

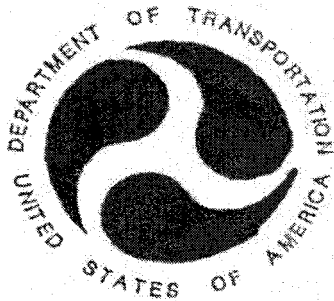
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REPORT NO. 121D-LTL- 06-007

SAFETY COMPLIANCE TESTING FOR FMVSS 121D
Air Brakes Systems - Dynamometer

INTERNATIONAL
2007 8600 Tractor Rear
Dana Spicer 5-23-170-23
NHTSA No.: C70800

LINK TESTING LABORATORIES, INC.
13840 Elmira Avenue
Detroit, MI 48227-3017



May 2, 2007

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
400 Seventh Street, SW
Room 6115 (NVS-220)
Washington, DC 20590

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Prepared By: Alex J. Nicholas

Approved By: [Signature]

Approval Date: 4/9/2007

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: [Signature]

Acceptance Date: 5/8/07

1. REPORT NUMBER 121D-LTL- 06-007	2. GOVERNMENT ACCESSION NUMBER		3. RECIPIENT'S CATALOG NUMBER	
4. TITLE AND SUBTITLE Final Report of FMVSS 121D Compliance 2007 International 8600 Tractor Rear Rear Axle: Dana Spicer 5-23-170-23 NHTSA No.C70800	5. REPORT DATE: 05/02/2007		6. PERFORMING ORGANIZATION CODE LTL	
7. AUTHOR(S) Carlos Agudelo, Engineering Manager Alex J. Nicholson, Associate Test Engineer	8. PERFORMING ORGANIZATION REPORT NUMBER: LTL-DOT-067453-001			
9. PERFORMING ORGANIZATION NAME AND ADDRESS Link Testing Laboratories, Inc. 13840 Elmira Avenue Detroit, Michigan 48227-3017	10. WORK UNIT NUMBER		11. CONTRACT OR GRANT NUMBER DTNH22-06-P-00017	
12. SPONSORING AGENCY NAME AND ADDRESS US Department of Transportation National Highway Traffic Safety Administration Safety Assurance Office of Vehicle Safety Compliance 400 Seventh Street, SW Mail Code: NVS-220, Room 6115 Washington, DC 20590	13. TYPE OF REPORT AND PERIOD COVER Final Test Report			
14. SPONSORING AGENCY CODE NVS-220	15. SUPPLEMENTARY NOTES			
16. ABSTRACT A compliance test was conducted on the 2007 International 8600 Tractor Rear Axle in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No TP-121D-01 for the determination of FMVSS 121D compliance. Test Failures identified were as follows: Failed 1st stop of the recovery section.				
17. KEY WORDS Compliance Testing FMVSS 121D 2007 International 8600 4x2 Rear Axle Test #2		18. DISTRIBUTION STATEMENT Copies of this report are available from- NHTSA Technical Reference Division Mail Code: NAD-52, Room 5108 400 Seventh Street, SW Washington, DC 20590 Telephone No.: 202-366-4946		
19. SECURITY CLASSIFICATION OF REPORT Unclassified	20. SECURITY CLASSIFICATION OF PAGE Unclassified	21. NUMBER OF PAGES 31	22. PRICE	

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SECTION I

PURPOSE OF COMPLIANCE TEST

A test was conducted on the braking performance of a 2007 INTERNATIONAL 8600 TRACTOR REAR AXLE VIN# 1HSHWAHNX7J377874, to determine compliance with the dynamometer portion of FMVSS 121, "Air Brake Systems."

The compliance test was conducted in accordance with the National Highway Traffic Safety Administration (NHTSA), Office of Vehicle Safety Compliance (OVSC) Laboratory Test Procedure TP-121D-01 Dated May 9, 1990 and the corresponding Link Testing Laboratories, Inc. test procedure Link \ D98071A0 dated October 2, 1998.

The test failed the 1st stop of the recovery section with a pressure of 85.8 psi.

SECTION II
TEST DATA SUMMARY

DYNAMOMETER TEST SUMMARY

S5.4.1.1 - BRAKE RETARDATION FORCE RATIO

REQUIRED		ACTUAL		PASS / FAIL
AIR PRESSURE	RETARDATION FORCE RATIO (Min)	AVERAGE AIR PRESSURE (psi)	RETARDATION FORCE RATIO	
20 psi	0.05	20	0.13	PASS
30 psi	0.12	30	0.20	PASS
40 psi	0.18	40	0.28	PASS
50 psi	0.25	50	0.35	PASS
60 psi	0.31	60	0.42	PASS
70 psi	0.37	70	0.48	PASS
80 psi	0.41	80	0.55	PASS

S5.4.2.1 - BRAKE POWER PHASE - Requirement: Max Pressure During Stops: 100 psi

SNUB	MAXIMUM AIR PRESSURE (psi)	PASS/FAIL	REMARKS
1	55	PASS	-
2	52	PASS	-
3	52	PASS	-
4	53	PASS	-
5	56	PASS	-
6	56	PASS	-
7	61	PASS	-
8	65	PASS	-
9	68	PASS	-
10	71	PASS	-

S5.4.2.1 - 20 MPH STOP

STOP	MAXIMUM AIR PRESSURE (psi)	PASS/FAIL	REMARKS
11	100	PASS	-

S5.4.3 - BRAKE RECOVERY - Requirement: Air Pressure (psi)

	MIN	MAX
w/o antilock	20	85
w/ antilock	12	85

STOP	AIR PRESSURE (psi)		PASS / FAIL	REMARKS
	MINIMUM	MAXIMUM		
1	55	86	FAIL	-
2	46	83	PASS	-
3	44	84	PASS	-
4	42	82	PASS	-
5	45	77	PASS	-
6	41	75	PASS	-
7	41	73	PASS	-
8	39	72	PASS	-
9	39	72	PASS	-
10	38	70	PASS	-
11	37	68	PASS	-
12	37	68	PASS	-
13	35	68	PASS	-
14	39	66	PASS	-
15	38	65	PASS	-
16	36	64	PASS	-
17	35	64	PASS	-
18	36	64	PASS	-
19	35	62	PASS	-
20	34	62	PASS	-

SECTION III

TEST DATA

SPECIFICATIONS

TEST NO.: 121D-LTL-06-006 DATE: 5/2/2007

VEHICLE:

MODEL YEAR/MAKE/MODEL: 2007 International 8600 Tractor Rear
NHTSA NO.: C70800 VIN: 1HSHWAHNX7J377874
AXLE: Dana Spicer 5-23-170-23

BRAKE ASSEMBLY:

