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The SINTEF Group is the largest independent research organisation in Scandinavia. Every year, SINTEF supports the development of 2000 or so Norwegian and overseas companies via our research and development activity. The abbreviation SINTEF means The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (NTH). SINTEF has played an important role in the development of Norwegian society since the Second World War, and has generated knowledge and technology aimed at meeting major national challenges. Today, we realise that the experience we have gained can also benefit other parts of the world. We wish to utilise our competence to develop societies at both national and international level. In SINTEF we wish to contribute to the creation of technology for a better society also beyond the borders of Norway, via an even stronger future involvement international research. We intend to concentrate especially on fields in which we have particularly high levels of expertise, such as oil and gas, energy and the environment, materials science and marine technology. But we believe that we can also make significant contributions in such areas as fisheries and aquaculture, medical technology and chemistry.

Summary of the SINTEF-Report

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Over the years both Jerven and others have made trials and tests of the various models. In 1997 we decided to do this scientifically. Scientists at Sintef Unimed in Trondheim were given the task of finding precise answers to the thermal properties of the various Jervenbag models. Even though the Jervenbag has multiple uses, it is its property of retaining the body-heat which is the most important.

The project was split into 4 main parts:

- Laboratory tests with people uses for experiments (Trondheim)
- Field test with people uses for experiments (the Snøhetta area)

- Laboratory tests with thermal doll (Trondheim)
- Tests with wind tunnel with people used for experiments (Oulu, Finland)

The full report is 28 pages, and we will therefore only include small extracts and conclusions. It was possibly the expedition leader Odd Harald Hauge from "Unarmed to the South Pole" who was the first to say: - I will maintain that it is just about impossible to freeze to death in a Jervenbag Thermo. We were then discussing hiking in the Norwegian mountains. Project leader at SINTEF Unimed, Jonny Hisdal said something similar: -In practice it is just about impossible to freeze to death in a Jervenbag Thermo. Strong words are not used by scientists, but this ought to be plain speaking!

Then to the report:

The following experiments were carried out in climate-chambers in Trondheim and show exceptional good results. Page 18 and 19 from the report follows here in their entirety:

Fig 3.3 shows clearly to which extend the various models of Jerven Bag protects the upper part of the body against chilling in the cold environment. Without protection from the Jerven Bag the chest temperature of the testpersons sank by approx 4°C (39,2 F) during an interval of two hours. Protected by Jerven Bag THERMO EXTREME the average chest temperature was approx. 2,5 degrees (36,5 F) higher after 3 hours in the climate-chamber, than at start of the test. Protected by the Jerven Bag ORIGINAL the test-persons had the same chest temperature after 3 hours in the climate-chamber as at the start of the test.

Chest temperatur

Figure 3.3

The chart shows the average chest temperature of all the test-persons (n=6) without protection from the Jervenbag, and with Jervenbag Original, Jervenbag Thermo and Jervenbag Thermo Extreme respectively. The test-persons wore standard two-layers mountain clothing, the temperature was -10°C (14 F), and the wind approx. 5m/s. The test without protection of Jervenbag had to be stopped after 120 minutes, but with protection of one of the Jervenbag models

the test period was set to 180 minutes.

3.1.2 Air temperature and humidity inside the windbags

The temperature inside the windbags were taken at chest height and at the foot-end during the trial. Summary of the temperatures are shown in table 3.1.2. Accumulated humidity inside the different Jerven Bags during the 180 min of the tests, was evaluated by weighing the Jerven Bag before and after the trials. All models had a weight increase during the 180 minutes the tests lasted. However, there was no different in weight gain for the various models. This should show that the humidity accumulated in the windbags caused by the perspiration of the person inside the Jerven Bag, does not vary between the various models. The condensation was found to be a bigger problem by testpersons in Jerven Bag ORIGINAL, compared to Jerven Bag THERMO and Jerven Bag THERMO EXTREME.

Table 3.1.2

The table shows average temperature (°C) taken at chest height and at the foot-end of the various windbags, after the test-persons had been sitting still for 180 minutes. The environmental temperature was -10°C (14 F) and the wind from 5-10m/s. This equates to a chill-factor of approx. -25°C (- 13 F).

