Rick Rudinger,CEO
Next Fiber Technology, LLC
7312 Parkview Drive
Frederick, MD 21702

Dear Mr. Rudinger:

This document presents the results of our evaluation of five base layer garments.

Please call me if you have any questions concerning this report. We look forward to working with you in the future.

Very truly yours,

Stephen A. Seeber

Drying Rate of Five Base-Layer Garments Utilizing Permeation Kettles with Infrared Thermographic Documentation

Test Documentation

Purpose and Scope

This test provides relative and absolute drying rate data for five base-layer garments.

Summary of Results

The tables below shows average drying rates for each pair of garments that were tested. The XOSKIN RAPIDriCOPPER garment dried substantially faster than the other test garments.

Test: Under Armour Cold Gear Infra-Red vs XOSKIN RAPIDriCOPPER

Garment	Drying Rate (Grams/Minute)
Under Armour Cold Gear	3.2
XOSKIN RAPIDriCOPPER	4.1

Test: Icebreaker Sonic Wool vs XOSKIN RAPIDriCOPPER

Garment	Drying Rate (Grams/Minute)
Icebreaker Sonic Wool	2.2
XOSKIN RAPIDriCOPPER	3.8

Test: The North Face FlashDry vs XOSKIN RAPIDriCOPPER

Garment	Drying Rate (Grams/Minute)
The North Face FlashDry	2.7
XOSKIN RAPIDriCOPPER	3.8

Test: XOSKIN Polypropylene \| RAPIDriCOPPER vs XOSKIN Nylon \| RAPIDriCOPPER

Garment	Drying Rage (Grams/Minute
XOSKIN Polypropylene | RAPIDriCOPPER	2.5
XOSKIN Nylon | RAPIDriCOPPER	3.2

Principle

This method determines the comparative and absolute rate of drying based on the evaporation rate from a uniformly wetted garment. Comparative data is obtained by testing two samples simultaneously and obtaining a stream of comparative performance data. Absolute data is obtained by calculating the weight of water loss per minute per unit weight of garment during the drying period.

Apparatus and Materials

1. Stainless steel kettles (2) with 400 watt immersion heater and thermowell with RTD sensor. The RTD sensor can be used to monitor kettle water temperature or control kettle water temperature.
2. Kettles to be sealed with an impermeable membrane.
3. Membrane temperature for each kettle to be monitored by 4 sensor thermocouple array. Array temperature can be used to control the test temperature set-point.
4. A digital hygrometer installed in each kettle will monitor temperature and humidity, 6 millimeters beneath the test fabric or garment. The hygrometer can be used to control the test set-point to maintain a specific vapor pressure differential between ambient and the micro-climate beneath the test fabric or garment.
5. High resolution Science Grade thermal imager (640x480 IR resolution, 30mk sensitivity, 1.3 mrad spatial resolution), capable of imaging both kettles simultaneously.
6. PC with direct continuous recording of real time fully radiometric thermal images.
7. Digital temperature controllers for kettle temperature from either the membrane thermocouple array or the thermowell RTD
8. PC temperature control via Labview software to maintain a specific vapor pressure differential based on digital hygrometer temperature and humidity data or temperature within several millimeters of the bottom surface of the test garment. Labview program will calculate partial vapor pressure for the microclimate between the impermeable membrane that seals the kettle and the test garment.
9. Digital scale to weigh samples.
10. Washing machine with spin cycle to wet fabric or garment
11. Portable digital hygrometer to measure ambient temperature and relative humidity.

Procedure

1. Preheat kettle water to obtain target temperature at top surface of impermeable membrane. Typical test temperature will be 120^{o}F at an ambient of 70^{o}F.
2. Weigh both test samples.
3. Place samples in washing machine and subject samples to rinse and spin cycles.
4. Begin recording thermal images of the kettles. Images will be acquired at a rate of 3 frame per second.
5. Begin recording temperature and humidity data from the digital hygrometer.
6. Record ambient temperature and humidity.
7. When rinse/spin cycle is completed, remove garments and weigh both test samples to determine absorbed water weight.
8. Install one garment on each kettle. Each garment will be installed with an elastic band around the edge of the sample.
9. Remove power from kettle heaters. No additional heat energy will be added to the process during the drying period.
10. Test will continue until thermal imager shows that both samples have reached a stable, elevated temperature. The hygrometer data will show equal low humidity levels in the microclimate beneath the test samples when drying is completed.
11. Remove and weigh the samples to confirm complete drying. If any water weight remains, repeat the test.
12. Repeat this procedure 4-5 times to evaluate the impact of wetting variation from the rinse/spin dry wetting method. Obtain data that is reflective of average moisture absorption for the series of tests
13. Analysis and reporting steps below will be conducted for the average sample results.
14. Review video to obtain time to dry for each sample. Time to dry for each sample will occur when stable, elevated sample temperatures are achieved.
15. Produce a time lapse video of the thermal images to compress the drying process to two minutes of video.
16. If desired, produce still infrared images at specific time intervals to illustrate the drying rate differential between the two garments.
17. Plot Time vs. Average Temp for each Kettle. When temperature rise levels, garment is dry. Read drying time from plot.
18. Plot Partial Vapor Pressure vs Time for each Kettle. When the microclimate partial vapor pressure reaches a constant low value, garment is dry. Read drying time from plot.
19. Calculate garment rate of drying: Water weight lost/garment weight /time

Test Report

Test Conditions:

Ambient—70^{o}F, 52% relative humidity
Kettle membrane temperature—120^{o}F
Initial Kettle water temperature—135^{o}F
Final Kettle water temperature—134^{o}F (typical)

Test Garments:

Icebreaker Sonic Long Sleeve Crew-USD$99.99
96% Merino Wool, 150 gm/meter2
4% Lycra

Under Armour Men's Cold Gear Infrared Long Sleeve V-Neck-USD$69.99
93% Polyester
7% Elastane

XOSKIN Nylon | RAPIDriCOPPER Long Sleeve-USD$87.00
66% Nylon
32% RAPIDriCOPPER Nylon
2% Spandex in neck and hem (not in the body of the shirt)

The North Face Men's Warm Long-Sleeve Crew Neck FlashDry-USD$50.00
100% Polyester

XOSKIN Polypropylene | RAPIDriCOPPER
66% Polypropylene
32% RAPIDriCOPPER Nylon
2% Spandex in neck and hem (not in the body of the shirt)

Garment Weights (all weights in grams):

Garment	Dry Weight (grams)	Wet Weight (grams)	Added Water (grams)	% Wetting
Icebreaker	183	269	86	47
UA Cold Gear	227	340	113	50
TNF FlashDry	219	378 (average)	159 (average)	73 (average)
XOSKIN Nylon	144	241 (average)	97 (average)	84 (average)
XOSKIN Polypropylene	168	234 (average)	68 (average)	39 (average)

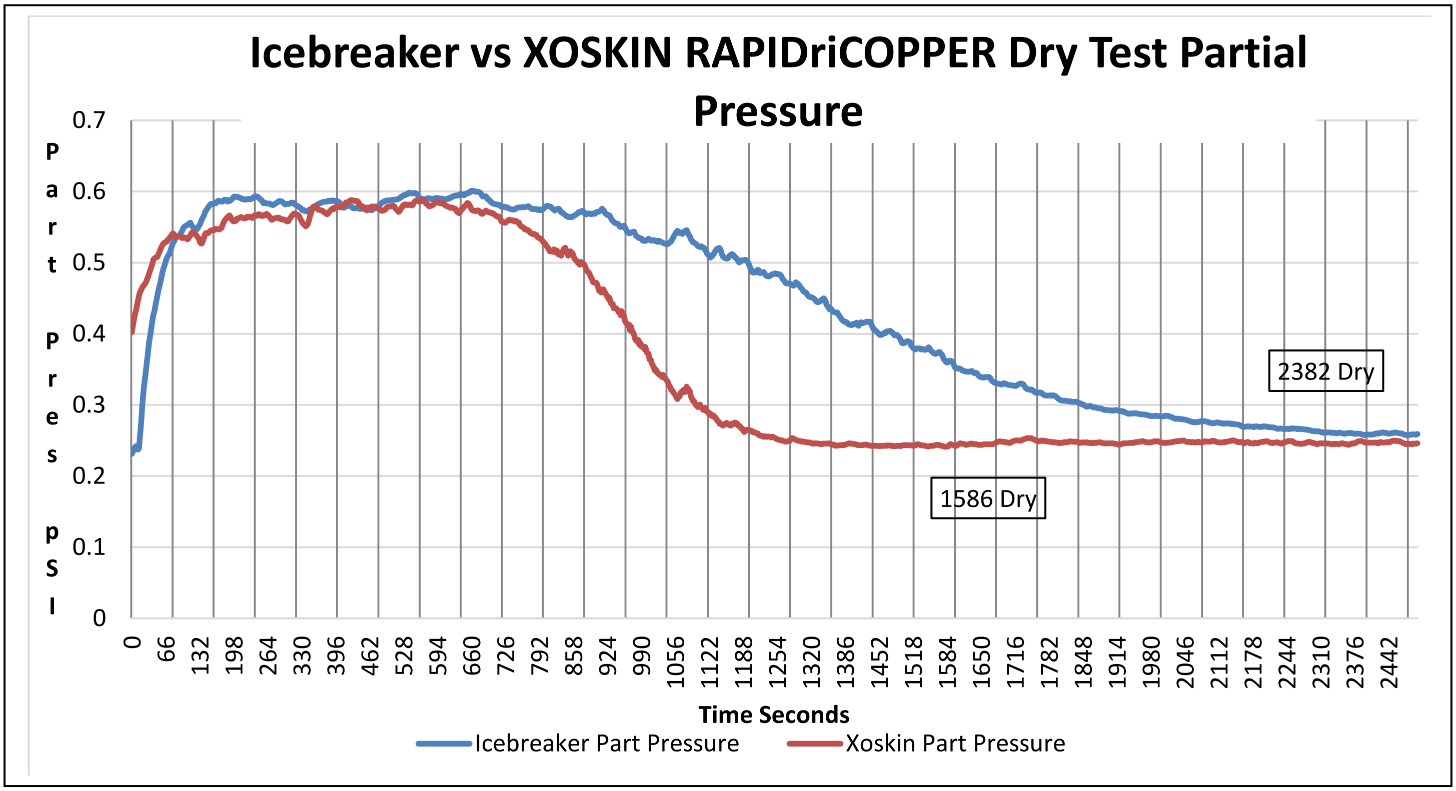
Drying Data Plots:

