain immersion plants are fitted with time locks. However, the operational parameters are still in the hands of the plant operator.

There is one exception to the above statement. Timber treated by the boron diffusion process is required by its specification to have a defined cross-sectional loading and a defined core loading on the basis of an 80 % compliance (see BWPA 105).

Section two. External woodwork in buildings and out of contact with the ground

NOTE. It is essential to read section one, 'General introduction', in conjunction with this section.

11. General

This section gives recommendations for the preservative treatment of non-structural external woodwork in buildings. It does not cover the quality requirements for which guidance should be sought in BS 1186 : Part 1, nor the preservation of structural timbers for which guidance should be sought in BS 5268 : Part 5. Particular recommendations in this section should be followed in conjunction with the general recommendations in section one. Examples of items covered by this section are as follows.

External joinery: window frames
casements and sashes
surrounds for non-wooden windows
doors (excluding flush doors*)
door frames
porches

External cladding

External fittings: soffits
fascias
barge boards

12. Hazards

This type of component is exposed to intermittent wetting, and if timbers of low natural durability are used a significant amount of decay, mainly due to attack by wet rot, may occur.

Attack by wood-boring beetles is very rare on painted external woodwork. Occasionally it may be found in external fixings and unpainted cladding where sapwood is present.

13. Performance

The preservative treatments in this section are intended to prevent premature decay, and to provide protection according to two performance categories defined as follows:

Performance category A: desired service life of 60 years
Performance category B: desired service life of 30 years

14. Timber species

Timbers rated as durable† or better may be used untreated for performance category A, and those rated as moderately durable or better may be used untreated for performance category B. Timbers of lower durability, and any timbers which contain appreciable quantities of sapwood, require treatment. Only those timbers most commonly used, i.e. European redwood, European whitewood and hemlock, are included in table 2, which recommends suitable treatments.

15. Timber condition

For satisfactory preservation, other than by the boron diffusion process, all timbers should have a moisture content of below 28 %. When timber is to be treated with an organic solvent preservative it should be at or near its service moisture content.

As preservative treatment of seasoned timber does not afford protection against deep-seated tree-borne infection, care should be taken to exclude timber infected with incipient decay.

Except for timber treated by the boron diffusion process, it is desirable that for maximum protection all shaping, drilling, cutting or machining should be done before treatment with any preservative (see clause 19).

Good preservation of these commodities requires maximum end-grain penetration. This is usually greatest when timbers are treated before assembly although other considerations such as any need to machine after assembly may make it preferable to treat at a later stage.

Where fabricated exterior components are treated after assembly, the performance of the preservative treatment can be adversely affected by such factors as the use of wood dowels of low durability and adhesive bonds which break down in service. The use of preservative of a water repellent grade is particularly desirable with such components. Wood dowels should be of timber rated durable or should be appropriately pre-treated with preservative.

16. Preservatives

The following timber preservatives may be used. Their suitability for specific uses is given in table 2.

- (a) Copper/chrome/arsenic (CCA) water-borne preservatives complying with the requirements of BS 4072.
- (b) Coal tar creosote complying with the requirements of BS 144 or BS 3051.
- (c) Copper naphthenate in organic solvent complying with the requirements of BS 5056.
- (d) Pentachlorophenol (PCP) in organic solvent complying with the requirements of BWPA 104 or BWPA 108.

*Flush doors are not included because of the difficulties in establishing suitable treatments at the present time.

†Technical Note No. 40, 1975, 'The natural durability classification of timber' published by the Princes Risborough Laboratory of the Building Research Establishment.

Table 2. Preservative treatments for external woodwork in buildings and out of contact with the ground

Performance category	Timber species	Copper/chrome/arsenic by vacuum pressure process			Creosote by pressure process		Organic solvent preservatives by double vacuum process*						Time of immersion for organic solvent preservatives or creosote	Boron diffusion treated timber*
		Vacuum time	Pressure time	Sblution strength	Min. net retention	Extended pressure period	Initial vacuum		Pressure stage		Final vacuum			
							pressure	period	pressure	period	pressure	period		
A Desired service life of 60 years	European redwood (20 mm thick or less)	min 30	min 60	% 3	kg/m ³ 100	min 60	—bar 0.33	min 3	bar 0	min 3	—bar 0.67	min 20	min 60	Treatment not recommended
	European redwood (thicker than 20 mm)	30	90	3	100	60	0.33	5	1	5	0.67	20	Treatment not recommended	Treatment not recommended
	European redwood	30	60	2	100	60	0.33	3	0	3	0.67	20	3	Treatment recommended
B Desired service life of 30 years	European whitewood	30	90	3	100	120	0.83	10	1 and 60 or 2 and 15		0.67	20	Treatment not recommended	Treatment recommended
	Hemlock	30	90	3	100	120	0.33	3	0	3	0.67	20	Treatment not recommended	Treatment recommended

NOTE. 1 bar = 100 kPa = 750 mmHg. All pressures quoted are 'gauge pressures', i.e. relative to normal atmospheric pressures as zero.

*These treatments are restricted to woodwork in which the weathered surface will be painted or given some other protective finish which will be maintained in service.