COLLECTING & FILTERING DUST

Typical OEM 30 Micron Bags

Heavy Usage Industrial-Sized Felt Bag
(Consumer versions are much smaller)

AMERICAN FABRIC FILTER'S "Short Course" on collecting and containing fine dust will help you understand how your collector works and what's required to improve its performance. While illustrating woodworking applications, our principles apply to many types of dry dust.

Begin with the mechanics of dust collection and conclude with realistic expectations. Once you see ***how*** the process works, you'll make informed decisions about objectives and limitations. With a few details from you, we'll "optimize" the performance of your system - regardless of size or age - for a cleaner, healthier workspace. If you already know everything, skip to the design section at the end. Otherwise, please read on……..

 (800) 367-3591 Fax (813) 991-9700

WHAT YOUR DUST COLLECTOR SHOULD DO

AMERICAN FABRIC FILTER COMPANY is a custom fabricator of *optimized* dust collection and air filtration bags for virtually any type or size of dust collector. These concepts apply to small home shop stand-alone dust collectors, cyclones and even full-scale bag houses. We do not inventory “stock” bags, nor will we try to sell you “something close” for your application.

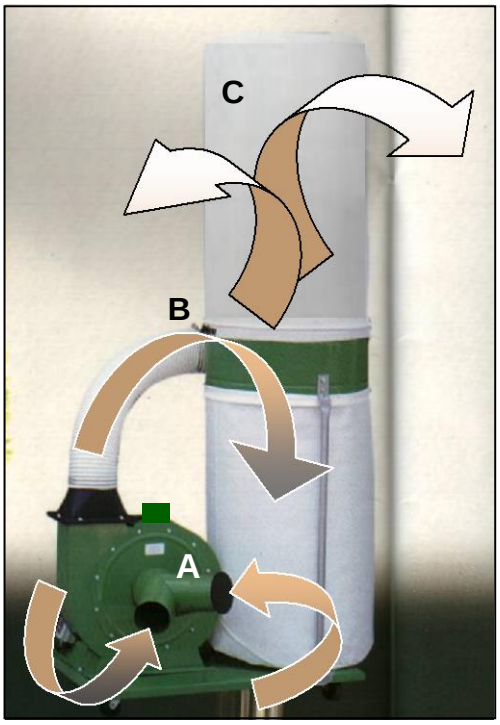
When you contact us, we ask you to measure or describe your specific needs, including your dust collector’s rated CFM (Cubic Feet of Air Per Minute), the output rim’s outside size (what the bag fits over), and space above and along side the collector. We also ask about the type of dust (is it mostly shavings, fines, coarse, sticky, high static, food grade, etc.) and expected usage (occasional / hobbyist; continuous / commercial shop, etc.).

From this information, we work with you to optimize your dust collector for the following three objectives:

A. Maximize suction to collect more dust at the source (your tools)

B. Contain chips and dust completely for convenient disposal.

C. ***Return safe, very clean air to your work space without significant back-pressure.***



REMEMBER

The dust collector’s purpose is not to uniformly redistribute fine dust all over your workplace! (Many people are unaware that they’re really buying 30 micron “chip” collectors.)

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IDENTIFY WHAT YOU HAVE TO WORK WITH

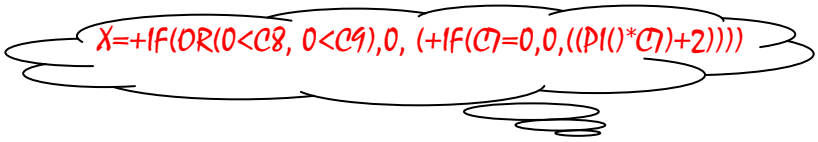
We assume you have (or are about to purchase) a dust collector that you want to optimize and have selected a location in your work place where it's going to be used.

Start with the basics. We keep specifications (dimensions, airflow, etc.) for many popular makes and models of equipment on the market, but have discovered that a manufacturer's in-line changes are not always announced.

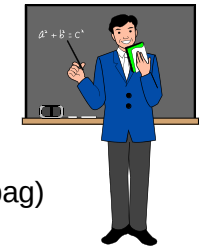
A well made custom bag will slide snuggly over the connecting rim about 2 inches without stretching the fabric or requiring a fold-over that can leak dust. Bottom collector bags reach the platform with about one inch of slack. That way the weight of the dust is supported and the flexing helps keep the dust loose. Top bags work best in *free air space* above the machine.

