This Custom Option is Available on:

Model:	Structural	Proximity	Technical Rescue and Recovery	EMS
Prefix ID:	☑ BPR ☑ LTO ☑ TAC ☑ PRH	☑ BPR ☑ LTO ☑ PRH	☑ USR (Also EMS, Liquid Splash/ HazMat, Wildland Certified)	☑ EMS

BiFlex Heat Channel Knee (Patented and Patent Pending)

- **Strongly recommended for all field tests**
- **High performance with easy motion**

At Morning Pride, we are constantly attempting to both develop new and refine even highly successful products. Our Heat Channel Knee is, we believe, simultaneously the most protective, most comfortable and most specified knee product on the market. The horizontal stitch lines mean this highly protective knee is as easy to bend as the outer shell alone.

Only one very minor negative is ever voiced about this knee: in a standing position, it can be a little one dimensional (flat on the curved leg). During in-depth studies of firefighter leg motion during vocational exercises, we also noted that some leg rotation occurs on the sides of the legs as the knees are bent. This suggested that a bi-flexing knee could even further facilitate motion without requiring protective trade-off or decreased comfort while crawling.

The photo to the above shows a pair of pants with a traditional Heat Channel Knee on the wearer's right leg (to the left in the photo) with notched corners (an option) and a new **BiFlex Heat Channel Knee** on the wearer's left leg (to the right in the above photo).

Traditional Heat Channel Knee **BiFlex Heat Channel Knee**

Note the "flatter" more one dimensional standard Heat Channel Knee on the left and the more leg conforming **BiFlex Heat Channel Knee** on the right.

Both knees are an industry leading 12" high (as a standard). The traditional Heat Channel Knee is 9" wide (as a standard) and the **BiFlex Heat Channel Knee**, because it conforms more closely to the leg, is 8"wide (as a standard).

Whether in a crouch or a kneel, both knees, based on their differing conformance to the leg and their width, give roughly equivalent area coverage.

The **BiFlex Heat Channel Knee** follows the leg curvature more closely because it is designed to automatically flex in two directions. Horizontal pleat lines in the center of the knee facilitate knee bending, while vertical pleat lines along the outseam and inseam of the knee allow the pant to flex AROUND the leg as the knee flexes. This replicates the bi-flexing action of the leg/knee during motion and makes it the most easily flexing, high protection knee we have ever manufactured (and it is hard to improve on the flexibility of the traditional Heat Channel Knee).

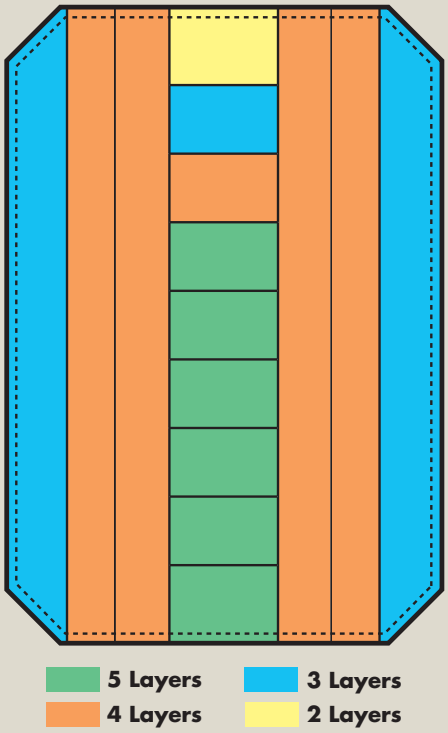
While both knees bend easily on horizontal pleat lines, note how the **BiFlex** knee to the right also bends around the knee naturally during motion.

