NHTSA

Vehicle Research and Test Center

INFORMATION REDACTED PURSUANT TOTHE FREEDOM OF INFORMATION ACT (FOIA), 5 U.S.C.552(B)(6)

Review of VRTC Inspections and Tests of Haldex Spring-Brake Chambers as Mounted on DTNA Sterling Autohaulers

January 30, 2013

VRTC Inspections and Tests of Haldex Spring-Brake Chambers

- Inspection and bench tests of chambers removed from service
- Disassembly, inspection, testing of debris
- Vehicle tests for unintended brake drag and parking brake operation
- Metallurgy of the power spring
- Comparison to peer spring-brake chamber
- Summary

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Cassens Transport Information						Initial Inspection				
Unit No.	VIN	Time in Service (days)	Failure Miles	Work Order No.	Rear Double-Axle Position	Type	Drop Test Sound	Exterior Inspection Comments	Actuator Pushrod Position	Bore-Scope Inspection
76093	2FZHCMCVX6[redacted]	1,566	199,176	551098330	na	24/303	spring vibration	when rotated sand fell out	slightly angled	corrosion
78063	2FZHCMCV57[redacted]	871	200,070	551100601	na	24/303	spring vibration	na	straight	corrosion
78109A	2FZHCMCV77[redacted]	812	145,180	551100967	na	24/303	spring vibration	na	straight	corrosion
78109B	2FZHCMCV77[redacted]	812	145,180	551100967	na	24/303	spring vibration	na	straight	corrosion
78271	2FZHCMCV57AX[redacted]	709	173,020	551120942	LF	24/303	spring vibration	housing different model	na	corrosion
76369	2FZHCMCV96[redacted]	1,495	267,928	OUTSIDE VENDOR	na	24/303	spring vibration	na	na	broken spring
77109	2FZHCMCV97[redacted]	1,034	238,640	551091791	na	24/303	spring vibration	na	straight	corrosion
78017	2FZHCMCV47[redacted]	1,037	240,910	551119562	RR	24/303	dead	pushrod angled and not returning	angled	broken spring
77071	2FZHCMCVX7[redacted]	1,019	212,120	551083156	LR	24/303	spring vibration	no tag, number on case	straight	corrosion
78003	2FZHCMCV77[redacted]	998	225,800	551113915	na	24/303	spring vibration	na	straight	corrosion
76039	2FZHCMCV16[redacted]	2,041	193,289	551161227	LR	24/303	dead	when rotated sand fell out, pushrod angle	angled	broken spring, torn diaphragm
78023	2FZHCMCVX7[redacted]	1,309	314,200	601150387	na	30/303	dead	housing different size	slightly angled	broken spring, torn diaphragm

Cassens	Initial Inspection					Pushro	Leak-Down Time/Pressure Test					
							Shop Air Supply, Turn Off,					
Unit No.	Type	Drop Test Sound	Exterior Inspection Comments	Actuator Pushrod Position	Bore-Scope Inspection	Push-rod Stroke (in)	With Shop Air	After 30 sec	After 60 sec	After 90 sec	After 120 sec	Detected Leak
76093	24/303	spring vibration	when rotated sand fell out	slightly angled	corrosion	3.06	100	100	100	100	100	no
78063	24/303	spring vibration	na	straight	corrosion	2.93	100	100	100	100	100	no
78109A	24/303	spring vibration	na	straight	corrosion	2.97	100	100	100	100	100	no
78109B	24/303	spring vibration	na	straight	corrosion	3.06	100	100	100	100	100	no
78271	24/303	spring vibration	housing different model	na	corrosion	3.00	100	100	100	100	100	no
76369	24/303	spring vibration	na	na	broken spring	2.56	100	100	100	98	98	yes, just on application of shop air
77109	24/303	spring vibration	na	straight	corrosion	3.06	100	96	92	88	83	yes, just on application of shop air
78017	24/303	dead	pushrod angled and not returning	angled	broken spring	2.62 *A 2.06 *B	100	95	95	95	95	sometimes at pushrod sleeve
77071	24/303	spring vibration	no tag, number on case	straight	corrosion	3.06	100	93	85	73	69	no leak heard
78003	24/303	spring vibration	na	straight	corrosion	3.06	100	87	75	70	36	yes, pushrod sleeve
76039	24/303	dead	when rotated sand fell out, pushrod angle	angled	broken spring, torn diaphragm	2.00	98	0	0	0	0	yes, diaphragm ruptured
78023	30/303	dead	housing different size	slightly angled	broken spring, torn diaphragm	0.63	46	0	0	0	0	yes, diaphragm ruptured

78003



78109B



78017



78109A



78017



78023



78023



78023





Ordinary spring brakes wear out too soon usually from corrosion and contamination.

Ordinary spring brakes have vent holes, some even have external breather tubes, many have missing caging tool plugs.

These ordinary spring brakes will usually perform adequately for one to three years in regular service (even less in vocational applications) but problems from water, dirt and road salt will lead to premature breakage of the power spring.

Broken power springs lead to unscheduled repair and replacement, costly downtime, roadside repairs and even unsafe or inadequate braking performance.



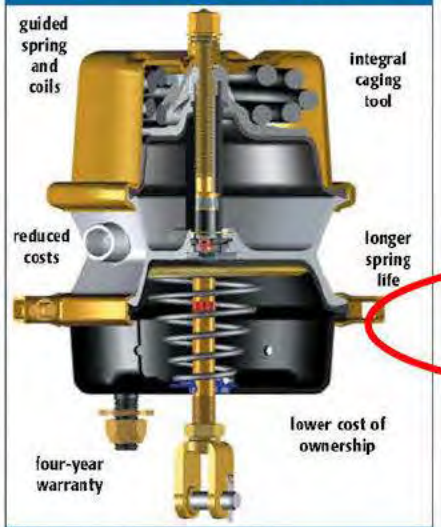


Severe corrosion testing with exposure to salt/mud slurry.

ORDINARY SPRING BRAKE AFTER ONLY 56 DAYS



THE SOLUTION



Haldex Life Seal® Actuators

Haldex Life Seal® Actuators – not your ordinary spring brake.

The spring chamber is totally sealed so contaminants simply cannot get in!

- ✓ No vent holes
- ✓ No filters
- ✓ No caging tool plugs
- ✓ No external breather tubes

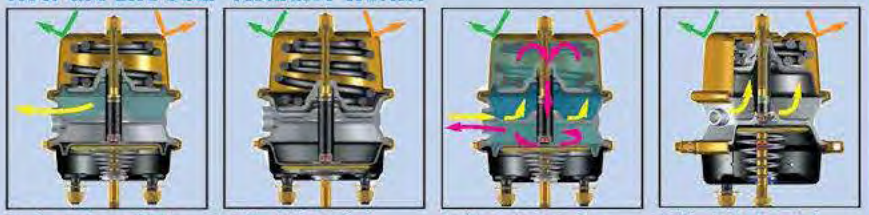
Water, road salt and deicing chemicals that cause corrosion are the worst enemies for the highly stressed steel power spring. Protecting the spring from these corrosive agents is the reason Life Seal® Actuators last so long.

Haldex offers a four (4) year, unlimited mileage warranty on all vocational applications. Refer to L20221 for complete warranty policy details.



LIFE SEAL® ACTUATOR AFTER 204 DAYS

How the Life Seal® Actuator works:



Parking Brake Application
Air is exhausted from the parking side. The integral caging tool and push rod maintain alignment as the main spring extends to apply the parking brake.

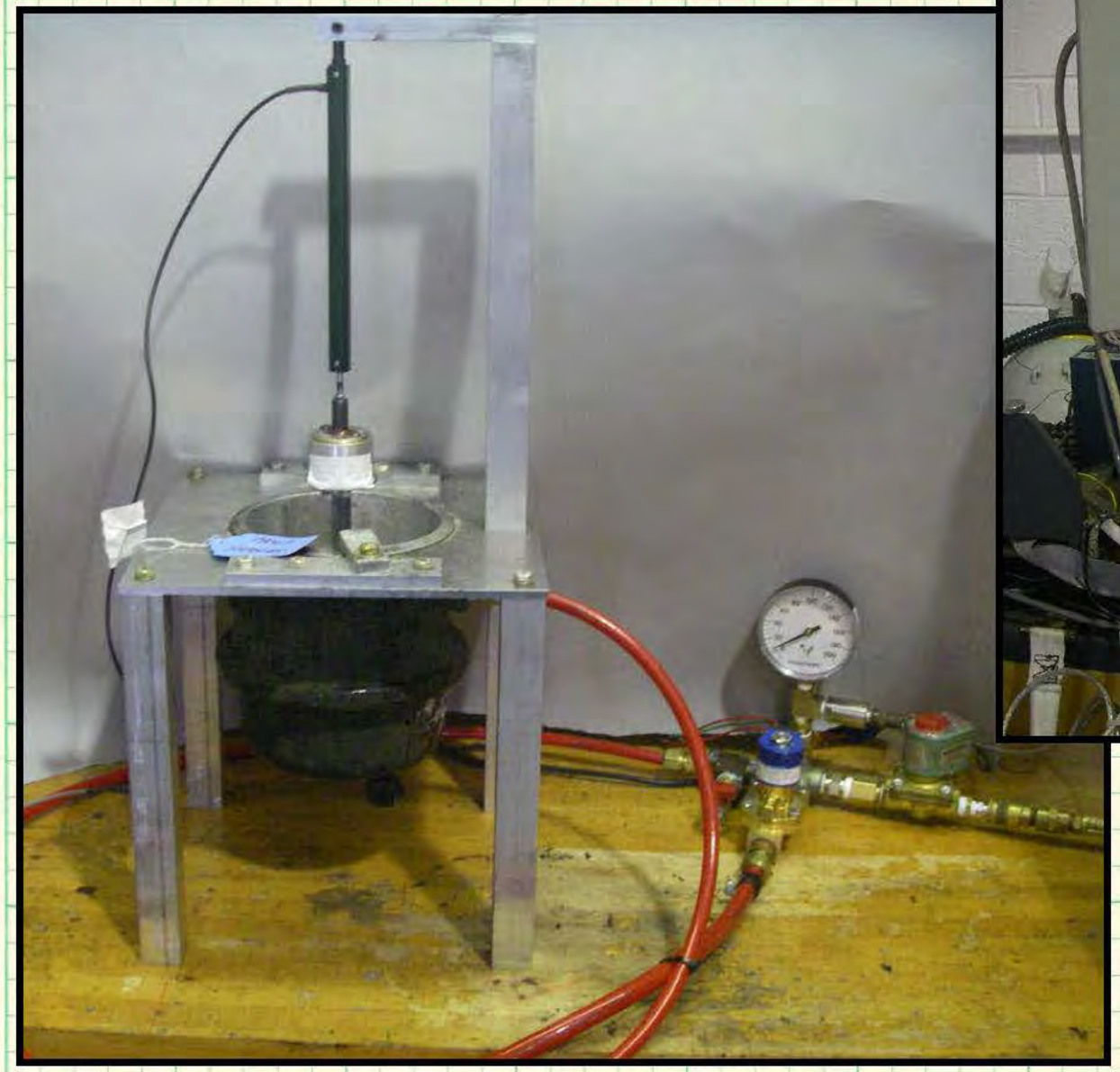
Parking Brake Applied
Vehicle parked. The spring chamber is totally sealed, contaminants are prevented from entering the spring chamber.

