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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

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August 22, 2012

Reply to:

Larry Hamilton

The Lubrizol Corporation

29400 Lakeland Blvd.

Wickliffe, Ohio 44092

(440) 347-2326

Larry.Hamilton@lubrizol.com

ASTM D02.B0.03 L-60-1 Surveillance Panel

Members and Guests:

Attached for your review and comments are the unconfirmed minutes of the August 8, 2012

L-60-1 Surveillance Panel meeting held at LRI; Warrendale, PA

Please direct any corrections or comments to my attention.

Sincerely,

Larry Hamilton; Chairman

L-60-1 Surveillance Panel

ASTM L-60-1 (D5704) Surveillance Panel Meeting Minutes

Warrendale, PA

08/09/2012

Attendees: voting member in BOLD

Afton	S. Higuchi (Phone), T. Gottwald, D. Bell, T. Boschert, K. Hobson
AAM	J. Dharte
Chevron	J. Zakarian
ExxonMobil	R. Banas , P. Kanga
Intertek	D. Smith , A. Trader
Lubrizol	L. Hamilton ; W. Venhoff, J. Gropp, M. Umerley
Meritor	B. McGlone
SwRI	B. Koehler , R. Thorpe
TMC	S. Parke , J. Clark
Volvo	A. Athey

Sign-in and review of membership

Attendance was taken and voting membership reviewed. Rob Banas replaced Steve Elliott (voting member) from Exxon Mobil. Allison Athey replaced Tom Bryson (voting member) from Volvo.

Motioned by Brain Koehler (SwRI) and **Seconded** by Dale Smith (Intertek) to except this voting membership change. Passed 6-0-0 (voting count will increase by two for the remainder of this meeting)

The sign-in sheets are included; see attachment.

Review of Agenda

The Agenda was reviewed and is included; see attachment

Approval of meeting minutes

May 8; 2012, Surveillance Panel Meeting

June 20; 2012, Surveillance Panel Meeting Conference Call

June 28, 2012, Surveillance Panel Meeting Conference Call

Motioned by Dale Smith (Intertek) and **Seconded** by Brain Koehler (SwRI) to except the three (3) sets of minutes. **Passed** 8-0-0

State of the L-60-1 test

Larry Hamilton (Lubrizol) reported; Pentane / Toluene changes have not been incorporated into Analytical Labs procedure. New Gear set have been approved for use. Current alternator is not available for purchase we are looking into a replacement.

Information Letter 10-1

Larry Hamilton (Lubrizol) reported that the latest version of the test procedure D5704-12 states that “this edition incorporates revisions in all Information Letters through 11-2”. In fact Information Letter 10-1 was not incorporated into this version. Frank Farber of the TMC will follow up with ASTM to ensure its addition later this year.

New Alternator Presentations

Ryan Thorpe (SwRI) and Angela Trader (Intertek) reported on their experiments with new alternators (see attachments). We discussed possible calibrations of the alternators or the use of torque meters. The decision of the group is we will address the replacement of a new alternator in steps. The first step is to select and purchase an alternator. Next steps would include, but not limited to, calibration of alternators; and possible use of a torque meter. This topic will be on the November agenda.

Motioned by Brain Koehler (SwRI) and **Seconded** by Dale Smith (Intertek) ; All Labs shall purchase and adapt the Remy part number 91751 alternator, as a modification to test procedure D5704; Annex A7, section 6.1.7, and foot note 13, affective, on a stand by stand basis, starting with the next reference test(s), after the information letter is issued. The old procedural alternator will not be allowed for use on a stand after the conversion on that stand takes place. The Testing Laboratories should use the fan and pulley standard to this alternator model or they may replace the pulley for use with a serpentine belt as long as the belt drive ratio remains at 1 to 1. **Passed 8-0-0**

Action Item: All Labs should contact Ryan Thorpe with the number of alternator they will plan to order

New Business

There was no new business brought up for discussion.

Adjournment

Motioned by Dale Smith (Intertek) and **Seconded** by Wes Venhoff (Lubrizol); to adjourn meeting.

