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Everything you need to know about winter jacket tech

Cut through the marketing speak and get a coat that will keep you warm.

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It's cold outside

We have come a long way from the days of draping ourselves in animal skins.*Columbia*

> With snow falling in Florida and temperatures along the East Coast dipping well below zero, the need for a good winter jacket has never been greater. The warmth from your body wants to get out into the cold atmosphere—that's just simple thermodynamics—but a good jacket can keep it from escaping, even when the temperatures hit "polar vortex" or "bomb cyclone" levels of frigidity.

At one point in humanity, animal furs and pelts were our best option—they're great insulators and give that cool "north-of-the-wall" look. Now, we have more efficient methods for bottling in body heat, but that has made the process of buying a winter warmer confusing, filled with tons of inconsistent standards and industry-specific jargon. Here's a guide to for finding the right jacket.

What to look for

While there are metrics you can use to guide your jacket purchase, there isn't one perfect jacket to suit everyone's needs. "Some people run hot and other run cold," says Woody Blackford, vice president of global design for Columbia sportswear. "There are other factors, too, like how active you are. You need a different jacket to stand at the bus stop every day than you do to go out running."

Almost every winter jacket has three main components: an outer shell, insulating fill, and a lining. Here's a breakdown of each piece.

FILL

Just about every piece of winter gear is designed to provide good insulation. The stuff you'll find in jackets works pretty much the same way as the scratchy, pink fiberglass stuff lining the walls of your house: Individual threads or strands of material create tiny pockets that trap warm air. "You're creating a microclimate around your body," says Blackford.

Down

The most popular kind of fill for a winter jacket is still down, the fluffy layer of insulation harvested from the skin of fowl like ducks and geese. Companies often mix down with typical feathers to reduce costs. Down is an extremely efficient insulator that's easy to compress and pack, which has made it the gold standard for jacket insulation for decades. The downside: it doesn't do well when wet.

Here are the variables to consider when buying a down jacket:

Fill power This is one of the stats jacket companies love to brag about, because it's basically an indicator of the overall quality of the down fill. The number, which typically ranges from 300 to 900, directly represents the amount of cubic centimeters one ounce of down will take up when compressed in a cylinder by a calibrated weight. Higher quality down won't compress as much, which leaves more room for air pockets (remember: we like those) and more effective heat retention.

The U.S. and Europe use the same methodology for determining this number, but Europe uses a wider cylinder and a heavier weight. The combination of those variables means that, on paper, the numbers should come out about the same.

In addition to better heat retention, higher fill power also often translates into a more comfortable jacket. Once you get below the 500 range, the material can start to feel stiff or lumpy. Anything in the 800 or 900 range pushes into the premium category.

Fill weight Once you've determined what kind of down will go into a jacket, then you have to find out how much of it there is. Fill weight is simply the amount of down found in a jacket measured in ounces. Yes, ore down is better, assuming the fill power remains constant.

So, just because a jacket has a high fill power rating, it can still have a very small amount of actual material between you and mother nature, which won't keep you as warm. Similarly, you can have a heavy jacket with a lot of low-quality insulation inside and it won't keep you as warm a**Down to feather ratio** Down specifically refers to the soft plume or clusters of material that reside right next to the bird's skin. It's different from feathers in that it's much fluffier and doesn't have hard stems that sometimes poke through the shell or lining of the jacket. A higher proportion of down clusters to feathers is ideal, but typically raises the price of the garment.s a lighter jacket with better insulation.

A higher down mixture will often compress down more, which is important if you're planning on packing the jacket on a trip. A good mix should be at least 70 percent

down, but mixes over 80 percent are common for premium jackets.

The downsides of down

Down comes from water fowl, but oddly down jackets are nearly useless if they get wet. “Down wads up when it’s wet,” says Blackford. “You lose all those holes that trap warm air, and you’re left with wet fiber next to your skin. It takes a long time to dry once you wet it out, too.”

It’s difficult to make a waterproof shell for down jackets because the garments need sewn-in pockets—called baffles—to keep all the down from slumping into the bottom of the jacket over time. Tthose seams create tiny areas without insulation or waterproofing. Manufacturers have started using heat-bonded or welded seams, but the methods still leave uninsulated areas that jettison warmth.