Also, because the **BiFlex** knee "positions" the knee even more precisely during motion, we can also scale the insulative layering for less bulk without significant impact upon effective insulation protection. The chart to the right shows the standard layering of the **BiFlex** insulation system. Just as the traditional Heat Channel Knee features 5 layers of insulation over the whole knee, the **BiFlex Heat Channel Knee** also offers 5 layers of protection in the primary kneeling area and reduced layering for less centered areas (we will report the lowest CCHR layering results in the 6" x 6" test area for reasons of conservatism, still to be far higher than essentially any other knee except the 5 layer traditional Heat Channel Knee).

Some final points:

- Traditional Heat Channel Knees will continue to be available; many customers have had such success that they do not want to even consider a change.
- **BiFlex Heat Channel Knees** will also be available.
- Both traditional and **BiFlex Heat Channel Knees** are the same price (there is some small material savings with the **BiFlex** design but more stitching expense).
- You must ask for **BiFlex Heat Channel Knees** on your order. If you ask for Heat Channel Knees, you will receive the traditional Heat Channel Knee (as you always have).

You may even vary the material in the horizontal sections to the center and in the vertical sections on each side (the price will reflect the higher material price selected). Your IMA or our Quote Department will be glad to help. An example of such a knee would be, say Arashield in the center for durability and non-arashield on the sides for easier flexing.



BiFlex Heat Channel Knee Enhancement

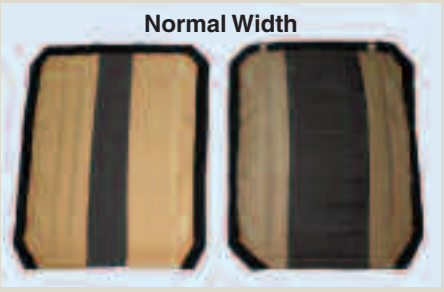
The BiFlex Knee as originally introduced was 2" narrower than the original Heat Channel Knee. Many of you have suggested that your customer is used to the width of the normal Heat Channel Knee and would prefer the same dimensionality on the new BiFlex product. An additional advantage of matching the width of both products would be that BiFlex Knees can be used in older heat channel knee frames. For that reason, as a standard and on a running change basis, we have added one extra vertical ridge on each side of the heat channel knee. This change makes the BiFlex Heat Channel Knees, the same width as the normal Heat Channel Knees. Obviously, the tiered layering of the BiFlex will still allow the BiFlex to curve around the leg more easily, it will only now be slightly wider. You may still order the "narrow BiFlex Knee" that we have been making if you prefer the narrower width. There is no extra charge for the extra BiFlex Knee width.

Design Refinements on BiFlex Heat Channel Knees

The BiFlex Heat Channel Knee design option is becoming VERY popular. Some in-field engineering has allowed us to advance the design even further. These enhancements will be standard in the future, and the cost of the option is not changed.

Sewn on or removable BiFlex Knee Refinements include:

A widened center section, shown here in optional Arashield material, makes the main section flex more readily, stabilizing the knee during motion even more.



Old Design **New Design**

Knee Options Continue...

Knee Options Continued...

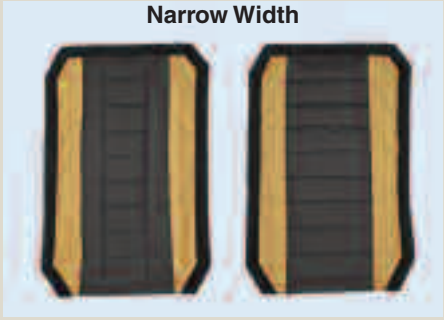
On removable BiFlex Knees only:

Two snaps will now be standard on the upper part of the frame (rides above the knee) to further stabilize the knee in the frame, when the removable option is specified.

Additional hook and pile tape has been added to further stabilize the knee.

Note: On requests for narrower replaceable knees or on smaller waist pants, the appearance of knee pads will be and are a little narrower and different. On size 34 waist and below, narrow width pads are standard.

Narrow Width



Old Design **New Design**

We have had tremendously positive reaction to the Bi-Flex design; with these refinements, we feel the reception will be even more positive. With almost unlimited insulative capacities and almost totally unrestricted motion, no other knee comes close.