Passed 8-0-0

Respectfully Submitted;



Larry Hamilton

L-60-1 Surveillance Panel Chairman

L-60-1 Surveillance Panel

August 8, 2012

Warrendale, PA

Agenda

- I. Call to Order
- II. Membership and agenda review
- III. Approval of the May 2012 SP meeting minutes; Conference Calls June 20 and 29 meeting minutes
- IV. State of the L-60-1
- V. Information Letter 10-1
- VI. New Alternator; presented by Ryan Thorpe (SwRI) and Angela Trader (Intertek)
- VII. New Business
- VIII. Adjournment

*For those not traveling, the call in number will be 216-706-7052; Code 324160

ASTM L-60-1 Surveillance Panel Membership/Mailing List

Meeting Date: August 8, 2012

Present / Initial	Name	Voting Status	Company Name & Address	Phone & Fax & E-Mail
AA	Athey, Allison	Non-voting	Volvo Group Trucks Technology 13302 Pennsylvania Avenue Hagerstown, Maryland 21740	Phone: 301-573-5684 Fax: E-Mail: allison.athey@volvo.com
ROB	Banas, Rob	Non-voting VOT.	ExxonMobil Fuels Lubricants & Specialties 114 Arcadia Park Drive Canton, GA 30114	Phone: 678-493-3930 Fax: E-Mail: rob.a.banas@exxonmobil.com
DB	Bell, Don	Non-voting	Afton Chemical Corporation 500 Spring Street Richmond, Virginia 23219	Phone: 804-788-6332 Fax: 804-788-6342 E-Mail: Don.Bell@aftonchemical.com
MB	Boschert, Tom	Non-voting	Afton Chemical Corporation 500 Spring Street Richmond, Virginia 23219	Phone: 804-788-5202 Fax: 804-788-6342 E-Mail: Tom.Boschert@aftonchemical.com Don.Bell@aftonchemical.com
	Bryson, Tom	Non-voting	Volvo Trucks 13302 Pennsylvania Avenue Hagerstown, Maryland 21740	Phone: 301-790-5454 Fax: 301-790-6744 E-Mail: tom.bryson@volvo.com
	Chambers, Harold	Non-voting	43945 Merrill Rd. Sterling Hts., MI 48314	Phone: (586) 770-4694 Fax: E-Mail: haroldchambers@gmail.com
JAC	Clark, Jeff	Non-voting	ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, Pennsylvania 15206	Phone: 412-365-1032 Fax: 412-365-1047 E-Mail: jmf@astmtmc.cmu.edu
	Comfort, Allen	Non-voting	AMSTA-TR-D/210 (Allen Comfort) U S Army Tank, Automotive, and Armament Command Warren, Michigan 48397-5000	Phone: 586-574-4225 Fax: 586-574-4244 E-Mail: comforta@cc.tacom.army.mil
AND	Dharte, John	Non-voting	American Axle IDAUCH DRIVE DETROIT, MI 48214	Phone: 313 758 4687 Fax: E-Mail: DHARTJE@aam.com
	Dwoenick, Bridget	Non-voting	AMSTRD-TAR-D/210 6501 E.11 Mile Rd Warren,MI 48397-5000	Phone: 586-574-4222 Fax: 586-574-4244 E-Mail: rachel.jackman@us.army.mil

* Initial to indicate attendance at subject meeting

ASTM L-60-1 Surveillance Panel Membership/Mailing List


Meeting Date: August 8, 2012

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	Eliot, Stephen W.	Non-Voting	Commercial Vehicle Lubricants ExxonMobil Lubricants & Specialties Leesburg, Virginia	Phone: 703-669-9916 Fax: 703-669-9917 E-Mail: stephen.w.eliot@exxonmobil.com
TG	Gottwald, Thomas	Non-voting	Afton Chemical Corporation 500 Spring Street Richmond, Virginia 23219	Phone: 804-788-5230 Fax: 804-788-6358 E-Mail: thomas.gottwald@aftonchemical.com
	Greene, Galen	Non-voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-2394 Fax: 440-347-2878 E-Mail: galen.greene@lubrizol.com
JH	Gropp, Jerry	Non-voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-1223 Fax: 440-347-1555 E-Mail: jerrold.gropp@lubrizol.com
/	Hamilton, Larry	Voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-2326 Fax: 440-347-2878 E-Mail: larry.hamilton@lubrizol.com
PHONE	Higuchi, Sam	Voting	Afton Chemical Corporation 500 Spring Street Richmond, Virginia 23219	Phone: 804-788-5375 Fax: 804-788-6358 E-Mail: samuael.higuchi@aftonchemical.com
	Huron, John	Non-voting	Chevron Oronite 4502 Centerview Drive, Suite 210 San Antonio, Texas 78228	Phone: 210-731-5609 Fax: 210-731-5699 E-Mail: HURO@ChevronTexaco.com
PK	Kanga, Percy R.	Non-Voting	Commercial Vehicle, Marine & Gas Engine Lubricants ExxonMobil Research & Engineering 600 Billingsport Road Paulsboro, NJ. 08066	Phone: 856-224-2094 Fax: 856-224-3613 E-Mail: percy.r.kanga@exxonmobil.com
	Kearney, Bill	Non-voting	Afton Chemical Corporation 500 Spring Street Richmond, Virginia 23219	Phone: 248-350-0640 Fax: E-Mail: bill.kearney@aftonchemical.com
	Koehler, Brian	Voting	Southwest Research Institute 6220 Culebra Road Bldg.209 San Antonio, TX 78238-5166	Phone: (210) 522-3588 Fax: (210) 684-7523 E-Mail: bkoehler@swri.org