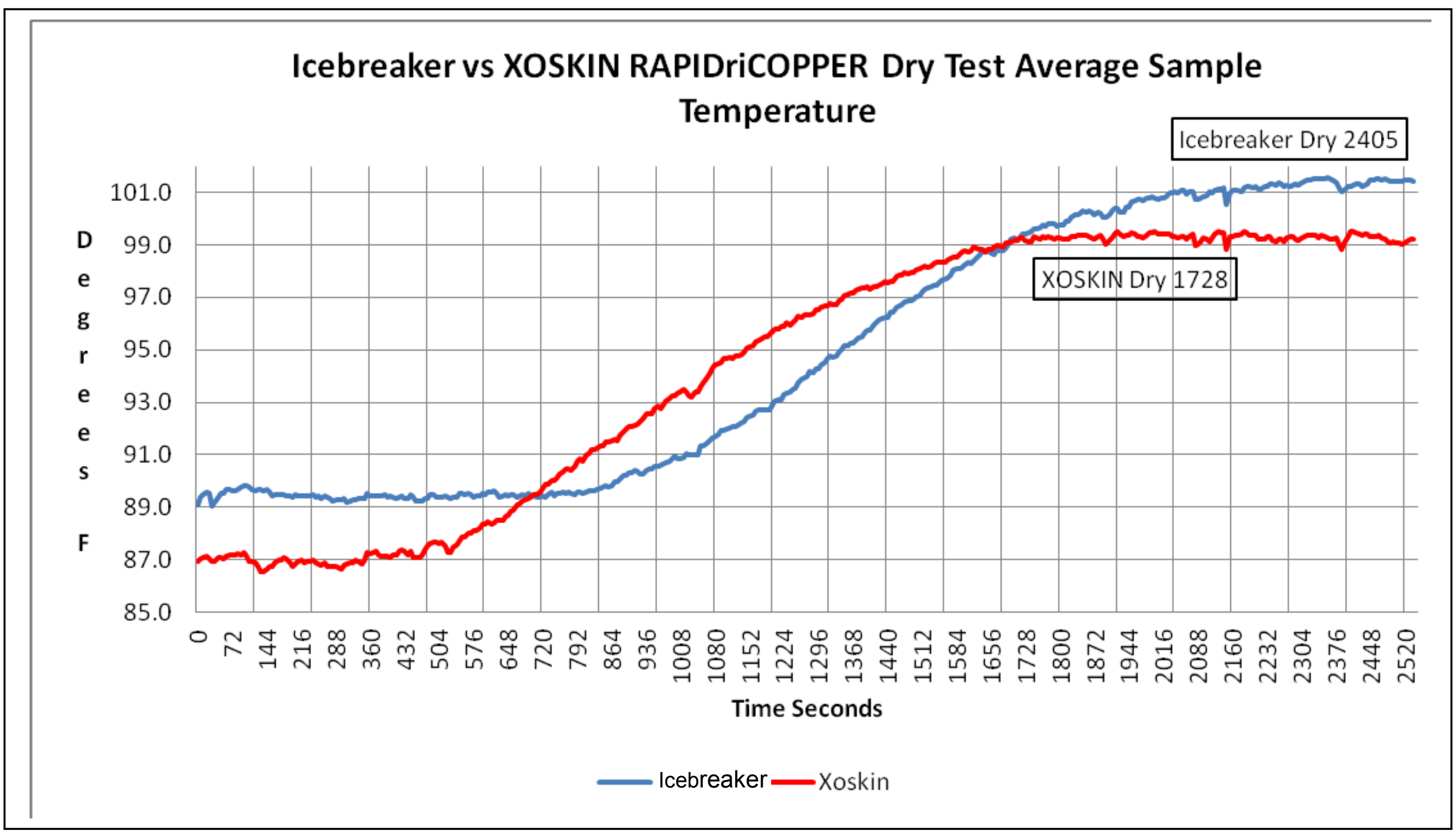
Drying data are shown below for each test. Two types of data are presented

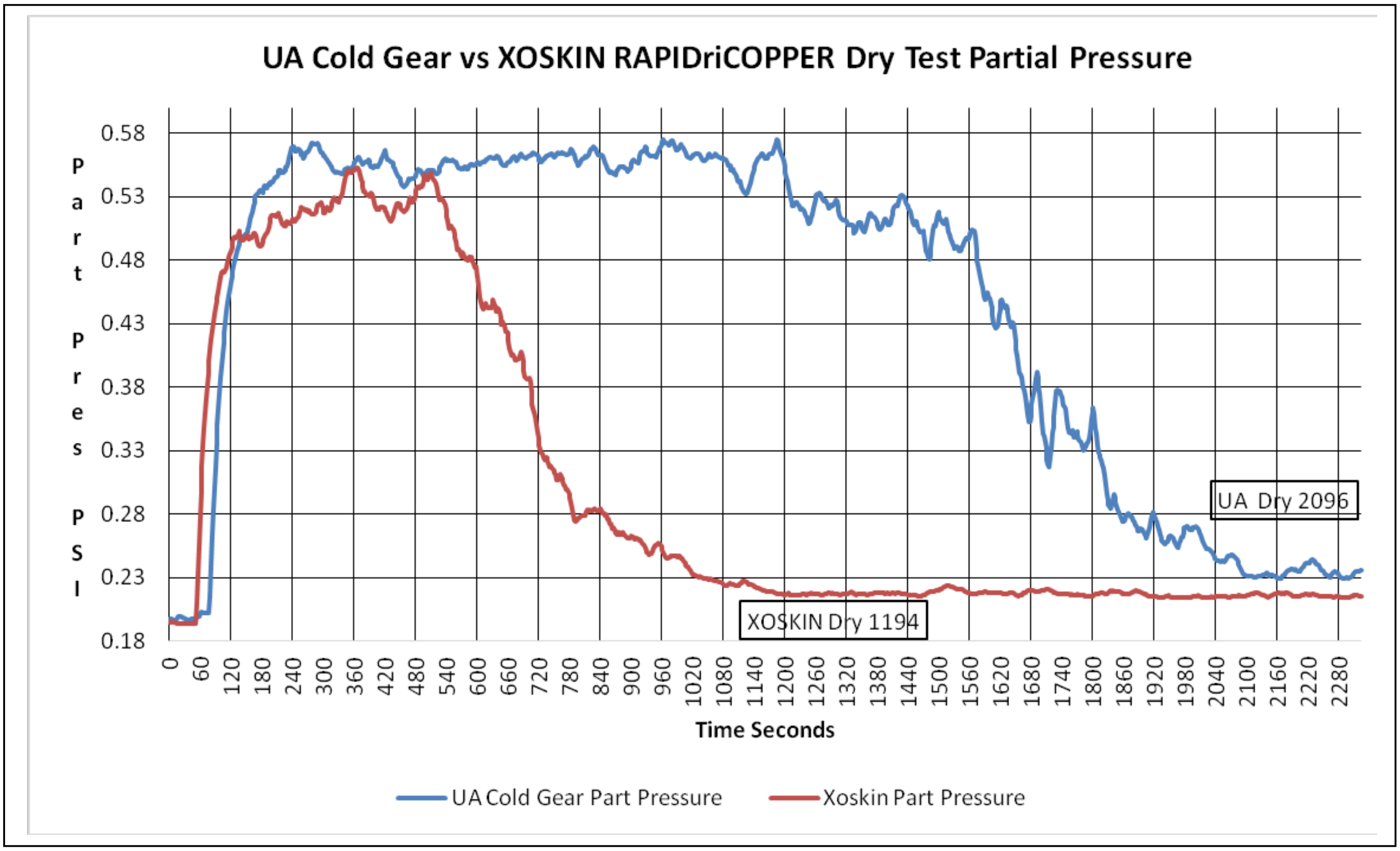
1) Partial vapor pressure is pressure that vapor exerts when mixed with other gasses. Partial vapor pressure is measured as a function of both temperature and humidity. As the quantity of water vapor in a unit of atmospheric gas diminishes, the partial water vapor pressure diminishes. When partial vapor pressure in the micro climate between the bottom of the garment and impermeable membrane at the top of the kettle is equal to the ambient partial vapor pressure, all added moisture in the test garment will have evaporated. When we look at partial vapor plots, the partial pressure increases rapidly at the beginning of the test when the wet garment is placed on the kettle. This is because moisture from the garment rapidly enters the micro-climate area. As the garment dries, moisture leaves the micro-climate area and partial vapor pressure falls. Ultimately, partial vapor pressure stops falling and levels off. At this point, the garment is dry.
2) Average garment outer surface temperature is measured using a thermal imager. As the wet garment dries, the surface temperature will increase. Initially, the garment temperature will remain at a reduced initial temperature for a period of time until evaporation begins to dry the garment. At this point, the surface temperature will show rapidly increase. As drying progresses, the rate of temperature increase will slow. When the garment is dry, the surface temperature will stabilize at an elevated temperature.