BRAKE TYPE: Spicer
MANUFACTURER: Spicer Assy P/N: ETN0975952
DRUM SIZE: 16.5" X 8.62"
MANUFACTURER: Gunite P/N: Gunite 3807 AX
FRICTION MATERIAL: Spicer
MANUFACTURER: Spicer Assy P/N: 975001 EES 450 FF
SLACK ADJUSTER: Auto 5.5"
MANUFACTURER: Spicer Assy P/N: ETN0975628
AIR CHAMBER: MGM Type 30/30 Long Stroke
MANUFACTURER: MGM P/N: ZAJ3232951

TEST PARAMETERS:

TEST START: 04/02/07 DYNAMOMETER: 84
TEST COMPLETE: 04/03/07 FIXTURE: 066652-1
REQUIRED WHEEL LOAD (lb): 10,000 ROLLING RADIUS (in): 19.8
ACTUAL WHEEL LOAD (lb): 10101 ROTATION: Left
REQUIRED INERTIA (slug ft²): 846.558 COOLING AIR TEMP: 84°F
ACTUAL INERTIA (slug ft²): 855.18 COOLING AIR VELOCITY (ft/min): 2,200

REMARKS:

Cooling air velocity was manually adjusted to ensure the flow over the brake was 2,200 feet/min.

BRAKE ADJUSTMENT S6.2.6

VEHICLE MY/MAKE/MODEL: 2007 International 8600 Tractor Rear

VEHICLE NHTSA NO.: C70800 DATE OF TEST: 04/03/07

SCHEDULE:

PERFORMANCE REQUIREMENT:

Brakes may be adjusted up to 3 times during the burnish procedure at intervals specified by vehicle manufactures, and may be adjusted at the conclusion of the burnishing in accordance with the vehicle manufacturer's recommendation

1st Brake Adjustment = Initial Before Burnish

2nd and 3rd Brake Adjustment = During Burnish

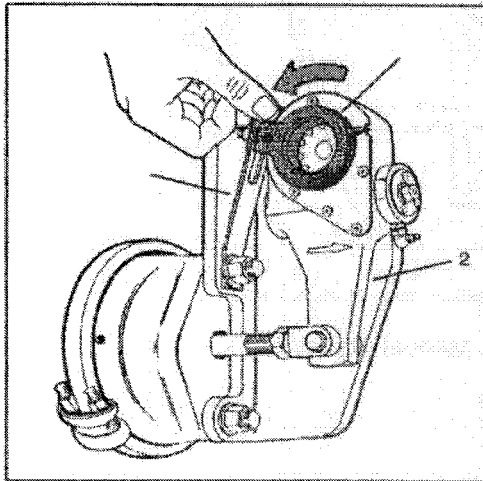
4th Brake Adjustment = Before Performance

*Refer to manual for brake adjustment on following pages.

BRAKE MANUAL FOR INSTRUCTIONS

HALDEX AUTOMATIC SLACK ADJUSTER

Refer to Figure 24 for the following procedure, steps 1 through 4.



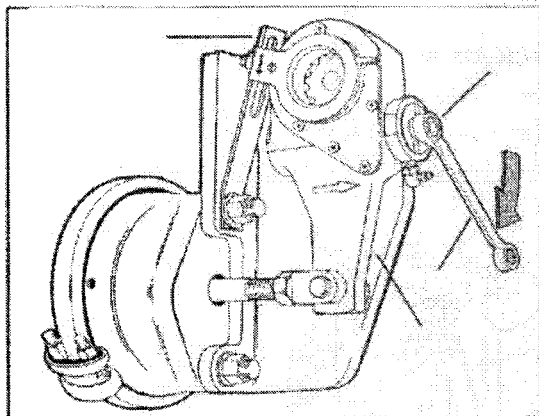
(Right click on graphic to bring up an option list)

Figure 24. Installation Of Control Arm

1. CONTROL ARM
2. AUTOMATIC SLACK ADJUSTER ASSEMBLY
3. ANCHOR BRACKET

1. Rotate the control arm away from the adjusting hex towards the air chamber, until it comes to a definite internal stop as illustrated.
2. Most adjusters will be equipped with an installation indicator. Indicator must fall within the slot for proper installation.
3. **If the control position is wrong, tight brakes will occur.**
4. Tighten all anchor bracket fasteners if loosened or removed. Make sure the control arm does not move while tightening the anchor bracket fasteners.

Refer to Figure 25 for steps 5 through 9.



(Right click on graphic to bring up an option list)

Figure 25. Manual Adjusting

1. HEX ADJUSTING NUT
2. WRENCH
3. AUTOMATIC SLACK ADJUSTER
4. ANCHOR BRACKET

5. The adjuster must be manually adjusted at this time.
6. Rotate the adjusting hex clockwise until the lining contacts the drum.
7. Back off the adjuster hex, turning the hex counterclockwise 1/2 turn.
8. A minimum of 13 ft-lbs. is necessary to overcome the internal clutch. A ratcheting sound will be heard.
9. **Final inspection.** With full air pressure, release spring and service brake and check that the installation indicator is within the slotted area. Remove clevis pin and check that the clevis hole and adjuster hole remain in alignment. If the air chamber push rod was pulled into the air chamber, repeat steps 1, 2 and 3. After final inspection, install cotter pin into clevis pin. Refer to Brake Adjustment Stroke Table, for push rod stroke adjustment.
10. If spring parking brake was serviced, uncage parking brake. Refer to GROUP 04 - AIR BRAKES in the CTS-5000 Master Service Manual.
11. Remove floor stands. Road test vehicle for correct brake operation before putting vehicle back into service.



BURNISH TEST DATA S6.2.6

VEHICLE NHTSA NO.: C70800 DATE OF TEST: 04/03/07

SCHEDULE:

200 stops from 40 MPH (340 rpm) @ 10 ft/s/s, IBT
 315-385°F each stop
 200 stops from 40 mph (340 rpm) @ 10 ft/s/s, IBT
 450-550°F each stop
 Stop time: 5.78-5.96 seconds

PERFORMANCE REQUIREMENT:

None

STOP	RPM	F/M TEMP. (315-385°F)	TORQUE (lb-ft)	STOP TIME (5.78 - 5.96 sec)	AVERAGE AIR PRESSURE	REMARKS
1	339	352	5081	5.88	56	-
20	340	355	5166	5.82	56	-
40	340	354	5175	5.81	64	-
60	340	355	5173	5.78	68	-
80	340	354	5167	5.83	59	-
100	340	353	5195	5.77	53	-
101	340	354	5189	5.79	53	-
120	340	351	5213	5.77	48	-
140	340	352	5196	5.77	45	-
160	340	355	5203	5.77	45	-
180	340	351	5228	5.74	43	-
200	340	353	5219	5.77	45	-
		(450-550°F)				
201	336	382	5193	5.73	49	-
220	339	501	5178	5.79	63	-
240	339	502	5149	5.81	67	-
260	339	504	5220	5.73	62	-
280	339	504	5217	5.74	64	-
300	339	502	5159	5.82	65	-
301	340	499	5219	5.75	65	-
320	339	501	5173	5.79	62	-
340	340	502	5191	5.79	60	-
360	340	503	5184	5.80	60	-
380	339	499	5173	5.79	63	-
400	340	503	5185	5.80	64	-