* Initial to indicate attendance at subject meeting

ASTM L-60-1 Surveillance Panel Membership/Mailing List

Meeting Date: August 8, 2012

Present / Initial	Name	Voting Status	Company Name & Address	Phone & Fax & E-Mail
	Marougy, Thelma	Non-voting	Eaton Corporation 26201 Northwestern Highway Southfield, Michigan 48037	Phone: 248-354-6985 Fax: 248-354-2739 E-Mail: thelmaemarougy@eaton.com
/	McGlone, Bruce	Voting	Meritor 2135 West Maple Troy, Michigan 48084	Phone: 248-435-9929 Fax: 248-435-1411 E-Mail: Bruce.McGlone@meritor.com
	Muransky, Troy	Non-voting	Meritor 2135 West Maple Troy, Michigan 48084	Phone: 248-435-1407 Fax: E-Mail: troy.muransky@meritor.com
	Parke, Scott	Voting	ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, Pennsylvania 15206	Phone: 412-365-1030 Fax: 412-365-1047 E-Mail: fmf@astmtmc.cmu.edu
	Recinos, Will	Non-voting	Afton Chemical Corporation 500 Spring Street Richmond, Virginia 23219	Phone: 804-788-5323 Fax: E-Mail: william.recinos@aftonchemical.com
	Shah, Rajesh	Non-voting	Koehler Instrument Company 1595 Sycamore Avenue Bohemia, New York 11716	Phone: 516-589-3800 Fax: 516-589-3815 E-Mail:
/	Smith, Dale	Voting	Intertek Automotive Research 5454 Bandera Rd San Antonio TX 78238	Phone: 412-855-6854 Fax: E-Mail: Dale.Smith@intertek.com
	Sullivan, Bill	Non-voting	WTSullivan, Inc. 5 Scheiber Drive Brick, New Jersey 08723	Phone: 908-930-3512 Fax: 267-220-7750 E-Mail: wtsullivan@comcast.net
/	Trader, Angela	Non-voting	Intertek Automotive Research 5454 Bandera Rd San Antonio TX 78238	Phone: 210-706-1533 Fax: E-Mail: angela.trader@intertek.com
	Ved, shintan	Non-voting	Ford- Trans & Driveline Lubrication 35500 Plymouth Rd. Livonia, MI 48150	Phone: 313-805-9695 Fax: 267-220-7750 E-Mail: cved@ford.com

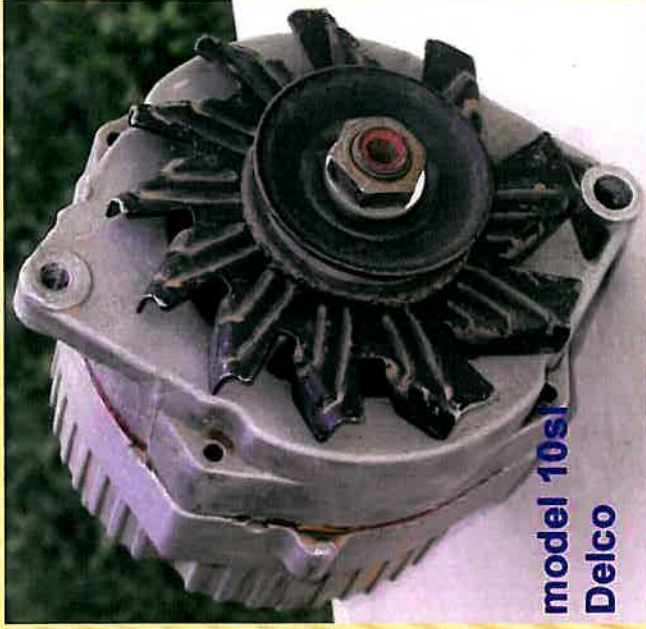
* Initial to indicate attendance at subject meeting