Parking Brake Retraction
Air enters the parking side compressing the main power spring; air in the spring chamber is exhausted down the push rod tube, through an internal valve, and out the vehicle air service side system.

Parking Brake Retracted
Vehicle under normal operation. Completely sealed spring chamber prevents road contaminants like water, salt and dirt from attacking the spring.

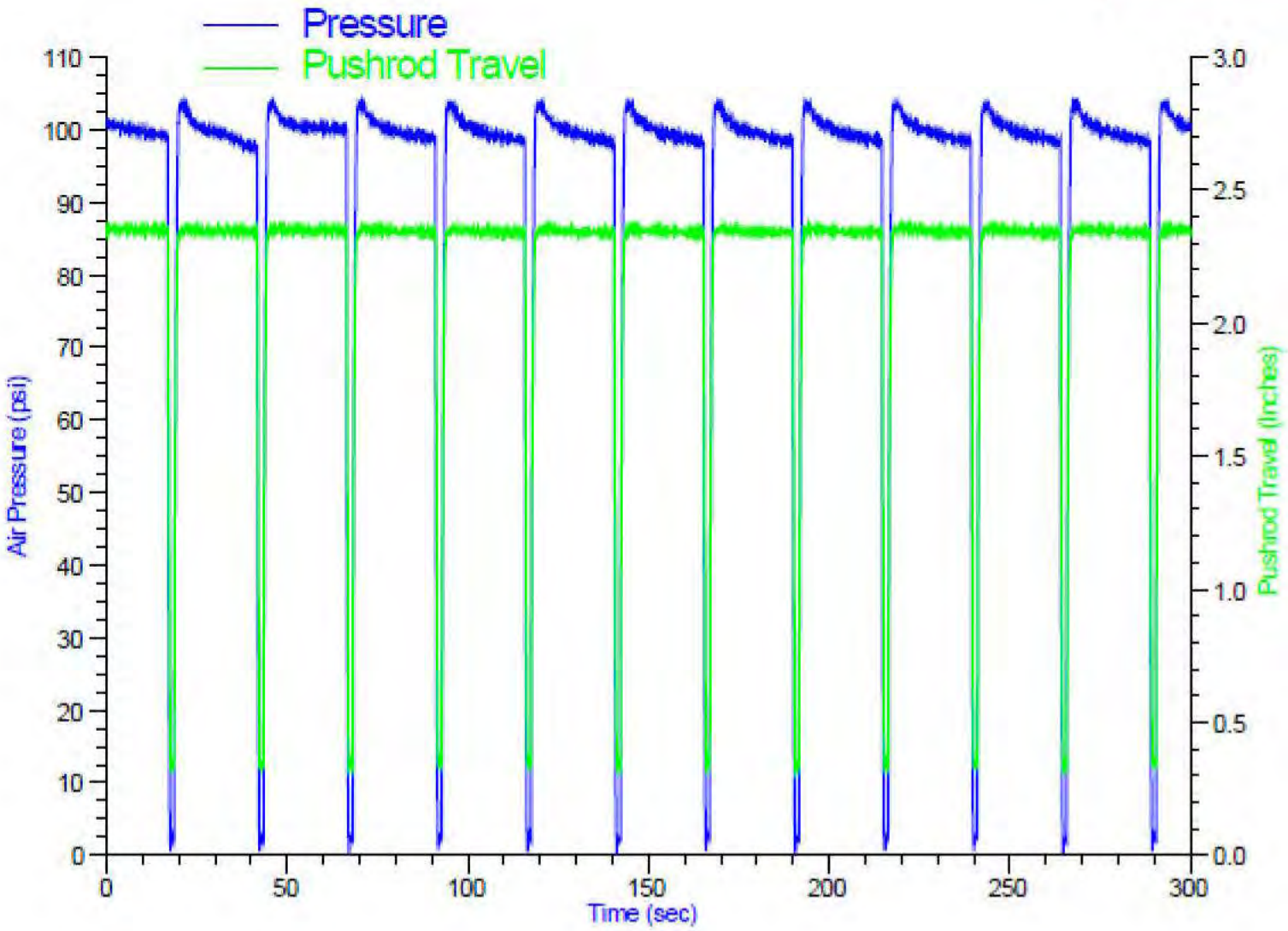


www.haldex.com

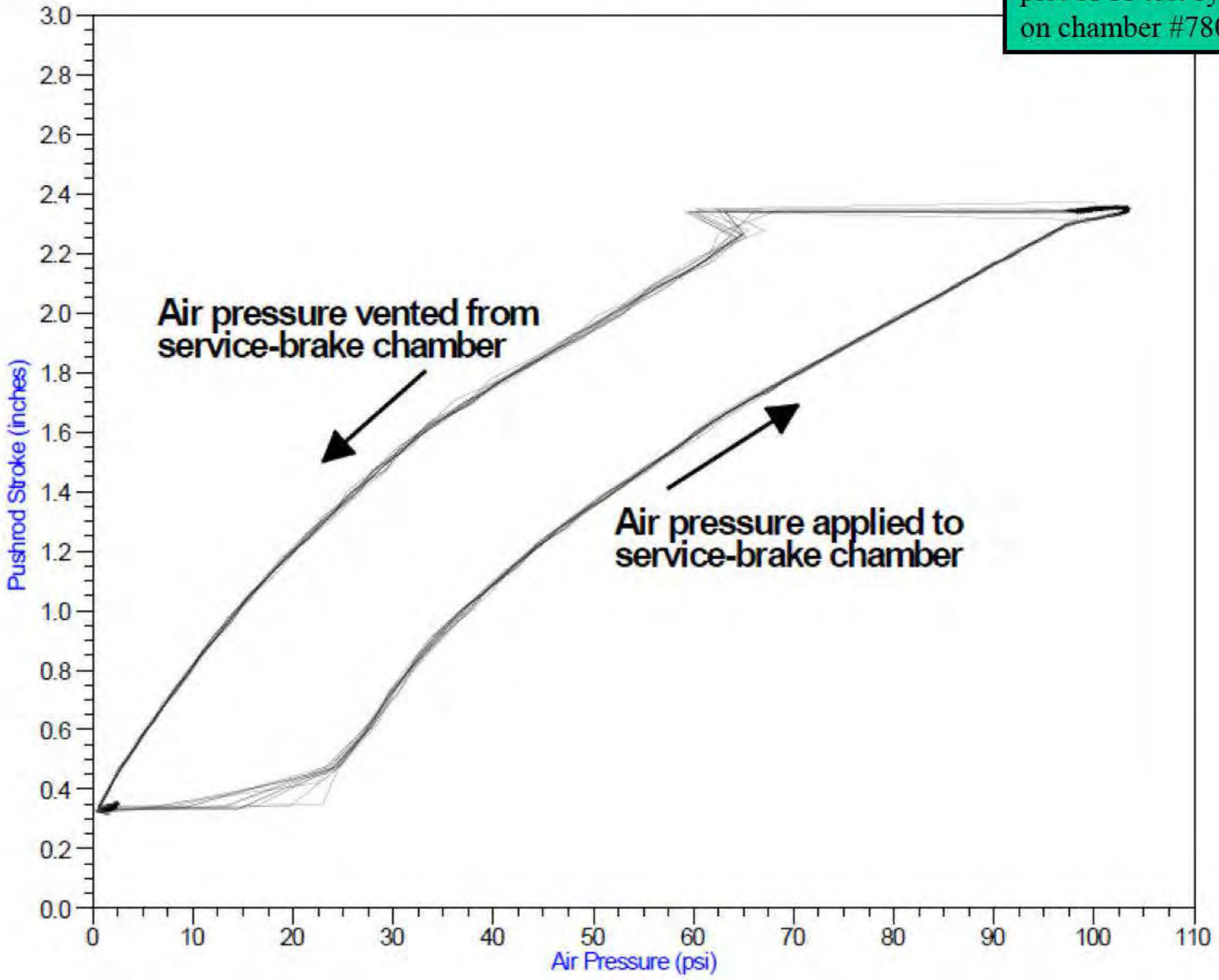




Time history plot of pressure and stroke for 11 test cycles on chamber #78017

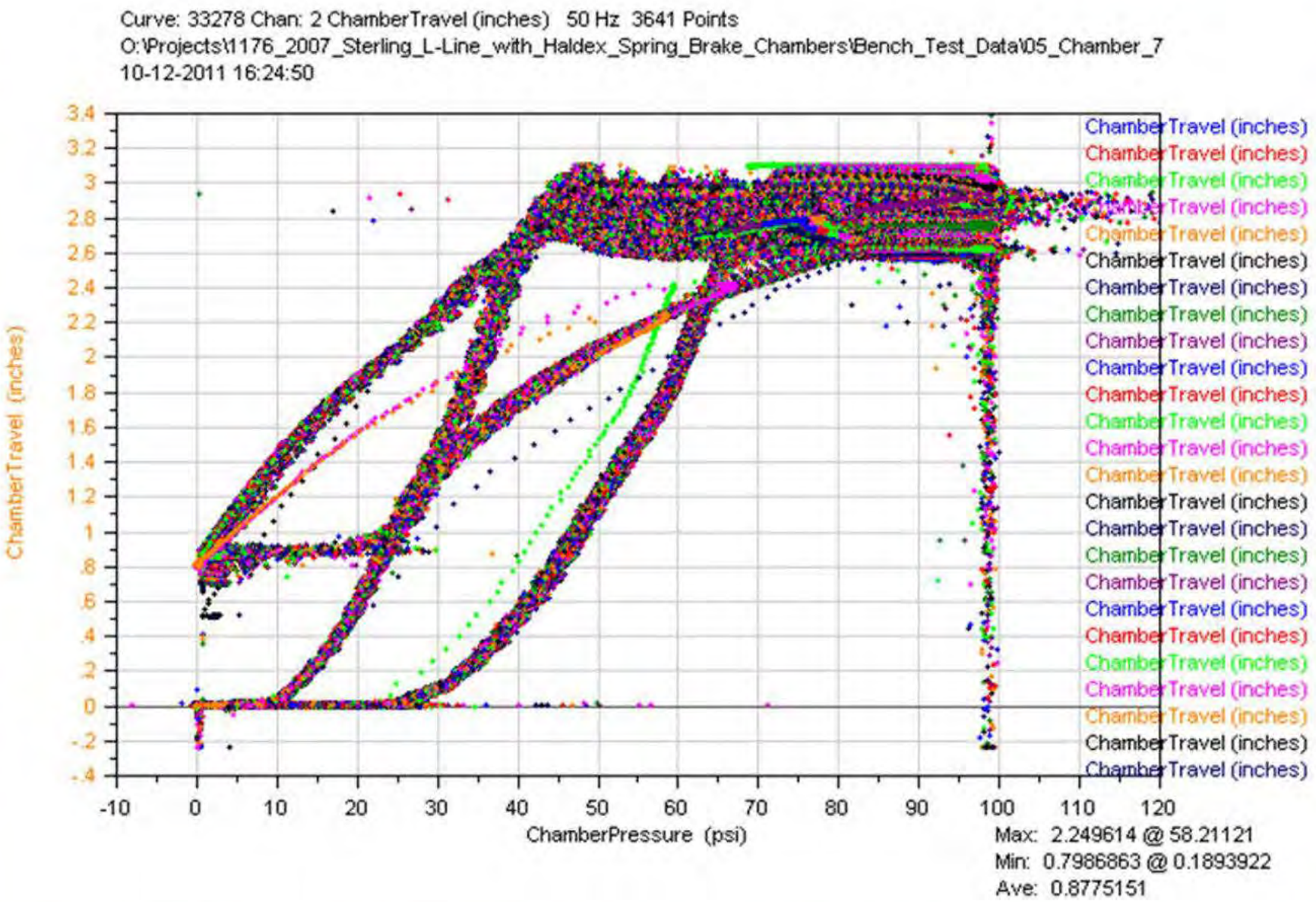


Force vs. displacement plot of 11 test cycles on chamber #78017



Total of 33,278 data curves:

