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Chapter 1 : How to Season Firewood: 8 Steps (with Pictures) - wikiHow

Timber is seasoned to bring it to a condition ready for its final use. It needs to be at the same moisture content as it will be in its final use so it will not move or bend once in place, and to.

Timber is seasoned to dry out the timber to bring it to a usable and workable condition. More than half the weight of freshly cut timber consists of moisture or sap. Before the timber can be used a large part of the moisture must be removed. Seasoned timber has many advantages over unseasoned timber, such as: To achieve greater stiffness and strength. To allow penetration of preservatives To obtain a surface that will accept paint, polish or glue. To protect against decay. Methods of Seasoning Air Seasoning The timber is stacked on foundations to keep it off the ground. Strips of wood about 38 x 19 mm are placed between the layers of boards to allow air to circulate. Ends of boards may be painted to retard drying and prevent splitting. A waterproof covering is placed over the stack to protect the timber from the sun and the weather. Air seasoning is slow, taking up to a year for a piece 25 mm thick and considerably longer for thicker pieces. But the timber produced is well suited to outdoor work. Kiln Seasoning Kiln seasoning is done in a large oven-like structure in which air circulation, humidity and temperatures are controlled. The timber is stacked on the trucks in the same way as for air drying. The trucks are on rails so that they can be moved into the kiln. Care must be taken to see that the drying process while removing the free water is not too rapid, as at this stage the timber is susceptible to degrade damage by checking and collapse. Many types of softwood, such as Radiata Pine, can be kiln dried easily and fairly cheaply from the green condition. But many of the Australian hardwoods are so slow in drying that their kiln drying is uneconomical. It is, however, satisfactory and economic to season them by the combined process of air and kiln drying mentioned below. Seasoning defect Defects in Timber Quality drying of lumber depends on numerous factors. This section describes some of the simpler aspects of stacking that can be more readily implemented and will yield immediate results. It is unfortunate, however, that some individual kilns will have even more variation. By keeping only one sticker thickness, it is impossible for stickers of various thickness to get mixed. Sticker thickness is important because uniformly thick stickers will block airflow during drying and result in warp and nonuniform drying. Thick stickers can be resurfaced to the target thickness, and thin stickers are best used at the next hot dog and marshmallow roast, if there is no wood-fired boiler. Sticker Straightness Crook and kink in stickers can often cause problems in sticker feeding automatic stackers and also in sticker alignment in semiautomatic or hand stacking. Discard stickers with more than 3 inches of crook or kink or 3 inches shorter than the width of the stack. Bolster Thickness Another common source of problems when stacking lumber are the bolsters used between lumber stacks. As was the case with sticker thickness, the chances also increase for the lumber to warp if bolsters are of uneven thickness. The uneven thickness of the bolsters can block airflow in adjacent lumber stacks in a kiln. Some kilns that have experienced airflow blockage have solved the problem by using bolsters that are the same thickness in both directions. It is important that the bolsters be nearly the same length of the lumber stack, but a problem arises when the rectangular bolsters are of uneven dimension in the other two directions. Therefore, if a bolster is turned the wrong way, this will have a similar effect as thick and thin bolsters. Sticker Placement Stickers serve two main purposes. First, they separate the courses of lumber so air can move through to dry the lumber. Second, they distribute the weight of the lumber vertically from top to bottomâ€”through the stickers and bolsters down to the kiln truck or load supports. Stickers out of alignment, on edge or missing can be costly to lumber quality by causing kink, twist, skitipped ends and other forms of warp. Sticker alignment is seldom perfect, especially with manual sticker placement. The ideal is to have all stickers vertically aligned in a column. The stickers should at least be placed so they overlap the ones above and below. If a sticker is missing, the courses above the space will sag down into the open space. The weight of the wood above bearing down on the unsupported board will place a very large bending force on the board, causing it and several boards above to warp. Stickers placed on edge will have the same effect as thick stickers. The board above will tend to warp or, in softer species, the sticker may actually indent the board above and below the turned sticker. Stickers should be within one sticker width of the end of the stack. One