Percent Shoe Contact	LEADING SHOE	90%
	TRAILING SHOE	90%

BRAKE RECOVERY S5.4.3

VEHICLE NHTSA NO.: C70800 DATE OF TEST: 04/03/07

SCHEDULE:

Speed 30 mph (255 RPM)
 Deceleration at 12 ft/s/s
 @ 1 minute intervals
 Stop time = 3.52 - 3.83 seconds

PERFORMANCE REQUIREMENT:

	Min.	Max.
w/o Antilock	20 psi	85 psi
w/ Antilock	12 psi	85 psi

STOP No.	RPM	F/M TEMP. (°F)	TORQUE (lb-ft)	AIR PRESSURE (psi)		STOP TIME (sec)	PASS/ FAIL
				MINIMUM	MAXIMUM		
1	255	395	6284	54.9	85.8	3.54	Fail
2	255	396	6261	46.5	83.1	3.56	Pass
3	255	392	6291	44.0	84.2	3.56	Pass
4	255	386	6143	41.6	81.5	3.62	Pass
5	255	383	6208	44.7	76.7	3.61	Pass
6	255	379	6182	41.0	75.3	3.62	Pass
7	255	372	6196	41.2	72.5	3.61	Pass
8	255	370	6225	38.7	72.1	3.62	Pass
9	255	369	6225	39.2	71.8	3.58	Pass
10	255	364	6227	37.9	69.6	3.62	Pass
11	255	363	6237	36.9	68.1	3.57	Pass
12	255	363	6235	36.9	67.9	3.57	Pass
13	255	362	6235	35.4	68.3	3.57	Pass
14	255	358	6254	38.6	66.3	3.59	Pass
15	255	354	6237	37.6	65.3	3.61	Pass
16	255	354	6258	36.0	64.4	3.56	Pass
17	255	354	6256	34.8	63.7	3.58	Pass
18	255	351	6235	36.0	63.5	3.57	Pass
19	255	348	6253	34.7	61.9	3.59	Pass
20	255	348	6246	34.5	61.9	3.56	Pass

DATA INDICATES: PASS XXXXX FAIL

TEST DATA PLOTS: S5.4.1, S5.4.2 AND S5.4.3

REPORT NUMBER:

LTL-DOT-067453-001

MODEL YEAR/MAKE/MODEL:

2007 International 8600 Tractor Rear

AXLE:

Dana Spicer 5-23-170-23

BRAKE TYPE:

Spicer

DRUM SIZE AND TYPE:

16.5" X 8.62" Gunitite Gunitite 3807 AX

FRICTION MATERIAL:

Spicer

AIR CHAMBER:

MGM Type 30/30 Long Stroke

SLACK ADJUSTER:

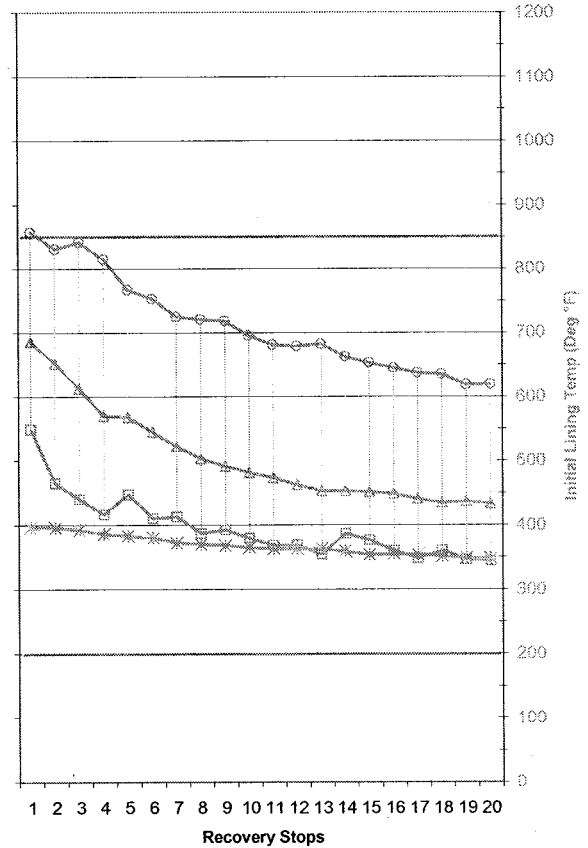
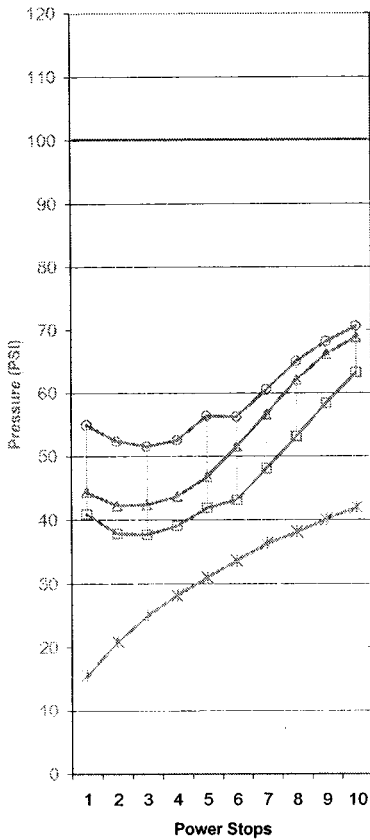
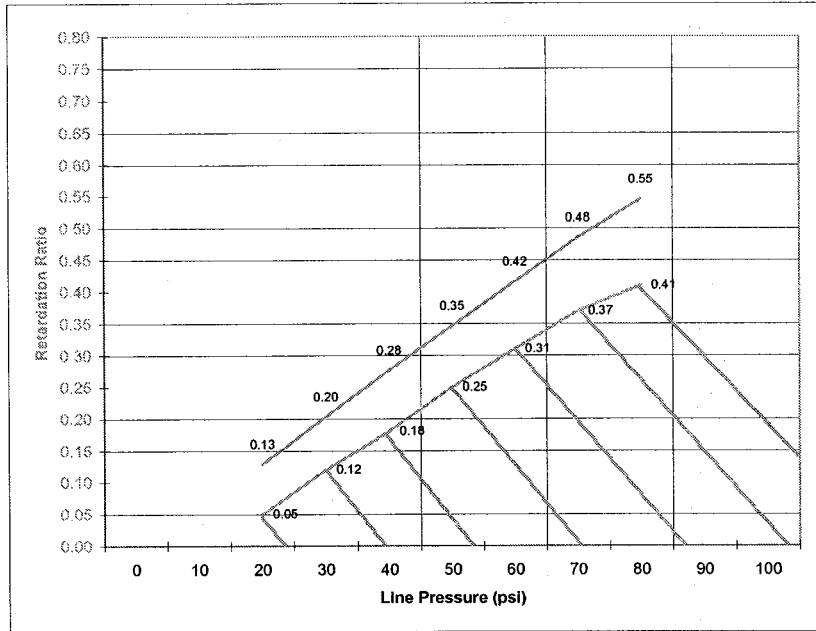
Spicer 5.5" Automatic