Chamber #77109



Cassens Transport Information		Initial Inspection				Pushro	n Time/Pre	Cycle		Final Inspection		
Unit No.	VIN	Drop Test Sound	Exterior Inspection Comments	Actuator Pushrod Position	Bore-Scope Inspection	Push-rod Stroke (in)	Detected Leak	Cycles to Failure	Cycles with Broken Spring	Preliminary Spring Micro Hardness (HV)	Coil Coating Thickness min/max (µm)	Comments
76093	2FZHCMCVX6[redacted]	spring vibration	when rotated sand fell out	slightly angled	corrosion	3.06	no	19,734 cycles spring broke, 19,842 cycles diaphragm ruptured	109	na	na	spring broken
78063	2FZHCMCV57[redacted]	spring vibration	na	straight	corrosion	2.93	no	32,342 & 34,201 cycles spring broke, 34,522 diaphragm ruptured	2,180	586	68	spring was found broken into in three pieces
78109A	2FZHCMCV77[redacted]	spring vibration	na	straight	corrosion	2.97	no	na	na	na	na	unit used as working cutaway for observation in use/driving
78109B	2FZHCMCV77[redacted]	spring vibration	na	straight	corrosion	3.06	no	32,661 cycles spring broke 33,342 cycles diaphragm ruptured	681	na	na	tested horizontally, as mounted on vehcle
78271	2FZHCMCV57[redacted]	spring vibration	housing different model	na	corrosion	3.00	no	na	na	na	na	built-in caging bolt, larger shaft diameter
76369	2FZHCMCV96[redacted]	spring vibration	na	na	broken spring	2.56	yes, just on application of shop air	at start spring broken, 16 cycles diaphragm ruptured	16	578	0 to 80	was clunking immediately when started
77109	2FZHCMCV9[redacted]	spring vibration	na	straight	corrosion	3.06	yes, just on application of shop air	30,363 cycles spring broke, 33,277 cycles diaphragm ruptured	2,914	na	na	pushrod position was at an angle part way throught testing
78017	2FZHCMCV4[redacted]	dead	pushrod angled and not returning	angled	broken spring	2.62 *A 2.06 *B	sometimes at pushrod sleeve	at start spring broken, 7,266 cycles, stopped to save	7,266+	na	na	cycle test #1: *A=as rec'd, *B=after 7,266 cycles creaking noise, stopped testing, still intact
77071	2FZHCMCVX[redacted]	spring vibration	no tag, number on case	straight	corrosion	3.06	no leak heard	30,328 cycles spring broke, 30,346 cycles diaphragm ruptured	18	na	na	no leak at start of cycle testing
78003	2FZHCMCV77[redacted]	spring vibration	na	straight	corrosion	3.06	yes, pushrod sleeve	42,988 cycles spring broke, 43,572 cycles diaphragm ruptured	584	na	na	small leak, but did not affect cycle testing
76039	2FZHCMCV[redacted]	dead	when rotated sand fell out, pushrod angle	angled	broken spring, torn diaphragm	2.00	yes, diaphragm ruptured	na	na	589	0 to 68	pushrod angled, ejected sand, clunks, max press with shop air 98 psi
78023	2FZHCMCV[redacted]	dead	housing different size	slightly angled	broken spring, torn diaphragm	0.63	yes, diaphragm ruptured	na	na	591	0 to 46	broken spring blocking cage tool port, max pressure with shop air 46 psi

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07-25-11
78063
07-25-11
78063


78063 at 50X

Results of Compound Analyses

Sample 78063

Major Constituents of the Powder	Relative Abundance (wt. percent)
Quartz: SiO_2	38.1
Dolomite: $CaMg(CO_3)_2$	23.0
Calcite: $Ca(CO_3)$	11.0
Microcline ($K(Si_3Al)O_8$)	10.2
Halite: NaCl	7.9
Albite ($Na(AlSi_3O_8)$	4.6
Iron Oxide Hydroxide: FeO(OH)	3.9
Magnetite	1.3

BUSINESS SENSITIVE

VRTC Inspections and Tests of Haldex Spring-Brake Chambers

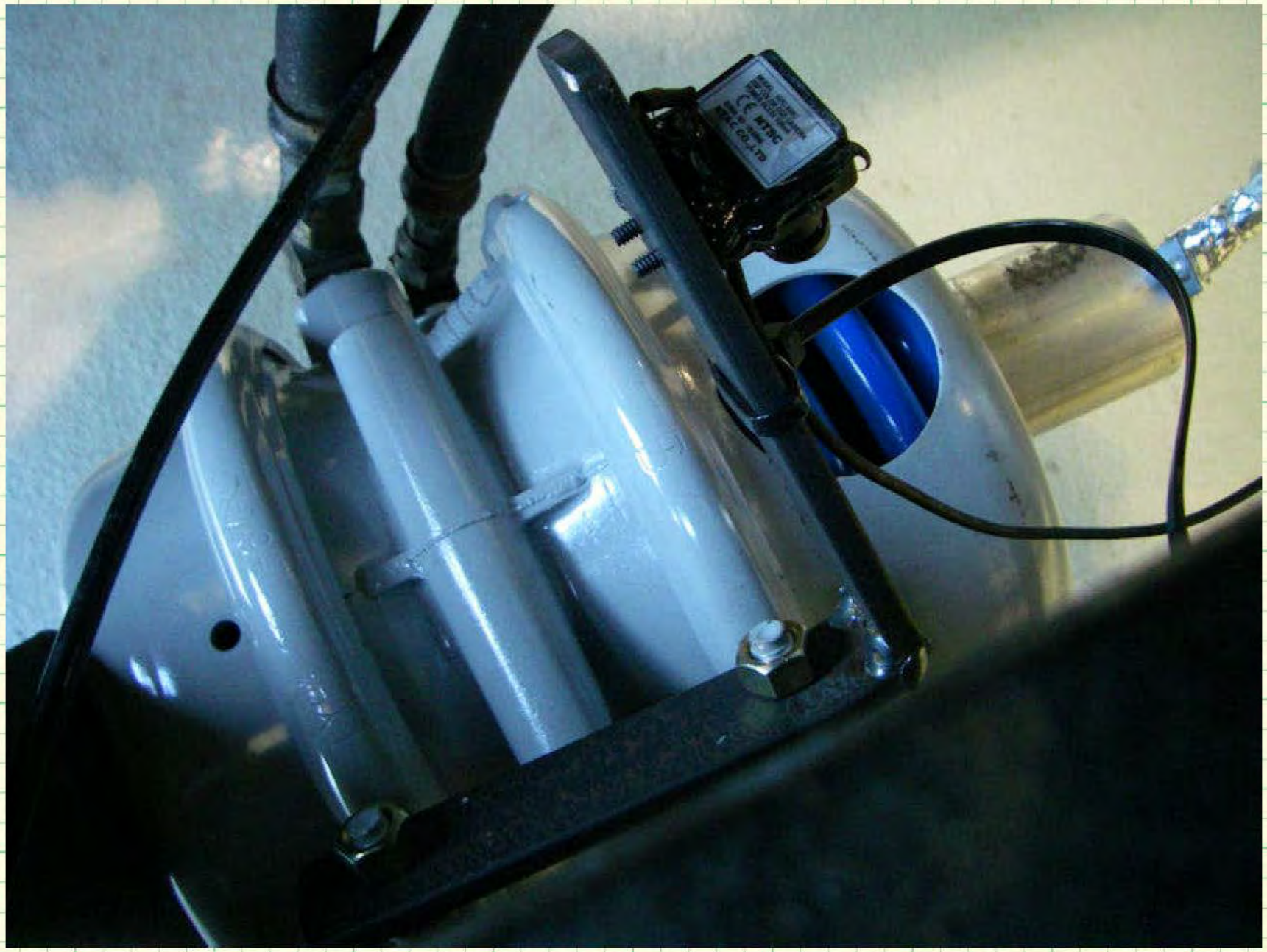
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Claim Number	Customer Concern and Claim Commments [13 of 126 do not mention air leak] [6 of the 13 mention drag]
[redacted]	CUSTOMER STATES LR BRAKE CAN NOT RELEASING. ROAD TEST,VERIFIED CONCERN. RELEASED BRAKES,FOUND LR BRAKE AN NOT RELEASING,STICKING INTERNALLY.CHECKED ALL AIR LINES TO ENSURE THAT NOTHING IN AIR LINES TO CAUSE AIR AN TO PLUG & NOT RELEASE PROPERLY, NOTHING FOUND. REMOVED & REPLACED FAILED LR BRAKE CAN AS NEEDED. REASSEMBLED & ROAD TEST, BRAKE CAN IS NOW RELEASING NORMAL AT THIS TIME.
[redacted]	BRAKE CHAMBER NUMBERS ARE HALDEX 108A084/ 1373030214.LEFT REAR DRIVE WHEEL BRAKE CHAMBER IS BINDING UP REPLACED LEFT REAR DRIVE PARK BRAKE CHAMBER THAT HAD SPRING OUT OF PLACE
[redacted]	EPAIR FOR BROKEN LR BRAKE CHAMBER LEFT REAR DRIVE PARK BRAKE CHAMBER HAS A BROKEN SPRING IN IT OVEDAND REPLACED LEFT REAR DRIVE PARK BRAKE CHAMBER THAT HAD BROKEN SPRING. HALDEX BRAKE CHAMBER UMBER HDX 1373030214 258A06A.
[redacted]	REPAIR FOR BROKEN SPRING IN BRAKE CHAMBER LEFT REAR DRIVE PARK BRAKE CHAMBER HAS A BROKEN INTERNAL SPR REPLACED CHAMBER ON LRD, CHAMBER HAS A BROKEN INTERNAL SPRING. NUMBERS ON DEFECTIVE BRAKE CHAMBER ARE 13730302/ 192A06A.
[redacted]	REPAIR FOR POOR STOPPING POWER LEFT FRONT DRIVE BRAKE CHAMBER HAS A BROKEN SPRIN INSIDE, REPLACED CHAMBER. INSPECT AND FOUND LEFT FRONT BRAKE CHAMBER BROKEN INNER SPRING. REPLACED. NUMBERS ON CHAMBER ARE 1373030214/109A06A.
[redacted]	LEFT FRONT DRIVE PARK BRAKE CHAMBER HAS A BROKEN SPRING. LEFT FRONT DRIVE BRAKE CHAMBER HAS A BROKEN SPRING IN IT. RE REMOVED AND REPLACED LEFT FRONT DRIVE PARK BRAKE CHAMBER-IT HAD BROKEN SPRING.. NUMBERS ON CHAMBER ARE 109306A--1373030214...
[redacted]	RIGHT REAR REAR BRAKE SMOKING BRAKE CHAMBER WILL NOT FULLY RETRACT. REPLACE BRAKE CHAMBER.FREIGHT IS ON CHAMBER.
[redacted]	CHECK RIGHT REAR MAXI CAN (SPRING BROKEN) CONFIRMED SPRING IS BROKEN REPLACED RIGHT REAR MAXI BRAKE CAN ADJUSTED BRAKE
[redacted]	R&R BAD MAXI CAN (NEW ONE THAT WAS INSTALLED).INTERNAL SPRING REAR BROKEN. REPLACED ON 11/05/08 MILEAGE - 36104.
[redacted]	ARKING BRAKE NOT HOLDING. BROKEN CHAMBER SPRING. INSPECTED. FOUND SPRING BROKEN IN RFDA BRAKE CHAMBER. ISCONNECTED AIRLINES. REPLACED CHAMBER. RECONNECTED AIRLINES. TEST, ALL OK.
[redacted]	C; CUSTOMER STATES RIGHT REAR BRAKE CHAMBER STICKING.C; DEFECTIVE BRAKE CHAMBER.C; JACK UP REAR & RELEASE RAKES. RIGHT REAR WHEEL STILL LOCKED WILL NOT TURN. INSPECT BRAKE COMPONENTS. SLACK IS NOT RELASES ALL THE WAY. BRAKE CHAMBER NOT RELEASEING ALL THE WAY. R/R BRAKE CHAMBER. CK BRAKE OPERATION WORKING PROPERLY. ATE CODE 05907 (HARD TO READ BUT THINK THIS IS CORRECT).
[redacted]	EFT FRONT DRIVE BRAKE LOCKING UP; CHECKED AND FOUND BRAKE CHAMBER CAME APART INSIDE; REMOVE AND REPLACED BRAKE CHAMBER AND ADJUSTED BRAKE; CK OPERATION OK
[redacted]	CHECKED WHEEL WHILE SPINNING THE WHEELS. THE RIGHT SIDE WHEELS WAS KNOCKED UP, CHECKED THE BRAKES AND SOMETHING WAS WRONG WITH THE SHOES. PULLED THE WHEELS OFF RIGHT SIDE AND THEN THE DRUM ANDSAW THAT ONE OF THE ROLLERS WAS MISSING. PUT NEW ROLLERS ON AND THEY WORK FINE BUT THE SPRING IN THE LEFT BRAKE CHAMBER WAS BROKE . REPLACED AND IT WAS WORKING FINE.
[redacted]	CHECK FOR RIGHT FRONT DRIVE BRAKE CHAMBER STICKING. TECH CHECKED ADJUSTMENT & WATCHED WHILE BRAKES WERE APPLIED, WHE APPLIED NOTHING WAS FOUND. POLICY CLAIM FOR LABOR ONLY.