primary purpose of the stickers is to hold the boards flat. If either end sticker is significantly removed from the pile end, there will be no support on the lumber ends. This can lead to warp, twist, cup and splitting of the unsupported ends. It is commonly stated that an end split will extend up to the first point of good sticker contact. Board Placement in Packages Providing adequate sticker contact and board control at the ends of a package is critical to good drying as discussed. Even ends on all packages are needed to provide optimum sticker placement and sticker contact on board ends. Most hardwood lumber is manufactured and sold random length, and many mills do not double-end trim. Unfortunately, stacking machines do not box pile. Instead, most even end at one end of the stack, letting the other end take up all the uneven lengths. The maximum length lumber to be stacked will determine the pile length. Full-length boards are selected for the edges of each course. Boards in between are alternately pulled to each end. Consideration must be given to the best mix of package lengths relative to kiln size when the pile lengths are established. Failure to consider the kiln dimensions could lead to mixes of packages that will not fit in the kiln without leaving open areas. Suspendisse at scelerisque urna. Aenean tincidunt massa in tellus varius ultricies. The yard should have big shady trees to protect the timber from direct sun. Ends of logs should be protected against splitting by applying anti-splitting compositions and stacked on foundations in closed stacks in one or more layers. Stacks should be protected against direct sun by providing a covering if needed. Precautions to be Taken in Stacking Timber Stacks of not more than sleepers are recommended to be made Poles are stacked either in closed heaps or with crossers. If stacked in closed heaps, then there should be alternate layers of butt ends and of top ends so that the two ends of the stack are level. Poles themselves could be used as crossers, which should not be spaced more than three metres. Fence posts should be stacked in open crib fashion in which successive layers of posts are at right angles to each other and there is a gap of about 8 cm between adjacent posts in the same layer. Centre to centre distance between crossers should not exceed 1. Horizontal stacking of sawn timber is done on vertical pillars of treated timber, brick masonry or of cement concrete 30 cm square in section and 30 to 45 cm high. The pillars are spaced 1. The length of material to be stacked decides the length of stacking unit. The ends should be protected with moisture proof coatings. Planks should be stacked on level platform with crossers of uniform thickness and section, which should be in vertical alignment in a stack. Heavy wooden beams should be placed on the top to prevent top layers from warping. A gap of about 2. The stack should be protected against rain and sun by providing a shed over it. VERTICAL STACKING Mainly used in rapid surface drying of non refractory wood The two precaution should be taken in vertical stacking the planks stacked for seasoning should be turned frequently at least twice a day expose both the sides to the sun otherwise warping may occur the lower of the planks should rest on some waste to prevent the fungal and insect attack and also prevent it from direct contact with the earth after partial drying better to stack in horizontal manner. This method is recommended for staking heavy structured timbers like sal in hot and dry localities. Perfect seasoning is the most effective means of preservation. Timber should be so used that either it is wholly dry and well ventilated or is wholly under water. It will not decay when kept under water but it will become soft and weak. Proper damp proofing of the building and providing free circulation of air around the built in portions of timber are essential for the preservation of the timber used. However, when these conditions cannot be obtained then preservatives have to be applied for preservation. Timber should be well seasoned before the application of preservatives as otherwise the preservatives would block the pores of timber thereby causing its decay due to the entrapped moisture. Direct contact with lime mortar should be avoided while using preservative with masonry. Methods of Preservation of Timber Following are some of the common methods of preservation adopted i Charring.

Chapter 2 : The Temple "Only A Sweet And Virtuous Soul, Like Seasoned Timber, Never Gives" - www.nx

It needs to be seasoned like any other wood. Most people think ash can be burned immediately because it has a lower moisture content than any other fresh cut woods. Ash can have as little as 30% moisture content compared to 50% of other species of wood.

By seasoning of timber, it is understood that the controlled reduction of moisture from the wood. This is necessary for reducing the unnecessary weight of timber, for effecting an increase in its strength, to improve its workability , to reduce the possibility of development of shrinkage defects and to ensure durability or long life of timber. The moisture content of standing trees may be as high as percent or even more. After careful seasoning, it could be brought down to percent by kiln seasoning or percent by air seasoning. Two general methods of seasoning of timber as applied today are air seasoning and Kiln seasoning. In air seasoning, timber in properly cut forms is stacked in a proper manner in the open air for losing moisture by process of evaporation. The Stacks are so constructed to allow free circulation of air around each part as far as possible. The stacks are properly sheltered from direct sun and winds and rain. It may take 6 months to 4 years for bringing down the original moisture content to allowable limits of percent by this method. Some times logs are placed in running water before subjecting to air seasoning. The water-saturated wood dried quicker as compared to sap-rich wood. In kiln seasoning, timber is dried for specific periods and under very controlled conditions of temperature and humidity in specially designed kilns. Tunnel type kilns can also be used for this purpose. Among the other methods of seasoning of timber and wood, the chemical seasoning and electric seasoning are of some importance. Timber can also be made fire proof to some extent by giving external coats and treatment of fire retarding chemicals like sodium silicate, sodium arsenate or borax. Left to itself, wood gets damaged slowly compared to steel in a house on fire. As already said trees contain a lot of moisture in the standing condition. The mode of occurrence of water in wood issue is rather complex and must be understood thoroughly. It is because a number of important properties of wood and timber depend on its moisture content and the way in which it is present in the wood. The wood tissue stores water in cell walls and the cell cavities. It is this water, loss or gain of which will affect the dimensional stability of the timber. It makes percent of the dry weight of the wood tissue when all the cell walls are fully saturated with water. This situation, in which all the cell walls of wood are fully saturated with water and the cavities are empty is termed as fiber saturation point. Its presence effects the mechanical properties of the timber. If the total moisture content in a species of timber is 75 percent, and its fiber saturation point is 30 percent, then, the free water is 45 percent. Whenever a freshly cut wood log is laid for drying, it is the free water from the cell cavities that is lost first. Once cell cavities are empty, and drying is continued, then the water from the cell walls will start moving out due to drying effect. And it is only the loss of water from the cell walls that will cause shrinkage in the wood. Similarly, if a dry piece of wood is left out in a humid atmosphere, wood will start absorbing moisture. Because, as already said, wood is a hygroscopic material. Supposing the original moisture content of the dry wood is only 6 percent and the humidity of the atmosphere is 40 percent, then the wood will go on absorbing moisture till its moisture content is the same as that of the atmosphere in which it is exposed. When water is absorbed by the wood, it is the cell walls that must be saturated before the cell cavities are allowed to get any water. This is the reason doors and windows made of wood show swelling effect during rainy seasons immediately after a few days of rains, especially when they are located where rain water can fall directly on them. Objectives of Seasoning of Timber. We may Summarize the objectives of seasoning of timber in five sentences: Reduces much of the useless weight of timber; 2. Increases its strength considerably; 3. Improves the workability of the timber; 4. Decreases the chances of development of shrinkage defects, and, 5. Increases the life of timber, i. Methods of Seasoning of Timber. At present timber can be seasoned by a number of methods. These can be conveniently discussed under two headings: Natural Seasoning of Timber. Air Seasoning of Timber. This is as yet the most common process of seasoning of timber used throughout the world. In this process, timber sleepers, planks, etc. This method requires careful preparation of; a Stock ground: It should be level, free from debris and on dry land. These are constructed at regular intervals out of