GAWR (lbs):

20000

ROLLING RADIUS (in):

19.8



SECTION IV
TEST EQUIPMENT AND
CALIBRATION RECORDS

Section IV - INSTRUMENTATION

Testing Equipment

Link Dynamometer No. 84

Description	Serial Number	*Calibration Date	Next Calibration Date
Torque	390	5/5/2006	5/5/2006
Brake Temperature	231748-4	5/5/2006	5/5/2006
Air Pressure	76898	5/5/2006	5/5/2006
Stroke	34030749	5/5/2006	5/5/2006
Shaft Speed	4020249	5/5/2006	5/5/2006

*Calibration By Matthew J. Curtis



Certificate of Calibration

Calibration Performed By:
 Link Engineering Company
 43855 Plymouth Oaks Blvd.
 Plymouth, MI 48170, USA
 (734) 453-0800

Calibration Performed For:
 Link Testing Laboratories
 13840 Elmira Ave
 Detroit, Michigan 48227

Project Description: Dynamometer 84
 Link Work Order Number: 063084
 Report Number: 904070-5-2006
 Certificate Number: 231748-42007
 Calibration File Name: 063084 - 231748-4.cal
 Calibration Date: 5/5/2006
 Next Calibration Date: 5/5/2007
 Procedure Used: 4 Temperature Calibration (thermocouple cond.)
 Technician: M.Curtis-M.Perry
 Technician's Initials: M.C.

Item Description: Temperature
 Manufacturer: M-Systems
 Condition: Good
 Serial Number: 231748-4
 Model Number: MST5-24-R/K
 Instrument Range: 2400 °F
 Rated Full-Scale: 1400 °F
 Temperature: 70 F
 Relative Humidity: 30 %
 Calibration Site: (Unspecified)

Calibration Standard Value (°F)	Initial "As Found" Value (°F)	Calibration Standard Value (°F)	Final Calibrated Value (°F)	Initial Percent (%) of Full Scale Range (FSR) Error	Final Percent (%) of Full Scale Range (FSR) Error
0.0	-2.2	0.0	0.3	-1.57%	.021%
350.0	348.9	350.0	351.0	-0.79%	.073%
700.0	698.6	700.0	700.4	-1.00%	.029%
1050.0	1048.4	1050.0	1050.2	-1.14%	.014%
1390.0	1388.6	1390.0	1390.3	-1.00%	.021%

	PRE-CAL	POST-CAL
Maximum % of full-scale error observed:	-0.157%	0.073%
Maximum % of FSR error allowable (+/-):	1.000%	1.000%
Pre-Calibration Status:	Instrument met required accuracy	
Post-Calibration Status:	Instrument meets required accuracy	

Technical Comments:

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with NIST technical note 1297. All measurements are traceable to NIST. This calibration was performed in accordance with the requirements of ISO/IEC 17025:2005 and applies only to the item listed above.

Calibration Equipment Utilized:

Ref.#	Description	Serial Number	Range	Accuracy	Uncertainty	Last Cal	Cal Due
REF 4	TEMP	T-125986	-210-760 C	±0.1 F	±0.1	11/7/2005	12/30

Total Measurement Uncertainty: (+/-) ERROR: Invalid units of 'C' for 'range'; the conversion returns zero. 1

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 (734) 453-0800 - service@linkeng.com

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Date: 5/2/2007
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Certificate of Calibration

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 Plymouth, MI 48170, USA
 (734) 453-0800

Calibration Performed For:
 Link Testing Laboratories
 13840 Elmira Ave
 Detroit, Michigan 48227

Project Description: Dynamometer 84
Link Work Order Number: 063084
Report Number: 904070-5-2006
Certificate Number: 340307492007
Calibration File Name: 063084 - 34030749.cal
Calibration Date: 5/5/2006
Next Calibration Date: 5/5/2007
Procedure Used: 6 Distance Calibration
Technician: M. Curtis-M. Perry
Technician's Initials: M.C.

Item Description: Stroke A
Manufacturer: UniMeasure
Condition: Good
Serial Number: 84030749
Model Number: PA-5-004-NJC
Instrument Range: 5 in
Rated Full-Scale: 5 in
Temperature: 70 F
Relative Humidity: 30 %
Calibration Site: (Unspecified)

Calibration Standard Value (in)	Initial "As Found" Value (in)	Calibration Standard Value (in)	Final Calibrated Value (in)	Initial Percent (%) of Full Scale Range (FSR) Error	Final Percent (%) of Full Scale Range (FSR) Error
0.000	0.000	0.000	0.000	.000%	.000%
1.000	1.004	1.000	1.002	.080%	.040%
2.000	2.009	2.000	2.000	.150%	.000%
3.000	3.013	3.000	3.003	.260%	.060%
4.000	4.029	4.000	4.015	.550%	.300%

	PRE-CAL	POST-CAL
Maximum % of full-scale error observed:	0.580%	0.300%
Maximum % of FSR error allowable (+/-):	1.000%	1.000%
Pre-Calibration Status:	Instrument met required accuracy	
Post-Calibration Status:	Instrument meets required accuracy	

Technical Comments:

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with NIST technical note 1297. All measurements are traceable to NIST. This calibration was performed in accordance with the requirements of ISO/IEC 17025:2005 and applies only to the item listed above.

Calibration Equipment Utilized:

Ref.#	Description	Serial Number	Range	Accuracy	Uncertainty	Last Cal	Cal Due
REF. 3	5 IN CALIBERS	33332	0-6 IN	±.001 IN	IN ±.001	10/7/2005	12/05

Total Measurement Uncertainty: (+/-) ERROR: invalid units of 'in' for 'range', the conversion returns zero. 1

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Certificate of Calibration

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 Plymouth, MI 48170, USA
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Calibration Performed For:
 Link Testing Laboratories
 13840 Elmira Ave
 Detroit, Michigan 48227

Project Description: Dynamometer 84
 Link Work Order Number: 063084
 Report Number: 904070-5-2006
 Certificate Number: 040252492007
 Calibration File Name: 063084 - 04020249.cal
 Calibration Date: 5/5/2006
 Next Calibration Date: 5/5/2007
 Procedure Used: 3 Rotational Speed Calibration
 Technician: M. Curtis M. Perry
 Technician's Initials: M.C.P.