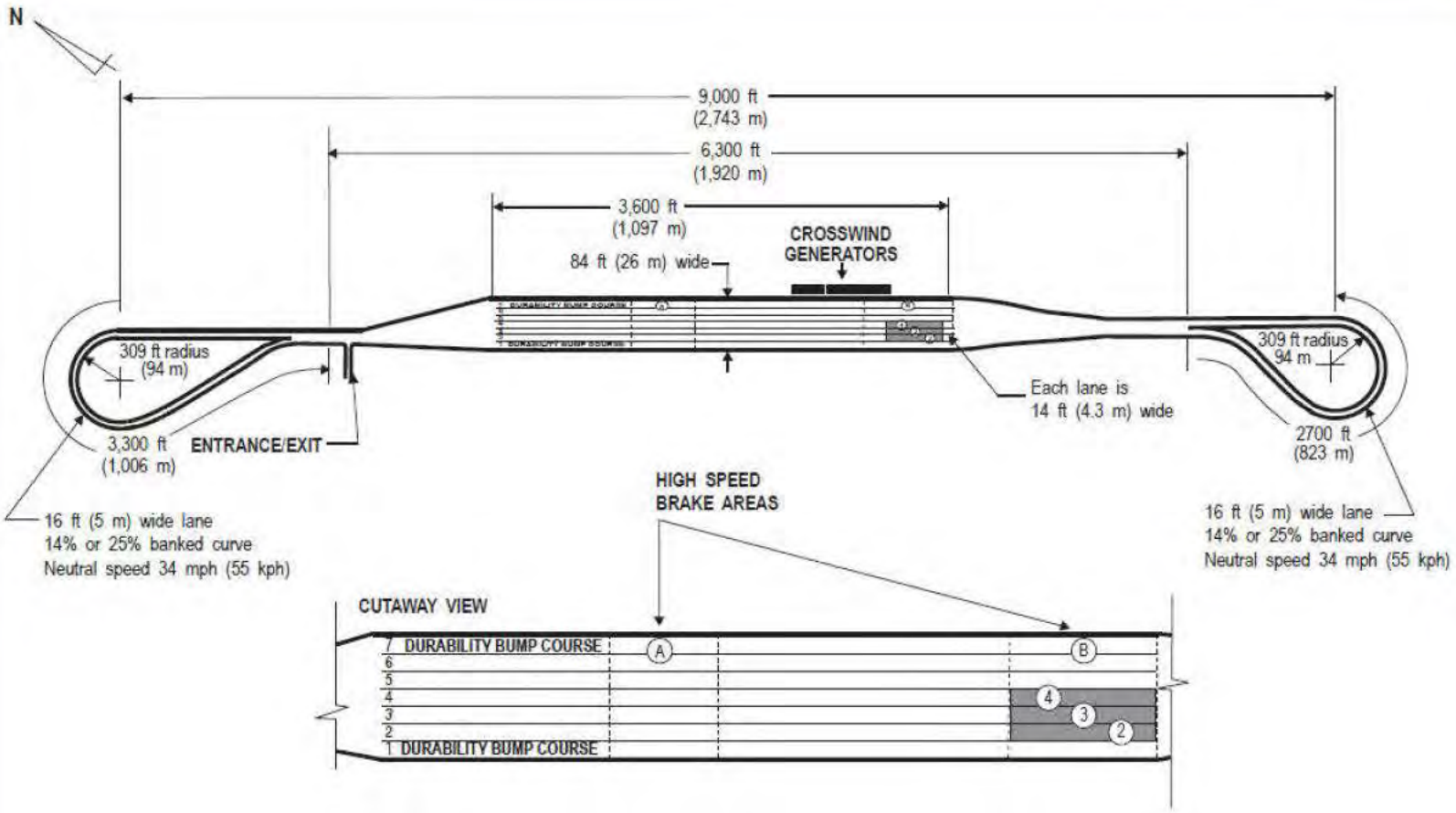












Not to Scale

GVW for Lane 1 and 7 (Asphalt Lanes) = 8,000 lbs (3,636 kgs)

GVW for All Other Lanes (Concrete Lanes) = 80,000 lbs (36,364 kgs)

All Concrete Broomed Surface

1 Lap (Including Loops) = Approximately 4 mi (6.4 klm)

SKID PAD

TRC®

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F-13 0308

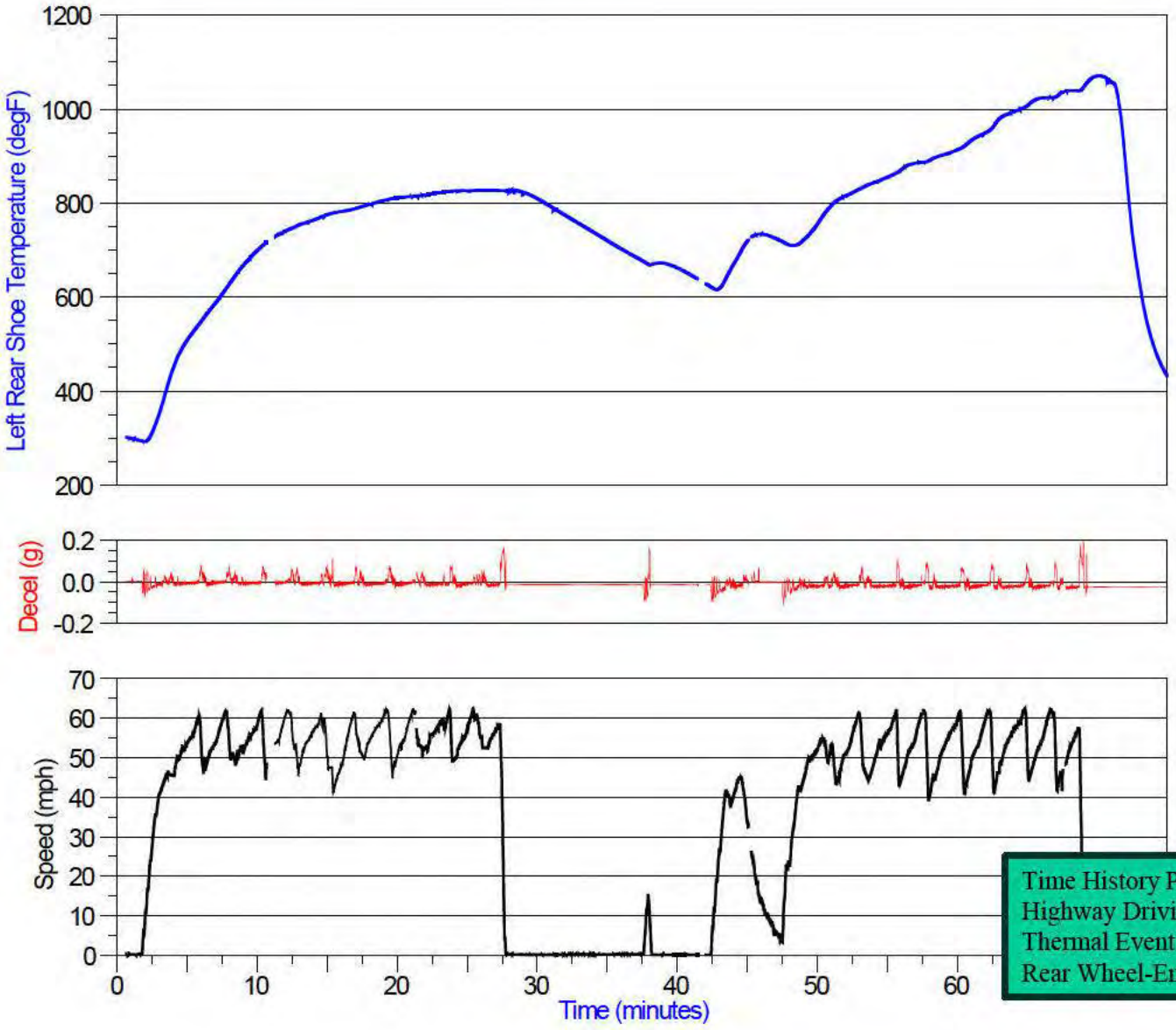
Simulated Parking Brake Drag Due to Spring Failure

Time into test: 8.5 minutes
Test Conditions: 1,242-lb drag, 0.016-g decel, 33 HP @ 10 mph
Tractor hot wheel end: left rear
Brake lining temp: 577ºF
Detectability: driver reported none

