
Report of Hydraulic Brake Hose Testing

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Report of Physical Testing of 1/8" Hydraulic Brake Hose Assemblies 0001

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INTRODUCTION:

This report presents the results of tests performed on Hydraulic Brake Hose Assemblies. These tests were conducted in accordance with the test requirements of the **Federal Motor Vehicle Safety Standard No. 106 (02/2012 Edition) and SAE J1401 (Feb 2013).**

Samples submitted for testing: 1/8" Hydraulic Brake Hose Assemblies
 Part Number (if given) 0001
 Work was authorized by: Roberto Barragán
 on behalf of: Mangueras SKS, S.A de C.V.

Samples were received: April 5, 2017
 Testing started on: April 17, 2017 and was completed on: April 26, 2017

DESCRIPTION OF SAMPLES SUBMITTED FOR TESTING:

Approximate free length (inches)	10.7
Number of hose assemblies	50
Approximate free length (mm)	271
Assembled with:	M10 X 1.0 Male/Female

SUMMARY OF RESULTS:

The following are results of testing conducted on the above-referenced hydraulic brake hose assemblies in accordance with the test requirements of FMVSS No. 106 and SAE J1401:

Tests	Remarks	
100% Pressure	Complies	
Construction	Complies	
Labeling	Complies	
Constriction	Complies	
	Original (Unsoaked Hose)	Water Absorption (Heat Soak)
Volumetric Expansion - Low	Complies	
Burst Strength	Complies	
Whip Resistance for assemblies: 10.7 inches long	Complies	
Tensile Strength (Slow Pull)	Complies	
Tensile Strength (Fast Pull)	Complies	
Low Temperature Resistance (Cold Bend)	Complies	
Brake Fluid Compatibility	Complies	
End Fitting Corrosion Resistance (Salt Spray)	Complies	
Ozone Resistance	Complies	
Dynamic Ozone Resistance	Complies	
Hot Impulse	Complies	

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April 28, 2017**SAMPLE IDENTIFICATION:****Construction (as supplied by the manufacturer):**

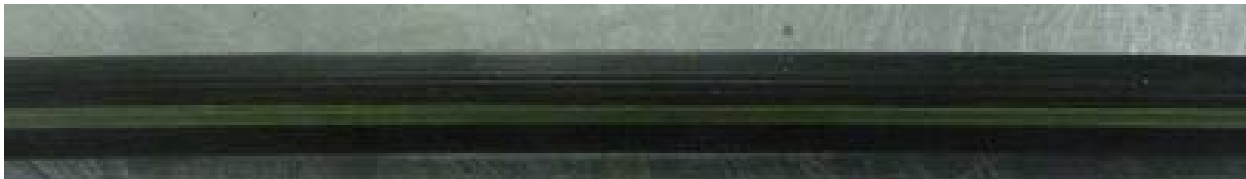
Inner Tube = EPDM / SBR
Reinforcement Braid = Poliester
Cover = EPDM / SBR
End Fitting = SAE 1006 steel

Identification Markings:

Hose Cover - Hose Identification and Markings:
NORFLEX SAE J1401 3.2 HL DOT



180 degrees oppositely prints:
Soild Yellow Line



End Fitting:



Tracer Cords: Yellow

TEST METHODS AND RESULTS:**100% Pressure**

All hose assemblies were subjected to a minimum pressure test of 1500 psi inert gas pressure per requirements of the standards.

Following a minimum of 10 seconds under the prescribed pressure, the number of assemblies which showed leaks:

Specifications state hose assemblies showing leaks under this test shall be rejected and destroyed.

0

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TEST METHODS AND RESULTS: (continued)
Constriction

Hose assemblies were measured for hose constriction by means of a gage plug.

"A" dimension diameter: 0.08 in (2.03 mm)

 To meet this requirement, all hose assemblies must permit the gage to drop of its own weight a distance of three inches into the hose assembly within three seconds and **all must be greater than 64 percent** of the nominal inside diameter.

Pass	Fail
X	

Specifications state that the inside diameter of any section of hydraulic brake hose assembly shall not be less than 64 percent of nominal inside diameter of the hose.

