



Vintage Triumph Register Maintenance Handbook

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Extend your top-down driving season with an electrically heated jacket

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Electrically heated clothing warms enthusiasts of other forms of exposed motorised transport: motorcyclists and open-cockpit flyers. This article presents the opportunity for heated clothing to extend the top-down driving season for drivers of convertible Triumph cars and discusses the making and purchase of suitable equipment.

Heated clothing has application in cold seasons for drivers of convertible Triumph cars and other marques by increasing driver warmth and comfort in even quite cold temperatures. Worn beneath normal out-door winter clothing, and with a tonneau on your car, ambient temperatures down to 32 degrees Fahrenheit (0 degrees Centigrade) or lower provide no discomfort, even at speed. So equipped, you can enjoy those ice-free (and salt-free) cool sunny days with crystal-clear, ice-blue skies at either end of winter that you would otherwise find too cold.

An illustration of how much your driving season can be extended is illustrated looking at the regional average temperatures where I live, near Philadelphia.

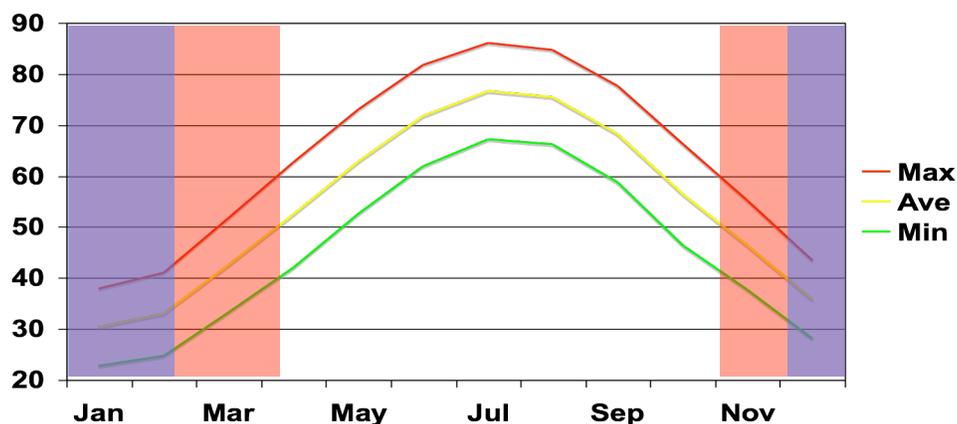


Figure 1. Temperatures in Philadelphia, Pennsylvania, USA over 30 years.

The above figure illustrates ambient temperatures at this representative N.E. USA location. The white central area of the chart represents the period with average daily temperatures of 50 degrees Fahrenheit or higher that may reasonably be considered the 'driving season'. The pink vertical bars represent the extension to the driving season made possible by the application of

heated clothing. The blue vertical bars represent garage-time for my TR. As you can see, I have extended my six to seven month top-down driving season by two months or more.

The ambient temperatures in spring and autumn may seem benign, however wind chill must be accounted for, summarised in the following table. Although a car's windshield protects from direct wind, the turbulent air around an open car provides a significant chilling effect. The fitting of a tonneau to your open car reduces wind turbulence and wind chill around your body. It also goes some way to contain the heat generated by your car's heater, if fitted, also improving your comfort.

Speed	Temperature in degrees Fahrenheit					
0 MPH	25	30	35	40	45	50
15 MPH	13	19	25	32	38	45
30 MPH	8	15	22	28	35	42
45 MPH	5	12	19	26	33	40
60 MPH	3	10	17	25	32	39

To address low ambient temperatures and the chilling effect of wind, it is perfectly practicable with minimal and reversible installation, to augment your cars heating system with electrically heated clothing to provide the opportunity to enjoy your car, top-down, on cool, even cold days.

The effect of heated clothing

Although complete heated suits, comprising pants, jacket, socks and gloves are available, the most important item warms the torso, and this can be a vest (no sleeves) or a jacket liner (with sleeves), and is the most relevant item for our application.

Heating the torso is most important due to how your body reacts to significant heat loss. When your body senses some risk due to heat loss, it acts to protect the core organs in your torso by withdrawing circulation from your limbs and extremities. You'll have noticed, when in the cold, how your hands turn pale? This is due to the skin being supplied less blood. Withdrawing the blood in this way maximises the volume of warm blood around your core organs and minimises the rate of heat-loss from your outer parts. At extremely low temperatures, such as those experienced by mountaineers, continued exposure can lead to tissue damage in the extremities, recognized as frostbite. This is not a concern for us, but helps explain the mechanism at play.

Keeping your torso warm with an electrically heated garment prevents your body from sensing any risk due to heat-loss, even at low ambient temperatures. The supply of warm blood to your extremities is maintained, keeping your limbs, fingers and toes warm, and you, comfortable.