Time into test: 26 minutes
Pre-event: stopped and heat soaked tire during adjustments, driver accelerated for 18 seconds
Event: left-rear inner dual tire blowout @ 36 minutes
Brake lining temp: 675ºF
Detectability: driver heard and stopped

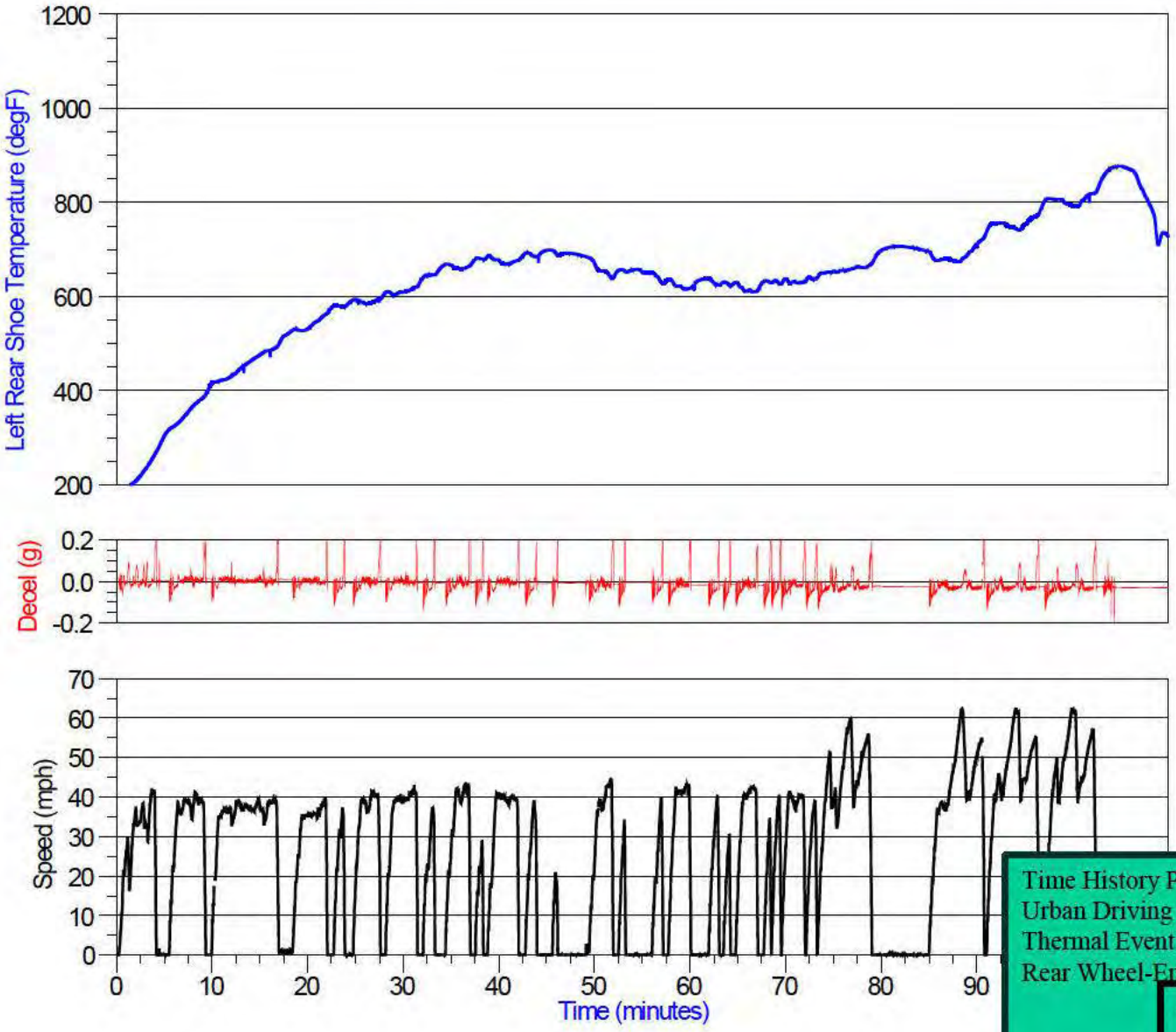
Time into test: 67 minutes
Test Condition: 2,407-lb drag, 0.031-g decel, 64 HP @ 10 mph
Tractor hot wheel end: left rear
Brake lining temp: 1,039ºF
Detectability: driver reported none

FIRE



Time History Plot of the Highway Driving Test with Thermal Event at the Left Rear Wheel-End





Time History Plot of the Urban Driving Test with Thermal Event at the Right Rear Wheel-End

FIRE

A — FDID: 01004 | State: IN | Incident Date: MM 07 DD 16 YYYY 2009 | Station: 5 | Incident Number: 09-0014430 | Exposure: 000 | Release / Change / No Activity | NFIRS -1 Basic

B Location*

- [X] Street address: Number/Milepost: | Prefix: | Street or Highway: Us 67 | Street type: EXPY | Suffix: SE
- [ ] Intersection
- [ ] In front of
- [ ] Rear of
- [ ] Adjacent to
- [ ] Directions

Apt/Route/Room: | City: Bryant | State: IN | Zip Code: 47326 - | Cross street or directions, as applicable:

Census Tract: -

C Incident Type * — 130 | Mobile property (vehicle) fire, other

D Aid Given or Received *

1 [X] Mutual aid received
2 [ ] Automatic aid recv.
3 [ ] Mutual aid given
4 [ ] Automatic aid given
5 [ ] Other aid given
N [ ] None

Their FDID | Their State | Their Incident Number

E1 Date & Times — Midnight is 0000

	Month	Day	Year	Hr Min Sec
Alarm *	07	16	2009	17:48:00
[X] Arrival *	07	16	2009	18:04:00
[X] Controlled	07	16	2009	20:43:00
[X] Last Unit cleared	07	16	2009	20:58:00

E2 Shift & Alarms — Local Option: A | 01 | Drs — Shift or Platoon | Alarms | District

E3 Special Studies — Local Option: Special Study ID | Special Study Value

F Actions Taken * — 58 | Operate apparatus or

Primary Action Taken (1) | Additional Action Taken (2) | Additional Action Taken (3)

G1 Resources * — [X] Check this box and skip this section if an Apparatus or Personnel form is used.

	Apparatus	Personnel
Suppression	0005	0009
EMS		
Other		

[ ] Check box if resource counts include aid received resources.

G2 Estimated Dollar Losses & Values — LOSSES: Required for all fires if known. Optional for non fires. — None

Property $	,000	,000
Contents $	,000	,000

PRE-INCIDENT VALUE: Optional

Property $	,000	,000
Contents $	,000	,000

Completed Modules

- [X] Fire-2
- [ ] Structure-3
- [ ] Civil Fire Cas.-4
- [ ] Fire Serv. Cas.-5
- [ ] EMS-6
- [ ] HazMat-7
- [ ] Wildland Fire-8
- [X] Apparatus-9
- [X] Personnel-10
- [ ] Arson-11

H1 * Casualties [ ] None

	Deaths	Injuries
Fire Service		
Civilian		

H2 Detector — Required for Confined Fires.

1 [ ] Detector alerted occupants
2 [ ] Detector did not alert them
U [ ] Unknown

H3 Hazardous Materials Release

N [X] None
1 [ ] Natural Gas: (incl fuel, incl evacuation or shelter ordered)
2 [ ] Propane gas: (21 lb. tank or 1 lb. tank for BBQ grill)
3 [ ] Gasoline: (vehicle fuel tank or portable container)
4 [ ] Kerosene: (not burning equipment or portable storage)
5 [ ] Diesel fuel/fuel oil: (vehicle fuel tank or portable)
6 [ ] Household solvents: (home/office spill, cleanup only)
7 [ ] Motor oil: (from engine or portable container)
8 [ ] Paint: (from paint cans totaling < 55 gallons)
0 [ ] Other: (Special Report required or spill > Sigal... Please complete the Report Form)

I Mixed Use Property

NN [ ] Not Mixed
10 [ ] Assembly use
20 [ ] Education use
33 [ ] Medical use
40 [ ] Residential use
51 [ ] Row of stores
53 [ ] Enclosed mall
58 [ ] Bus. & Residential
59 [ ] Office use
60 [ ] Industrial use
63 [ ] Military use
65 [ ] Farm use
00 [ ] Other mixed use

J Property Use * — Structures

131 [ ] Church, place of worship	341 [ ] Clinic,clinic type infirmary	539 [ ] Household goods,sales,repairs
161 [ ] Restaurant or cafeteria	342 [ ] Doctor/dentist office	579 [ ] Motor vehicle/boat sales/repair
162 [ ] Bar/Tavern or nightclub	361 [ ] Prison or jail, not juvenile	571 [ ] Gas or service station
213 [ ] Elementary school or kindergarten	419 [ ] 1-or 2-family dwelling	599 [ ] Business office
215 [ ] High school or junior high	429 [ ] Multi-family dwelling	615 [ ] Electric generating plant
241 [ ] College, adult education	439 [ ] Rooming/boarding house	629 [ ] Laboratory/science lab
311 [ ] Care facility for the aged	449 [ ] Commercial hotel or motel	700 [ ] Manufacturing plant
331 [ ] Hospital	459 [ ] Residential, board and care	819 [ ] Livestock/poultry storage(barn)
	464 [ ] Dormitory/barracks	882 [ ] Non-residential parking garage
	519 [ ] Food and beverage sales	891 [ ] Warehouse

Outside

124 [ ] Playground or park	936 [ ] Vacant lot	981 [ ] Construction site
655 [ ] Crops or orchard	938 [ ] Graded/care for plot of land	984 [ ] Industrial plant yard
669 [ ] Forest (timberland)	946 [ ] Lake, river, stream	
807 [ ] Outdoor storage area	951 [ ] Railroad right of way	
819 [ ] Dump or sanitary landfill	960 [ ] Other street	
931 [ ] Open land or field	961 [X] Highway/divided highway	
	962 [ ] Residential street/driveway	

Lookup and enter a Property Use code only if you have NOT checked a Property Use box:

Property Use 961 — Highway or divided highway

NFIRS-1 Revision 03/11/99

Geneva Volunteer Fire Department — 01004 — 07/16/2009 — 09-0014430

A — FDID: 01004 | State: IN | Incident Date: MM 07 DD 16 YYYY 2009 | Station: 5 | Incident Number: 09-0014430 | Exposure: 000 | Delete / Change / No Activity | NFIRS -2 Fire

B Property Details

B1 — [X] Not Residential. Estimated number of residential living units in building of origin whether or not all units became involved.

B2 — Number of buildings involved | [X] Buildings not involved

B3 — Acres Burned (outside fires) | [ ] None | [X] Less than one acre

C On-Site Materials or Products [ ] None — Enter up to three codes. Check one or more boxes for each code entered. Compliers of these were any significant amounts of commercial,industrial, energy or agricultural products or materials on the property, whether or not they became involved.