- If a breather/filter bag gets pressed against a smooth wall or ceiling, escaping air will be blocked and it will perform like a smaller bag.
- If it rubs on ceiling joists, wall studs, pipes or shelves the air flow isn't affected as much, but a hole could be prematurely worn in the bag. (*We do sell replacements)*

Compared to bags provided with most dust collectors, our computer-optimized bags will be physically larger to breath more freely and capture finer dust. To create the correct fit and function we need you to gather a few facts and make some measurements. *Just tell us how you measured. We will do the conversions and the math*.



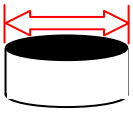
THE DUST COLLECTOR SPECS:



- Brand and Model
- Airflow (fan or system CFM or HP)
- Distance from platform to bottom collection bag rim.
- Rim size (max. diameter, circumference or the flat width of the current bag)
- If the fan motor is on top of the plenum (i.e. along side the top bag), measure its height and distance from the closest rim.

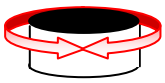
Please Tell Us How You Measured The Rim Size

DIAMETER



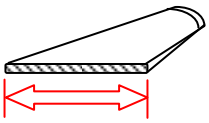
Measure across outside of output

CIRCUMFERENCE



Measure around outside of output

FLAT WIDTH



Fold your old bag flat. Measure its full width

F Y I

Circumference divided by 3.14 (Pi) equals the Diameter

Flat Width equals one-half the Circumference.

THE SPACE AVAILABLE AROUND IT:

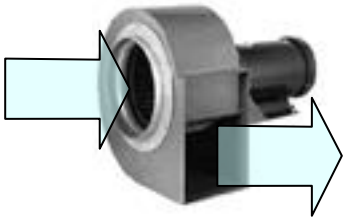
- Top bag rim to ceiling distance (for support rod clearance if collector is mobile, or for determining maximum bag length if it will be hanging from the ceiling)
- The minimum clearance between the collector and nearby walls, pipes, shelves, etc.
- If you have a multi-top bag collector, measure the distance between rims.

HOW DUST COLLECTORS WORK:

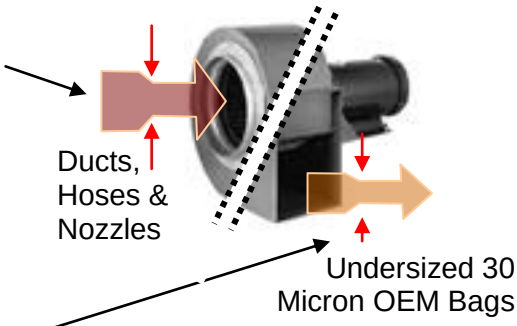
Start with the obvious. It gathers up dust-laden air around the source of dust (your tool) and moves it to another location where the dust is (hopefully) separated out and clean air is returned to the workspace. A motor and fan pushes or pulls the air through various tool nozzles, duct-work or hoses and sends it out through some filtering media.

Volume vs. Velocity Several factors control the total usable amount of airflow a system provides. Some are inherent in the design, some you control, and some we can help optimize. They break down as follows:

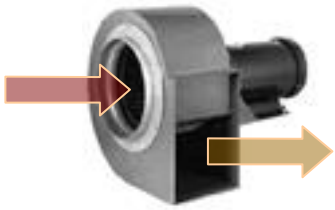
- **Fan CFM rating** is frequently provided by manufacturers of small to mid-sized ready-to-use dust collectors. It measures the cubic feet of air (an amount) moved by the fan in one minute (a fixed time). It's an accurate specification – for those of you who remove the fan from the collector and run it in free air on your workbench! A realistic system rating is more complex.
- **Velocity** If a fixed CFM of air is forced from a large duct into a smaller diameter pipe it will move faster, and vice-versa. Sometimes even a large volume of slow-moving air may not suspend dust moving through a long duct.
- **Input Resistance** caused by friction in long ductwork, sharp bends, flexible hoses, small pick-up nozzles, etc. will restrict the amount of air the fan can move. You should do everything possible to minimize restrictions using properly sized nozzles, smooth ductwork, and blast gates. AFF is not a system designer, however there are many good books, magazine articles, web pages and forums on this subject. (See our LINKS)
- **Output Resistance** is almost totally a factor of the design of the filter bag(s) you use. (Plenum design may also be a small factor here, but there's usually little you can do to change it.) Typical OEM (Original Equipment Manufacturer) bag-sets are both poor dust filters and very restrictive to airflow. AFF's *optimized* felt breather/filter bags are custom designed for each application to provide the right amount of fabric area. This allows easy breathing (low back-pressure) and the more effective "surface" filtration that efficiently captures very fine dust.