Item Description: Rotational Speed
 Manufacturer: Stegmann
 Condition: Good
 Serial Number: 04020249
 Model Number: CI25
 Instrument Range: 1000 RPM
 Rated Full-Scale: 1000 RPM
 Temperature: 70 F
 Relative Humidity: 30 %
 Calibration Site: (Unspecified)

Calibration Standard Value (RPM)	Initial "As Found" Value (RPM)	Calibration Standard Value (RPM)	Final Calibrated Value (RPM)	Initial Percent (%) of Full Scale Range (FSR) Error	Final Percent (%) of Full Scale Range (FSR) Error
0.0	0.0	0.0	0.0	.000%	.000%
50.0	50.0	50.0	50.0	.000%	.000%
300.0	300.0	300.0	300.0	.000%	.000%
600.0	600.0	600.0	600.0	.000%	.000%
800.0	800.0	800.0	800.0	.000%	.000%

	PRE-CAL	POST-CAL
Maximum % of full-scale error observed:	0.000%	0.000%
Maximum % of FSR error allowable (+/-):	1.000%	1.000%
Pre-Calibration Status:	Instrument met required accuracy	
Post-Calibration Status:	Instrument meets required accuracy	

Technical Comments:

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with NIST technical note 1297. All measurements are traceable to NIST. This calibration was performed in accordance with the requirements of ISO/IEC 17025:2005 and applies only to the item listed above.

Calibration Equipment Utilized:

Ref #	Description	Serial Number	Range	Accuracy	Uncertainty	Last Cal	Cal Due
REF-10	DIGITAL TACHOMETER	054096092	1-25000 RPM	±.2RPM MAX	RPM ±.2	11/7/2005	5/2006

Total Measurement Uncertainty: (+/-) 0.0 RPM

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 (734) 453-0800

Calibration Performed For:
 Link Testing Laboratories
 13840 Elmira Ave
 Detroit, Michigan 48227

Project Description: Dynamometer 84
 Link Work Order Number: 063084
 Report Number: 904070-5-2006
 Certificate Number: 390(REV)2007
 Calibration File Name: 063084 - 390(REV).cal
 Calibration Date: 5/5/2006
 Next Calibration Date: 5/5/2007
 Procedure Used: 1 Torque Calibration
 Technician: M. Curtis-M. Perry
 Technician's Initials: M.C.

Item Description: Torque A-End Reverse
 Manufacturer: Lebow
 Condition: Good
 Serial Number: 390(REV)
 Model Number: 3157
 Instrument Range: 10000 lb
 Rated Full-Scale: 20000 lb-ft
 Temperature: 70 F
 Relative Humidity: 30 %
 Calibration Site: (Unspecified)

Calibration Standard Value (lb-ft)	Initial "As Found" Value (lb-ft)	Calibration Standard Value (lb-ft)	Final Calibrated Value (lb-ft)	Initial Percent (%) of Full Scale Range (FSR) Error	Final Percent (%) of Full Scale Range (FSR) Error
0.0	0.0	0.0	0.0	.000%	.000%
3530.2	3519.8	3530.2	3519.8	-.052%	-.052%
7516.5	7505.7	7516.5	7505.7	-.054%	-.054%
11063.6	11055.4	11063.6	11055.4	-.041%	-.041%
15027.1	15034.6	15027.1	15034.6	.038%	.038%

	PRE-CAL	POST-CAL
Maximum % of full-scale error observed:	-0.054%	-0.054%
Maximum % of FSR error allowable (+/-):	1.000%	1.000%
Pre-Calibration Status:	Instrument met required accuracy	
Post-Calibration Status:	Instrument meets required accuracy	

Technical Comments:

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with NIST technical note 1297. All measurements are traceable to NIST. This calibration was performed in accordance with the requirements of ISO/IEC 17025:2005 and applies only to the item listed above.

Calibration Equipment Utilized:

Ref #	Description	Serial Number	Range	Accuracy	Uncertainty	Last Cal	Cal Due
REF 3	DISPLAY MODULE	13944-1	9999 COUNTS	± 0.05%	± 0.05%	11/22/05	12 MO
REF 10	LOAD CELL 3000 LB	37781	3200 LB	± 0.0005%	± 0.05%	11/22/05	12 MO

Total Measurement Uncertainty: (+/-) ERROR: Missing Length and/or Force

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Certificate of Calibration

Calibration Performed By:
 Link Engineering Company
 43855 Plymouth Oaks Blvd.
 Plymouth, MI 48170, USA
 (734) 453-0800

Calibration Performed For:
 Link Testing Laboratories
 13840 Elmira Ave
 Detroit, Michigan 48227

Project Description: Dynamometer B4
Link Work Order Number: 063084
Report Number: 904070-5-2006
Certificate Number: 6814392007
Calibration File Name: 063084 - 681439.cal
Calibration Date: 5/5/2006
Next Calibration Date: 5/5/2007
Procedure Used: 2 Pressure Calibration
Technician: M Curtis M. Perry
Technician's Initials: M.C.

Item Description: Pressure Air A-End
Manufacturer: Sensotec
Condition: Good
Serial Number: 681439
Model Number: TJE-3897-05TJG
Instrument Range: 200 PSI
Rated Full-Scale: 200 PSI
Temperature: 70 F
Relative Humidity: 30 %
Calibration Site: (Unspecified)

Calibration Standard Value (PSI)	Initial "As Found" Value (PSI)	Calibration Standard Value (PSI)	Final Calibrated Value (PSI)	Initial Percent (%) of Full Scale Range (FSR) Error	Final Percent (%) of Full Scale Range (FSR) Error
0.0	0.0	0.0	0.0	.000%	.000%
25.0	25.0	25.0	25.0	.000%	.000%
50.0	50.0	50.0	50.0	.000%	.000%
75.0	75.0	75.0	75.0	.000%	.000%
119.9	120.1	119.9	120.1	.100%	.100%

	PRE-CAL	POST-CAL
Maximum % of full-scale error observed:	0.100%	0.100%
Maximum % of FSR error allowable (+/-):	1.000%	1.000%
Pre-Calibration Status:	Instrument met required accuracy	
Post-Calibration Status:	Instrument meets required accuracy	

Technical Comments:

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with NIST technical note 1297. All measurements are traceable to NIST. This calibration was performed in accordance with the requirements of ISO/IEC 17025:2005 and applies only to the item listed above.

Calibration Equipment Utilized:

Ref #	Description	Serial Number	Range	Accuracy	Uncertainty	Last Cal	Cal Due
REF 3	DISPLAY MODULE	13944-1	9868 COUNTS	+/- .01%	1/15/05	11/9/2005	12/15/05
REF 5	PRESSURE CELL 200 PSI	812263	200 PSI	+/- .25% FSR	% FSR +/- .25	11/9/2005	12/15/05

Total Measurement Uncertainty: (+/-) ERROR: Invalid units of 'counts' for 'range'; the conversion returns 26

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Certificate of Calibration

Calibration Performed By:
 Link Engineering Company
 43855 Plymouth Oaks Blvd.
 Plymouth, MI 48170, USA
 (734) 453-0800

Calibration Performed For:
 Link Testing Laboratories
 13840 Elmira Ave.
 Detroit Michigan 48227

Project Description: Dynamometer 84
 Link Work Order Number: 063084
 Report Number: 904070-5-2006
 Certificate Number: 390(FWD)2007
 Calibration File Name: 063084 - 390(FWD).cal
 Calibration Date: 5/5/2006
 Next Calibration Date: 5/5/2007
 Procedure Used: 1 Torque Calibration
 Technician: M.Curtis-M.Perry
 Technician's Initials: M.C.