On-site material (1)	1 [ ] Bulk storage or warehousing	2 [ ] Processing or manufacturing
	3 [ ] Packaged goods for sale	4 [ ] Repair or service
On-site material (2)	1 [ ] Bulk storage or warehousing	2 [ ] Processing or manufacturing
	3 [ ] Packaged goods for sale	4 [ ] Repair or service
On-site material (3)	1 [ ] Bulk storage or warehousing	2 [ ] Processing or manufacturing
	3 [ ] Packaged goods for sale	4 [ ] Repair or service

D Ignition

D1 — 82 | Cargo/trunk area - all — Area of Fire Origin *

D2 — 00 | Heat source: other — Heat source *

D3 — 00 | Item First Ignited — Item First Ignited * | 1 [ ] Check box if fire spread was confined to object of origin

D4 — 00 | Type of material first — Type of Material First Ignited | Required only if item first ignited code (1.00 or 2.00)

E1 Cause of Ignition — [ ] Check box if this is an exposure report. Skip to section G

1 [ ] Intentional
2 [X] Unintentional
3 [ ] Failure of equipment or heat source
4 [ ] Act of nature
5 [ ] Cause under investigation
U [ ] Cause undetermined after investigation

E2 Factors Contributing To Ignition — [ ] None

20 | Mechanical — Factor Contributing To Ignition (1)

Factor Contributing To Ignition (2) | Factor Contributing To Ignition (3)

E3 Human Factors Contributing To Ignition — Check all applicable boxes

1 [ ] Asleep — [X] None
2 [ ] Possibly impaired by alcohol or drugs
3 [ ] Unattended person
4 [ ] Possibly mental disabled
5 [ ] Physically Disabled
6 [ ] Multiple persons involved
7 [ ] Age was a factor

Estimated age of person involved

1 [ ] Male 2 [ ] Female

F1 Equipment Involved In Ignition — [ ] None If Equipment was not involved,Skip to Section G

Equipment Involved | Brand | Model | Serial # | Year

F2 Equipment Power — Equipment Power Source

F3 Equipment Portability

1 [ ] Portable
2 [ ] Stationary

Portable equipment normally can be moved by one person, is designed to be use in multiple locations, and requires no tools to install.

G Fire Suppression Factors — Enter up to three codes. [ ] None

Fire Suppression Factor (1) | Fire Suppression Factor (2) | Fire Suppression Factor (3)

H1 Mobile Property Involved — [ ] None

1 [ ] Not involved in ignition, but burned
2 [ ] Involved in ignition, but did not burn
3 [X] Involved in ignition and burned

H2 Mobile Property Type & Make

20 | Freight road transport — Mobile property type

FO | Ford — Mobile property make

starling — Mobile property model | 2007 — Year

P656163 — License plate number | IL — State | 2f2hcmcv2[redacted] — VIN number

Local Use

[ ] Pre-Fire Plan Available

Some of the information presented in this report may be based upon reports from other Agencies

[ ] Arson report attached
[ ] Police report attached
[ ] Coroner report attached
[ ] Other reports attached

NFIRS-2 Revision 01/19/99

This gentleman saw and heard the whole thing

WITNESS CARD

Did you see the accident? ____ Did anyone appear injured? ____ Were you riding in a vehicle involved? NO Which one? ____ Who do you think was responsible for the accident? ____

Your Name [redacted]

Address [redacted] STATE KS 67 [redacted]

Phone [redacted]

PLEASE RETURN THIS CARD TO THE DRIVER

Thank You!

Also called 911

WHAT HAPPENED

At what distance did you first see danger? N/A Ft.

How fast were you going? 50 MPH

What was your speed at impact? N/A MPH

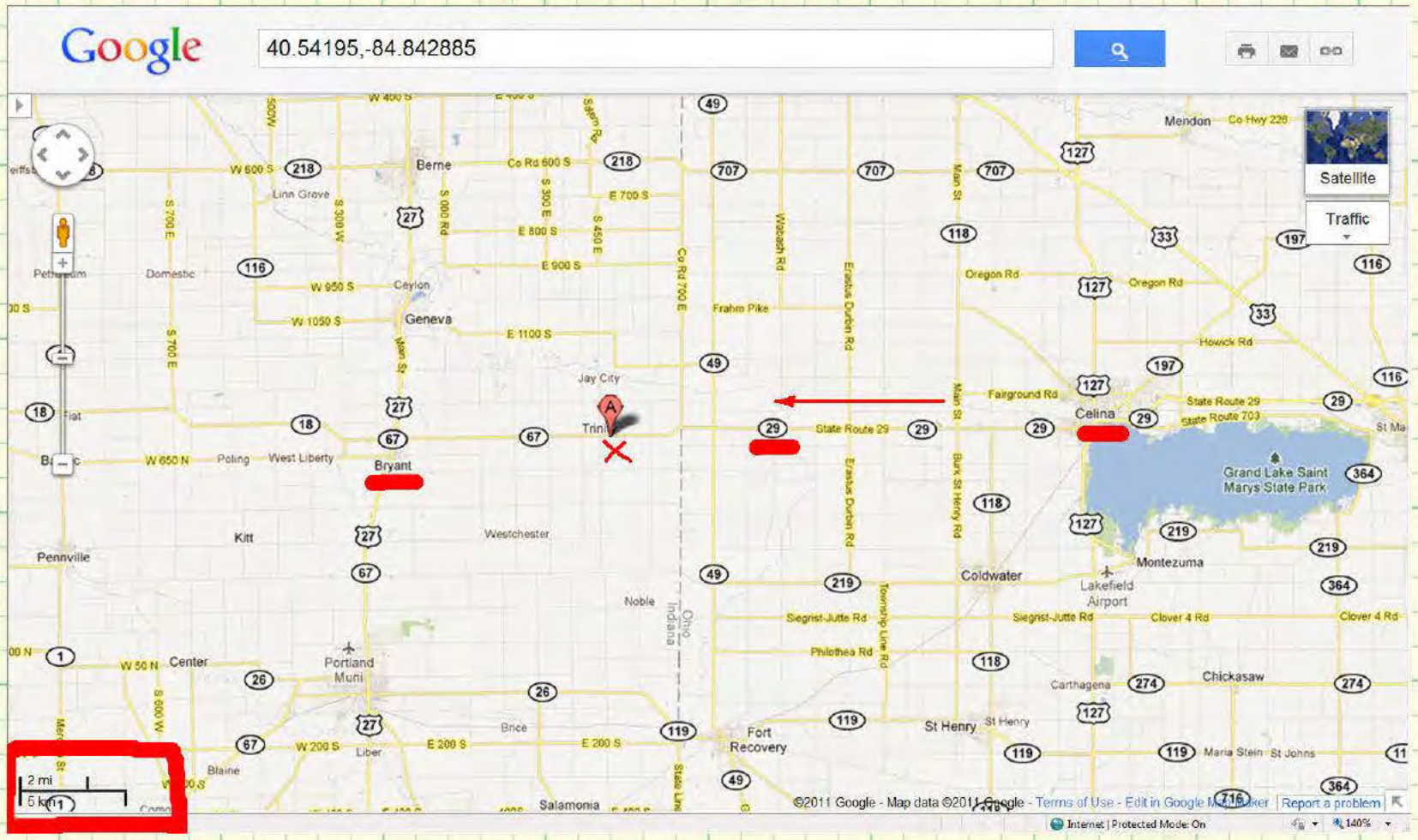
How far did your vehicle go after impact? N/A Ft.

Describe in your own words the circumstances of the ~~accident~~ INCIDENT/FIRE

I LOADED A TENCHE LOAD FROM THREE OAKS AND WAS ENROUTE TO KOKOMO, IN FOR FIRST DROP. I WAS HEADED WESTBOUND 3 MILES WEST OF INDIANA STATE LINE ON ROUTE 67 WHEN I HEARD A LOUD BANG. I PULLED OVER WITHIN 30 TO 40 FEET ON SHOULDER BECAUSE I THOUGHT I HAD A BLOW OUT. DIDN'T SEE ANY THING ON DRIVER SIDE OF TRACTOR BUT WHEN I LOOKED PASSENGER SIDE OF TRACTOR IT APPEARED ALL WAS WELL EXCEPT AN ORANGE GLOW COMING FROM THE #5 TIRE - THE INSIDE TIRE ON #3 AXLE. A CLOSER EXAMINATION SHOWED THE ORANGE GLOW WAS ACTUALLY FLAMES. I IMMEDIATELY GOT THE FIRE EXTINGUISHER FROM THE CAB AND ATTEMPTED TO PUT THE FIRE OUT FROM DIFFERENT ANGLES UNTIL THE EXTINGUISHER WAS EXHAUSTED. AT THAT POINT THE FLAMES APPEARED TO BE OUT OF CONTROL. I IMMEDIATELY GOT MY OWN PHONE CALLED 911; MARYSVILLE SHOP AND TERMINAL MANAGER GARY ROBERTSON. I THEN ATTEMPTED TO REMOVE PERSONAL ITEMS FROM TRACTOR UNTIL FIRE BECAME TOO INTENSE CAUSING EXPLOSIONS ALL ALONG THE TRUCK. FIRE DEPARTMENT ARRIVED TO PUT OUT FIRE. ONLY ONE ONE #6 AXLE CONTINUED THE FIRE.

[redacted]

Date 7-17-09


Google
40.54195,-84.842885
Satellite
Traffic
Berne
Linn Grove
Geneva
Ceylon
Jay City
Bryant
Kitt
Pennville
Westchester
Noble
Portland Muni
Center
Poling
West Liberty
Domestic
Frahm Pike
Fairground Rd
State Route 29
Celina
Grand Lake Saint Marys State Park
Coldwater
Montezuma
Lakefield Airport
Siegrist-Jutte Rd
Clover 4 Rd
Phlothea Rd
Carthagena
Chickasaw
Fort Recovery
St Henry
Maria Stein
St Johns
Brice
Liber
Blaine
Salamonia
Mendon
Oregon Rd
Howick Rd
Co Hwy 226
Co Rd 600 S
Co Rd 700 E
Main St
Wabash Rd
Erastus Durbin Rd
Bank St Henry Rd
Township Line Rd
Ohio
Indiana
2 mi
5 km
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VRTC Inspections and Tests of Haldex Spring-Brake Chambers

- Inspection and bench tests of chambers removed from service
- Disassembly, inspection, testing of debris
- Vehicle tests for unintended brake drag and parking brake operation
- Metallurgy of the power spring
- Comparison to peer spring-brake chamber
- Summary