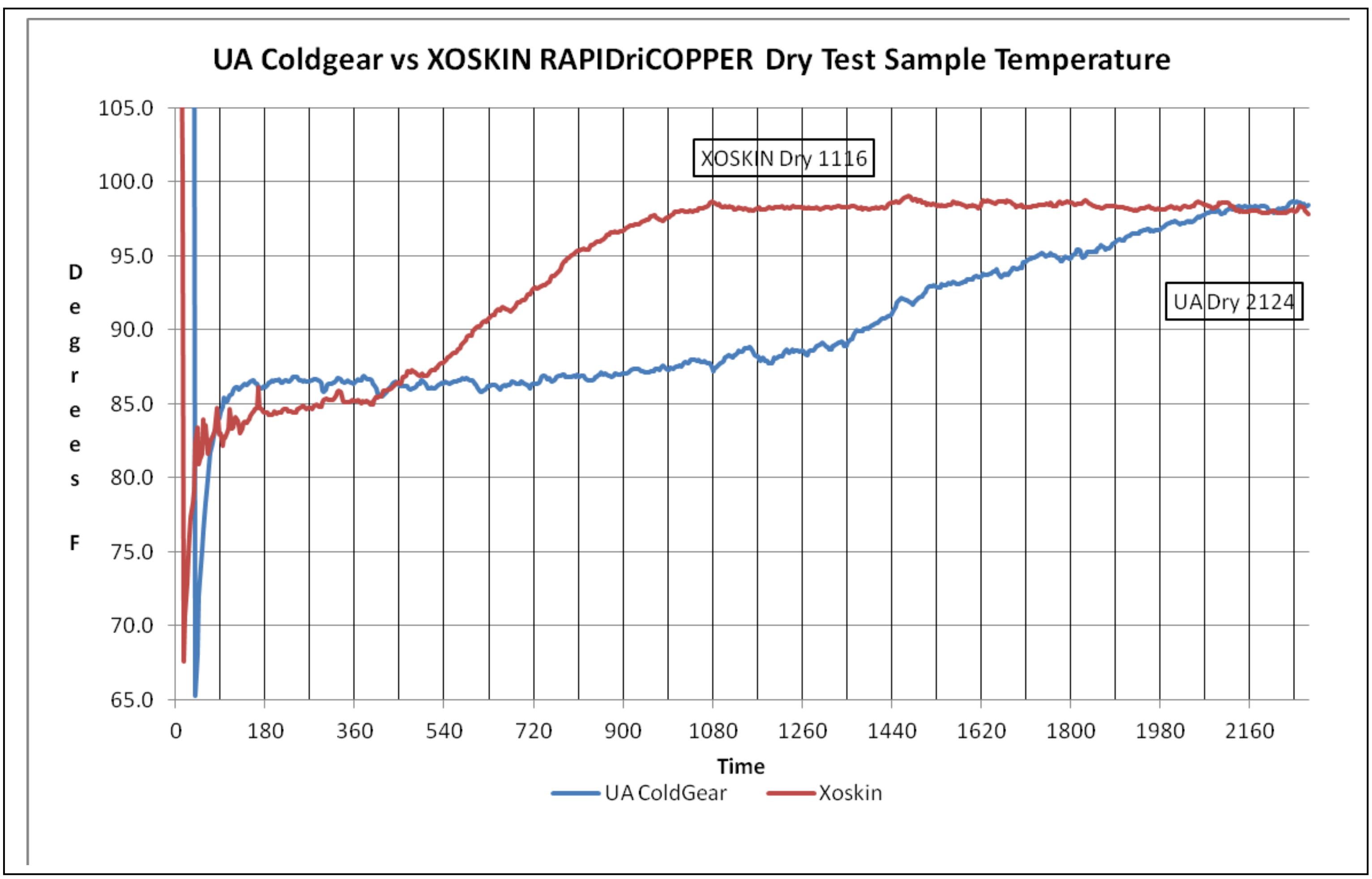
In both types of plots, drying is achieved when the drying curves become flat at the right side of the plot.

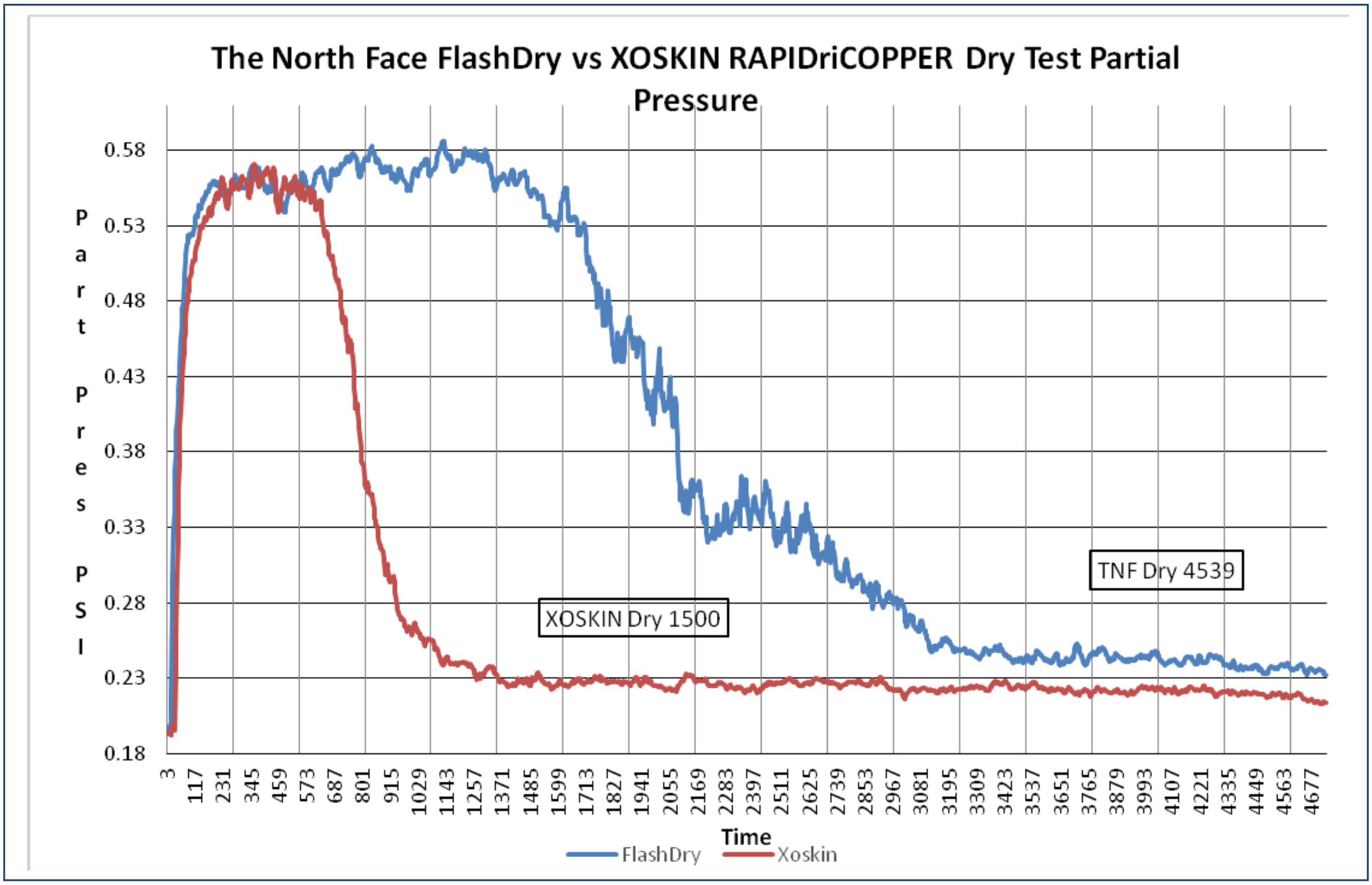
Drying times in seconds are displayed for each garment on each plot. The elapsed dry times for each type of plot will differ because the time base of the temperature plot differs from the time base of the partial pressure plot.