Volumetric Expansion and Burst Strength

The expansion and bursting strengths were determined in accordance with the methods and apparatus specified.

The following tabulations show the results of expansion and burst on four original (un-soaked) hose assemblies.

Expansion Per Meter (Foot) of Free Length in Cubic Centimeters

Un-Soaked Hose Sample No.	@ 1000 psi		@ 1500 psi		@ 2900 psi		Bursting Strength* lbs/sq in	
	cc/m	cc/ft	cc/m	cc/ft	cc/m	cc/ft	MPa	psig
1	0.43	0.13	0.55	0.17	1.05	0.32	77.03	11,172
2	0.54	0.17	0.69	0.21	1.21	0.37	93.08	13,500
3	0.51	0.15	0.64	0.20	1.15	0.35	91.36	13,251
4	0.42	0.13	0.59	0.18	1.14	0.35	92.64	13,436
Specification Requirement								
Low Expansion Hose	1.08	0.33	1.38	0.42	2.00	0.61	49	7,000
	Maximum		Maximum		Maximum		Minimum*	

 (*) All assemblies withstood water pressure of 27.6 MPa (4,000 psi) for 2 minutes **without rupture** prior to the burst test.

Water Absorption Burst Strength

The expansion and bursting strengths were determined in accordance with the methods and apparatus specified.

The following tabulations show the results burst test on four hose assemblies that are soaked for 70-72 hours in distilled water heated to 85 degrees Celsius (185 degrees Fahrenheit).

Soaked Hose Sample No.	Bursting Strength*	
	MPa	psig
36	94	13,628
37	78	11,327
38	82	11,822
39	92	13,279
Specification Requirement	49	7,000
	Minimum*	

 (*) All assemblies withstood water pressure of 27.6 MPa (4,000 psi) for 2 minutes **without rupture** prior to the burst test.

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TEST METHODS AND RESULTS: (continued)
Whip Resistance

Four original hose assemblies were coupled to the connecting rods of a Whip Test Machine conforming to ASTM D571-72. Hoses were mounted with slack length as specified.

While under constant water pressure, maintained between 235 and 250 psi supplied through the adjustable headers, the samples were subjected to the swirling action caused by the arms rotating at a speed of 800 +/-10 rpm continuously for a period of **≥40 hours**.

The apparatus was equipped with a pressure gage installed on the manifold, a pressure regulator to operate a limit switch to stop the machine when the pressure drops, a revolution counter, and an electric timer to indicate elapsed time.

Set with free length of: 10.7 in. (271 mm)

 There was **no water leakage** through rupture on the hose assemblies during the period of this test:

 Test was discontinued after: **40 hours**

True	False
X	

Specifications state the minimum life of any one of the sample hose assemblies, with free length raging from 8 to 24 inches, running continuously on the flexing machine, **shall be 35 hours**. Hose armor, if present, shall be removed prior to the test.

PASS	FAIL
X	

Water Absorption Whip Resistance

Four hose assemblies that were soaked 70 hours in room temperature distilled water were coupled to the connecting rods of a Whip Test Machine conforming to ASTM D571-72. Hoses were mounted with slack length as specified.

While under constant water pressure, maintained between 235 and 250 psi supplied through the adjustable headers, the samples were subjected to the swirling action caused by the arms rotating at a speed of 800 +/-10 rpm continuously for a period of **≥40 hours**.

The apparatus was equipped with a pressure gage installed on the manifold, a pressure regulator to operate a limit switch to stop the machine when the pressure drops, a revolution counter, and an electric timer to indicate elapsed time.

Set with free length of: 10.6 in. (270 mm)

 There was **no water leakage** through rupture on the hose assemblies during the period of this test:

 Test was discontinued after: **40 hours**

True	False
X	

Specifications state the minimum life of any one of the sample hose assemblies, with free length raging from 8 to 24 inches, running continuously on the flexing machine, **shall be 35 hours**. Hose armor, if present, shall be removed prior to the test.

