

# DUI THERMAL GUIDELINES



The thermal guidelines are designed to help the diver predict the performance of their insulation given several variables – anticipated work rate, water temperature, length of dive, and average metabolic rate. You may also use these charts to determine the most appropriate insulation for the type of diving you normally do. While there is no way to determine a diver's exact personal thermal rating due to personal preferences, this should provide a good place to start. Make sure you test the results before relying on it for a strenuous dive.

## DETERMINE YOUR PERSONAL THERMAL RATING

The first step in determining the correct amount of insulation for various thermal conditions is to determine your personal rating. See the chart below:

*This is a sample for a 145lb woman diving in a TLS350 drysuit*

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
BODY WEIGHT (lbs)	TENDENCY TO BE COLD/WARM	GENDER	AGE	SUIT TYPE	PERSONAL RATING
90	0	0	0	0	0
105	2	2	2	2	2
120	4	4	4	4	4
135	6	6	6	6	6
150	8	8	8	8	8
165	10	10	10	10	10
180	12	12	12	12	12
195	14	14	14	14	14
210	16	16	16	16	16
225	18	18	18	18	18
240	20	20	20	20	20

Column 1 Start with your body weight

Column 2 Ask yourself if you are typically as comfortable as others when in a room, or are you typically warmer or colder than others?

- ▶ If warmer than most people, move one level down the chart (the number will be higher). If you normally perspire when others are comfortable, move two levels down.
- ▶ If colder than most people, move one level up the chart (the number will be lower). If you need a sweater or jacket when others wear a shortsleeved shirt, move two levels up.

- Column 3 If you are female, move one level up the chart. If you are male, skip Column 3 and go to Column 4.
- Column 4 If you are over 50, move one level up the chart. If you are under 50, skip Column 4 and go to Column 5.
- Column 5 If you are using a CF200 or CN<sup>SE</sup> drysuit, move two levels down the chart. If you are using a fabric drysuit (TLS350, CL<sup>X</sup>450 or FL<sup>X</sup>50/50), skip Column 5 and go to Column 6.
- Column 6 This is your personal rating. Use that number in the *Selecting the Proper Insulation* section.

Now try it for yourself.

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BODY WEIGHT (lbs)	TENDENCY TO BE COLD/WARM	GENDER	AGE	SUIT TYPE	PERSONAL RATING
90	0	0	0	0	0
105	2	2	2	2	2
120	4	4	4	4	4
135	6	6	6	6	6
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165	10	10	10	10	10
180	12	12	12	12	12
195	14	14	14	14	14
210	16	16	16	16	16
225	18	18	18	18	18
240	20	20	20	20	20

These figures are appropriate for dives that are less than 60 minutes. For longer dives, particularly those longer than 90 minutes, you will need significantly more insulation for a given water temperature.

## SELECTING THE PROPER INSULATION

Below, the chart shows the effective temperature range for different types of insulation depending on your personal thermal rating. The temperature range is based on varying levels of exercise during the dive. A light exercise rate will require more insulation (you will be at the higher end of the temperature range) while heavy work underwater will mean you need less insulation (you will be at the lower end of the temperature range). Most divers actively swimming in the water are somewhere in the middle.

<i>Personal Thermal Rating from Chart 1</i>	0	2	4	6	8	10	12	14	16	18	20
Expedition-weight polypropylene underwear	84-92	82-90	80-88	78-86	76-84	74-82	72-80	70-78	68-76	66-74	64-72
ActionWear™ 150 or ThermalMax™ 150	82-90	72-84	70-82	68-80	66-78	64-76	62-74	60-72	58-70	56-68	54-66
Thinsulate™ 200	80-88	62-78	60-76	58-74	56-72	54-70	52-68	50-66	48-64	46-62	44-60
ActionWear™ 300, ThermalMax™ 300, Polartec® PowerStretch® 300	78-86	54-74	52-72	50-70	48-68	46-66	44-64	42-62	40-60	38-58	36-56
Thinsulate™ Ultra 400	76-84	42-68	40-66	38-64	36-62	34-60	32-58	30-56	30-54	30-52	30-50

AUXILIARY INSULATION: Add-on items for additional warmth

- Add a Plus 5 Vest or expedition-weight polypropylene and you can dive in 5-degree colder water.
- Insulation booties should always be worn to ensure a good fit with the drysuit boot and fin. Always use the warmest type of insulation on your feet. They will not get too warm. Not wearing appropriate insulation on your feet will degrade the effectiveness of your primary insulation.
- Dry gloves are appropriate for many people in water temperatures as warm as 70 degrees. Dry gloves should be considered a necessity for water temperatures below 45 degrees. While dry hands will be warmer than wet hands, it is also important to consider blood circulation into the hands. Getting warm blood to the hands is just as important, if not more so, than keeping them dry. The presence of a wrist seal will lessen blood circulation and a dry glove system that does not use a wrist seal should be considered for those with colder than average hands or for diving in very cold water.