ASTM L-60-1 Surveillance Panel Membership/Mailing List

Meeting Date: August 8, 2012

Present / Initial	Name	Voting Status	Company Name & Address	Phone & Fax & E-Mail
WVE	Venhoff, Wes	Non-voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-4879 Fax: 440-347-2878 E-Mail: wes.venhoff@lubrizol.com
	Villahermosa, Luis	Non-voting	AMSTA-TR-D/210 (Luis Villahermosa) U S Army Tank, Automotive, and Armament Command Warren, Michigan 48397-5000	Phone: 586-574-4207 Fax: 586-574-4123 E-Mail: villahel@cc.tacom.army.mil
/	Zakarian, Jack	Non-voting	Chevron Products Company 100 Chevron Way Richmond, California 94802-0627	Phone: 510-242-3595 Fax: 510-242-3758 E-Mail: jaza@chevron.com
	Zreik, Khaled	Non-voting	General Motors	Phone: 248-977-9214 Fax: E-Mail: khaled.zreik@gm.com
MTUE	Umerley, Matt	Non-Voting	Lubrizol	Phone: 440 347 4589 Fax: 440 347 2878 E-Mail: matthew.umerley@lubrizol.com
RT	Thorpe Ryan	Non Voting	SWRI	Phone: 210 522 6409 Fax: E-Mail: ryan.thorpe@swri.org
/	KEVIN HOBSON	N-V	AFTOK	Phone: Fax: E-Mail:
				Phone: Fax: E-Mail:
				Phone: Fax: E-Mail:
				Phone: Fax: E-Mail:
				Phone: Fax: E-Mail:

* Initial to indicate attendance at subject meeting



Preliminary L-60 Alternator Candidate Study

Ryan Thorpe
SOUTHWEST RESEARCH INSTITUTE
San Antonio, Texas



BACKGROUND

- ✘ ASTM D5704-10 Standard Test Method for Evaluation of the Thermal and Oxidative Stability of Lubricating Oils Used for Manual Transmissions and Final Drive Axles [L-60 test]
- ✘ Uses alternator to load a lubricated gear set
 - + Delco-Remy GM#1105360 Model 10-SI Type 100 63A, 12V
 - + Torque loading must be consistent

PROBLEMS

- ✗ Wattage loss during test
 - + If 128 Watts can not be held due to worn alternator, test invalid
 - ✗ Currently, worn alternators are rebuilt (reman)
 - * Reman alternator service life << New alternator service life
- ✗ Procedural GM # is not available as a new alternator
 - + 1105360 is obsolete

SOLUTIONS

- ✘ New Alternator ←
- + Focus of this study
- ✘ New Remanufactured Alternator
- ✘ Rebuilt Alternator

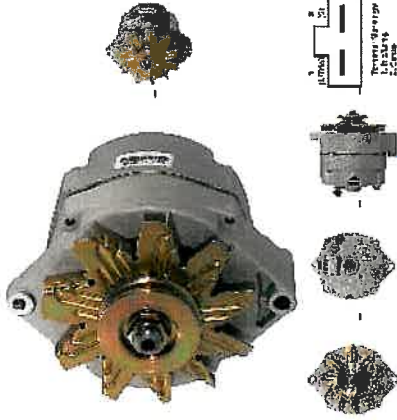
SOLUTIONS - NEW ALTERNATOR

- ✘ Is it mechanically/electrically equivalent to existing 1105360 alternator?
 - + Will replacement put equal torque load on gear set?
- ✘ Can replacement be purchased for foreseeable future?

SOLUTIONS - CANDIDATE ALTERNATOR

- ✗ Remy 91751
- + 63A, 12V 10SI model
- + 1978 Camaro, 8cyl, w/AC
- ✗ According to Delco-Remy 1105360 to 91751 relationships:
 - + Same Part numbers → "Same" parts
 - ✗ Rotor
 - ✗ Stator
 - ✗ Fan
 - ✗ Bearings
 - + Same Bill of Materials
 - ✗ Same parts assembled in the same places

Product Detail 91751 New Alternator



Part Number	91751
Status	Active
Model	DR10SI
Type	New Alternator
Vehicle System Voltage	12
Rated Output	63 Amps
Pulley Type	V-Belt
Pulley # Grooves	1
Nominal Pulley Diameter	66 mm
B+ Output Terminal	M6X1.0
Regulator Type	IR
Regulator Plug Position	3:00
Rotation	CW
Fan Type	EF

