



**NEMO | etc.**

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ENGINEER

TEST

CONSULT

## Laboratory Report 4r-CGT-19-SSTHP-01.E

**Physical Properties Testing**

*of*

**Econodek - Premium Series**

*produced in*

**Cambridge, ON**

*in accordance with*

**ASTM D4434-21**

**Prepared for: Tuff Industries, Inc.**

9570 Bottom Wood Lake Road  
Lake Country, BC V4V 1S7, Canada  
c/o: Bryan Hughes

**Test Lab: NEMO | etc.**

10 Mauney Court  
Columbia, SC 29201

**Date of Issuance: 2024-04-05**

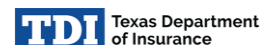
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[TL-199](#)



[21-1115.01](#)





**LABORATORY REPORT**

**CUSTOMER OBJECTIVE**

Establish physical property data in accordance with codified material standards.

**TESTING SCOPE**

Physical properties testing in accordance with ASTM D4434-21, Type III.

**SAMPLES**

PRODUCT	BY	Manufacturing Location
Econodek - Premium Series	Tuff Industries	Cambridge, ON

**TEST PROGRAM**

PROJECT		DURATION		PERSONNEL	
NUMBER:	4r-CGT-19-SSTHP-01	AUTHORIZED:	2019-03-18	NEMO:	S. Dock
CUSTOMER PO:	4500049149	SAMPLING:	N/A		D. Rhodes
MD NOTIFICATION:	NEMO000125	MATERIALS ON HAND:	N/A		
TEST MATERIAL ROUTING		MATERIALS RECEIVED:	2019-06-25		
VIA:	Per Customer	TEST START:	2019-06-05		
BY:	Contact Customer	TEST END:	2020-02-04		

**APPENDICES**

- Appendix 1 Statement of Limitation
- Appendix 2 Decision Rule 1
- Appendix 3 Manufacturing Traceability & Test Material Routing
- Appendix 4 Tests, Standards, Equipment & Outsourced Log




RESULTS <sup>1</sup> :		Econodek - Premium Series						Cambridge, ON		ASTM D4434, TYPE III	
PROPERTY		TEST DATA						RESULTS		CRITERIA	
		1	2	3	4	5	6	Avg.	SD		
Overall thickness	in.	0.057	0.057	0.057	0.057	0.058	–	0.057	0.000	≥ 0.045	
Thickness over scrim	in.	0.016	0.016	0.017	0.024	0.023	0.021	0.019	0.004	≥ 0.016	
Breaking strength	lbf/in.	MD	334	337	328	334	311	–	329	10	≥ 200
		XMD	254	262	269	262	277	–	265	8	
Elongation at break	%	MD	27	27	27	27	25	–	27	1	≥ 15
		XMD	27	27	27	27	28	–	27	1	
Seam strength	lbf/in.	XMD	494	475	470	469	507	–	483	17	≥ 199 (75% breaking strength)
Tearing strength	lbf	MD	55.8	39.3	41.7	49.8	43.6	–	46.0	6.7	≥ 45.0
		XMD	88.7	68.9	81.5	72.9	88.3	–	80.1	9.0	
Low temperature bend	-40°F	MD	Pass	Pass	Pass	Pass	Pass	–	Pass	N/A	No cracks
		XMD	Pass	Pass	Pass	Pass	Pass	–	Pass	N/A	
Linear dimensional change	%	MD	0.0	0.0	0.0	0.0	–	–	0.0	0.0	≤ 0.5
		XMD	0.0	0.0	0.0	0.0	–	–	0.0	0.0	
Change in weight after immersion in water	%		0.3	0.3	0.3	–	–	–	0.3	0.0	± 3.0
Static puncture resistance	33 lbf		Pass	Pass	Pass	–	–	–	Pass	N/A	No puncture
Dynamic puncture resistance	20 J		Pass	Pass	Pass	Pass	Pass	Pass	Pass	N/A	No puncture
<b>POST-HEAT AGING:</b>											
Breaking strength	lbf/in.	MD	334	321	336	329	230	–	310	45	≥ 296 (90% control)
		XMD	235	245	241	244	55	–	244	7	≥ 238 (90% control)
Elongation at break	%	MD	28	26	28	27	27	–	27	1	≥ 24 (90% control)
		XMD	24	25	25	26	26	–	25	1	≥ 25 (90% control)
<b>ACCELERATED WEATHERING (5,000 HOURS):</b>											
Visual	at 7x magnification		Pass	Pass	Pass	Pass	Pass	–	Pass	N/A	No cracking or crazing

<sup>1</sup> All properties except overall thickness reflect performance of nominal 50-mil material, which has been found through criticality testing and analysis to be extendable to the nominal 60-mil material.