## INSULATION EFFECTIVENESS

All insulation is trapped gas (air, argon etc.) and the effectiveness of the insulation is determined by its ability to trap gas while under compression. Therefore many materials commonly used as insulation for surface outdoor activities are not appropriate for diving. Materials that rely on a high loft, such as some types of Thinsulate™ and high-loft polyester batting sold under a variety of trade names (Hollofil® and Primaloft®), will not work as effectively in a diving environment. Much of the insulation is lost when the insulation is subjected to ½ psi of compression, which is the amount experienced by a drysuit diver in proper trim. Radiant barriers (i.e. Titanium-lined wet or drysuits) are also not effective as almost all of the diver's heat is lost through conduction, not radiation. DUI has chosen the following materials for their performance in a diving/underwater environment:

**ACTIONWEAR™:** Polyester fibers used in today's fleece wear are a relatively effective and inexpensive material to use. The fleece used in ActionWear™ is a one-way stretch material with approximately 280 g/m<sup>2</sup> in the 150 model and 560 g/m<sup>2</sup> in the 300 model. While fleece is relatively cost effective, it has greater bulk compared to Polartec® PowerStretch® material, does not wear as well and requires a looser fit. You will need to wear more weight fleece for the same warmth in the Polartec® PowerStretch®.

**THERMALMAX™:** This type of insulation combines the fleece of the ActionWear™ with a micro-fiber exterior shell for wind and splash protection. It is available in 280 g/m<sup>2</sup> (150) and 560 g/m<sup>2</sup> (300). Although the diver gains the protection of the outer shell they lose the stretch of the ActionWear™ because the outer shell does not stretch.

**POLARTEC® POWERSTRETCH®:** The polyester fibers used in Polartec® PowerStretch® material are the highest density available, and thus are particularly effective at resisting compression and are less buoyant for the warmth provided. The two-way stretch is more formfitting and will move easily with the diver. This material provides the least amount of restriction of any material. This model is only available in the 560g/m weight (300).

**THINSULATE™ and THINSULATE™ ULTRA:** *The most effective insulation per unit of thickness is non-compressible Thinsulate™.* This microfiber is a modified wax that resists water and retains its insulation even when wet. The microfibers are extremely fine and thus trap gas very well. DUI uses the type originally designed for footwear insulation and is the most compression resistant. We make the garments in both 200 (200 gm/m<sup>2</sup>) and 400 (400 gm/m<sup>2</sup>) using pure Thinsulate™ – no fillers. Thinsulate™ has no stretch so it requires a looser fit. It also requires more care to maintain.

## CALCULATING WEIGHT AND BUOYANCY

The amount of weight required with your drysuit will vary depending on the type of insulation and its size. To check your weight, gather the different combinations you wish to use for insulation under your drysuit and conduct a buoyancy check in controlled water, preferably a pool. You will need to use different insulation packages (from the lightest to the heaviest) with the same scuba setup you normally use. With each insulation combination, check for neutral buoyancy underwater. Swim around for a few minutes to make sure you have purged all of the excess air from the suit but still have enough gas in your suit to offset suit squeeze. Have trim weights nearby to make quick adjustments. Make note of the insulation combination and the amount of weight needed to achieve neutral buoyancy.

### Where to Start

This is a very general guide of where to start when checking your buoyancy with new insulation in fresh water, and wearing an aluminum tank and a Polartec® PowerStretch® 300 jumpsuit:

WEIGHT	WEIGHT NEEDED
100 LBS	12-14 lbs
120 lbs.	14-16 lbs
140 lbs.	16-20 lbs
160 lbs.	18-22 lbs
180 lbs	20-24 lbs
200 lbs.	22-26 lbs
220 lbs.	25-30 lbs
240 lbs.	26-32 lbs

### Some Other Considerations:

#### GOING FROM FRESH TO SALT WATER

Diver weight	Weight Differential
125 lbs	add 4 lbs
155 lbs	add 5 lbs
185 lbs	add 6 lbs
215 lbs	add 7 lbs

#### CHANGE IN TANK BUOYANCY

You will need to add weight to make up for the change in buoyancy as the air in the tank is used.

80 CF tank	add 4 lbs.
100 CF tank	add 5 lbs.
120 CF tank	add 6 lbs.

Steel tanks are generally more negative and you should check the characteristics of your tank and adjust accordingly.

#### OTHER TYPES OF INSULATION

Adjustments required for varying types of insulation:

Thinsulate™ Ultra 400	Add 4-8 lbs
Thinsulate™ 200	Subtract 2-4 lbs
ActionWear™ 150 and ThermalMax™ 150	Subtract 2-4 lbs
ActionWear™ 300 and ThermalMax™ 300	Add 2-4 lbs