Product Detail 20039 Reman Alternator



Part Number	20039
Status	Active
Model	DR10SI
Type	Reman Alternator
Vehicle System Voltage	12
Rated Output	63 Amps
Pulley Type	V-Belt
Pulley # Grooves	1
Nominal Pulley Diameter	66 mm
B+ Output Terminal	M6X1.0
Regulator Type	IR
Regulator Plug Position	3:00
Rotation	CW
Fan Type	EF

CANDIDATE ALTERNATOR - EQUIVALENCE

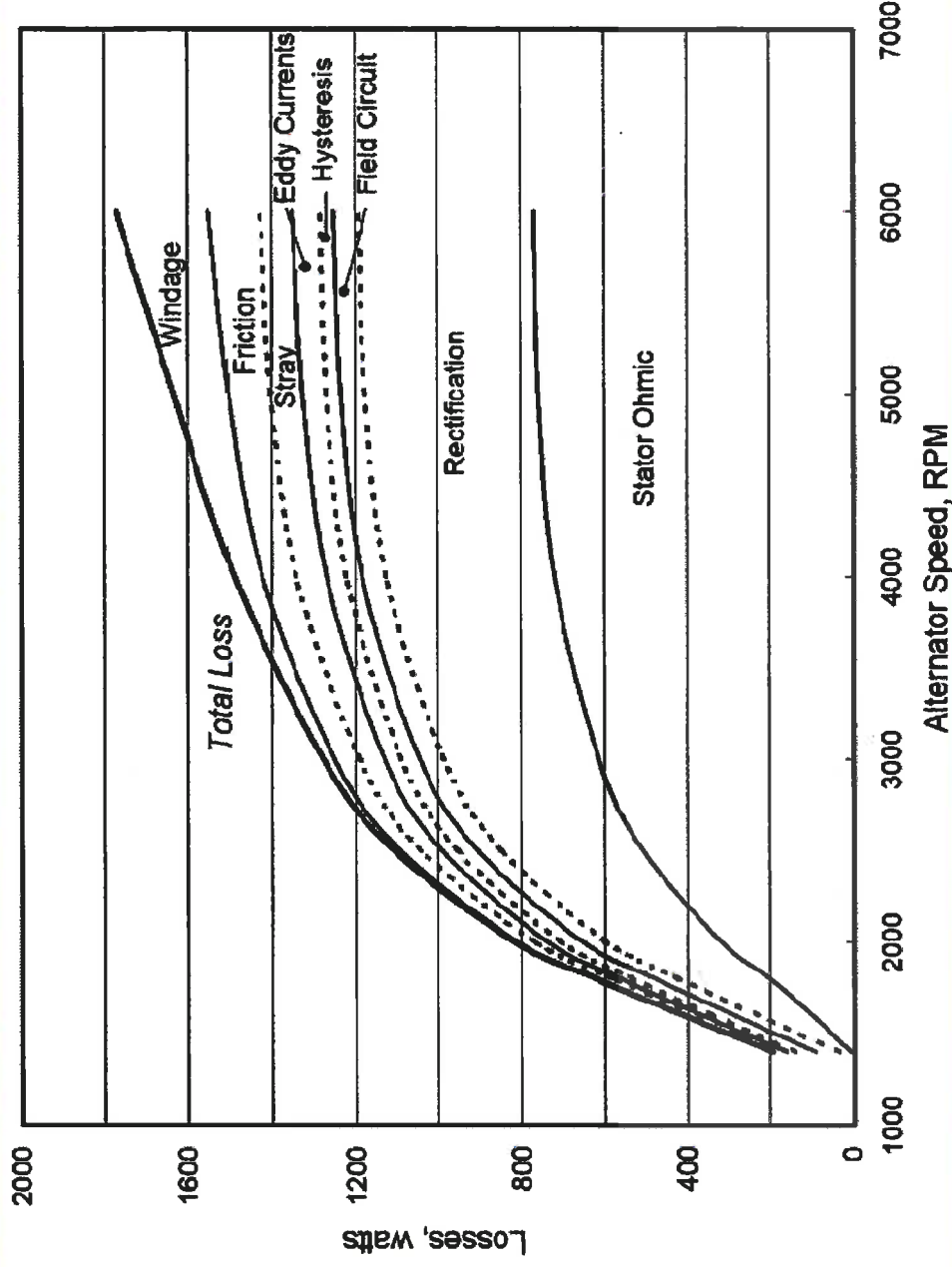
- ✗ Further technical justification needed before 1105360 and 91751 are claimed equivalent
- ✗ Quantify efficiency losses in legacy and candidate alternators
 - + Losses are equal → make equivalency claim
 - ✗ Understand operational differences, use engineering judgment to make equivalence claim
 - ✗ Build an alternator test stand, use data to make equivalence claim