Silicone Knees Versus Heat Channel Knee Insulation Enhancements

We are in stock and have certification on Silicone insulation knee layering. While we are glad to provide this product, unlike other firms, we do not "push" Silicon knee thermal pads. Our patented Heat Channel Knee is more flexible, more insulative and far more comfortable while crawling.

Silicone Coated Kevlar® Knee Reinforcements

We are in stock and have certification on Silicone Kevlar® reinforcements (one firm has trademarked their use of this material as "Dragon Hide" – we refer to the material as EZ-Flex)). While we are glad to provide this product, we find Kevlar®/ Nomex® is easier to flex, offers exceptional durability in our biggest metro accounts and is easier to move in.

Comparing Arashield and Silicone Coated Kevlar® Knees

Silicone coated kevlar® is more flexible than Arashield, but it is also less durable, as the chart below shows. Our Bi-Flex Heat Channel Knee, discussed on the previous pages, is one design that allows the use of the more durable Arashield, but only in the center where most abrasion occurs (so, minimizing the amount of stiffer Arashield, but still having it where most abrasion occurs).

Material	Cycles to Failure H-18 Abrasion Wheel	Weight Grams
Dragon Hide	1,600+	500
Arashield	3,000+	1,000

NOTE: Please also see Flex Tucks and Flex Facilitator Panel options under Liner Options pages 138 and 139. When removable knees are ordered, frame will typically match knee (please see price list for full details).

On knee reinforcements, Heat Channel and Puncture Resistant Technology also available on other body areas. Contact our Customer Service Department for details.

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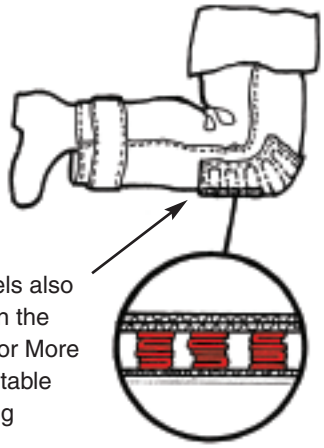
Heat Channel Knees

(Patented)

Improves crawling comfort while increasing insulation

Some departments have found that knee burns are a particular problem for them. At certain points of the burn curve, compression can reduce insulative performance. When kneeling, the firefighter's entire weight is spread over only a few square inches. If this compression at the knee decreases insulative performance, the transfer of heat is facilitated and conductive or scald burns could occur (in the presence of sweat or water). The Heat Channel Knee option addresses this potential problem in several ways:

- the pads are highly insulative (in excess of 280 TPP units, when tested per NFPA 1971)
- knee bending is very easy since the bend occurs at the lateral stitch points where there is no added bulk
- the pads hold the firefighter's knees above the kneeling surface, thus minimizing contact with hot embers, super-heated surfaces and scalding liquids
- in the event of a steam filled environment, the channels provide a "a path of least resistance" for steam to move away from the firefighter's body

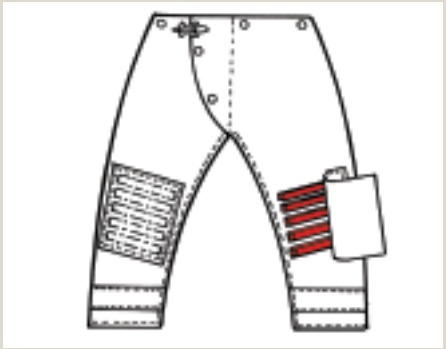


Channels also Cushion the Knee for More Comfortable Crawling

Note: Heat Channel Shoulders also now available for high intensity applications like advanced fire combat or advanced fire training.

Heat Channel Knees can be ordered for either outer shell or liner placement (please see photos to right). The exterior placement is strongly recommended, as it is far more comfortable; although the interior placement will keep the assembly drier (i.e. inside the moisture barrier) and therefore lighter. The replaceability option is also highly recommended since it allows adjustment of knee systems to firefighter preference and easy field replacement of this high wear garment area.