bricks or masonry or concrete and may be of 50 cm height from the ground level. Their top surfaces should be flat and level with each other. These are made of sawn timber shapes sleepers, planks. One stack should have timber of one shape and same length and width. The timber shape to be seasoned is stacked in layers in such a manner that: The stack length and height depend upon the length of the wood part being seasoned. A single stack may be 3 to 4 meters in height. The most essential consideration in making such a stack is ensuring free circulation of air around each part of the wood placed in a stack. It is also essential that the stack should be safe from direct winds and direct scorching heat. This is because, in air seasoning of timber, the loss of water is due to evaporation. Watch the Video Below for better understanding. The rate of evaporation will depend to a great extent on the atmospheric conditions. Efforts should be made to maintain a uniform rate of evaporation. Scorching heat and strong winds can cause excessive evaporation that may lead to the development of shrinkage cracks. The seasoning stack should also be protected from rains because wood being hygroscopic material can absorb moisture quickly. Outline of Stacking Arrangement: The time taken for air seasoning of timber depends on climatic conditions and thickness of the timber. It may take years to bring down the moisture content to percent level. The advantages of natural air seasoning are: It is highly economical; It is applicable to thicker timber parts as well as a thin section. Disadvantages of Air Seasoning: Among the major disadvantages, following are more important: It is a very slow process; It keeps the valuable land and timber blocked for longer periods and hence in some cases may be uneconomical. Moisture content cannot be brought below a certain limit percent. Seasoning is not always uniform in all the sections of timber. Water Seasoning of timber. This is a process of natural seasoning of timber that gives good results with logs of freshly cut trees. When the logs are placed in running water, the sap from the cells can be easily washed out. In place of sap, the cells get filled with ordinary water. When such logs are taken out, and wood from them placed for air seasoning, it takes comparatively less time to become dry. The timber logs can also be placed in stagnant water if running water is not available nearby. In such a case, the water should be replaced every week. Placing the logs in water also saves them from unequal shrinkage at the cut ends and along the length if left for more time in the open without sawing into smaller pieces. Hence it is a useful process in two ways. Artificial Seasoning of Timber Kiln. This is the modern method of seasoning any type of timber in a short time. It involves drying the timber in a specially designed kiln where there is perfect control over temperature, humidity and air circulation. With the help of kiln seasoning of timber, it is possible to reduce the moisture content to as low level as 6 percent. The method involves broadly the following steps: The kiln is then heated to low initial temperatures, only slightly higher than the atmospheric temperature outside. It is kept at that temperature for some time. This initial low heat is essential to avoid cracking or splitting of timber which would become certain if the temperature is suddenly raised to high drying rates. In that case, moisture from the surface of the wood will dry out fast causing shrinkage whereas moisture in deeper cells will be slow in moving out. In slow heating, this risk is adequately covered. Humidity is reduced, and air circulation is made faster. This aspect is the most difficult one in kiln seasoning and requires expert handling for good quality seasoning. Many modifications of kilns for seasoning timber are available. Chemical Seasoning of Timber Salt Seasoning. This may be grouped under processes of artificial seasoning. In this method, the timber piece to be seasoned is treated with a chemical solution like sodium chloride, sodium nitrate or urea.