3A.3 Subjective evaluation - Shivering:

The results from the subjective evaluation show that all test-persons started to shiver to increase heat production when in the climate-chamber in standard clothing, without the protection of Jerven Bag. On average the test-persons started to shiver after 48 minutes. Protected by the Jerven Bag ORIGINAL only one of the six test-persons started to shiver. This person started to shiver after 100 minutes. Protected by Jerven Bag THERMO or Jerven Bag THERMO EXTREME none of the test-persons started to shiver during the 180 minutes of the test in climate-chamber.

We have made following extracts from the field-tests:

The weather varied from day to day during the field-tests, from snowy weather to dry spells and from mostly calm to violent storm. During the days of the

strongest wind, we experienced the best effect when protected by one of the Jerven Bag models. During all test conditions, the test-persons carried out the planned test of 180 minutes. On the days with the strongest wind, all tests with test-persons having no protection of one of the Jerven Bag models, had to be abandoned before 60 minutes had passed due to high degree of chilling. The feet of test-persons were most affected, and no further tests were carried out to avoid the toes getting frost damage. A general chilling down of the bodies to the persons not protected by Jerven Bag, was observed on the days with the strongest wind.

The days we measured violent storm, the test-persons without protection of a Jerven Bag model would have been completely helpless within two hours due to the cold, and none of them would have survived a night in the open. The test-persons protected by one of the Jerven Bag models would most probably all have survived the night. The test-persons in Jerven Bag ORIGINAL, giving the lowest thermal protection would probably also have been chilled after a while, but due to the very gradual reduction in temperature it would have been quite a few hours before the situation had become life threatening, compared to having no protection.

The two most insulated models, Jerven Bag THERMO and Jerven Bag THERMO EXTREME, gave such good thermal protection, even with a wind up to violent storm and an air temperature of -2°C ($28,4^{\circ}\text{F}$), that the test-persons probably would have survived several days before the situation had become critical due to the cold.

During the storm two of our tents were damaged by the wind, and three test-persons chose to stay overnight in the open protected by the Jerven Bag THERMO EXTREME. The test-persons had on two-layer clothing, and were lying on ground-sheet as issued by the Armed Forces. They chose an area in the lee of a snow-dune, with the entire body inside the wind-bag and all zippers firmly closed. All three test-persons slept soundly through the night and were thermal-neutral when they woke up in the morning, despite strong wind with drifting snow and an air temperature of approx. $-3,5^{\circ}\text{C}$ ($25,7^{\circ}\text{F}$) during the night.

The most extreme test was carried out in Finland in co-operation with Dr. Hannu Rintamäki at Oulu Regional Institute of Occupational Health. In the wind tunnels in Oulu the temperature was lowered to -40°C (-40°F), and with the

wind factor this corresponds to minus 80 degrees (-112 F). During such conditions naked skin would freeze in 15 seconds. The test-persons therefore had to be inside the Jerven Bag before the fans were switched on.

The results from the test:

Inside the Jerven Bag Original: -20°C (-4 F), a difference of 60°C (diff. of 108 F) outside/inside. Inside the Jerven Bag Thermo Extreme: +8°C!! (46,4 F), a difference of 88°C (diff. of 158,4 F) outside/inside.

The effect of the Jerven Bag models was a great surprise. Nobody had expected such sensational results. It is not very probable that any of us "normal" people will experience these kind of temperatures, but it is nice to know what the product is good for. Finally, some good advice: Always have a groundsheet inside the Jerven Bag. It is important to insulate to the ground/snow to avoid heat-loss that way. You also avoid the risk of the groundsheet blowing away. Also keep your rucksack on, preferably empty, to avoid the Jerven Bag coming in direct contact with the back. Rub cold feet to keep the blood circulating, and then you can contemplate why you didn't take your holiday in warmer climate instead!

The table below shows the importance of protection against the chilling effect of the wind. Minus -5°C (23 F) and moderate breeze (force 4) constitutes as much as minus -18°C (-0,4 F)! As long as you are moving it is usually OK, but sooner or later you need a rest.... Inside Jerven Bag you get shelter and warmth.

Do not leave the Jerven Bag at home!

Jerven AS
Eitrheimsveien 52
N5750 Odda
NORWAY
Tlf: 0047 5364 8050
post@jerven.no