High demand for down requires lots of birds, and the harvesting process isn't always kind. Ideally, features would come from molting birds that are already losing

their feathers, but manufacturers have been accused of "live plucking," which is painful for the birds. Down is also largely a byproduct of the food industry, which means the plume may have been plucked from a goose that was force fed and fattened to create fois gras.Many of the major manufacturers including The North Face, Columbia, and Patagonia have made efforts in this arena.

Synthetic insulation

The other option for jacket insulation is synthetic polyester. The individual fibers achieve the same purpose as down: creating tiny holes that trap warm air around your body.

Apocalypse Design, an Alaska-based outdoor gear company, makes custom coats and outerwear for truly brutal conditions, including Iditarod races. The company is based in Fairbanks, where temperatures of -40 degrees Fahrenheit are the norm in the winter. The company's synthetically insulated Expedition parka is meant to

withstand temperatures to -60 degrees for extended periods of time.

PrimaLoft (shown below) is one of the most common varieties of synthetic fill.

“We use two layers of a synthetic material called Climashield under a layer of another material called Primaloft,” says Shawna Biesanz, Apocalypse’s product manager and a Fairbanks resident. “We’re using the same materials you’ll find in a heavy sleeping bag to keep in heat. It will work even if it gets wet. It will be heavy and you’ll still be miserable, but it will work.”

PrimaLoft is interesting because it uses synthetic fibers arranged in down-like clusters instead of a continuous sheet. It still can’t match the warmth-to-weight ratio of organic material.

Synthetics are often heavier than high-quality down, and they don’t pack down as small. But, they give more

consistent coverage since baffles aren't required to keep the sheets of insulation in place.

Outer shell

The primary function of the outer layer is to keep out wind and moisture.

Ryan Knapp is a senior staff meteorologist and weather observer at the Mount Washington observatory in New Hampshire, where temperatures regularly cross the -40 degree point with gusting winds that push the feels-like temperature down even more. "Temperatures that cold—especially in the wind—can cause frostbite in less than five minutes," he says over the phone. "We'll use a mirror or a selfie camera on our phones to make sure there's no visible skin sticking out of our hoods or our face masks before we go out."

Outer layers are typically made from tightly-woven synthetic materials with a hydrophobic coating like Gore-Tex, which allows water vapor to pass out into the

atmosphere while blocking outside moisture from getting in.

You may see jackets say things like “PFC-Free,” and that’s typically regarding the shell. Perfluorinated acids were once a typical ingredient in hydrophobic coatings which were hazardous because of their penchant for bioaccumulating in the environment. Manufacturers have made efforts to move away from the nasty chemicals.

The outer shell doesn’t do much to actually keep you warm except for keeping out wind. Its primary function is to protect the insulation inside.

Liner

The layer that goes next to your skin seems like the least important, but in many cases, it actually handles a lot of the initial heat retention.

Columbia and other companies use reflective material it calls Omni-Heat—Blackford likens it to non-contiguous strands of a NASA thermal blanket—to reflect infrared

wavelengths back toward your skin. It literally bounces heat back at your body. If you see a jacket reference “infrared” in the name or the spec sheet, this is typically what its referring to.

“If you’re standing still, about 87 percent of your heat loss comes from your body radiating heat in the infrared spectrum. Only about 13 percent is lost to conduction, where you transfer heat to the atmosphere,” says Blackford. “The reflection of heat works immediately. Imagine your jacket is sitting in a freezing temperature and you have to fill all those tiny air pockets with warm air from your body before it will start to keep you warm.”

Many interior linings also can wick moisture to pull water away from your skin. According to Blackford, wet skin emits heat roughly 30 times faster than dry skin.

How should a jacket fit?

It’s important to keep out the wind, which is why a good, tight seal at the cuffs, neck, and waist of a jacket are important. But, while you don’t want to leave room for

wind, you also don't want to squish the insulation. "The insulation needs those air pockets to trap warmth," says Knapp. "If you compress it, it won't work as well, just like in your home."

So, what jacket should I buy?

It's important to get a jacket that's warm enough to bottle in your body heat, but you also don't want to drastically overestimate your need for insulation. Find the balance of flexibility, weight, and warmth that matches your actual lifestyle.

An Apocalypse Design Expedition jacket that's good in -60 degrees will keep you warm when you're tromping around in the Arctic, but it will weigh you down and have you sweating if you're just walking to the subway. "A jackets is only good if you wear it," says Biesanz.

Sweating too much is suffering, too.