Chapter 3 : The trouble with buying SEASONED firewood - Chimney Keepers

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Lumber or timber is seasoned by heating it up in a kiln tocompletely dry it out. Some places will let it air dry but thattakes much longer. How long does it takes? Seasoning is the name given to the methods of drying timber. What are the different types of seasoning timber? Seasoning of timber Seasoning is the name given to the methods of drying timber There are two methods by which timber can be dried: Air drying Air-drying is the drying of timber by exposing it to the air. The technique of air-drying consists mainly of making a stack of sawn timber with the layers of boards separated by stickers on raised foundations, in a clean, cool, dry and shady place. Rate of drying largely depends on climatic conditions, and on the air movement exposure to the wind. For successful air-drying, a continuous and uniform flow of air throughout the pile of the timber needs to be arranged. Coating the planks with any substance that is relatively impermeable to moisture can control the rate of loss of moisture; ordinary mineral oil is usually quite effective. Coating the ends of logs with oil or thick paint, improves their quality upon drying. Mineral oil will generally not soak in more than mm below the surface and is easily removed by planning when the timber is suitably dry. Natural seasoning of timber Kiln drying The process of kiln drying consists basically of introducing heat. In the process, deliberate control of temperature, relative humidity and air circulation is provided to give conditions at various stages moisture contents or times of drying the timber to achieve effective drying. For this purpose, the timber is stacked in chambers, called wood drying kilns, which are fitted with equipment for manipulation and control of the temperature and the relative humidity of the drying air and its circulation rate through the timber stack Kiln drying provides a means of overcoming the limitations imposed by erratic weather conditions. In kiln drying as in air drying, unsaturated air is used as the drying medium. Almost all commercial timbers of the world are dried in industrial kilns. A comparison of air drying, conventional kiln and solar drying is given below: The drying times are considerably less in conventional kiln drying than in solar kiln drying, followed by air-drying. This means that if capital outlay is involved, this capital is just sitting there for a longer time when air-drying is used. On the other hand, installing an industrial kiln, to say nothing of maintenance and operation, is expensive. In addition, wood that is being air-dried takes up space, which could also cost money. In air-drying, there is little control over the drying elements, so drying degrade cannot be controlled.. Air-drying is the drying of timber by exposing it to the air. Mineral oil will generally not soak in more than mm below the surface and is easily removed by planning when the timber is suitably dry.. In air-drying, there is little control over the drying elements, so drying degrade cannot be controlled. There are many purposes for seasoning timber. What is timber seasoning? If you try to burn wood that was cut down that year, there will be some left over water in the wood that will make it harder to burn. So, the wood is seasoned, by being storedâ€¦ for a few years before being burned, to let the wood dry out.

Chapter 4 : Top 6 Properties of Wood and Timber used in Construction.

Seasoning of Timber or Drying of Wood Wood drying (also seasoning lumber or wood seasoning) reduces the moisture content of wood before its use. When the drying is done in a kiln, the product is known as kiln-dried timber or lumber, whereas air drying is the more traditional method.

Gas Log Pilots do wear out. With a bit of practice you can learn to recognize seasoned wood when you see it. One telltale sign is that the bark has loosened its hold, or has already been knocked off with handling. When it really is well seasoned, expect to pay more. Cutting trees down, transporting handing and working up wood is a risky, labor-intensive pursuit; any do-it-yourself woodbumer will testify to that. He dumped it in a pile by the shed, at which point my son Joel took over. He split the larger pieces and stacked it all under one of the open ends of my woodshed. Even seasoned wood generates some creosote in a fire starved for air. They worked it up with chainsaw and splitting maul, then stacked it in the woodshed to start the seasoning process Seasoned wood is easy to recognize: The ends have darkened and started to crack, the bark has loosened or fallen away. These well-engineered round woodpiles, which speed the seasoning process, are not all that hard to construct and can hold several cords of wood. Your local chimney sweep may have the directions for this. Last winter I was close to running out of seasoned wood and ordered some through a local classified ad. He brought me a good mix of well-seasoned hardwoods and softwoods. So get to know some of your local sellers. See what type of operation they run, then order your firewood in the spring or summer, at least a year ahead of when you intend to burn it. A full cord measures 4x4x8 feet, or cubic feet. Prices will vary tremendously from area to area. And better planning next time! It will take at least six months. A year is better, although some species require far less time than others. Criss-cross ends of stack to help the air get to it. Splitting the logs will hasten seasoning. And rained on seasoned wood will dry out again fir for burning within a few days.

Chapter 5 : How is timber seasoned?? | Yahoo Answers

Among the other methods of seasoning of timber and wood, the chemical seasoning and electric seasoning are of some importance. Timber can also be made fire proof to some extent by giving external coats and treatment of fire retarding chemicals like sodium silicate, sodium arsenate or borax.