How heated clothing works

In the same way that an electric blanket is constructed, electrically heated clothing is fitted with a wire that provides resistance to a current passed through it. The resistance to the current produces heat.

The length of the wire and the current passed through it determine the amount of heat created, as explained by Ohm's Law.

$$\text{Current [Amps]} = \text{Voltage [Volts]} \text{ divided by Resistance [Ohms]}$$

The electrical draw required

If, for illustration we consider wire with a resistance of 0.1 Ohms per linear foot, in addition to the resistance in any connections to the car's loom, 30 feet of wire will provide 3 Ohms of resistance. Using Ohm's Law, the draw on the electrical system will be:

$$\begin{aligned} \text{Current [amps]} &= 13.5 \text{ Volts divided by } 3 \text{ Ohms} \\ \text{Current} &= 4.5 \text{ Amps} \end{aligned}$$

So for this setup, to protect your car and your jacket you would fit an in-line fuse of 7 Amps.

We can now estimate how much heat 4.5 Amps would deliver by calculating the power required by the vest, in Watts.

$$\begin{aligned} \text{Current [Amps]} \times \text{Voltage [Volts]} &= \text{Power [Watts]} \\ 4.5 \text{ Amps} \times 13.5 \text{ Volts} &= 60 \text{ Watts} \end{aligned}$$

So we can see that the power draw is similar to switching on a single headlight. To get an idea of the heat output, think of the heat generated by a 50-Watt light bulb. If you have a modern car with heated seats, it's a similar amount of heat that these seats seem to generate, but spread over your torso, not just where you touch the seat. The efficiency of the heat transfer is directly related to the snugness of the fit of the jacket to your body.

Making electrically heated clothing

Homemade heated clothing uses 30 AWG stranded wire, Teflon coated, sometimes called 'hook-up wire'. 50-foot spools of wire are available from \$7 on ebay. Greater quantities are available from suppliers online. As we calculated earlier, you need about 30 feet of wire for an effective supply of warmth for one garment.



Figure 2. 30AWG stranded Teflon-coated wire

The easiest item to 'electrify' is a jacket lined with quilted polyester. This is achieved by threading the wire in long loops inside the lining. However, you can add wiring almost anything. Unlined jackets require that you line the garment with a thin cotton lining after the wiring has been installed. The lining is important because the wire gets too warm to be in very close contact with your skin. A thin lining next to the wire, and a shirt next to you, is perfect.

If I were to add wire an item now, I'd go to a charity store and pick up a simple leather jacket with a quilted lining that fits snugly over just a shirt.

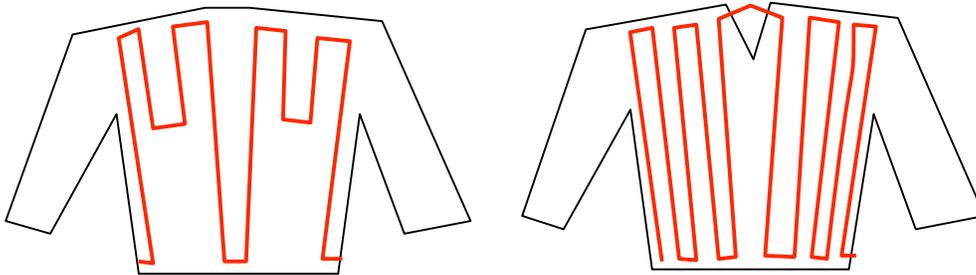


Illustration 2. Suggested routing of wire in a jacket rear panel, shown left, and jacket front panels, shown right. The loop joining the left and right of front panels goes around the collar behind the neck.

Installing heating wire

Having obtained your heater wire, and identified the item of clothing to electrify, you are ready to begin installation.

1. Mark every 10 feet of a 35-foot length of string with masking tape to track how much wire you are planning to fit. Depending on your size, 30 feet is a good starting-point. As a guide, plan to layout 10 feet on the back panel and 10 feet to each of the two front panels
2. Lay out the string where you plan to locate your wire, fixing in place with tape as you progress. Begin and end your circuit at the same point. For a driver, begin and end just inside the bottom of your jacket, at your hip on the gearbox side of your body, if your plan is to install the socket around the central part of the car. Reverse this for your passenger's layout.
3. Where you place more wire, you will create more warmth. Plan to additionally address the exposed areas when in a car seat: your neck, shoulders and collar, chest and abdomen.
4. Keep one continuous run, with no overlaps or crossed wires.
5. With an upholsterers needle, thread the wire along your layout, inside your lining, if you have one. Every few inches use a regular needle and appropriately colored thread to lock the heater wire in place. Loop around the wire several time and tie the thread off. If your garment is unlined, attach the heater wire to your garment with iron-on dressmaker's tape, and line the garment before use.
6. Test continuity at each step, and sew in or tape in for robustness. Don't do a flimsy job.
7. Work your way along your planned route in this way, threading and securing your heater wire inside the lining of your garment.
8. Secure the completed circuit of wire at your start point, ready for adding your connection. This needs to be secure because undoubtedly you'll step out of the car while still hooked up.