WHAT MANUFACTURERS SPECIFY



WHAT REALLY HAPPENS



RESULT: POOR PERFORMANCE
(*Because… input = output*)

HOW TO OPTIMIZE YOUR COLLECTOR'S PERFORMANCE:

There are three (3) players working together to optimize performance.

- **Manufacturers** can sometimes provide higher performance components (…but you probably already own a dust collector);
- **You** can examine all of the components in your pick-up side of the system, and remove as much input resistance as possible to the incoming air; and…

- **We,** at American Fabric Filter Co., can design a filter and collection bag system that best fits your shop virtually eliminating restrictive back pressure, containing both chips and dust, and returning very clean air to your workplace. For a typical stand-alone dust collector, bottom bag(s) become non–breathing collection bags made of rugged canvas fabric or heavy duty plastic, and top bag(s) are the high efficiency felt filter bags easily capable of containing dust down into the 1 micron range. Together, they become part of a system that helps maximize collection and containment of dust and chips for disposal in the manner you prefer.

* **OTHER SYSTEM CONFIGURATIONS**: In other applications the system's appearance may be much different, but the collection and filtration process is quite similar. For example, some very small collectors may have a single bag to breathe and contain dust. Some fans sit on top of a 55 gallon drum that collects the chips, and use a breather / filter bag on the side to catch the fines and filter the air. Larger systems may use a cyclone to drop out the heavier chips and one or more filter bags to catch the fines and filter the air. The biggest systems rely on a baghouse filled with dozens or even hundreds of bags to provide the surface area (air-to-cloth ratio) required for industrial-sized dust removal. Baghouse bags are either shaken mechanically, or blasted with compressed air on a routine basis to loosen the layers of dust that build up on them.

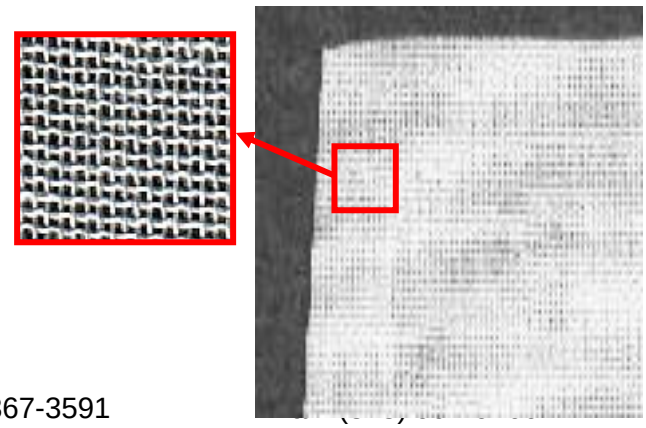
Occasionally, users request replacing only the top bag for better breathing. While this does produce better suction by reducing back-pressure, keeping the original open weave bottom collector bag in place will result in continued distribution of 30 micron dust. (See below)

This is usually done to save money, but it defeats your objective to provide clean, healthy air to breath. We do not encourage this practice. A somewhat clumsy substitute for a proper non-breathing bottom bag might be to use a larger sized heavy duty trash bag contained within your OEM bag. Without such protection, ordinary trash bags are likely to partially fill, burst and …….

THE FABRIC IS NOT "1 MICRON"

For this discussion, we consider typical small to mid-size (1 to 10 HP) stand-alone single-stage dust collectors having top and bottom bags. The very first time you turn on this brand new collector it has pretty good suction. There's strong vacuum at the intake side because the fan's air is exhausting through clean and empty upper and lower bags. So far… GREAT!

Less Dust, Less Air Look closely at the filter fabric. Most original equipment bags are a *woven* cloth such as Cotton or Polyester Sateen made up of "threads & holes". Since threads don't breath, air sucked in by the fan can only go out through the *holes* between them. Woven fabrics with smaller *holes* will stop finer dust from escaping, but less air is able to escape and back-pressure (resistance to system airflow) will build up inside the bag(s).