THE fleet astronomer can bore And thread the spheres with his quick-piercing mind: He views theirs stations, walks from door to door, Surveys, as if he had designed To make a purchase there: The nimble diver with his side Cuts through the working waves, that he may fetch His dearly-earned pearl, which God did hide On purpose from the ventrous wretch; That he might save his life, and also hers, Who with excessive pride Her own destruction and his danger wears. The subtle chymick can devest And strip the creature naked, till he find The callow principles within their nest: There he imparts to them his mind, Admitted to their bed-chamber, before They appear trim and drest To ordinary suitors at the door. What hath not man sought out and found, But his dear God? Poor man, thou searchest round To find out death, but missest life at hand. What house more stately hath there been, Or can be, than is Man? He is a tree, yet bears no fruit; A beast, yet is, or should be more: Reason and speech we only bring. Parrots may thank us, if they are not mute, They go upon the score. Man is all symmetry, Full of proportions, one limb to another, And all to all the world besides: Each part may call the farthest brother: For head with foot hath private amity, And both with moons and tides. Nothing hath got so far, But Man hath caught and kept it, as his prey. His eyes dismount the highest star: He is in little all the sphere. Herbs gladly cure our flesh; because that they Find their acquaintance there. Nothing we see, but means our good, As our delight, or as our treasure: The whole is, either our cupboard of food, Or cabinet of pleasure. The stars have us to bed; Night draws the curtain, which the sun withdraws; Music and light attend our head. All things unto our flesh are kind In their descent and being; to our mind In their ascent and cause. Each thing is full of duty: Waters united are our navigation; Distinguished, our habitation; Below, our drink; above, our meat; Both are our cleanliness. Then how are all things neat? Man is one world, and hath Another to attend him. Since then, my God, thou hast So brave a palace built; O dwell in it, That it may dwell with thee at last! Till then, afford us so much wit; That, as the world serves us, we may serve thee, And both thy servants be. Here will I smell my remnants out, and tie My life within this band. My hand was next to them, and then my heart: Farewell, dear flowers, sweetly your time ye spent, Fit, while ye lived, for smell or ornament, And after death for cures. I follow straight without complaints or grief, Since if my scent be good, I care not, if It be as short as yours. My thoughts are working like a busy flame, Until their cockatrice they hatch and bring: And when they once have perfected their draughts, My words take fire from my inflamed thoughts. My words take fire fro m my inflamed thoughts, Which spit it forth like the Sicilian hill. They vent their wares, and pass them with their faults, And by their breathing ventilate the ill. But words suffice not, where are lewd intentions: My hands do join to finish the inventions. My hands do join to finish the inventions: And so my sins ascend three stories high, As Babel grew, before there were dissentions. Let ill deeds loiter not: Sorry I am, my God, sorry I am. I humbly crave, Let me once know. A hollow wind did seem to answer, No: I did; and going did a rainbow note: I will search out the matter. But while I lookt, the clouds immediately Did break and scatter. Then went I to a garden, and did spy A gallant flower, The crown Imperial: Sure, said I, Peace at the root must dwell. But after death out of his grave There sprang twelve stalks of wheat: Which many wondring at, got some of those To plant and set. For they that taste it do rehearse, That virtue lies therein, A secret virtue bringing peace and mirth By flight of sin. Take of this grain, which in my garden grows, And grows for you; Make bread of it:

Chapter 6 : Unseasoned | Define Unseasoned at www.nxgvision.com

Only a sweet and virtuous soul, like seasoned timber, never gives.

To understand the best wood to use for you project you have to first understand what each type of wood is, and then which is the best wood for your project. Green Wood Green wood refers to wood that has been recently cut down and has not had an opportunity to season. Seasoning refers to the drying on the internal moisture that is in the wood. There are two processes that are used to do this, one is air drying, and the other is kiln dried. It is the more traditional method of drying wood and gives the timber a little more flexibility. Kiln Dried Wood Kiln dried wood is wood that is sawn, placed in a kiln and dried using warm air currents. Kiln drying is a considerably faster process to traditional air drying. This method produces a much harder product usually reserved for the building trade. So which wood should I use? However you have to bear in mind that the greener the wood the more likely it is to warp or even crack as the moisture dries. For building and furniture projects, green wood is definitely not the best choice. The unstable nature of the wood drying naturally can warp and even rupture the structural integrity of the build. Not only does the moisture in the wood give off less heat than dried wood, but it can also cause creosote to be created as a by-product of moisture evaporation. Creosote deposits in chimney flues can lead to chimney fires under the right conditions. Air dried wood Air dried wood contains much less moisture than green wood, but a little bit more than the faster and more aggressive method of Kiln drying. Air dried wood is a much better alternative to green wood when it comes to fuel. The long weathering process helps to eliminate moisture and other elements, making it a much more efficient and safe fuel. Kiln Dried Wood Kiln Dried wood is the industry standard for construction. It is the most consistent and stable product offered after the drying process. Smaller woodworking projects, such is with chisels or on the lathe may want to consider using air dried wood as kiln dried wood can be unforgiving and hard on tools. Air dried wood can be used for construction and is a good burner, it is more forgiving on tools than kiln dried wood, so can be used for wood working projects. Kiln dried wood is the go to for construction and fuel, although it can be unforgiving on tools so you should take caution when using it. Over to you If you have a project and are wondering which wood or timber to use please do feel free to get in touch or drop us a line on Facebook or Twitter.

Chapter 7 : What is the difference between seasoned and unseasoned timber? - Golden Cypress Rescued

Seasoning is the name given to the methods of drying timber There are two methods by which timber can be dried: (i) natural drying or air drying, and (ii) artificial drying. Air drying Air-drying is the drying of timber by exposing it to the air.