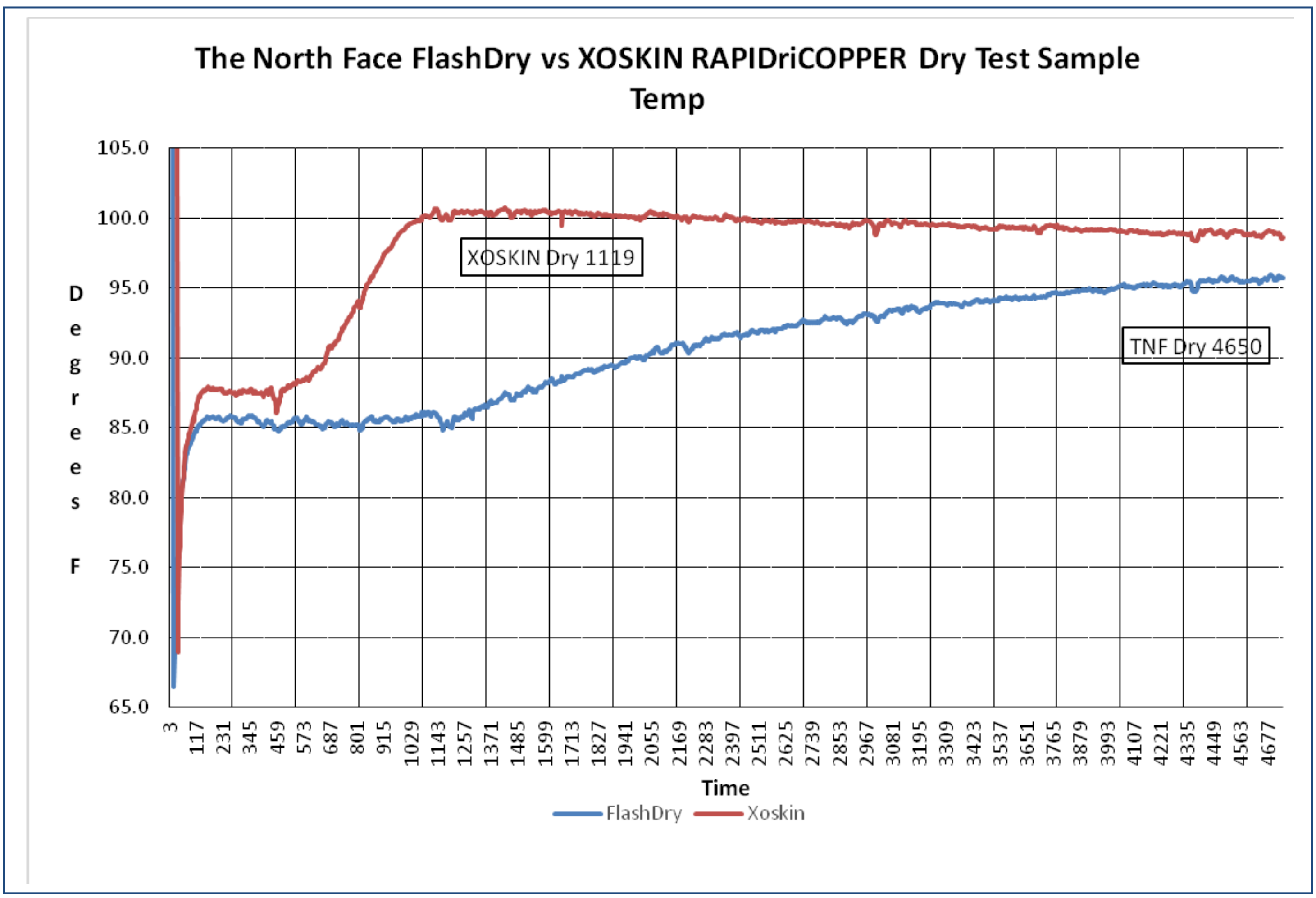

Icebreaker vs XOSKIN RAPIDriCOPPER Dry Test Partial Pressure
Part Pres pSI
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2382 Dry
1586 Dry
0
66
132
198
264
330
396
462
528
594
660
726
792
858
924
990
1056
1122
1188
1254
1320
1386
1452
1518
1584
1650
1716
1782
1848
1914
1980
2046
2112
2178
2244
2310
2376
2442
Time Seconds
Icebreaker Part Pressure
Xoskin Part Pressure