The net result is loss of vacuum to pick up dust at the tool. In an effort to expel some of the pressure building up inside the filter bag, the *holes* are forced to *open wider*, letting both very fine and larger (in some cases, up to 50 micron) dust that was just picked up to find its way right back into your workspace.

In these systems the top bag is *always* a breather bag, and the bottom bag can also be a breather when it's empty - but not when it's full. If a manufacturer counts on the bottom bag as part of the breather / filter media, the airflow resistance (backpressure) will gradually increase as the collector bag fills. Not only does a full bottom bag increase the pressure inside the top bag to force more dust 'through the holes', but the swirl of accumulated dust inside the bottom bag drives even more dust through *that* bag, too!

If your current bags blow up very hard, and/or create a cloud of dust when you turn the collector on, THEY ARE NOT DOING THEIR JOB!

THE BETTER WAY - OPTIMIZED BAGS

After picking up (collecting) the dust, a collector has two remaining functions: (a) contain all of it for disposal and (b) return clean air back to the work space. These are separate and distinct tasks, and each require a *different* solution.

Dust and Chip Collection Containers should be virtually air-tight. Their only purpose is to store dust and chips while directing all the airflow to the filter-breather bags. Containment systems for the dust vary considerably and designs are most often driven by the volume of material to be handled.

- **Large** (10 ~ 50+ HP) baghouses often use hoppers, bins, or even semi-trailers.
- **Medium** (3 ~ 20 HP) sized systems may use 55 gallon drums which may be mechanically sealed to a fan housing, clamped to a breather-filter bag, or connected to a plenum by an air-tight sleeve. For the latter, we make custom fitted canvas (tightly woven # 8 cotton duck – similar to an Army duffel bag) airtight connector sleeves that actually go *into* the barrels, with a 'skirt' that gets clamped around the outside to create the air-tight seal. All the dust follows the inner sleeve and doesn't pile up on the edge of the drum. (It's *much* cleaner.) This is the same canvas used to make rugged, reusable airtight fabric collector bags. If the convenience of carting off sealed bags of dust is appealing, heavy-duty 5 ~ 6 mil poly bags designed specifically for high pressure and high strength may be used. Available in several sizes, they are sometimes called 'industrial-disposable' bags. A home woodworker, handling them carefully, should be able to reuse them several times (but not indefinitely).
- **Small** (1/2 ~ 3 HP) systems, like a dedicated single-tool collector or one a home hobbyist woodworker might use, are best served by a custom-made non-breathing canvas fabric collector bag or the poly bags mentioned above. As mentioned before, woven cloth OEM bags can't contain fine dust.

PICK THE BEST FABRICS

Breather and Filter Bags must allow the air leaving the fan to escape without resistance while blocking even the finest dust from returning to your workspace. The choice of fabrics and the size of the breathing surface are absolutely critical to a successful design.

Is there "One Best Fabric" for all breather-filter bags? Strictly speaking, NO! Filter bags can be made from dozens of fabrics to solve unusual dust problems or function properly in a particular collector. For example a bakery may request woven fabrics because they are easy to wash *and dry*. Industrial applications with high operating temperatures call for exotic (read as *expensive*) fabrics like fiberglass or even stainless steel cloth.

However, in a high percentage of applications the overwhelming fabric of choice is non-woven **Felt** (*typically Polyester*). Felts are available in a range of base fibers, weights (thickness) from 10 oz. to 22 oz. per sq. yard, as well as many specialized surface treatments.

Plain felt catches lots of dust in between its fibers by depth filtration. In fact the fabric is a *very effective* filter – for a relatively *short* period of time – because the captured dust can quickly block airflow by packing in the air spaces between the fibers to 'blind' the fabric.

Singed felt is one of the most popular surface treated fabrics for general dust filtering. A controlled flame process slightly hardens the fuzzy surface fibers (similar to burning the end of a cut piece of rope) which determines just how much dust can stick to that surface. As this *highly desirable layer of dust* builds up on the inside surface (or outside surface in many baghouses) of a breather-filter bag, it reaches a point where it can no longer be supported and, with a little help, falls away.