Color and odor, specific gravity, moisture content, grain, shrinkage and swelling, and strength are the important characters which determine the properties of wood and timber. Most trees are characterized by a typical color and odor. Thus, dark brown color is typical in walnuts, golden yellow is characteristic of fresh teak wood, and the creamish white color is found in softwoods like deodar. Resinous smells are typical of pines. Specific gravity is one of the very fundamental properties of wood and timber. All types of wood have Specific gravity below 1. The hardwoods have a specific gravity ranging between 0. Hardness and strength of wood depend to a great extent on its density. Cork is the lightest wood having a specific gravity of 0. The moisture content of wood is another property of timber which effects the quality of timber to a great extent. Moisture is contained in timber as free moisture in cell cavities and as imbibed moisture in cell walls. Wood is a highly hygroscopic substance. When fully saturated in cell walls and cavities, the moisture content of wood may be as high as percent in some cases. Mostly, however, the moisture content of many trees lies between percent. When cutting and exposed to the atmosphere, a balance may be achieved between the moisture in the atmosphere humidity and the wood. Hence, its quantity has to be reduced to the lowest possible limits by natural seasoning or artificial drying methods. The air seasoned timber contains percent moisture whereas in the kiln seasoned timber it can be brought down to as low limits as percent. Grain signifies arrangement and direction of fibers and vessels in the wood: Straight-grained timber is considered best, other things being the same. The deviation or the slope in grain from the straight alignment that may be due to disturbing conditions during the growth of the tree is considered a natural defect for construction purpose because many properties of timber are related to the grain. Shrinkage and swelling are properties of wood related to the loss or gain of moisture by timber. When trees are cut and laid to exposed conditions of the atmosphere. Properties of Timber and Wood. Most important properties of wood and timber may be discussed under the following general headings. Thus, walnut wood is distinguished by its typical dark brown color. Similarly, a freshly cut teak wood has a golden yellow shade. The softwoods like deodar and pine show light white colors. As regards odor smell , quite a few kind of wwoods are immediately identified by their characteristic smell. Teak kinds of wood have an aromatic smell. The pines smell of resins. The color and odor, however, may show variation. Wood is a very light material, its specific gravity being always less than 1 that of water. It is interesting to note, however, that if the wood tissue is compacted in such a way that not even a few pores are left in it, then its specific gravity will approach 1. Such compression is, however, not possible as a natural process. Woods shows a good deal of variation in their Specific gravity. Some varieties may be as light as 0. This depends on their structure and presence of pores in them. The heartwood is heavier than sapwood in the same tree. Similarly, hardwoods are always denser than soft woods as a whole. Watch the Video Below for more Information. All woods are porous to some extent. Further, all woods are hygroscopic in nature. They gain moisture from the atmosphere and lose moisture to the atmosphere depending on moisture content of their cells vis-a-vis the humidity in the atmosphere. The natural moisture content, Mc, of wood is easily determined from the below relationship. W2 is the weight of the same sample after it is oven dried. The cell walls and hence the cell cavities of many kinds of woods are quite easily stretched. As such, wood may absorb moisture more than 2 to 2. Hence, Mc values of natural green wood may sometimes be as high as percent. Wood that has been lying in the air for quite some time six months to one year after felling, however, loses most of its moisture to the atmosphere. The air seasoned woods can be made to lose further moisture by prolonged exposure up to four years. Moisture content of percent of air-seasoned woods is considered quite safe for timber being used in any construction. Woods can be seasoned in kilns with less than percent moisture. By grain, it is understood that the arrangement and direction of growth of the wood elements tracheids, fibers, and vessels in the wood. In a normal wood, the tracheids and vessels called collectively as fibers grow parallel to the length of the tree trunk. This type of structure is called a straight grain. The fibers may be very tightly and

closely packed giving rise to a fine-grained texture in wood. In other cases, they may be broad and quite wider comparatively. The structure is then termed coarse-grained. Sometimes the fibers do not grow essentially parallel to the trunk. These may be arranged in a twisted, spiral or interlocked manner. Preservation of Timber and Wood. The newly cut wood loses moisture when subject to drying naturally or artificially. On drying, the wood undergoes a shrinkage. Similarly, dry wood on getting rain melted or wetted may undergo considerable swelling. It is known that in the drying process, moisture from the wood is lost first from the cell cavity and then from the cell walls. It is only when the water is lost from the cell walls then the wood starts shrinking. Conversely, when dry wood is wetted the water is first received by the cell walls. Only when the walls become saturated, water goes to the cell cavities. Hence, on wetting, the swelling starts quickly. Thus, shrinkage and swelling are related to the behavior of the cell wall of the wood tissue towards the water. It is now fairly established that: Thick walled cells shrink more than the thin-walled cells. It is for this reason that the hardwoods shrink more than the softwoods. Shrinkage in the longitudinal direction is least 0. In the radial direction, it is of an intermediate order. Deformation is caused by the board cut from timber due to shrinkage and swelling. The extent of deformation will depend on the direction in which it has been cut with respect to the grain of the tree. The most important fact about the strength of timber is that it is not the same in all directions. This is because wood is an anisotropic material having a different structure in different directions. Hence, the Strength of wood is determined with reference to the direction of the grain of the wood under load. Besides grain, many other factors also influence the strength of the timber. Higher the density of timber, greater will be its strength. This is because the high density of timber is a result of thicker cell walls, i. Higher the moisture content, lower is the strength of the timber. This is because water in itself has no load-bearing capacity. Its increased volume in the cell simply decreases the volume of the wood tissue. Moreover, the higher amount of water in the cells invites many fungal and insect growths which destroy the wood tissue. They tend to reduce the strength indirectly. There may be some of the natural and artificial defects in timber such as cross-grain, knots, and shakes, etc. All of them cause a decrease in the strength of the timber. It is, however, to be noted that other things being same, the compressive strength parallel to grain is always less than that determined at right angles to the grain in the same type of wood. Wood is very strong to tensile forces acting parallel to grain but very weak when these forces are made to act perpendicular to the grain. The most important use of timber as beams is based on the fact that wood has very high bending strength.