Item Description: Torque A-End Forward
 Manufacturer: Lebow
 Condition: Good
 Serial Number: 390(FWD)
 Model Number: 3157
 Instrument Range: 10000 lb
 Rated Full-Scale: 20000 lb-ft
 Temperature: 70 F
 Relative Humidity: 30 %
 Calibration Site: (Unspecified)

Calibration Standard Value (lb-ft)	Initial "As Found" Value (lb-ft)	Calibration Standard Value (lb-ft)	Final Calibrated Value (lb-ft)	Initial Percent (%) of Full Scale Range (FSR) Error	Final Percent (%) of Full Scale Range (FSR) Error
0.0	0.0	2.5	1.8	.000%	-.004%
3514.0	3498.9	3424.5	3413.8	-.074%	-.054%
7484.4	7465.2	7544.4	7535.7	-.096%	-.043%
10995.4	10974.0	11124.0	11120.4	-.107%	-.018%
15050.6	15030.9	14996.0	14995.4	-.098%	-.003%

	PRE-CAL	POST-CAL
Maximum % of full-scale error observed:	-0.107%	-0.014%
Maximum % of FSR error allowable (+/-):	1.000%	1.000%
Pre-Calibration Status:	Instrument met required accuracy	
Post-Calibration Status:	Instrument meets required accuracy	

Technical Comments:

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with NIST technical note 1297. All measurements are traceable to NIST. This calibration was performed in accordance with the requirements of ISO/IEC 17025:2005 and applies only to the item listed above.

Calibration Equipment Utilized:

Ref #	Description	Serial Number	Range	Accuracy	Uncertainty	Last Cal	Cal Due
REF 3	DISPLAY MODULE	12344-1	2000 COUNTES	±.00%	±.00%	11/02/06	12 MO
REF 10	LOAD CELL 3000 LB.	07761	3000 LB	±.05%	±.05%	11/02/06	12 MO

Total Measurement Uncertainty: (+/-) ERROR: Missing Length and/or Force

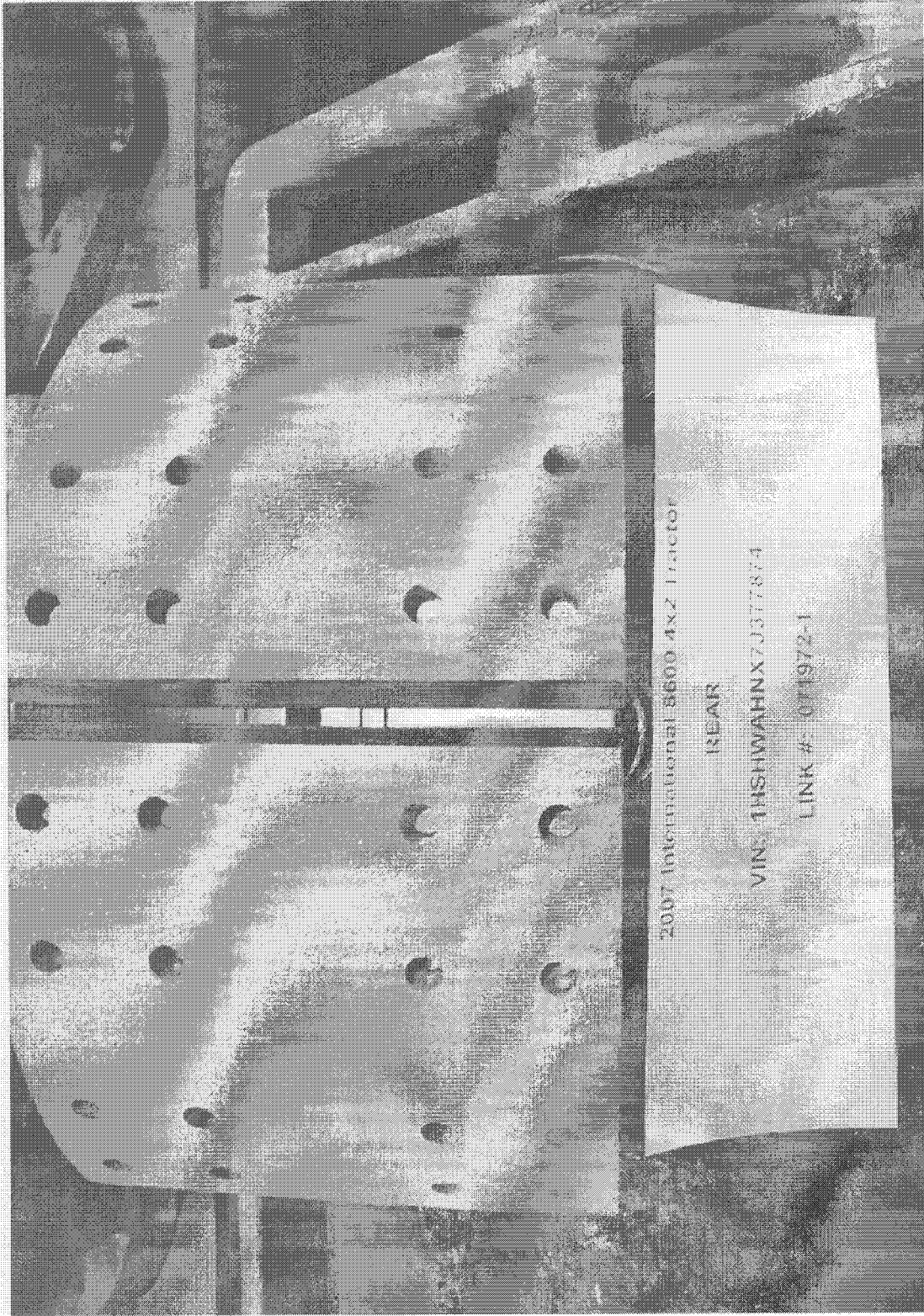
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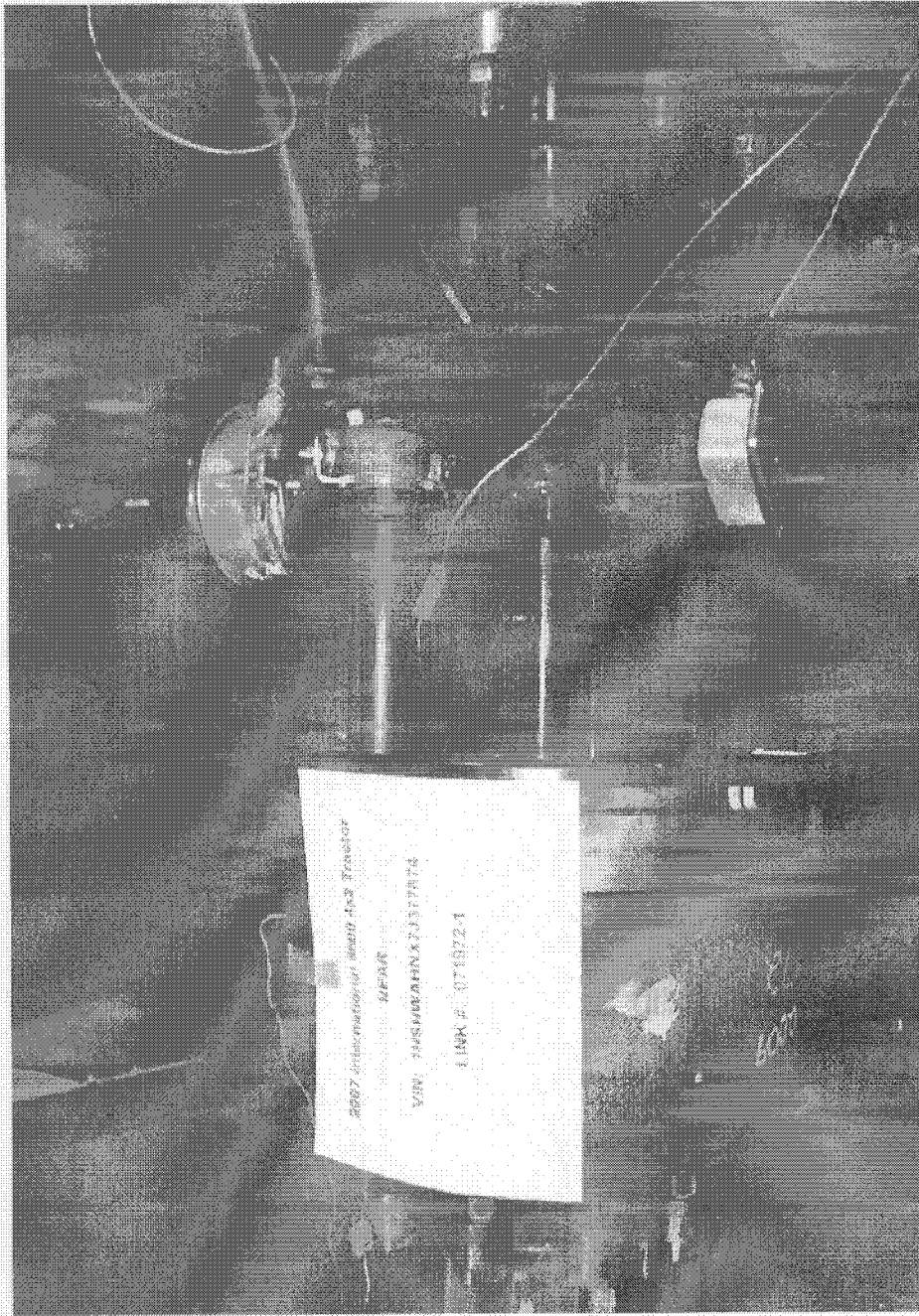
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SECTION V
DYNAMOMETER
BRAKE ASSEMBLY
SET UP
PHOTOGRAPHS