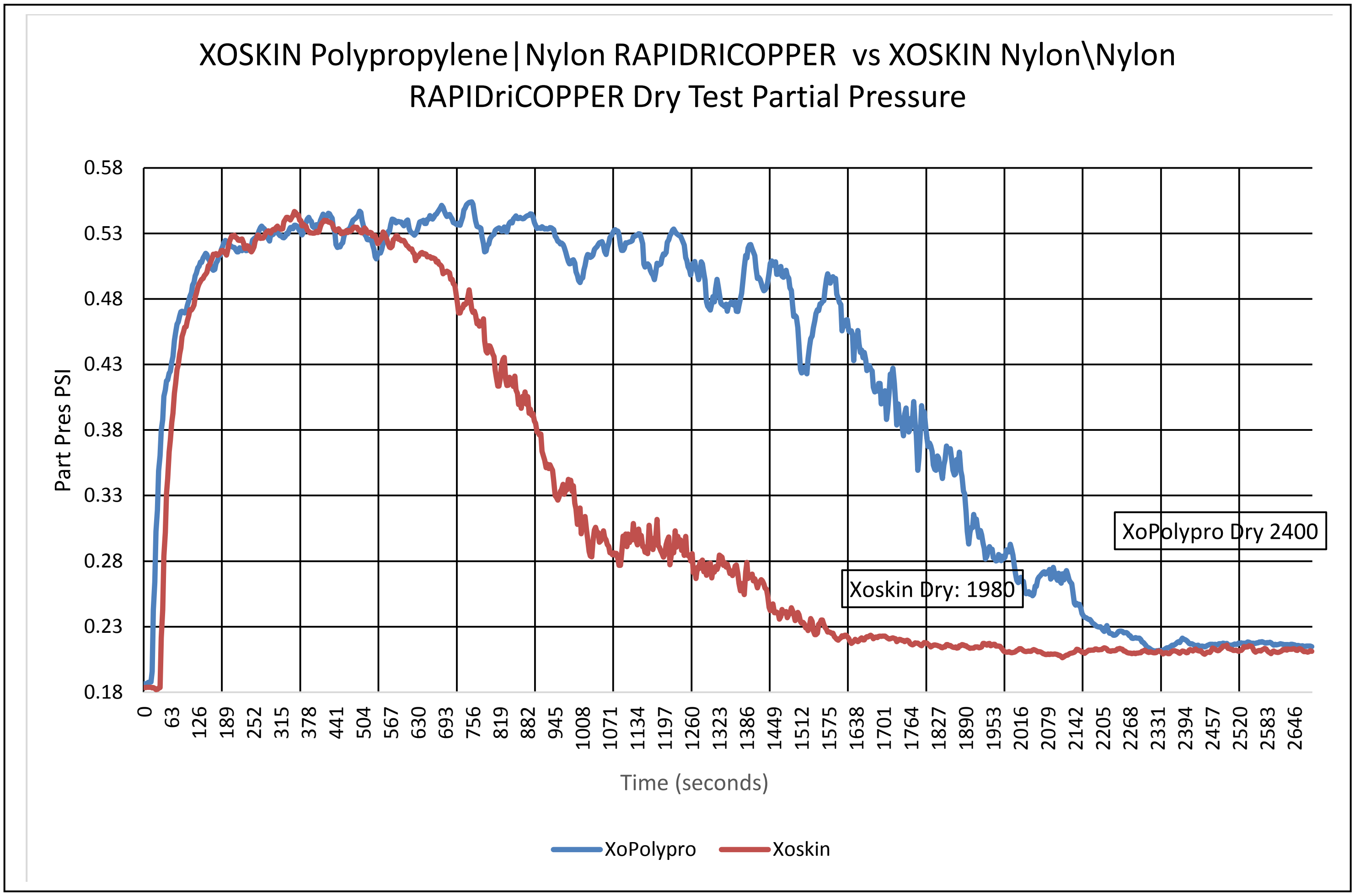

Icebreaker vs XOSKIN RAPIDriCOPPER Dry Test Average Sample Temperature
Icebreaker Dry 2405
XOSKIN Dry 1728
Degrees F
101.0
99.0
97.0
95.0
93.0
91.0
89.0
87.0
85.0
0
72
144
216
288
360
432
504
576
648
720
792
864
936
1008
1080
1152
1224
1296
1368
1440
1512
1584
1656
1728
1800
1872
1944
2016
2088
2160
2232
2304
2376
2448
2520
Time Seconds
Icebreaker
Xoskin


UA Cold Gear vs XOSKIN RAPIDriCOPPER Dry Test Partial Pressure
Part Pres PSI
0.58
0.53
0.48
0.43
0.38
0.33
0.28
0.23
0.18
0 60 120 180 240 300 360 420 480 540 600 660 720 780 840 900 960 1020 1080 1140 1200 1260 1320 1380 1440 1500 1560 1620 1680 1740 1800 1860 1920 1980 2040 2100 2160 2220 2280
Time Seconds
UA Dry 2096
XOSKIN Dry 1194
UA Cold Gear Part Pressure
Xoskin Part Pressure

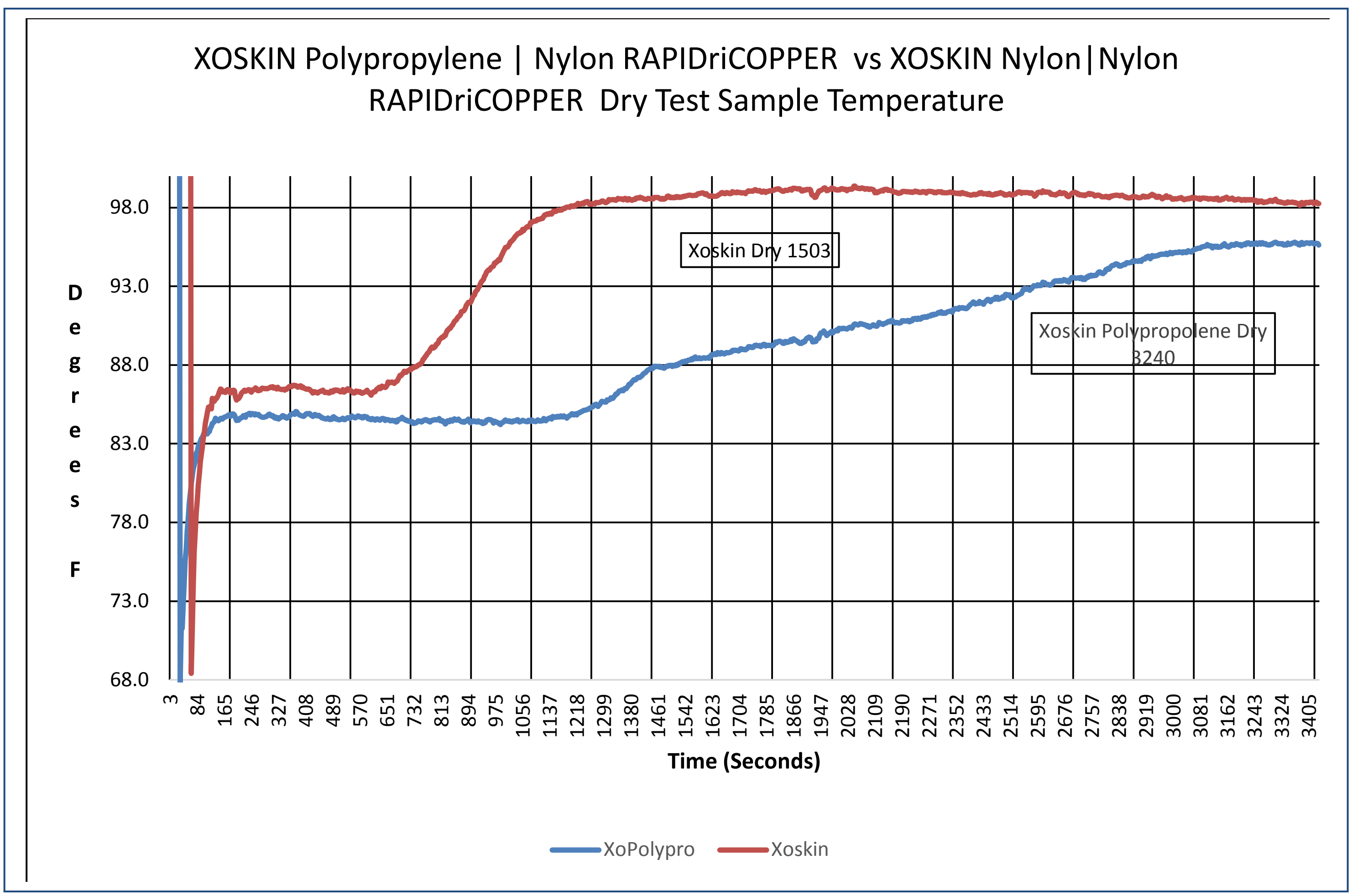

UA Coldgear vs XOSKIN RAPIDriCOPPER Dry Test Sample Temperature
Degrees F
105.0
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
0 180 360 540 720 900 1080 1260 1440 1620 1800 1980 2160
Time
XOSKIN Dry 1116
UA Dry 2124
UA ColdGear
Xoskin


The North Face FlashDry vs XOSKIN RAPIDriCOPPER Dry Test Partial Pressure
Part Pres PSI
0.58
0.53
0.48
0.43
0.38
0.33
0.28
0.23
0.18
Time
TNF Dry 4539
XOSKIN Dry 1500
FlashDry
Xoskin


The North Face FlashDry vs XOSKIN RAPIDriCOPPER Dry Test Sample Temp
Degrees F
105.0
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
Time
XOSKIN Dry 1119
TNF Dry 4650
FlashDry
Xoskin



XOSKIN Polypropylene|Nylon RAPIDRICOPPER vs XOSKIN Nylon\Nylon RAPIDriCOPPER Dry Test Partial Pressure
Part Pres PSI
0.58
0.53
0.48
0.43
0.38
0.33
0.28
0.23
0.18
Time (seconds)
XoPolypro Dry 2400
Xoskin Dry: 1980
XoPolypro
Xoskin



XOSKIN Polypropylene | Nylon RAPIDriCOPPER vs XOSKIN Nylon|Nylon RAPIDriCOPPER Dry Test Sample Temperature
Degrees F
98.0
93.0
88.0
83.0
78.0
73.0
68.0
Time (Seconds)
Xoskin Dry 1503
Xoskin Polypropolene Dry 3240
XoPolypro
Xoskin

Kettle Thermal Images

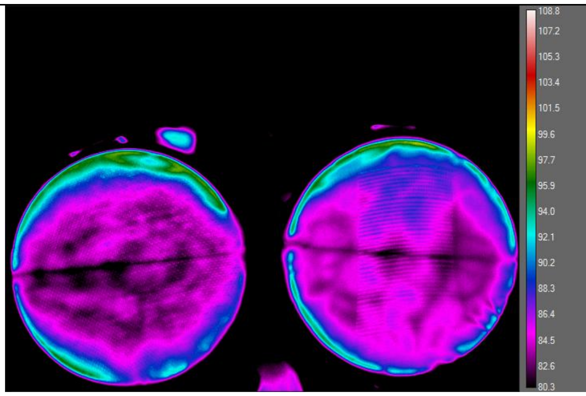
The pages below provide thermal images that illustrate the drying process for each garment pair. The progress of drying can be seen from the color changes.

The wet garments are mounted on the kettles. At the start of the test, wet garments are typically purple in color due their low temperatures. As the fabric drives, the surface temperatures rise and as they warm become green, then yellow and finally red. When the warming ceases and elevated surface temperatures remain constant, the garment is dry.