EQUIVALENCE - LOSSES

Typical Alternator at Full Output conditions

Electrical	
Stator winding loss	
Rotor winding loss	
Rectifier diode voltage drop loss	
Regulator output device drop loss	
Brush drop	
Magnetic	
Eddy current	
Hysteresis	
Stray	
Mechanical	
Bearing friction	
Windage	

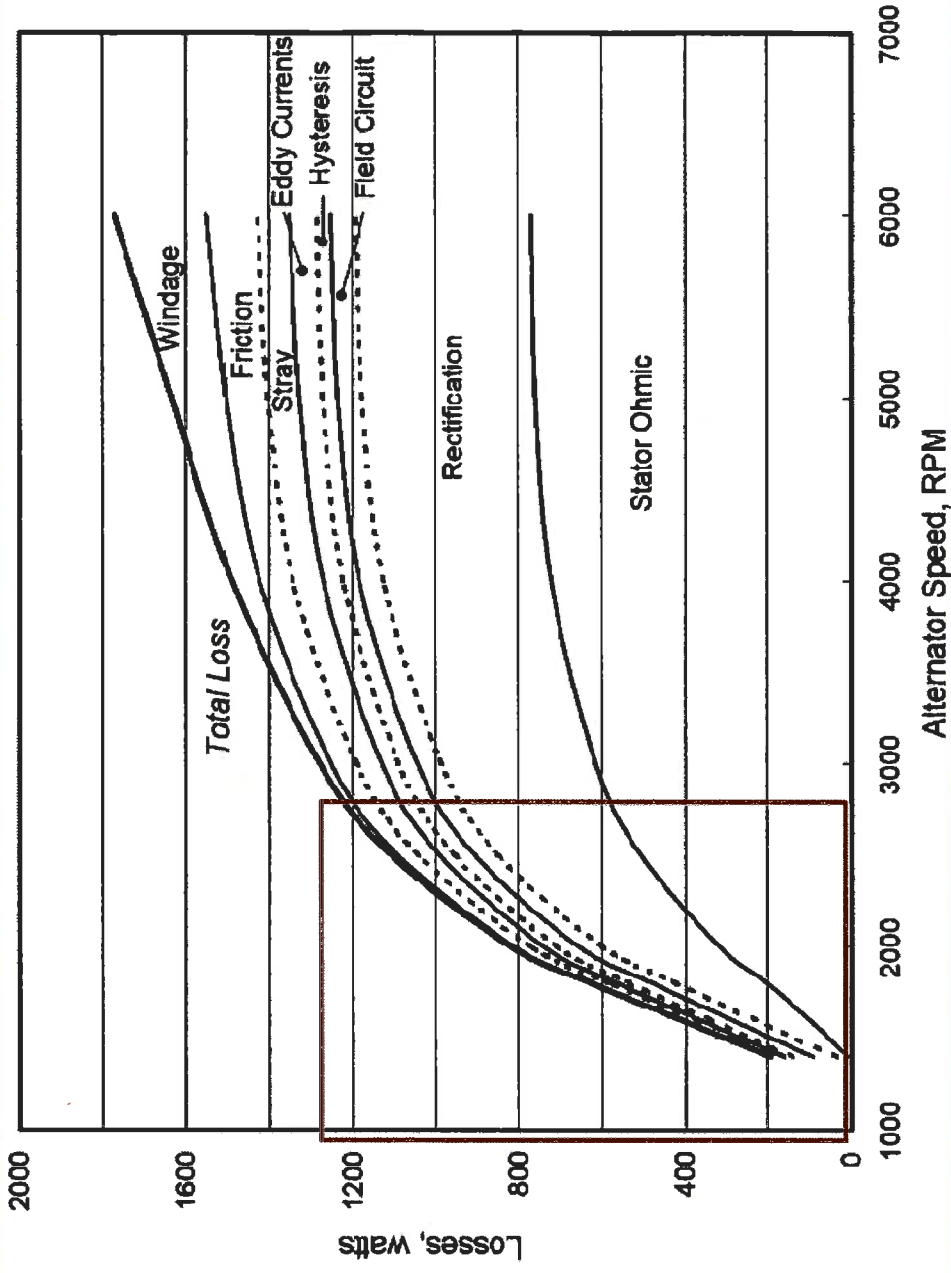
Operational Speed:
2500 RPM



✘ Remy, Inc. (2008). *Improving Alternator Efficiency Measurably Reduces Fuel Costs*. Retrieved from www.delcoremy.com/documents/high-efficiency-white-paper.aspx