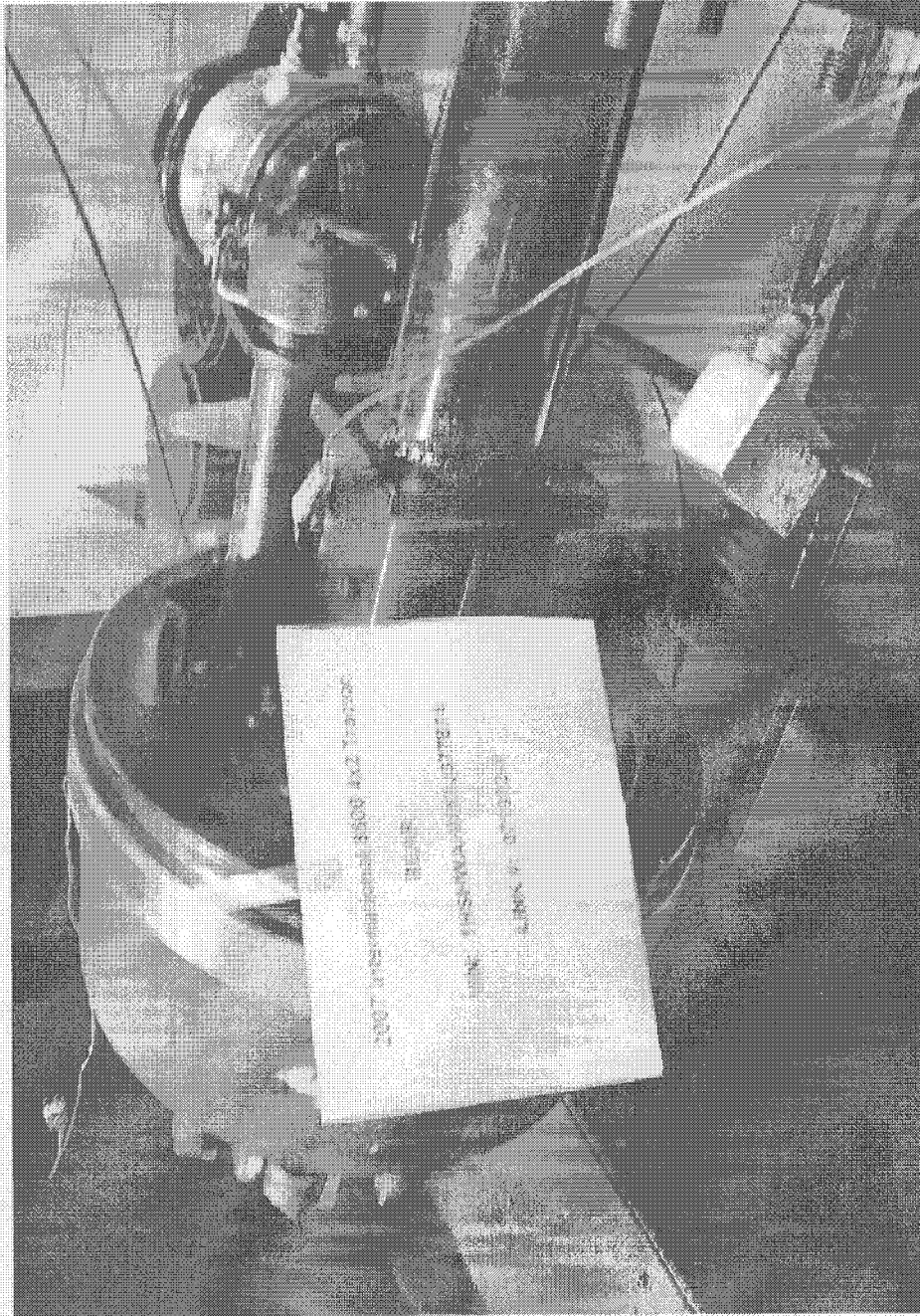
Thermocouple Installation



Dynamometer Setup



Dynamometer Setup



Link Test #: 071972-1

**Link Testing Laboratories, Inc.
Brake Dynamometer Testing**

Cust Ref: 121D-LTL-06-006

Test Description

NHTSA FMVSS121-2007 INTERNATIONAL 8600 REAR

Test Information

Test Requestor:	NAT'L HWY TRAFFIC SAFETY	n:\data\2
Requested By:	James Jones	
Test Procedure:	Fmvss121	
Link Control Program:	W05002A0	
Dynamometer:	84	
Fixture ID:	066652-1	
Test Coordinator:	NICHOLSON, ALEX	
Test Technician:	WK	
Date Started:	04/02/07	
Date Completed:	04/03/07	
Date Parts Received:	3/28/2007	
Datalog Version:	2.56	

Dynamometer Information

Rolling Radius:	19.8 inch	502.9 mm
Required Wheel Load:	10000 lb	4536 Kg
Actual Wheel Load:	10101 lb	4582 Kg
Gross Axle Weight:	20000 lb	9072 Kg
Required Inertia:	846.6 slug-ft ²	1147.8 Kg-m ²
Actual Inertia:	855.2 slug-ft ²	1159.5 Kg-m ²