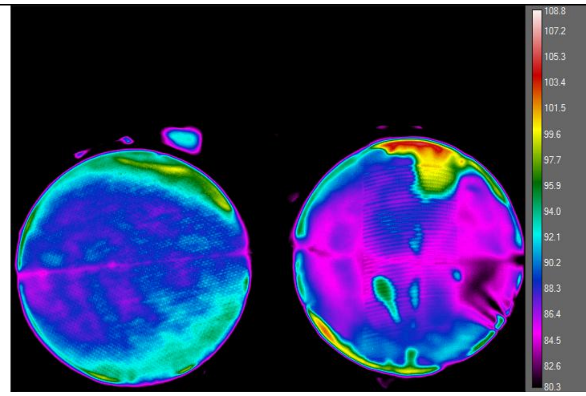
The images are produced at 10 minute intervals.

Following the still images are embedded videos that illustrate the drying process in compressed time. This means that the drying process, which occurs over 20-40 minutes is viewed in less than a minute.

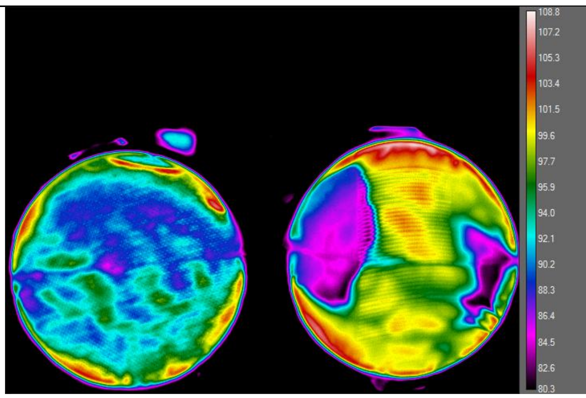
Icebreaker vs XOSKIN RAPIDriCOPPER Infrared Drying Images at 10 Minute Intervals



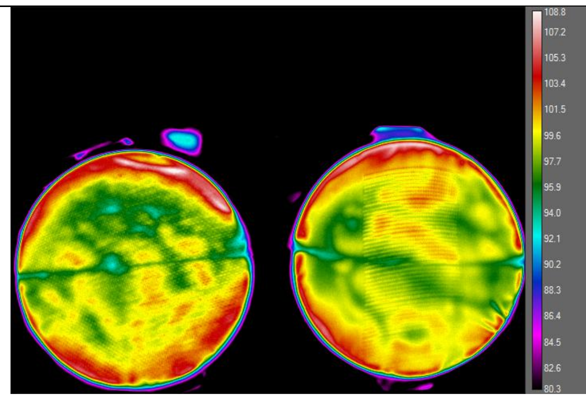
0 Minutes



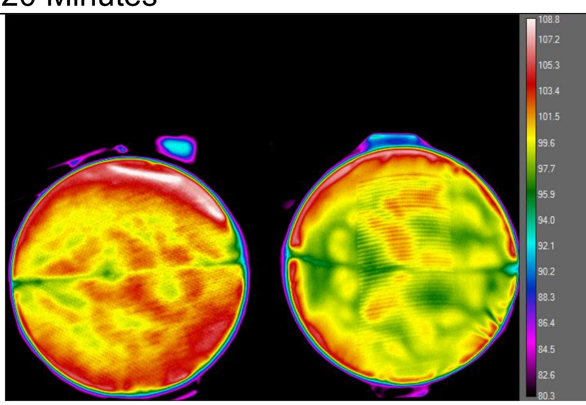
10 Minutes



20 Minutes



30 Minutes



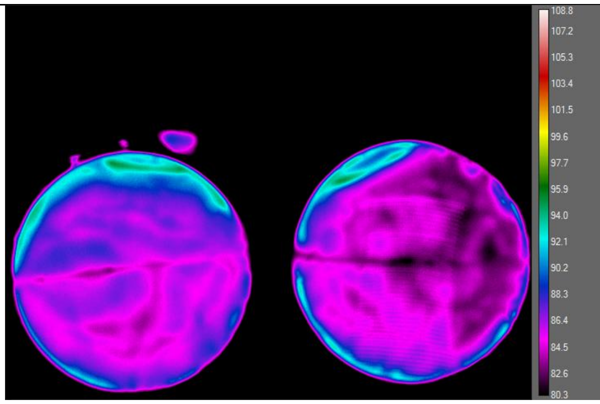
40 Minutes

Icebreaker is Left Image
XOSKIN is Right Image

Cold (purple is wet)
Warm (yellow, green, red) is dry.

The XOSKIN garment achieves temperature stability by 30 minutes. The surface temperature of the Icebreaker continues to rise for approximately 10 minutes more.

Under Armour Cold Gear vs XOSKIN RAPIDriCOPPER Infrared Drying Images at 10 Minute Intervals



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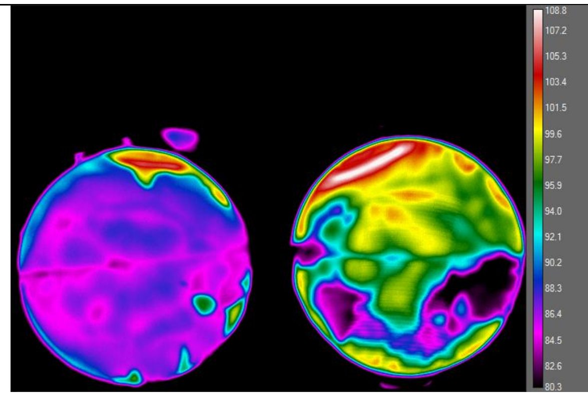
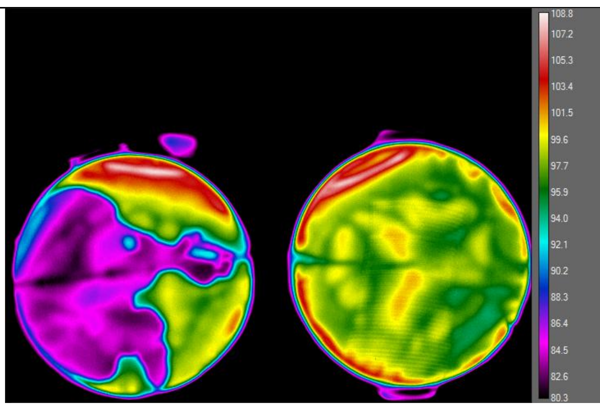
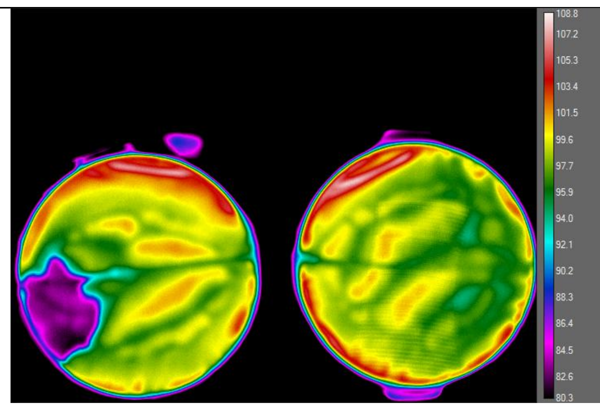


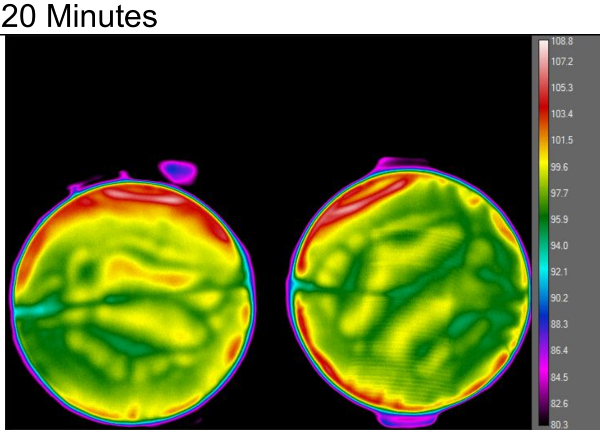
10 Minutes



20 Minutes



30 Minutes



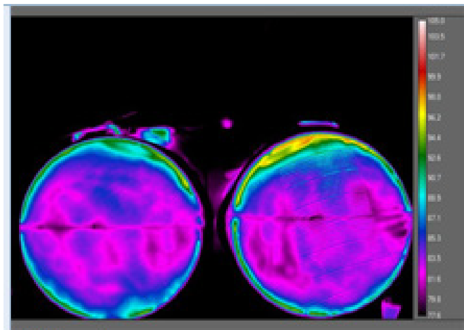
40 Minutes

Under Armour Cold Gear is Left Image
XOSKIN RAPIDriCOPPER is Right Image

Cold (purple is wet)
Warm (yellow, green, red) is dry.