Glazed (a.k.a. Eggshell) felt has an even smoother surface for very sticky powders such as powdered sugar, starch, etc. or wood shavings that can get caught on fabric fibers.

Special treatments and additions like anti-static carbon or stainless steel fibers, grounding wires, and/or Teflon™ membranes are also engineered into many high-end systems with difficult problems. [The details of large industrial applications and/or these fabrics are beyond the scope of this discussion. For help with a specific application, please call AFF at (800) 367-3591 between 9 AM and 5 PM EST, Monday – Friday.]

- **More Airflow:** Engineered for strength, durability and consistency, the fibers in felt are "needle-punched" into a homogeneous pad. Felt breaths over the *total* surface (as opposed to a woven cloth's *holes*), providing higher air permeability / CFM ratings* than most woven fabrics. Even though the spaces between fibers are closer together, air has many more paths to pass through.

** CFM ratings are a way of measuring how many **C**ubic **F**eet of air can pass through one square foot of a fabric in one **M**inute with a specified minimum amount of resistance. For the technically inclined, we are looking for a static pressure loss of 1/2 in. water column. Fabrics are rated new and clean, and will lose CFM permeability as they get dirty.*

- **Depth Filtration:** Since all felt fibers are uniformly close together, they can capture and hold onto much finer dust particle sizes that would easily pass through the much larger *holes* in a woven fabric. Thicker felt fabrics provide increased 'depth-filtration' capacity, but with correspondingly less overall airflow.

- **Surface Filtration:** If we provide an oversized surface area for the dust-laden air to flow through, pressure is spread out and the driving force of the air is greatly diminished. Now the majority of the dust will simply stop when it hits the surface of the felt – inside the filter bag - where it will begin to build up a uniform layer of dust known as a "**dust cake**". Now the dust cake becomes the prime filter media supported by fabric. This layer continues to catch fine dust and grow thicker over time, which reduces the airflow (CFM) of the bag – yet another reason to oversize the bag. Fine dust will *agglomerate*, or be captured by the dust cake. If properly designed, it will catch particles as fine as 1 MICRON!!!

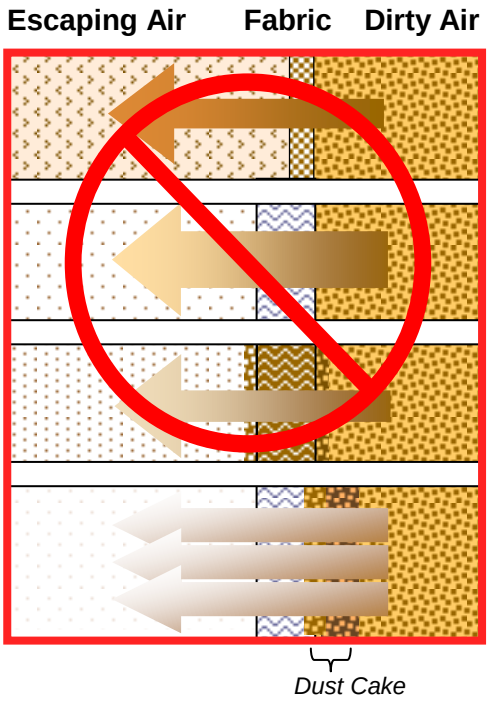
BAG FABRIC TYPES AND RESULTS

WOVEN CLOTH: “Threads and holes”. Undersized OEM bags have low airflow and pass 30 Micron and smaller dust.

FELT (TYPICAL OEM SIZED, NEW AND CLEAN): Filters to about 5 Microns with good airflow in the beginning.

FELT (TYPICAL OEM SIZED, USED AND DIRTY): Felt becomes “blinded” with dust that gets pushed through it.

FELT (OPTIMIZED): Dust builds up a cake inside the bag that stops dust down to 1 Micron range. Reduced airflow is compensated for by larger size. Fabric becomes support for “dust cake filter”.



The design process starts by specifying the equipment you have and how it is used...

Breather / Filter Bags: We use the fan’s CFM rating to approximate the maximum volume of dust-laden air that *could* pass through the system, and provide enough fabric area to handle twice that amount - when they’re new and clean. (Many of our bags inflate softly at first.) After the collector has been used for a while and the dust cake forms inside the bag, the airflow *through* the fabric is decreased and the oversized bag becomes just right!