Connecting your jacket to your car

Source your power directly from your battery. Use ring terminals to connect 12-gauge wire. Pass the wire through your firewall to a convenient location. On my TR4, my connection to the battery ends with a connector tucked behind the central bracket beneath the switch plinth.

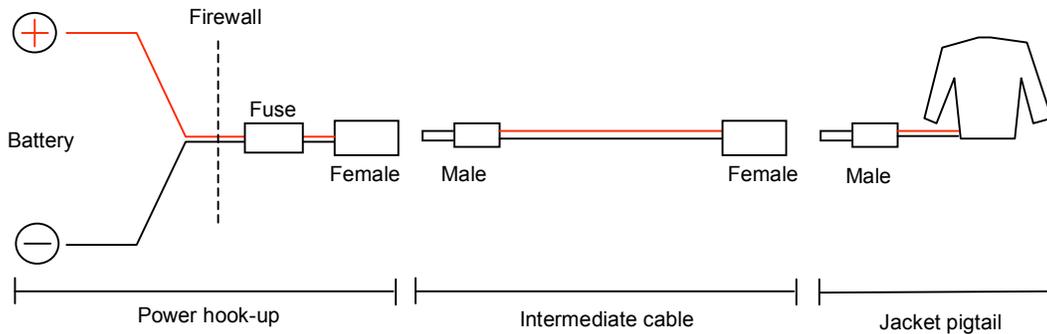


Illustration 3. The three sections of electrical hook-up that connect the circuit.

There are many ways to connect to your set-up. One method uses large 'headphone' jacks and sockets. Not the ipod size, but the big 'HiFi' connectors. Use Mono connectors, if you can find them. Connect to the battery, pass through the firewall, and complete with a socket somewhere central and concealable. My connector tucks away beneath the radio. I have a 'Y' connector, comprising a jack and two sockets for my passenger and myself. The logic of the female sockets and male jacks illustrated above is to avoid exposed connectors (jacks in this case) carrying exposed live connectors able to complete a short circuit. The inline fuse should be on the non-ground lead from your battery.

Having a jack on a short pigtail on your jacket, and a socket tucked away in your car, requires a short length of lamp cord or similar with a jack at one end and a socket at the other to make a convenient arrangement: you can step out of the car carrying just a short pigtail beneath your jacket, and your car is protected from a possible short-circuit. The intermediate cable between the car-mounted socket and your jacket can be removed in warmer seasons. Some find success making the intermediate cord with coiled wire used for microphones and other applications. This often has four wires, so combine them in pairs.

Even though you may choose to make your own vest, you may elect to buy connecting equipment from vest suppliers, including coiled wire, on-off switches and even thermostats. More information will be found in the following section.

Buying heated clothing

Heated clothing is available from a range of manufacturers, including specialists in heated clothing and motoring manufacturers, such as BMW. Motorcyclists are their main customers, and new or used items are readily available. A new vest can be bought for less than \$150, a used vest for less than \$50. Importantly, a snug fit is required to maximise heat transfer to the torso. The vest or jacket should fit closely over no more than a shirt, and if a vest, an outdoor winter coat should be worn over it.

I have indicted here what I believe to be ideal examples items for convertible car use, and examples of appropriate connectors.

Table 2. Examples of heated clothing from Reputable manufacturers				
Item	Description	Supplier	Cost (end-2007)	Website
	Heated vest, fleece outer	Aerostitch	\$147	www.aerostitch.com
	Heated vest, fleece outer, air-inflatable bladder. Can add sleeves.	Aerostitch	\$167	www.aerostitch.com
	Powerlet jacket liner	Powerlet	\$199	www.powerlet.com
	Heated sleeves and thinsulate, wind proof	Gerbing	\$199	www.gerbing.com
	Can add sleeves, windproof, insulated	Widder	\$115	www.widder.com

Table 3. Examples of connection systems available from suppliers

	Aerostich connectors, SAE	Aerostich	\$9 and up	www.aerostitch.com
	Aerostich connectors, cigarette	Aerostich	\$9 and up	www.aerostitch.com
	Powerlet connector	Powerlet	\$7.95	www.powerlet.com
	Gerbing connector, cigarette	Gerbing	\$15 and up	www.gerbing

Finally

If you choose to buy a heated jacket liner or vest, also buy connector cables from that manufacturer's range to ensure compatibility with your jacket.

If buying connectors to complete a homemade heated garment, remember to order an appropriate cable to provide the donor connector for your garment's pigtail.

All that remains is to enjoy your extended riding season. Driving cars such as ours, we get some admiring and some quizzical looks. The quizzical looks increase noticeably when driving in apparent comfort on a surprisingly cool, even cold day. Don't forget your hat and gloves!

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