Chapter 8 : Wood drying - Wikipedia

Unseasoned timber means timber than has not yet dried to a moisture content matched to its intended environment (this could be 12% for indoor flooring in Victoria and around 16% for outdoor decking in June in Victoria).

Many properties of wood show considerable change as the wood is dried below the fibre saturation point, including: Equilibrium moisture content[edit] Main article: Equilibrium moisture content Wood is a hygroscopic substance. It has the ability to take in or give off moisture in the form of vapour. Water contained in wood exerts vapour pressure of its own, which is determined by the maximum size of the capillaries filled with water at any time. If water vapour pressure in the ambient space is lower than vapour pressure within wood, desorption takes place. The largest-sized capillaries, which are full of water at the time, empty first. Vapour pressure within the wood falls as water is successively contained in smaller capillaries. A stage is eventually reached when vapour pressure within the wood equals vapour pressure in the ambient space above the wood, and further desorption ceases. The amount of moisture that remains in the wood at this stage is in equilibrium with water vapour pressure in the ambient space, and is termed the equilibrium moisture content or EMC Siau, Because of its hygroscopicity, wood tends to reach a moisture content that is in equilibrium with the relative humidity and temperature of the surrounding air. The EMC of wood varies with the ambient relative humidity a function of temperature significantly, to a lesser degree with the temperature. Siau reported that the EMC also varies very slightly with species, mechanical stress, drying history of wood, density, extractives content and the direction of sorption in which the moisture change takes place i. Moisture content of wood in service[edit] Wood retains its hygroscopic characteristics after it is put into use. It is then subjected to fluctuating humidity, the dominant factor in determining its EMC. These fluctuations may be more or less cyclical, such as diurnal changes or annual seasonal changes. To minimize the changes in wood moisture content or the movement of wooden objects in service, wood is usually dried to a moisture content that is close to the average EMC conditions to which it will be exposed. These conditions vary for interior uses compared with exterior uses in a given geographic location. The primary reason for drying wood to a moisture content equivalent to its mean EMC under use conditions is to minimize the dimensional changes or movement in the final product. Shrinkage and swelling[edit] Shrinkage and swelling may occur in wood when the moisture content is changed Stamm, Shrinkage occurs as moisture content decreases, while swelling takes place when it increases. Volume change is not equal in all directions. The greatest dimensional change occurs in a direction tangential to the growth rings. Shrinkage from the pith outwards, or radially, is usually considerably less than tangential shrinkage, while longitudinal along the grain shrinkage is so slight as to be usually neglected. The longitudinal shrinkage is 0. Tangential shrinkage is often about twice as great as in the radial direction, although in some species it is as much as five times as great. Differential transverse shrinkage of wood is related to: This section has an unclear citation style. The references used may be made clearer with a different or consistent style of citation and footnoting. August Learn how and when to remove this template message Wood drying may be described as the art of ensuring that gross dimensional changes through shrinkage are confined to the drying process. Ideally, wood is dried to that equilibrium moisture content as will later in service be attained by the wood. Thus, further dimensional change will be kept to a minimum. It is probably impossible to completely eliminate dimensional change in wood, but elimination of change in size may be approximated by chemical modification. For example, wood can be treated with chemicals to replace the hydroxyl groups with other hydrophobic functional groups of modifying agents Stamm, Among all the existing processes, wood modification with acetic anhydride has been noted for the high anti-shrink or anti-swell efficiency ASE attainable without damage to wood. However, acetylation of wood has been slow to be commercialised due to the cost, corrosion and the entrapment of the acetic acid in wood. There is an extensive volume of literature relating to the chemical modification of wood Rowell, , ; Kumar, ; Haque, Drying timber is one method of adding value to sawn products from the primary wood processing industries. However, currently used conventional drying processes often result in significant quality problems from cracks, both externally and internally, reducing the value of the product. Thus, proper drying under controlled