PASS	FAIL
X	

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TEST METHODS AND RESULTS: (continued)
Tensile Strength

Tension tests were conducted in a testing machine conforming to ASTM E4 of 1000 pounds capacity. The specimens were secured so that the hose and fittings had a straight centerline corresponding to the machine pull.

Results of the tension test are for the original (unsoaked) hose are as follows:

Slow Pull (1 in per min) Tensile Strength

Hose Sample No.	Un-Soaked Hose		
	kN	lbs	*
9	2.89	650	A
10	3.28	736	A
11	2.74	616	A
12	2.40	539	A

* Location of Rupture: A = End Fitting B = Hose

Specification Requirements: At one inch per minute separation: 1.44 kN (325 lbs) minimum

Fast Pull (2 in per min) Tensile Strength

Hose Sample No.	Un-Soaked Hose		
	kN	lbs	*
13	2.30	516	A
14	2.47	556	A
15	3.72	837	A
16	3.28	736	A

* Location of Rupture: A = End Fitting B = Hose

Specification Requirements: At two inches per minute separation: 1.65 kN (370 lbs) minimum

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TEST METHODS AND RESULTS: (continued)
Water Absorption Tensile Strength

Tension tests were conducted in a testing machine conforming to ASTM E4 of 1000 pounds capacity. The specimens were secured so that the hose and fittings had a straight centerline corresponding to the machine pull.

The following tabulations show the results of tensile tests on four hose assemblies that are soaked for 70-72 hours in distilled water heated to 85 degrees C (185 degrees F):

Slow Pull (1 in per min) Tensile Strength

Hose Sample No.	Soaked Hose		
	kN	lbs	*
28	2.95	663	A
29	2.76	621	A
30	3.95	888	A
31	2.92	656	A

* Location of Rupture: A = End Fitting B = Hose

Specification Requirements: At one inch per minute separation: 1.44 kN (325 lbs) minimum

Fast Pull (2 in per min) Tensile Strength

Hose Sample No.	Soaked Hose		
	kN	lbs	*
32	2.55	573	A
33	3.64	819	A
34	3.96	889	A
35	2.93	659	A

* Location of Rupture: A = End Fitting B = Hose

Specification Requirements: At two inches per minute separation: 1.65 kN (370 lbs) minimum

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TEST METHODS AND RESULTS: (continued)

Low Temperature Resistance

One original hose assembly was conditioned in a cold cabinet in a straight position at negative 48° C for 70 hours. After conditioning and without removal from the cold cabinet, the hose was bent around a mandrel.

Mandrel Diameter: 3 in.

The hose assembly **did not crack or break** per specification:

True	False
X	

Specifications state no visible crack without magnification when bent around a mandrel after conditioning at negative 45° C to negative 48° C (negative 49° to negative 54° F) for 70 hours.

Mandrel Diameter specified: 3 in.

Brake Fluid Compatibility

Four brake hose assemblies were filled with SAE RM 66-05 compatibility brake fluid, the lower end sealed and placed in a vertical position in an oven at 120° C (248° F) for 70 hours. After removal from the oven, the specimen was allowed to cool to room temperature for 30 minutes and then drained. Constriction was again determined as well as burst strength.

The constriction measurements were again found to be satisfactory as they **exceed 64 percent** of the nominal inside diameter requirement.

True	False
X	

Hose Sample No.	Bursting Strength*	
	MPa	psig
36	86	12,491
37	86	12,453
38	83	12,094
39	90	13,024

Specification Requirement: 34.5 MPa (5,000 psi) Minimum*

(*) All assemblies withstood water pressure of 27.6 MPa (4,000 psi) for 2 minutes **without rupture** prior to the burst test.

True	False
X	

End Fitting Corrosion Resistance

Hose assembly end connections, after being exposed to the 24-hour salt spray in accordance with ASTM B117-97, **exhibited no evidence** of red rust or white corrosion.

True	False
X	

Specifications state end fittings shall exhibit no base metal corrosion except where crimping or stamping has caused displacement of the protective coating.