We recommend Kevlar®/Nomex® as the Heat Channel outer shell material of choice since it offers the highest level of abrasion resistance. Kevlar®/Nomex® is available in Black, and that color works well with any outer shell material.



The Heat Channels run horizontally to facilitate knee bending. Bending occurs only on thin layers at stitch lines. Because they are a soft material, they also effectively cushion crawling.

The Technical Rescue and Recovery standard requires elbow and knee reinforcements. The Heat Channel Knee is very popular for Technical Rescue and Recovery applications since it is kneeling and crawling on an easy bending pillow (it is also our most popular Structural, Proximity and EMS knee for the same reasons).

Channels also "raise" knees above most hot debris & scalding liquids.

Photo shows replaceable **Exterior Placement** Heat Channel Knee. Attachment is via Hook & Pile tape, as well as corner straps. A three sided "picture frame" helps prevent the knee from catching on items in the fire environment. The bottom of the knee is secured with interior Hook & Pile. This exterior placement is so comfortable than field testers report they are not even aware of the assembly as they work. Its one comparative difference to interior placement, availability for wetting and drying, can be minimized with the removability feature that allows substitution of a new assembly in the field easily. For departments that wish to avoid the channels on the exterior of the knee assembly, a "domed" cover may be specified which will cover the interior channels.

Photo shows replaceable, **Interior Placement** Heat Channel Knee. Please note attachment is via Hook & Pile tape. Top "flap" prevents catching of foot or boot on pad as pants are put on. Customers are cautioned this interior placement is NOT as comfortable as exterior placement (but does prevent more wetting, since it rides inside the moisture barrier).

Knee Options Continue…

Knee Options Continued…

Demonstrating Heat Channel Knee Technology Advantages

As most firefighters are aware, there are three typical knee thermal enhancement designs commonly used in this market place:

#1 Typical technology aramid constructioning used by many manufacturers
#2 Typical PVC foam based constructioning used by only one manufacturer
#3 Our patented Heat Channel Knee aramid construction

The data presented is from a recent study conducted for a major bid/contract on sample material "As Received," then hit with a CCHR three consecutive times. All composites were the same (our 54i2) and only the knee reinforcements/thermal enhancements varied. As you will see, the Heat Channel Knees out performs the designs other manufacturers often provide, both in the overall level of protection, and also in consistency over the area protected.

The following charts compare performance of these typical systems during repeat cycles of NFPA Standard 1971 CCHR test protocols. NFPA currently only requires 1 CCHR test exposure and 25 seconds of protection before second degree burn. But, given that firefighters encounter repeated heat exposures, we believe the additional test cycles provide critical information. As you can see, the testing isolates several key points:

- Both of the aramid based systems (#1 and #3) tend to show consistent or increasing results after repeated CCHR exposures.
- The PVC based systems (#2) however, tend to have decreasing results with repeated CCHR exposures.
- The Heat Channel Knee technologies (#3) clearly out perform the competitive products in essentially all conditions