EQUIVALENCE - LOSSES

- ✗ Operational Speed
- ✗ ~2500 RPM



- ✗ Remy, Inc. (2008). *Improving Alternator Efficiency Measurably Reduces Fuel Costs*. Retrieved from www.delcoremy.com/documents/high-efficiency-white-paper.aspx

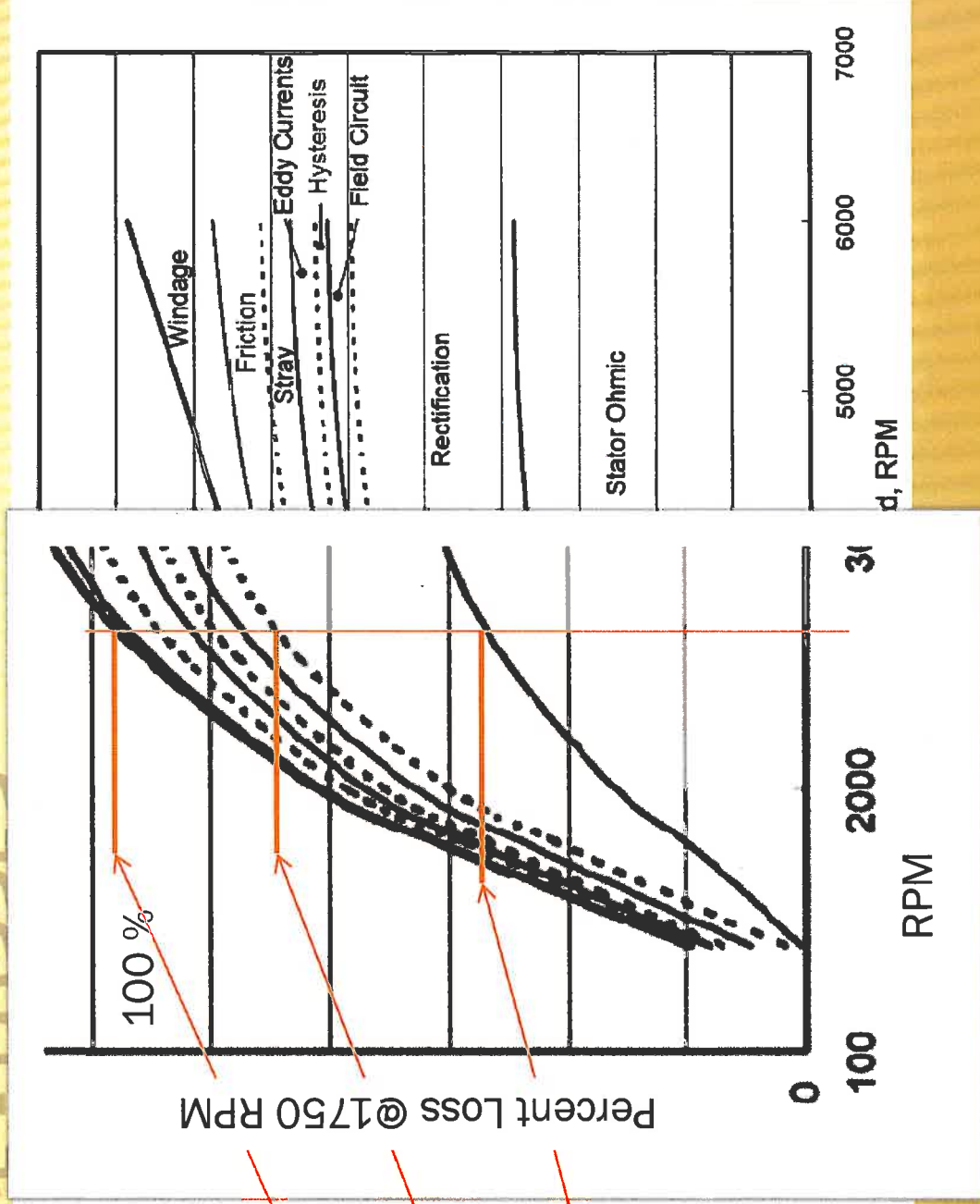
EQUIVALENCE - LOSSES

✗ Normalize Losses at 2500 RPM

✗ Mechanical/Magnetic and Windage ~ 20%

✗ Rectification Losses ~ 30%

✗ Stator Ohmic Losses ~ 50%