conditions prior to use is of great importance in timber use, in countries where climatic conditions vary considerably at different times of the year. Several, though not all, insect pests can live only in green timber. In addition to the above advantages of drying timber, the following points are also significant Walker et al. Dried timber is lighter, and the transportation and handling costs are reduced. Dried timber is stronger than green timber in most strength properties. Timbers for impregnation with preservatives have to be properly dried if proper penetration is to be accomplished, particularly in the case of oil-type preservatives. In the field of chemical modification of wood and wood products, the material should be dried to a certain moisture content for the appropriate reactions to occur. Dry wood generally works, machines, finishes and glues better than green timber although there are exceptions; for instance, green wood is often easier to turn than dry wood. Paints and finishes last longer on dry timber. The electrical and thermal insulation properties of wood are improved by drying. Prompt drying of wood immediately after felling therefore significantly upgrades and adds value to raw timber. Drying enables substantial long-term economy by rationalizing the use of timber resources. The drying of wood is thus an area for research and development, which concern many researchers and timber companies around the world. Mechanisms of moisture movement[edit] Water in wood normally moves from zones of higher to zones of lower moisture content Walker et al. Drying starts from the exterior of the wood and moves towards the centre, and drying at the outside is also necessary to expel moisture from the inner zones of the wood. Wood subsequently attains equilibrium with the surrounding air in moisture content. Moisture passageways[edit] The driving force of moisture movement is chemical potential. However, it is not always easy to relate chemical potential in wood to commonly observable variables, such as temperature and moisture content Keey et al. Moisture in wood moves within the wood as liquid or vapour through several types of passageways, based on the nature of the driving force, e. These pathways consist of cavities of the vessels, fibres, ray cells, pit chambers and their pit membrane openings, intercellular spaces and transitory cell wall passageways. Movement of water takes place in these passageways in any direction, longitudinally in the cells, as well as laterally from cell to cell until it reaches the lateral drying surfaces of the wood. The higher longitudinal permeability of sapwood of hardwood is generally caused by the presence of vessels. The lateral permeability and transverse flow is often very low in hardwoods. The presence of gum veins, the formation of which is often a result of natural protective response of trees to injury, is commonly observed on the surface of sawn boards of most eucalypts. Moisture movement space[edit] The available space for air and moisture in wood depends on the density and porosity of wood. Porosity is the volume fraction of void space in a solid. The porosity is reported to be 1. On the other hand, permeability is a measure of the ease with which fluids are transported through a porous solid under the influence of some driving forces, e. It is clear that solids must be porous to be permeable, but it does not necessarily follow that all porous bodies are permeable. Permeability can only exist if the void spaces are interconnected by openings. For example, a hardwood may be permeable because there is intervessel pitting with openings in the membranes Keey et al. If these membranes are occluded or encrusted, or if the pits are aspirated, the wood assumes a closed-cell structure and may be virtually impermeable. The density is also important for impermeable hardwoods because more cell-wall material is traversed per unit distance, which offers increased resistance to diffusion Keey et al. Hence lighter woods, in general, dry more rapidly than do the heavier woods. The transport of fluids is often bulk flow momentum transfer for permeable softwoods at high temperature while diffusion occurs for impermeable hardwoods Siau, These mechanisms are discussed below. Driving forces for moisture movement[edit] Three main driving forces used in different version of diffusion models are moisture content, the partial pressure of water vapour, and the chemical potential Skaar, ; Keey et al. These are discussed here, including capillary action, which is a mechanism for free water transport in permeable softwoods. Total pressure difference is the driving force during wood vacuum drying. Capillary action[edit] Capillary forces determine the movements or absence of movement of free water. It is due to both adhesion and cohesion. Adhesion is the attraction between water to other substances and cohesion is the attraction of the molecules in water to each other. As wood dries, evaporation of water from the surface sets up capillary forces that exert a pull on the free water in the zones of wood beneath the surfaces. When there is no longer any free water in the wood capillary forces are no longer of importance. Moisture content differences[edit] The chemical potential is explained here

since it is the true driving force for the transport of water in both liquid and vapour phases in wood Siau, The Gibbs free energy per mole of substance is usually expressed as the chemical potential Skaar, The chemical potential of unsaturated air or wood below the fibre saturation point influences the drying of wood. Equilibrium will occur at the equilibrium moisture content as defined earlier of wood when the chemical potential of the wood becomes equal to that of the surrounding air. The chemical potential of sorbed water is a function of wood moisture content. Therefore, a gradient of wood moisture content between surface and centre , or more specifically of activity, is accompanied by a gradient of chemical potential under isothermal conditions. Moisture will redistribute itself throughout the wood until the chemical potential is uniform throughout, resulting in a zero potential gradient at equilibrium Skaar, The flux of moisture attempting to achieve the equilibrium state is assumed to be proportional to the difference in chemical potential, and inversely proportional to the path length over which the potential difference acts Keey et al. The gradient in chemical potential is related to the moisture content gradient as explained in above equations Keey et al. The diffusion model using moisture content gradient as a driving force was applied successfully by Wu and Doe et al. Though the agreement between the moisture-content profiles predicted by the diffusion model based on moisture-content gradients is better at lower moisture contents than at higher ones, there is no evidence to suggest that there are significantly different moisture-transport mechanisms operating at higher moisture contents for this timber. Their observations are consistent with a transport process that is driven by the total concentration of water. The diffusion model is used for this thesis based on this empirical evidence that the moisture-content gradient is a driving force for drying this type of impermeable timber. Differences in moisture content between the surface and the centre gradient, the chemical potential difference between interface and bulk move the bound water through the small passageways in the cell wall by diffusion. In comparison with capillary movement, diffusion is a slow process. Diffusion is the generally suggested mechanism for the drying of impermeable hardwoods Keey et al.

Chapter 9 : George Herbert quote: Only a sweet and virtuous soul, like seasoned timber, never

Seasoned wood is easy to recognize: The ends have darkened and started to crack, the bark has loosened or fallen away. It's lighter in weight than an unseasoned piece of the same species.