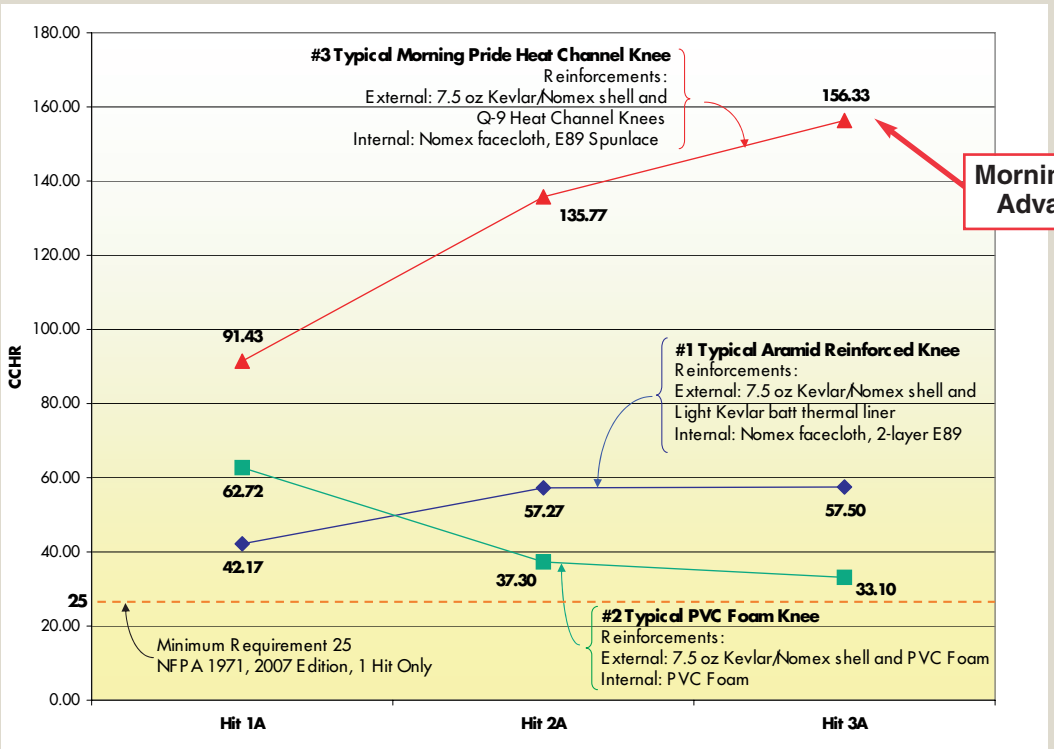
Remember, we can also reproduce these comparative tests in our lab RIGHT IN FRONT OF YOUR EYES. We have found this kind of demonstration is a powerful tool for customers to see and clearly differentiates us from competitive offerings. The comparative condition of the materials alone, after test, is a powerful demo of the comparative performance characteristics of the designs.

Knee CCHR

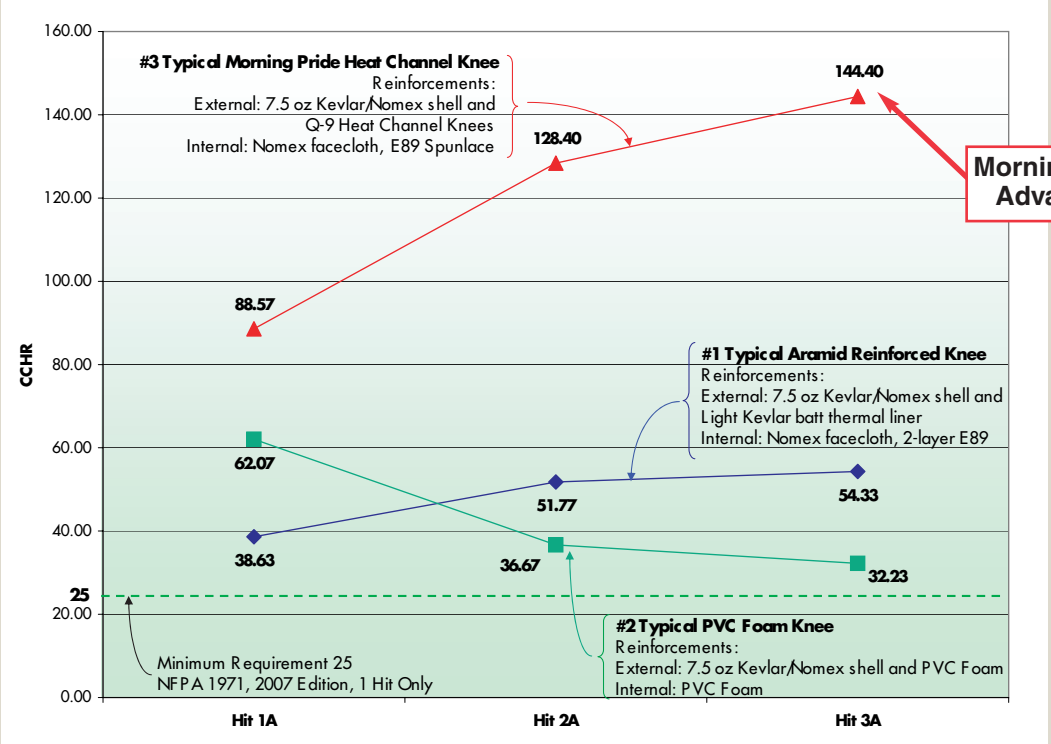
All After 5 Wash/Drys, 8 psi Three Consecutive Hits