The XOSKIN garment achieves a stable temperature in less than 20 minutes. The UA Cold Gear garment requires an additional 20 minutes to achieve stable temperatures.

The North Face FlashDry vs XOSKIN RAPIDriCOPPER Infrared Drying Images at 10 Minute Intervals



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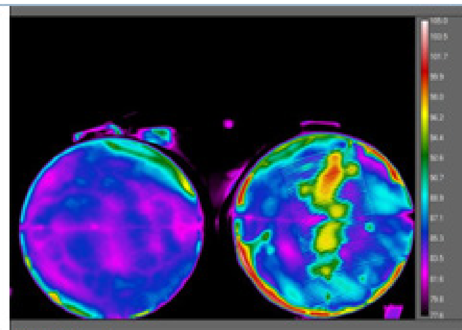
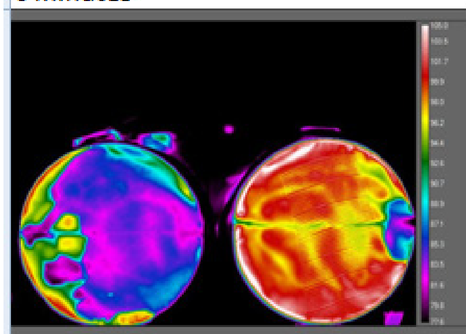


10 Minutes



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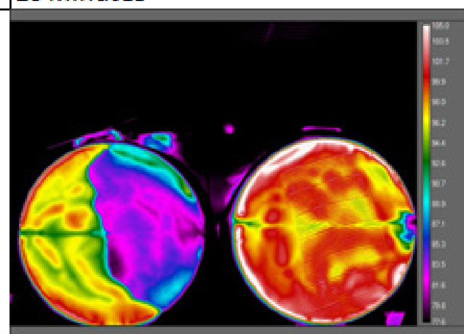
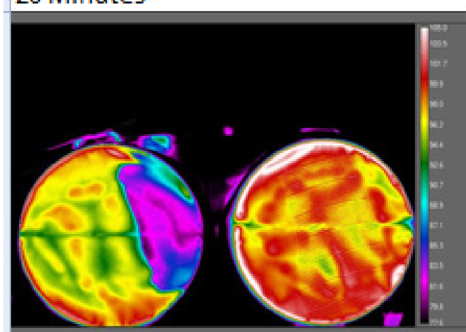
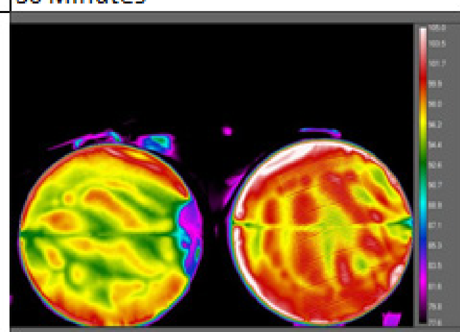


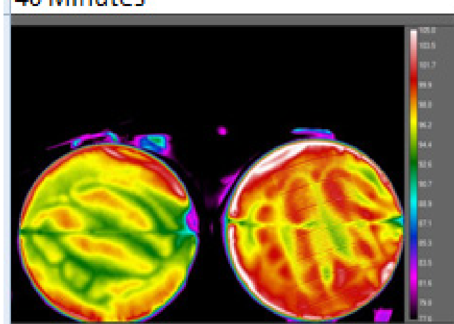
30 Minutes



40 Minutes



50 Minutes



55 Minutes

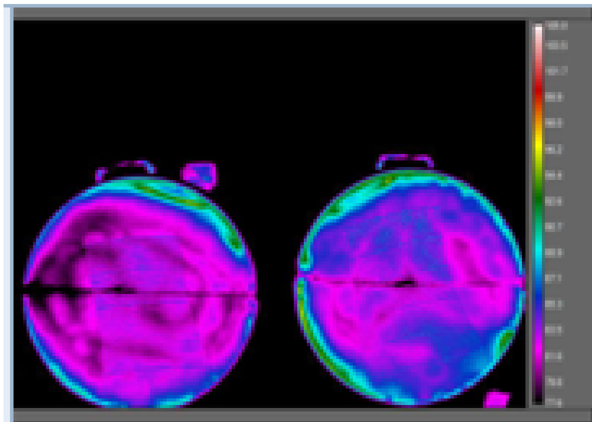
The North Face FlashDry is Left Image.

XOSKIN RAPIDriCOPPER is Right Image

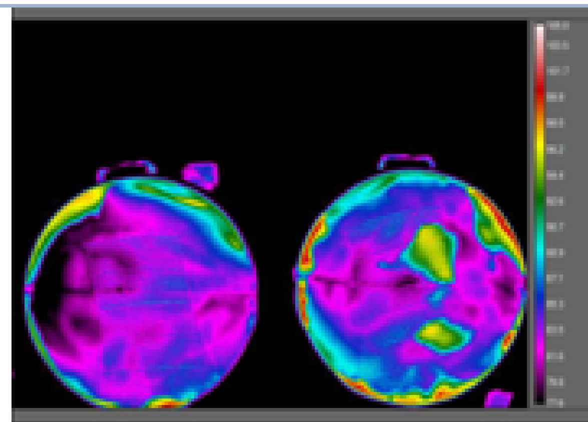
Cold (purple is wet)
Warm (yellow, green, red) is dry.

The XOSKIN garment achieves a stable temperature in about 25 minutes. The North Face FlashDry garment requires an additional 30 minutes to achieve stable temperatures.

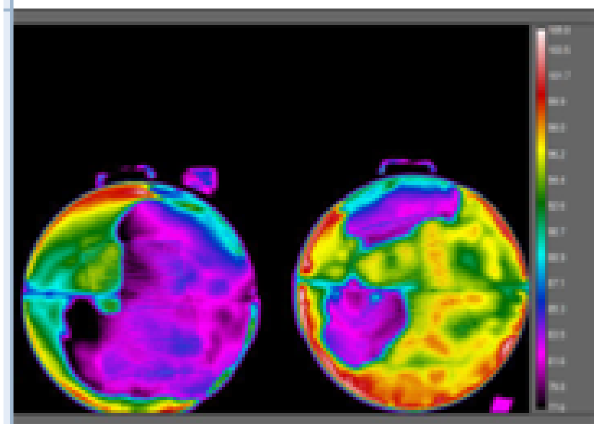
XOSKIN Polypropylene | Nylon RAPIDriCOPPER vs XOSKIN Nylon | Nylon RAPIDriCOPPER Infrared Drying Images at 10 Minute Intervals



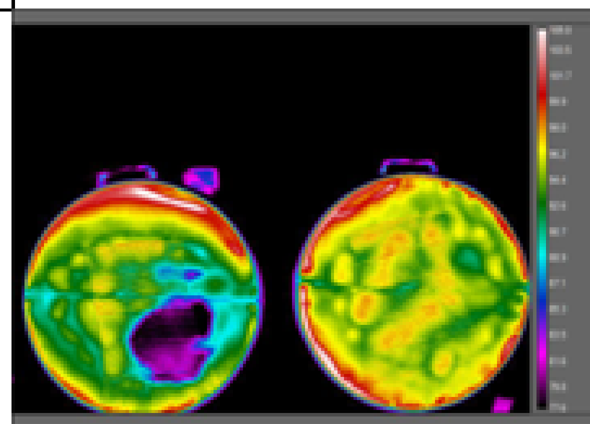
0 Minutes



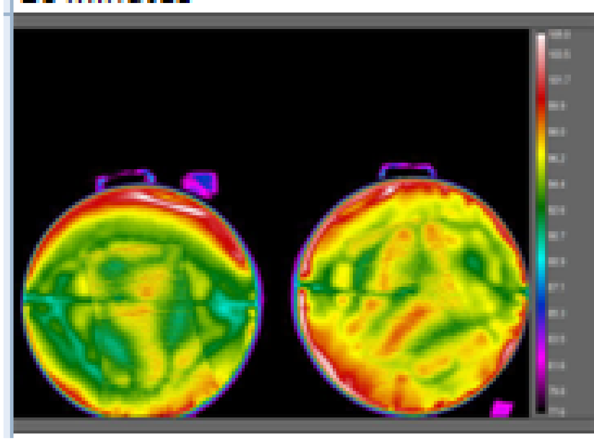
10 Minutes



20 Minutes



30 Minutes



40 Minutes

XOSKIN Polypropylene is Left Image.