Air Chamber:	MGM 30/30 LONG STROKE	
Slack Adjuster:	Spicer 5.5" Automatic	

Brake Information

Brake Type:	2007 INT'L 8600 REAR
Brake Size:	16.5 X 8.62
Assy P/N:	GUNITE 3807AX
Pri/Lead/Inner Lining:	EES 450
Sec/Trail/Outer Lining:	EES 450
Drum/Rotor Type:	CAST
Brake Orientation:	Left

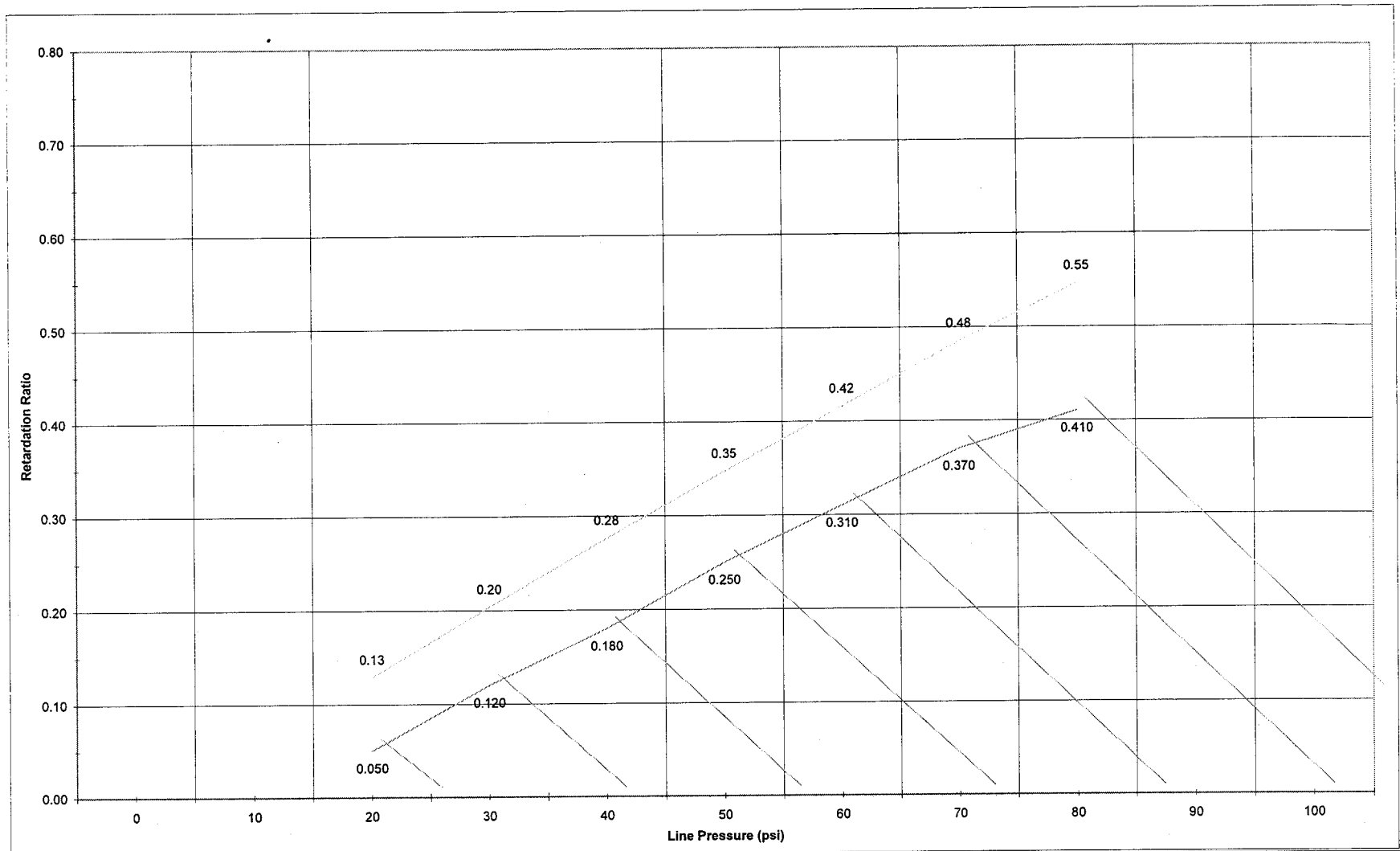
Final Comments:

Link
Signature:

Title:

Date:

Data applicable to the materials tested. Valid if signed by the test engineer. Report can be copied in full. Bilateral uncertainty of measurements 0.63% of FS. Coverage factor of 2. Confidence of 95%. Details available upon request.



Link Test #:	071972-1	Brake Type:	2007 INT'L 8600 REAR	
Cust Ref:	LTL-DOT-067453-001	Rolling Radius (in):	19.8	RETARDATION RATIO
Link Control Program:	W05002A0	Slack Adjuster:	SPICER 5.5"	
Actual Wheel Load (lb):	10101.5	Pri/Lead/Inner Lining:	EES 450	
Actual Inertia (slug/ft ²):	855.18	Sec/Trail/Outer Lining:	EES 450	