All Composites: Outer Shell = 7.5 oz Kevlar®/Nomex®, Moisture Barrier = Crosstech®, Thermal Liner = Nomex® Facecloth w/E89 Spunlace
See Individual Charts for Reinforcement Materials

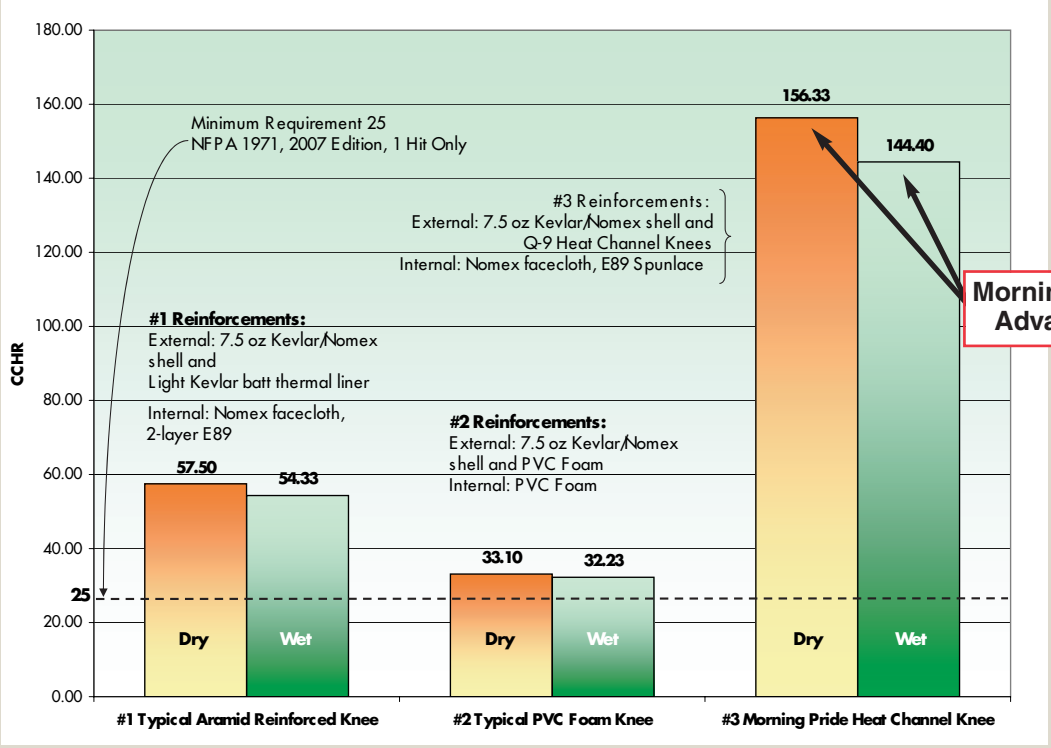
DRY



WET



DRY vs WET



Note: Systems tested were NFPA 1971, 2000 edition (2007 competitive systems not yet available prior to catalog printing).

Knee Options Continue…

Knee Options Continued…

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Puncture Resistant Knees

(Patented and Patent Pending)

A better Heat Channel Knee (see page 128) and available only in combination with the Heat Channel Knee, since the puncture resistant panel requires cushioning to stabilize.