- Ducts, flex hoses, pick-up nozzles, blast gates, and filter bags reduce airflow and create back pressure. Maximum airflow will always be less than the fan rating. Our objective is to design bags that will add as little additional output resistance as possible.

Measure the size of the collector-to-bag connections (outside circumference or diameter of flanges) to ensure an air tight fit. Also, measure how much space is available above, below and along side the collector. Some bags will be short and fat, others are thin and tall. Remember…

- If a breather bag is placed up against a flat wall or ceiling, air flow will be blocked which is like buying a smaller bag.
- If a breather bag rubs against a rafter, pipe, shelf, light fixture, etc., the rubbing could wear the fabric and make a hole in it.

The final factor is what kind of dust will be filtered. A weekend hobbyist collecting mixed fine and coarse dust needs a lighter duty fabric than a production shop with a constantly operating wide-belt sander. Fabric choices change the size of the bag.

Many bags have hanging loops, belt loops, extra inlets, tapers, skirts, etc. More sophisticated collectors may have special features like automatic shaker systems or pulsed high pressure air jets. Bigger systems, such as baghouses or large cyclones, can have several, dozens or even hundreds of bags. (If you have a large system, please call us at 1-800-367-3591 for personal assistance.)

Collector Bags contain dust and chips. We don’t count them for part of the system’s breathing since that would cause a variation in airflow / vacuum as they fill. OEM bags often bleed through lots of fine dust. Felt bags are not the answer. Felt is not made to carry heavy weight.

Canvas fabric bags, typically # 8 cotton duck, are very strong (think of an old Army duffel bag) and air-tight. Even with rough handling, they'll last a very long time. We size them to fit snuggly around the collector's lower output flange and make them a little bit long to ensure that the weight of the sawdust inside is supported by the platform or floor under the bag.

Trash cans, 55 gallon drums, etc. are also commonly used as collectors. Rugged, air-tight cotton duck connector sleeves work best here. They can even connect items with different diameters (but we need to know both sizes as well as how long to make the sleeve). To make emptying containers a lot cleaner, we can add a 3-4 in. long second layer of fabric called a "skirt" around the bottom of the sleeve. This way the sleeve goes into the container and all the dust follows it. The outer skirt gets clamped onto the outside of the container to form an air-tight seal.

Some collector systems use a 55 gallon drum as the base with the breather bag attached to the top of it, and have an inlet fabric tube going through the side or into the top. Others put the fan / motor on top of the drum with a bag hanging on the side. Any of these approaches can easily be improved for better airflow (suction) and finer filtration. Note your airflow (CFM), drum size, space available for the bag, size of the inlet connection, and it's exact location on the bag. For hanging side bag replacements, please call us to request a "Drum Top" worksheet.

A final note on collectors – heavy duty plastic bags (5 to 6 mil) may be used successfully, especially if easy disposal is an important factor. Good clamps are a necessity here.

IN SUMMARY…

To optimize your dust collector, the system should have the *maximum* vacuum, *least* amount of resistance to airflow and *finest* filtration possible. While there are many resources to help you optimize your *input* side, installing **American Fabric Filter's** high efficiency felt bags is one of your best ways to optimize *output* … and return clean air back to your workspace. At the end of this, there's a worksheet to help you gather the facts about your equipment before you e-mail or fax us. You can also call us at 1 (800) 367-3591 for personal assistance.

The web sites listed below provide a wealth of valuable information including equipment tests and comparisons, along with design tips and much more. Tell them we sent you.

Magazines & Forums

FINE WOODWORKING MAGAZINE: www.taunton.com > Fine WoodWorking > tools

MODERN WOODWORKING MAGAZINE: www.modernwoodworking.com > manufacturers

WOOD MAGAZINE: http://talk.woodmagazine.com/woodtalkindex.html > Dust Collection / Air Filtration

WOOD DIGEST MAGAZINE: www.woodworkingpro.com

WOODWORKING INDUSTRY INFORMATION (General): www.woodweb.com

WOOD CENTRAL (General & Chat): www.woodcentral.com

THE OAK FACTORY (General & Chat): www.theoak.com > Woodworker's Bulletin Board

WOODSMITH MAGAZINE: www.woodsmith.com

WOODNET FORUMS: www.forums.woodnet.net

WOOD & WOOD PRODUCTS: www.iswonline.com > Wood & Wood Products

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