SMITHERS RAPRA

August 29, 2011

CUSTOMER: Tuf-Tite Inc.
1200 Flex Court
Lake Zurich, IL 60047
USA

ATTENTION: Ted Meyers
P.O. #
Smithers Job # F20693JE

SUBJECT: TEST REPORT
The above mentioned firm submitted (1) samples for testing identified as

- Rubber Connector TS-RB4

TESTING:
Shore A Hardness ASTM D2240
Properties in Tension for Vulcanized Rubber and Thermoplastic Elastomers ASTM D412
Heat Resistance ASTM D573
Compression Set ASTM D395
Effects of Fluids ASTM D471
Resistance to Ozone ASTM D1149
Tear Strength of Vulcanized Rubber & Thermoplastic Elastomers – ASTM D624
Brittleness Temperature of Plastics and Elastomers by Impact – ASTM D746

APPROVED BY:
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REVIEWED BY:
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GW/tmy

SUMMARY OF RESULTS:

Spec Ref.	Test		Rubber Connector TS-RB4	Requirements	Comment
ASTM D543	**Chemical Resistance**				
	48 hours @ 22°C				
	1 *N* sulfuric acid		No Weight Loss	No weight loss	Pass
	1 *N* hydrochloric acid		No Weight Loss	No weight loss	Pass
ASTM D412	**Tensile Properties of Rubber**				
	Tensile Strength	psi	1583	1200 min	Pass
	Ultimate Elongation	%	809	350 min	Pass
ASTM D2240	**Shore A Hardness**	points	68	info	info
ASTM D573	**Accelerated Oven-Aging**				
	7Days @70°C				
	Change in Tensile Strength	%	-8	-15 max	Pass
	Change in Elongation	%	0.7	-20 max	Pass
ASTM D395	**Compression Set**				
	22 hours @ 70°C (plied)	%	27	25 max	Fail
ASTM D471	**Fluid Resistance**				
	48 hours @ 70°C Distilled Water				
	Change in Mass	%	0.3	10 max	Pass
ASTM D1149	**Ozone resistance**				
	72Hrs, 40°C, 50pphm, bent loop	Rating*	3	0	Fail
ASTM D746	**Low Temperature Brittlepoint**				
	Pass/Fail @ -40°C	p/f	Pass	Pass	Pass
ASTM D624	**Tear Resistance of Rubber**				
	Tear Strength Die B	pli	211	200 min	Pass

***Rating system:** **0 – no cracks @7x magnification**
1 – small cracks @7x magnification
2 – small cracks visible to naked eye
3 – medium to large cracks visible to naked eye

SUMMARY OF TEST CONDITIONS

PHYSICAL TESTING:

Shore A Hardness ASTM D2240
- Date of testing: 8/27/11
- Laboratory conditions: 23° ± 2°C, 50% ± 5% RH
- Durometer manufacturer, Type, and Serial Number: Shore Instruments, S/N 122688
- Date of Last calibration: 7/11
- Calibration due date: 7/12
- Means of testing: Type 2
- Description of test specimen: plied/0.250" nom.
- Indention hardness time interval: 1 sec

Properties in Tension for Vulcanized Rubber and Thermoplastic Elastomers ASTM D412
- Test method: A
- Test specimen: Die C
- Date of testing: 8/27/11
- Date of vulcanization: Unknown
- Rate of extension: 20"/min
- Laboratory conditions: 23° ± 2°C, 50% ± 5% RH
- Sample preparation per ASTM D3183

Heat Resistance ASTM D573
- Test method: A
- Date of testing: 8/26/411
- Laboratory conditions: 23° ± 2° C, 50 ± 5% RH

Compression Set ASTM D395
- Test method: B
- Specimen type: Plied, Type 1
- Test period: 22 hours
- Test temperature: 70°C
- Surface lubrication: PTFE
- Start date: 8/25/11
- Finish date: 8/26/11

Effects of Fluids ASTM D471
- Test description: Change in volume, weight and change in tensile properties
- Exposure temperature: 70°C
- Testing Date: 8/12/11

Chemical Resistance ASTM D543
- Testing conditions: 22° C for 48 hrs
- Testign Date: 8/12/11

SUMMARY OF TEST CONDITIONS (continued)

PHYSICAL TESTING:

Resistance to Ozone ASTM D1149
- 72 hrs @ 40°C @ 50 pphm
- Preconditioned 24 hrs @ 40°C
- Type of specimen used: Bent Loop
- Exposure Time and Rating under 7x Magnification
- Date in: 8/15/11
- Date out: 8/18/11

Tear Strength of Vulcanized Rubber & Thermoplastic Elastomers – ASTM D624
- Date of testing: 8/27/11
- Test specimen type: Die B
- Specimen preparation: Die cut
- Rate of extension: 20.0"/min.
- Laboratory conditions: 23° ± 2° C, 50 ± 5% RH
- Test temperature: 23°C
- Test machine & grips: Instron 4465 CRE w/pneumatic grips

PHYSICAL ANALYSIS:

Brittleness Temperature of Plastics and Elastomers by Impact – ASTM D746
- Sample conditioning: 3 min @ test temperature
- Date of testing: 8/20/11
- Specimen type: Type II
- Torque to clamp: 5 lbf-in.
- Type of apparatus: Guillotine type
- Clamp type: Type A
- Heat-transfer medium: Ethyl Alcohol C200
- Method of calculation: Procedure B
- Number of specimens: 5