View of steel insert

For years now, firefighters' boots have offered ANSI Z-41 puncture resistance (NFPA 1971 mandates puncture resistant bottom plates in all fire fighting footwear). The need is even more critical now with the possibility of encountering AIDS or hepatitis-infected hypodermics, etc. in the dimly lit fire fighting environment.

But let's face it, when the visibility is the worst – you are on your knees, not your feet. Morning Pride's Puncture Resistant Dry Knee features the same MIL-S-301, Rev D3,.020, Full-Hard, Corrosion Resistant Stainless Steel protection as the insole of your fire boots. With this option, the Heat Channel Knee (Patented – please see page 128) is backed with a Kevlar® encased, pre-bent stainless insert.

The Kevlar® prevents stainless movement and the padding (besides its insulative value) makes it impossible to even detect the presence of the metal.

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Reinforced and Cushioned Reinforced Knees

Photo illustrates a khaki Kevlar®/ Nomex® knee reinforcement on a Pbi™ outer shell. A reinforced knee is a single layer of the specified reinforcement. A cushioned reinforced knee features both the reinforcing piece and an additional layer of flame resistant cushioning (although for maximum cushioning, the Heat Channel Knee on page 128 is recommended). For all exterior knees discussed, see pages 125 to 130.

The most durable outer shell reinforcements available are Kevlar® twill (available only in pale yellow) and Kevlar®/ Nomex® (available in black, yellow or brick red). Please consult the price list for a complete listing of all available reinforcements and pricing. Leather reinforcements are not recommended (but are available), because of dry rot and decontamination problems. Similarly, customers are cautioned that Arashield reinforcements can be a heat sink under certain conditions and are not recommended. For Proximity garments, only aluminized reinforcements may be specified (except for at collar and cuffs where our standard is 7.5 oz rip-stop Pbi™). If your order for a knee reinforcement does not specify a material or color, we will match your outer shell material and color. If your order calls for a different material knee reinforcement from your outer shell material and does not specify a color, your knee reinforcement will be black (or pale yellow if you specify Kevlar® twill). Please specify on your order any other color combination.

This Custom Option is Available on:

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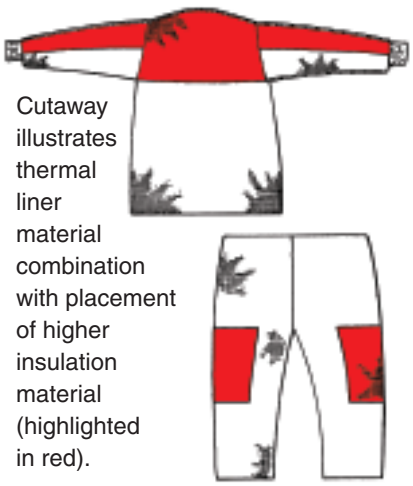
Body Armor Linings

(Patented) – The Body Armor Lining concept is based on the recognition that the shoulders, outside of the arms and fronts of the legs, are the most thermally loaded during typical fire fighting. While many departments prefer to avoid the bulk of the most insulative liner (Quilt Batt), overall its insulative advantage is very attractive in these specific body areas. The Body Armor Lining places Quilt Batt (as an integral, integrated element) in these body areas in an otherwise lighter liner system.

NOTE: To match lubricity of liners and Body Armor...

- When the base liner for the garment uses a regular Nomex® face cloth (including the xxix liner with "Smooth" facecloth), the Body Armor panels will be an xx2x liner, Nomex® facecloth with Q9 batt.
- When the base liner for the garment uses a Semi-slick facecloth, the Body Armor Panels will be an xx6x liner, Semi-slick facecloth with Q9 batt (unless your order specifies otherwise).



Cutaway illustrates thermal liner material combination with placement of higher insulation material (highlighted in red).

A great approach for departments currently specifying Quilt Batt.

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