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TEST METHODS AND RESULTS: (continued)
Ozone Resistance
Static Ozone

A specimen was wrapped around a mandrel (approximately eight times the nominal outside diameter of the hose) and the ends were bound with tape where they crossed one another. After conditioning for a period of 24 hours at room temperature and while on the mandrel, the specimen was placed in a cabinet containing air mixed with ozone in the proportion of 100 +/-5 parts of ozone per 100 million parts of air by volume. The ambient temperature in the cabinet was maintained at 40° C (104° F) during the exposure of the specimen.

Mandrel Diameter: 2.5 in.

After the specimen had been exposed to this mixture for a period of 70 hours, the cover of the specimen was examined under 7-power magnification ignoring the areas immediately adjacent to or within the area covered by the tape.

The outer cover of the hose was observed at the specified magnification after the above exposure test, and **did not exhibit cracking**.

True	False
X	

Specifications state no visible crack under 7-power magnification ignoring areas immediately adjacent to or within the area covered by binding after conditioning as detailed above.

Dynamic Ozone

Four hose specimens (cut to lengths of 218 +/-3 mm (8.6 +/-0.1 inch)) were subjected to a dynamic ozone exposure test.

Samples were assembled on a prescribed SAE test apparatus in a stabilized ozone chamber containing air mixed with ozone in the proportion of 100 +/-5 parts of ozone per 100 million parts of air by volume. The ambient temperature in the cabinet was maintained at 40° C (104° F) during the exposure of the specimens. The flex rate was set at 0.30 Hz +/- 0.05 Hz and the hoses were examined for cracks every 24 hours in the area of worst stress condition, for cracks visible to the eye without magnification.

The test was discontinued following completion of 48 hours when **no cracks were visible** in any of the samples.

True	False
X	

Specifications state no visible crack without magnification ignoring areas immediately adjacent to or within the area covered by band clamps after conditioning as detailed above.

Hot Impulse

Four hose assemblies were pressure cycled 150 times with fluid and ambient temperatures maintained at 146° C (295° F). The cycles consisted of 1 +/-0.1 minute at 11 Mpa +0.5, -0.0 Mpa (1600 psi +75, -0 psi) pressure followed by 1 +/- 0.1 minute at 0 pressure. The pressure medium was hydraulic brake fluid.

Following the pressure cycling described above, the hose assemblies were conditioned at room temperature for 45 minutes minimum then tested for pressure hold and burst strength.

Sample No.	Bursting Strength*	
	MPa	psig
40	85	12,367
41	91	13,142
42	87	12,626
43	99	14,421

Specification Requirement: 34.5 MPa (5,000 psi) Minimum*

* Prior to the burst test, all of the samples withstood water pressure of 27.6 MPa (4,000 psi) for 2 minutes **without fluid seepage**.

True	False
X	

No sign of fluid seepage, cracking or separation were noted during the impulse cycling.

True	False
X	

Specifications state samples shall show no signs of fluid seepage, cracking or separation while being cycled.

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April 28, 2017**Calibrated Test Equipment:**

PT-174-038	Digital Caliper	Due Date:	10/25/2017
PT-172-036	Temp/Humidity Recorder	Due Date:	2/3/2018
PT-172-037	Constriction Gauge	Due Date:	1/3/2018
PT-172-050	Mandrel, Size: 3 in.	Due Date:	6/22/2017
PT-174-036c	Digital Thermometer	Due Date:	8/10/2017
PT-173-033	Thermotron	Due Date:	8/10/2017
PT-174-036	Salt Spray Chamber	Due Date:	5/1/2017
PT-174-003	Oven	Due Date:	8/10/2017
PT-174-037b	Pressure Transducer	Due Date:	8/10/2017
PT-174-015	Pressure Transducer	Due Date:	8/10/2017
PT-174-037a	Whip Machine	Due Date:	8/10/2017
PT-174-029	Tensile / Compression Tester	Due Date:	8/9/2017
PT-174-035 a	Ozone Chamber Temperature Monitor	Due Date:	11/11/2017
PT-174-035 b	Ozone Chamber Analyzer	Due Date:	8/9/2017

Remarks:

The samples will be discarded thirty days from the date of this report unless further instructed by the Client.

Respectfully submitted,**Brian S. Escherich**
Operations Manager