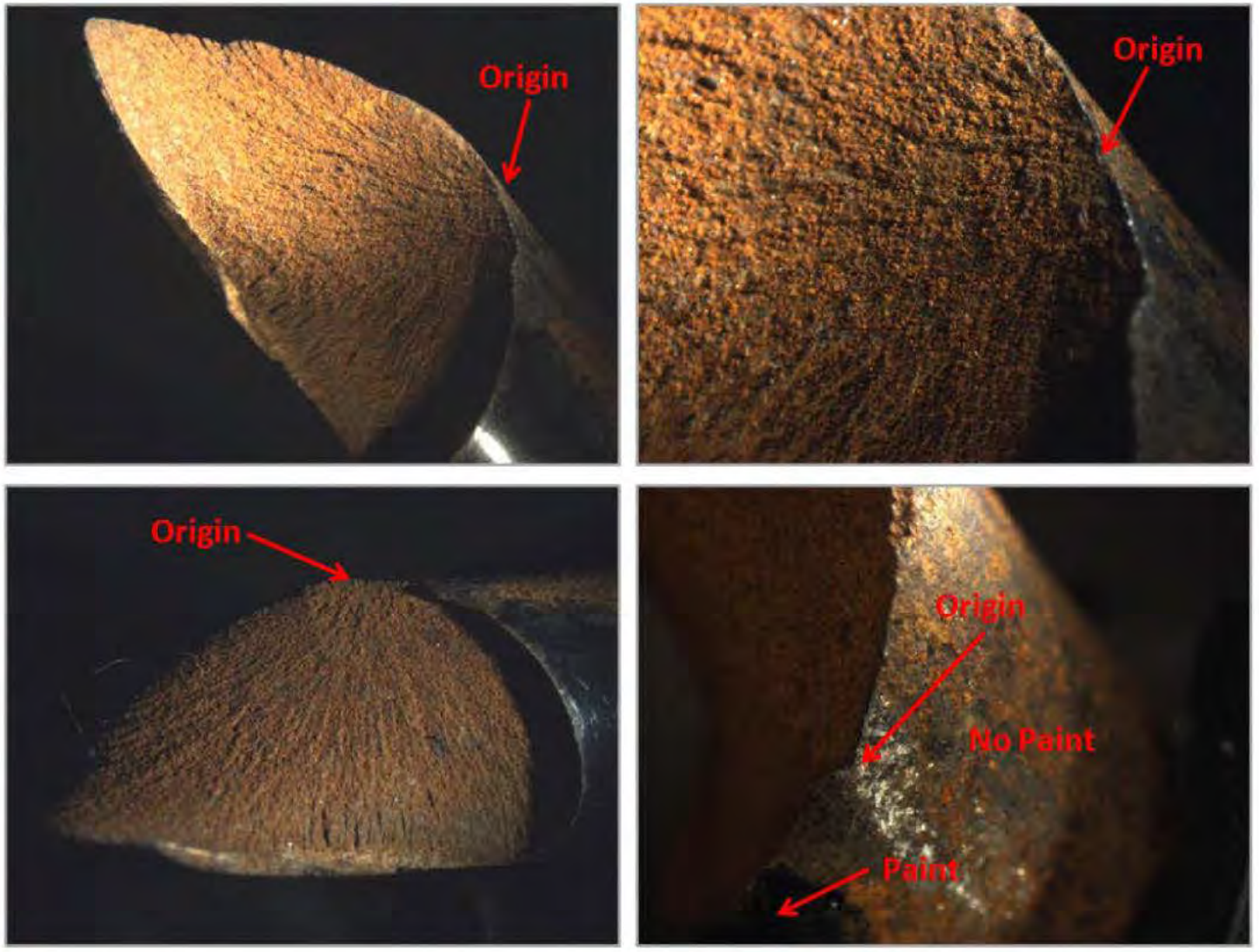
Intertek APTECH examined specimens from two Haldex springs

- Materials chemistry and microstructure appear to be within specified limits
- The power springs failed due to torsional fatigue initiated at a corrosion pit on the spring OD caused by corrosion of the exposed steel in the environment in regions where the paint had de-bonded from the spring surface
- Abrasion of the paint by clashing of spring coils was accelerated through interaction with debris causing it to de-bond in sections from the surface of the spring

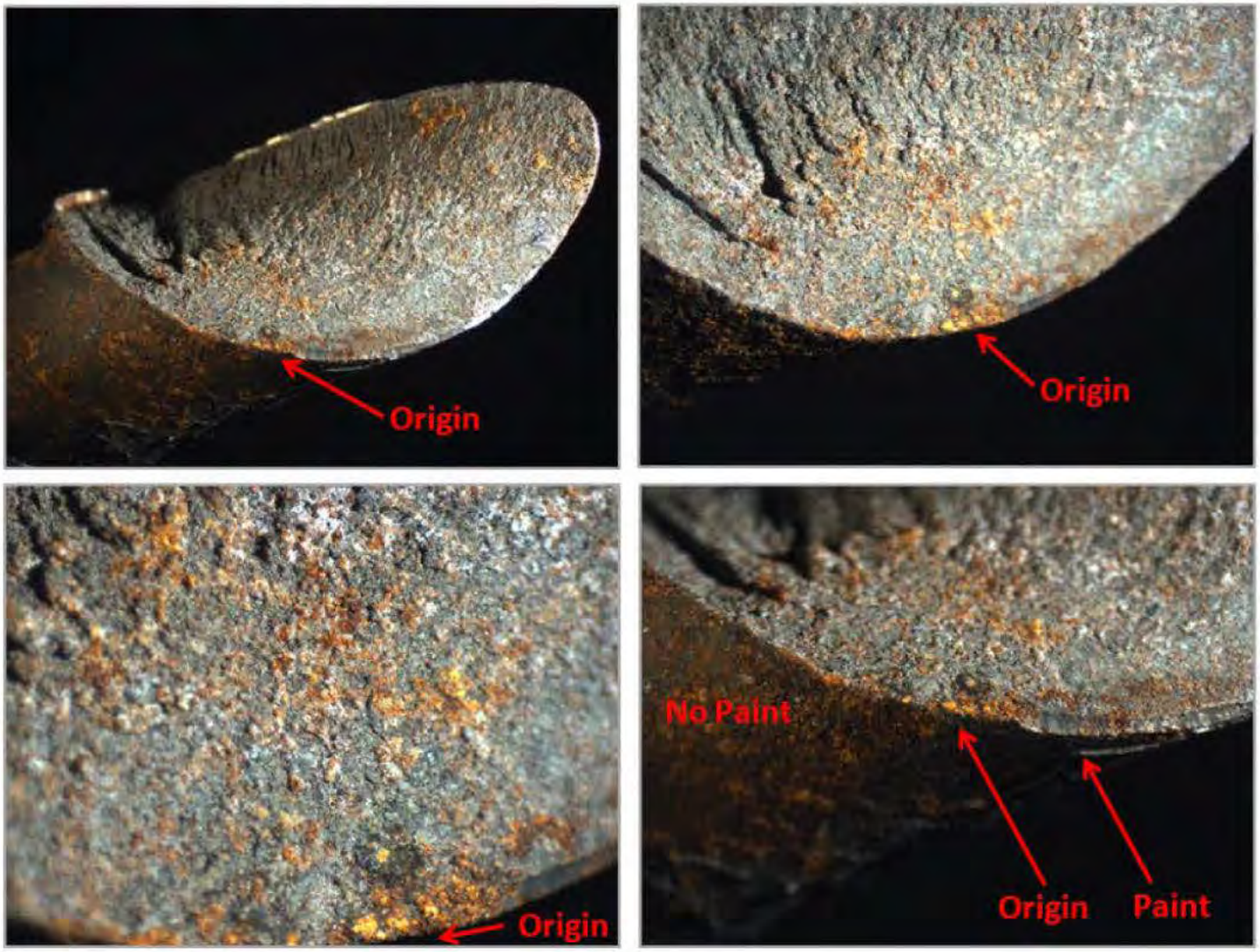
Intertek APTECH examined specimens from two Haldex springs

- The acceptance criteria in ESF-3029-F were flawed in that they allowed exposed metal caused by coil clashing or contact with spring supports to pass inspection. It is recommended that these criteria be changed to only allow springs to pass with a complete coating of paint remaining after testing. Again, the mechanical design should be changed to avoid coil clashing, or at the very least specify a more durable protective coating.

Intertek APTECH examined specimens from two Haldex springs



Intertek APTECH examined specimens from two Haldex springs



Institute for Spring Technology examined specimens from two Haldex springs

- The microstructure appeared to be appropriate with even grain structure for high strength
- The maximum stresses in a coil spring are along the inner diameter, these failed at the coil to coil contact points
- With any spring of this nature, if the coating is breached locally, corrosion will occur causing pitting and stress risers and then the spring will fail quickly
- It is not appropriate for the spring coils to contact each other in normal use

VRTC Inspections and Tests of Haldex Spring-Brake Chambers

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VRTC Inspections and Tests of Haldex Spring-Brake Chambers



The power Spring in the Haldex chamber and the MGM chamber appear identical



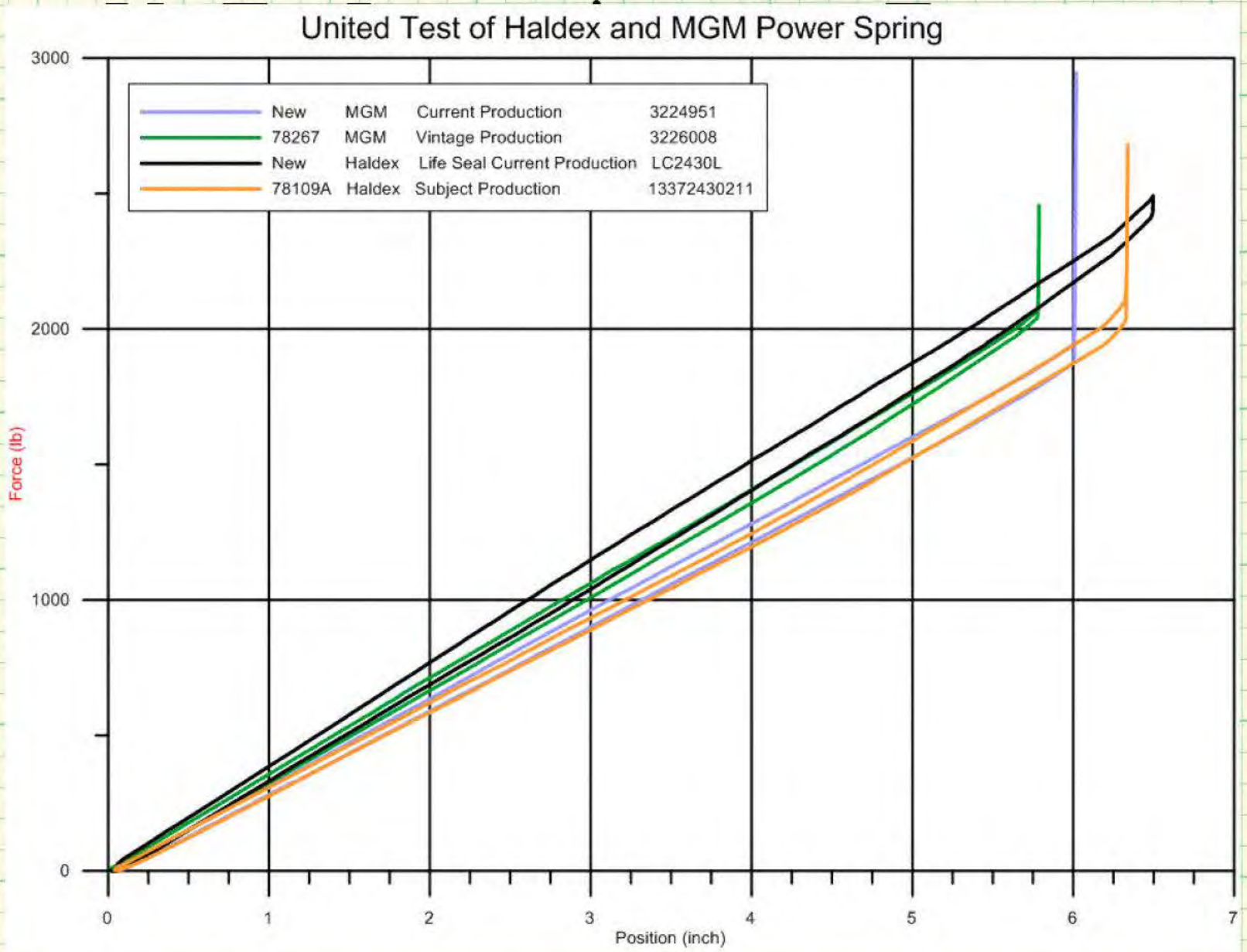
VRTC Inspections and Tests of Haldex Spring-Brake Chambers