**COMPLIANCE STATEMENT**

Econodek - Premium Series, as produced in Cambridge, ON, Canada has demonstrated compliance with requirements of ASTM D4434-21, Type III.

**Signed:**   
 David Carey  
 Small Scale Section Lead

**Signed:**   
 Robert Nieminen, P.E.  
 President

**REPORT HISTORY:**

DATE	EVENT	NOTES	AUTHORIZATION
2024-04-05	FINAL	New report per directive of program sponsor, supported by SPE	RN

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TRPT- 0210      TRPT- 0048      REVISION HISTORY: LOG-0700      RELEASED BY: MDA

**-END OF REPORT-**

**APPENDIX 1: STATEMENT OF LIMITATION**

The results presented are applicable solely to the products tested herein.

**APPENDIX 2: DECISION RULE 1**

All results reported to the customer reflect observed values without incorporating measurement uncertainty. Determination of conformity to specifications will depend on acceptance limits, where results will be declared to pass if within the limits, and fail if outside the limits.

**APPENDIX 3: MANUFACTURING TRACEABILITY & TEST MATERIAL ROUTING**

Manufacturing traceability for component tests is confirmed by counter-signed contractual agreement or by signed statement from customer, retained in the custody of NEMO|etc. Test materials routing is included if randomly sampled, or if the sample bears NEMO|cert. certification mark. Random sampling is acceptable if conducted by an ISO/IEC 10720 or ISO/IEC 10725 accredited entity, which includes sampling on its Scope of Accreditation, and is independent of the manufacturer and the customer. If conducted by NEMO|etc., third-party random sampling is conducted in accordance with the sampling plan detailed in SOP-0005, and as stated in ICC-ES AC85.

**APPENDIX 4: TESTS, STANDARDS, EQUIPMENT & OUTSOURCED LOG**

PROPERTY	ASTM D4434		TEST EQUIPMENT		CALIBRATION		
	SECTION	BASE METHOD	DESCRIPTION	ASSET #	PRE-TEST	NEXT	
Overall thickness	8.2	D751	EJ Cady micrometer	0637	2019-03-20	2020-03-20	
Thickness over scrim	8.3	D7635	Meiji microscope	0232	-	-	
Breaking strength	8.4	D751, Procedure A	Instron 5969	0595	2019-04-10	2020-04-10	
Elongation at break	8.5	D751, Procedure A	Instron 5969	0595	2019-04-10	2020-04-10	
Seam strength	8.6	D751, Procedure A	Instron 5969	0595	2019-04-10	2020-04-10	
Heat Aging (HA)	56 days, 176°F	8.7	D3045	-	-	-	
Breaking strength	post-HA	8.4	D751, Procedure A	Instron 5969	0595	2019-04-10	2020-04-10
Elongation at break	post-HA	8.5	D751, Procedure A	Instron 5969	0595	2019-04-10	2020-04-10
Tearing strength		8.9	D751, Procedure A	Instron 5969	0595	2019-04-10	2020-04-10
Low temperature bend	-40°F	8.10	D2136	So-Low freezer 2 NEMO ½" mandrel	0264	2019-03-20	2020-03-20
Linear dimensional change		8.12	D1204	Starrett 799 12"	0511	2019-03-19	2020-03-19
Change in weight after immersion in water		8.13	D570	Boekel Hot Tub	0522	2019-03-19	2020-03-19
Static puncture resistance		8.14	D5602	Static puncture apparatus	0619	-	-
Dynamic puncture resistance		8.15	D5635	Dynamic puncture apparatus	0420	-	-
				Mettler Toledo Scale	0514	2019-03-19	2020-03-19
Accelerated Weathering (AW)	5000 hrs	8.11	G154	QUV-SE	0596	-	-
Visual	post-AW	8.11		-	-	-	-