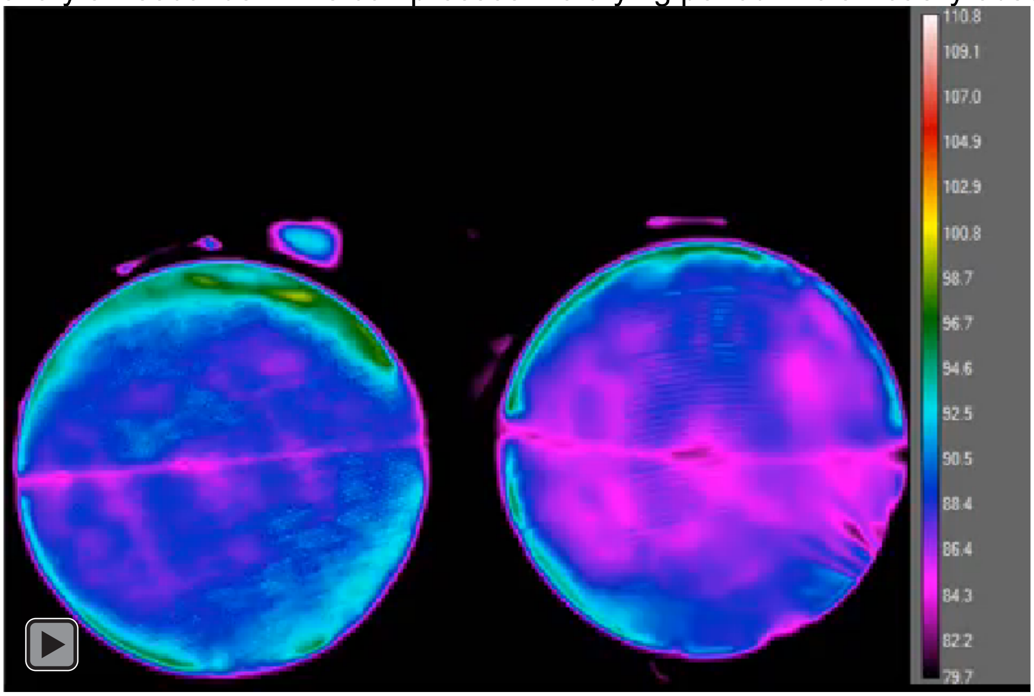
XOSKIN Nylon is Right Image

Cold (purple is wet)
Warm (Yellow, green, red) is dry.

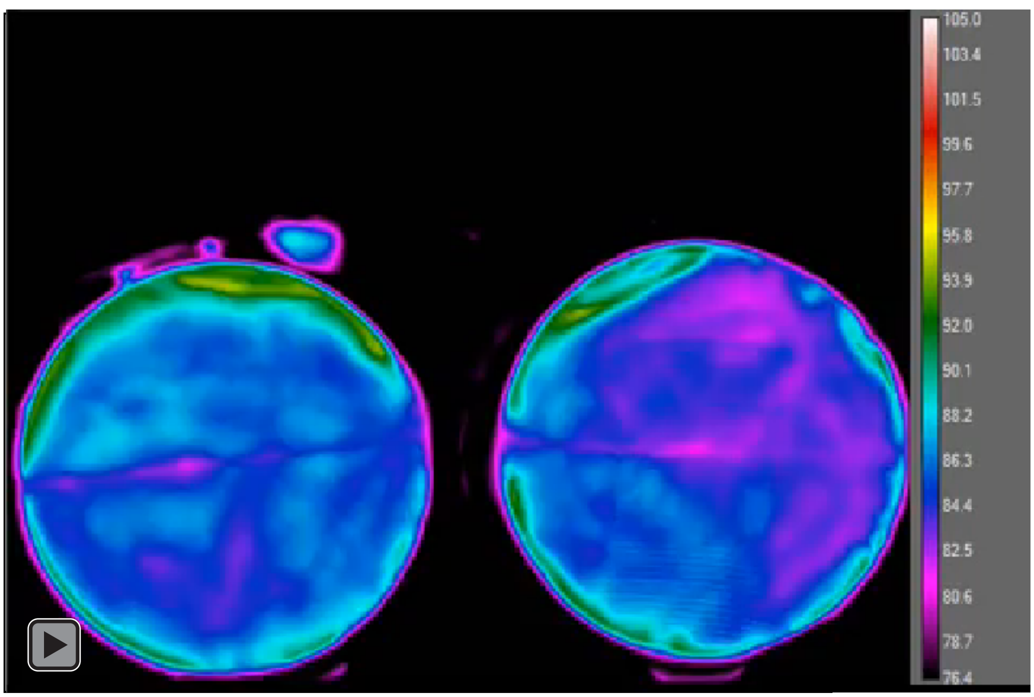
The XOSKIN Nylon garment achieves a stable temperature in about 25 minutes. The XOSKIN Polypropylene garment requires an additional 35 minutes to achieve stable temperatures.

Infrared Drying Videos

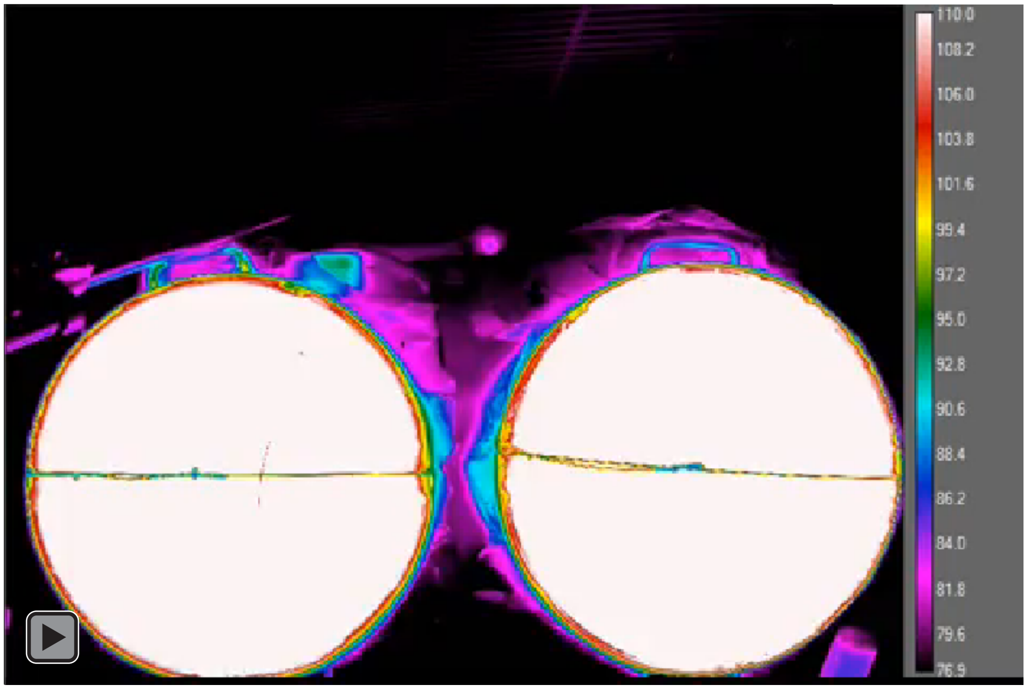
The videos below provide time lapse images of the drying process for each garment pair. These videos are produced at a frame rate of six seconds. One image is provided every six seconds. This compresses the drying period into an easily observed process.



Icebreaker vs XOSKIN RAPIDriCOPPER



Under Armour Cold Gear vs XOSKIN RAPIDriCOPPER



The North Face FlashDry vs XOSKIN RAPIDriCOPPER

XOSKIN Polypropylene | Nylon RAPIDriCOPPER vs XOSKIN Nylon | Nylon RAPIDriCOPPER

Quantitative Drying Data

The table below provides drying time and rate data for each garment pair.

Test Garment	Vapor Pressure Test Dry Time (seconds)	Tempera-ture Test Dry Time (seconds)	Avg Dry Time Data (seconds)	Drying Rate (grams/minute)
Icebreaker vs XOSKIN				
Icebreaker	2382	2405	2393.5	2.2
XOSKIN	1586	1728	1657	3.8
Dry Time Diff	796	677	736.5	
% Difference	67%	72%	69%	73%
UA Cold Gear vs XOSKIN				
Cold Gear	2096	2124	2110	3.2
XOSKIN	1194	1116	1155	4.1
Dry Time Diff	902	1008	955	
% Difference	57%	53%	55%	28%
TNF FlashDry vs XOSKIN				
FlashDry	3600	3755	3678	2.7
XOSKIN	1455	1208	1332	3.8
Dry Time Diff	2145	2547	2346	
% Difference	40%	32%	36%	41%
XOSKIN Polyprop vs XOSKIN Nylon				
XOSKIN Polyp	1643	1943	1793	2.5
XOSKIN Nylon	1788	1772	1780	3.2
Dry Time Diff	-145	171	13	
% Diff	109%	92%	99%	28%

The data shows that the XOSKIN RAPIDriCOPPER garment dries significantly faster in each case.