Power Spring Comparisons Measured Physical Dimensions and Spring Constant								
Spring-Brake Chamber Manufacturer	Chamber Data Plate Number	Free Length (inch)	Maximum Spring OD at Free Length (inch)	Minimum Spring OD at Free Length (inch)	Wire Diameter (inch)	Total Wire Length (inch)	Minimum Working Height (inch)	Spring Constant (lb/inch)
Subject Haldex	13372430211	7.87	5.39	3.72	0.52	64.00	1.47	282
Vintage MGM	3226008	7.68	5.39	3.54	0.53	64.00	1.88	354

The power Spring in the Haldex chamber is reported to have a solid height at 1.43 inches

VRTC Inspections and Tests of Haldex Spring-Brake Chambers

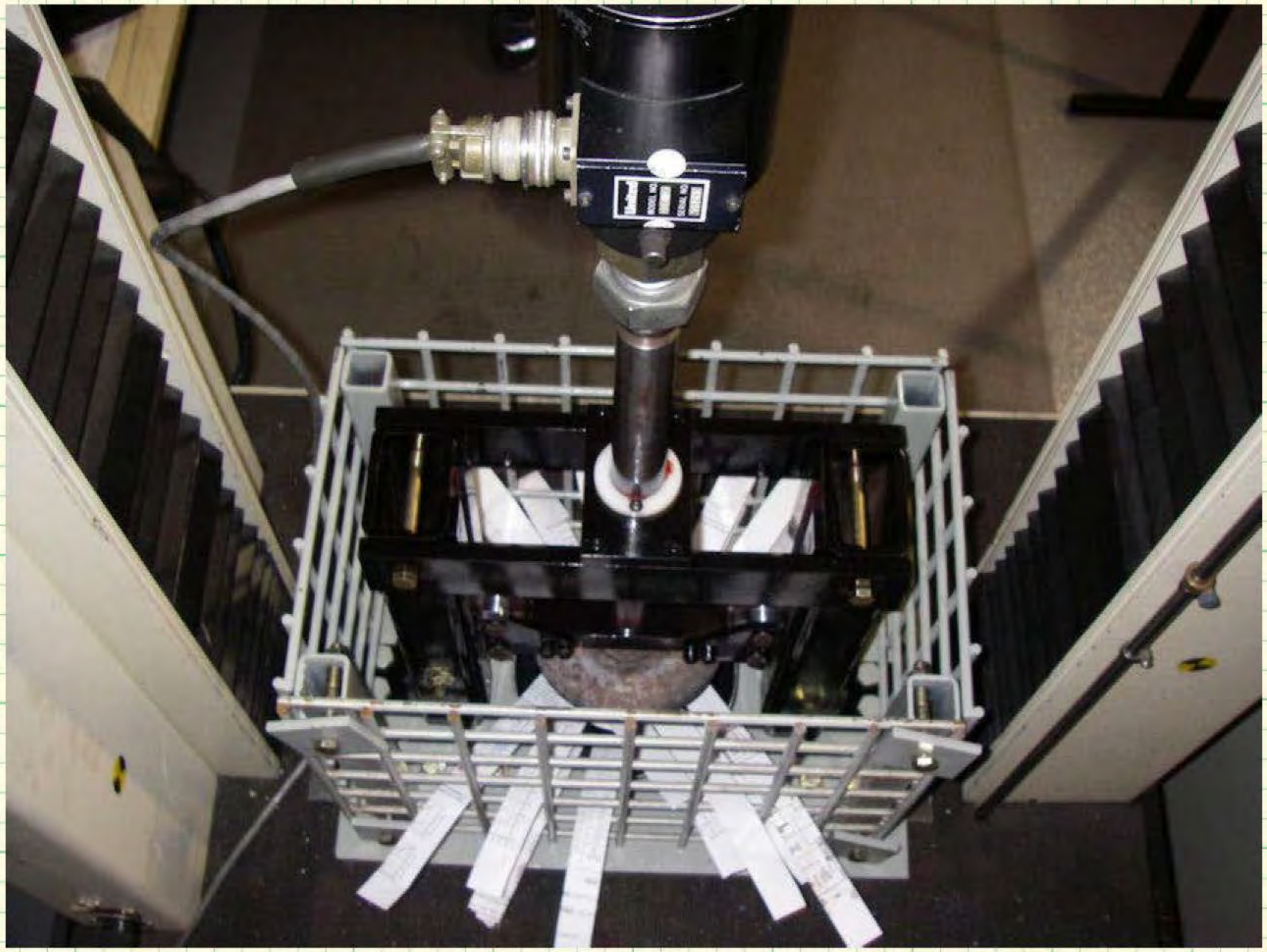



United Test of Haldex and MGM Power Spring
New MGM Current Production 3224951
78267 MGM Vintage Production 3226008
New Haldex Life Seal Current Production LC2430L
78109A Haldex Subject Production 13372430211
Force (lb)
3000
2000
1000
0
0
1
2
3
4
5
6
7
Position (inch)

VRTC Inspections and Tests of Haldex Spring-Brake Chambers

Power Spring Comparisons Surface Length of Corrosion								
Spring-Brake Chamber Manufacturer	Chamber Data Plate Number	Total Wire Length (inch)	Wire Length of "Center" of Spring [Excludes 1.5 Turns at Each End] (inch)	Total Length of Wire Found Corroded on "Top" (inch)	Total Length of Wire Found Corroded on "Bottom" (inch)	Total Length of Wire Found Corroded in "Center" and on "Top" (inch)	Total Length of Wire Found Corroded in "Center" and on "Bottom" (inch)	Percent of "Center" Wire Found Corroded "Top"+"Bottom" (inch)
Subject Haldex	13372430211	64.00	25.50	17.25	19.00	6.50	11.50	18.00
Vintage MGM	3226008	64.00	26.25	6.50	11.50	1.25	1.75	3.00

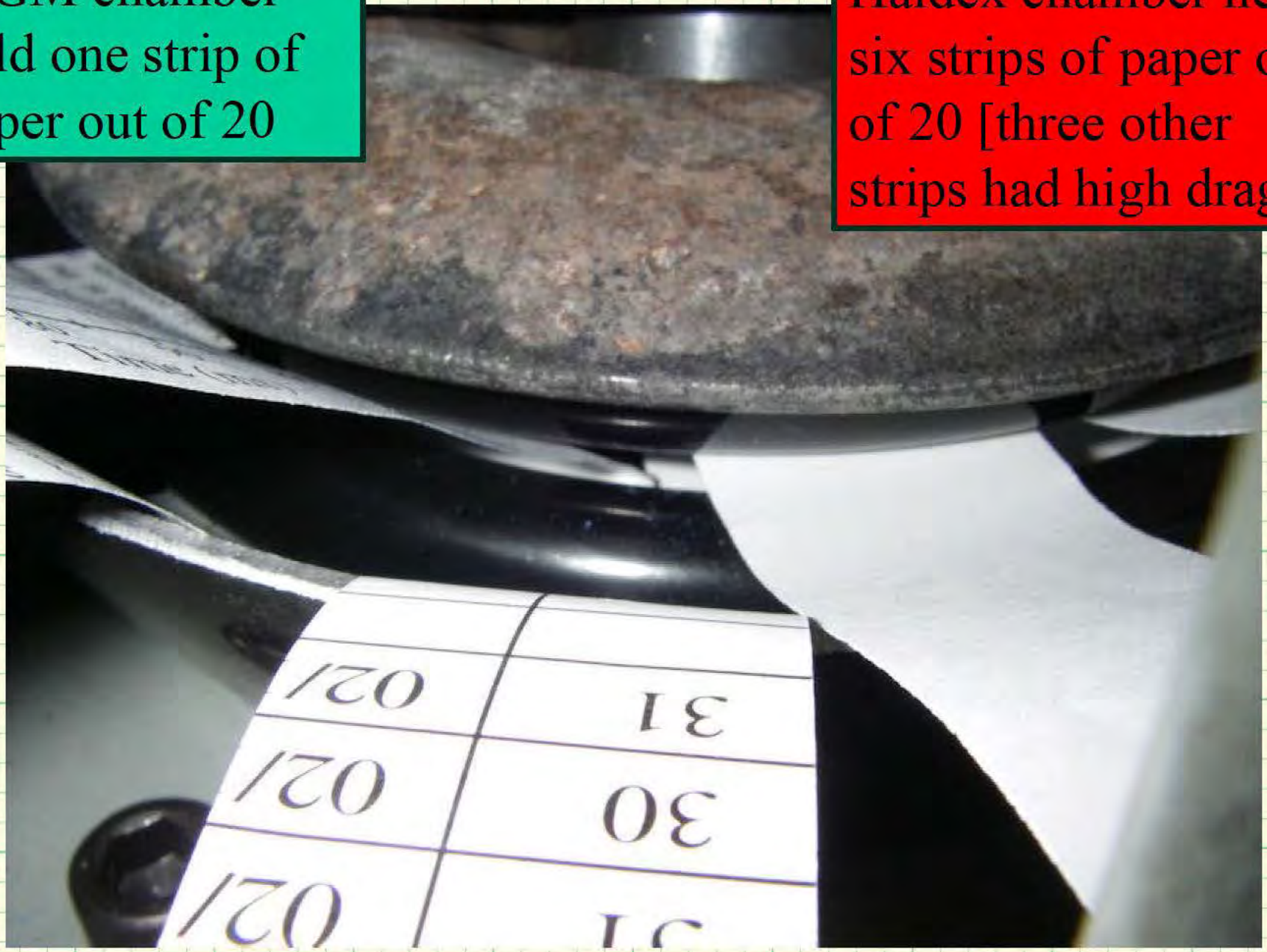





TruckSim Run
ISA Experimental Run
Time (sec)
Trailer Roll Compa
TruckSim Run
0
10
20

MGM chamber held one strip of paper out of 20

Haldex chamber held six strips of paper out of 20 [three other strips had high drag]



Summary

- Twelve spring-brake chambers collected at local autohauler were found with springs that had missing paint, corrosion, Halite (NaCl) debris
- Six of eight chambers subjected to durability testing continued to operate with a broken power spring for 108 to 7,266+ cycles (for an average of 2,292 cycles) compromising the stroke on some actuators, this failure is not detectable upon normal pre-trip inspection (unless raise vehicle and check for drag)
- Testing on the test track showed little detectability (visible smoke or vehicle deceleration) and similar sequence of events as occurred during the reported autohauler fire
- The parking portion of the spring brake was found to deploy at 63 psi, audible alarm and dash light at 60 psi, and dash knobs popped at 25 psi, a variable leak was created at the pressure hose attached to the spring-brake chamber at the right forward drive axle, and found multiple brakes would be applied
- Similar Haldex and MGM springs are compressed to a shorter minimum working height in the Haldex design

End of Presentation

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