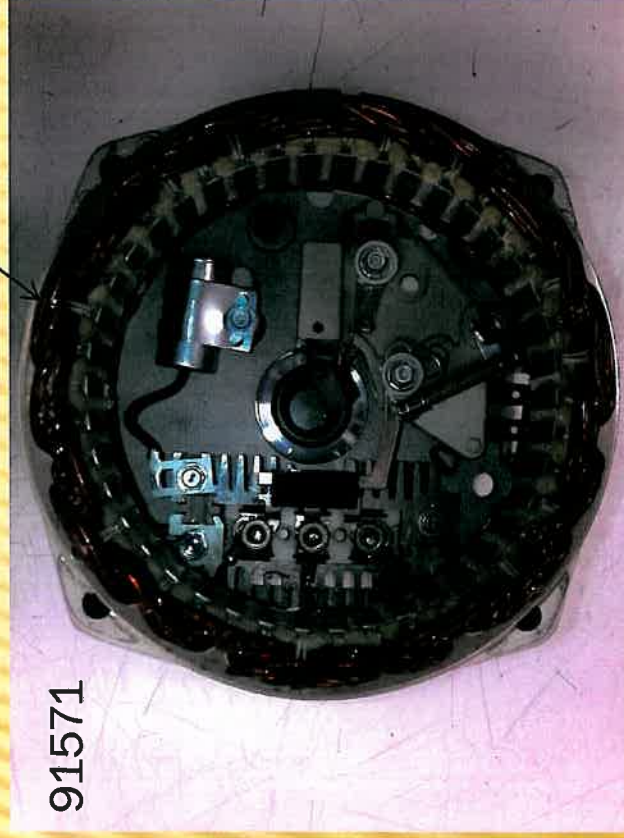


EQUIVALENCE - FINDINGS

- ✗ Ohmic losses are largest
- + Unlikely this will vary between alternators of similar design, unless the following differ:
 - ✗ Conductive materials
 - ✗ Lengths/gauges of wires

EQUIVALENCE - OHMIC LOSS

- ✗ Length of copper winding seems similar
- + Less wire → less ohmic losses → Softer gear loading

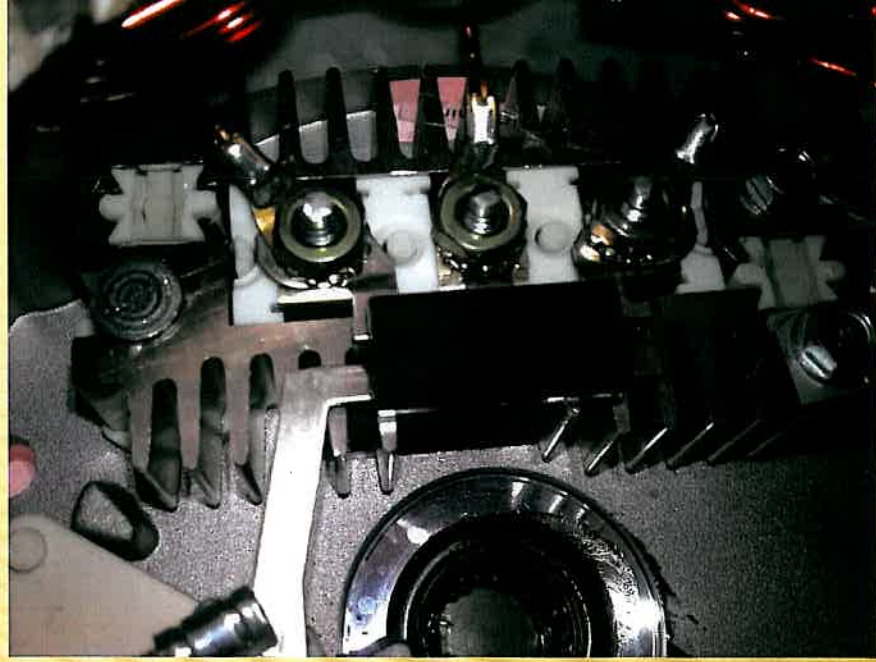


EQUIVALENCE - FINDINGS

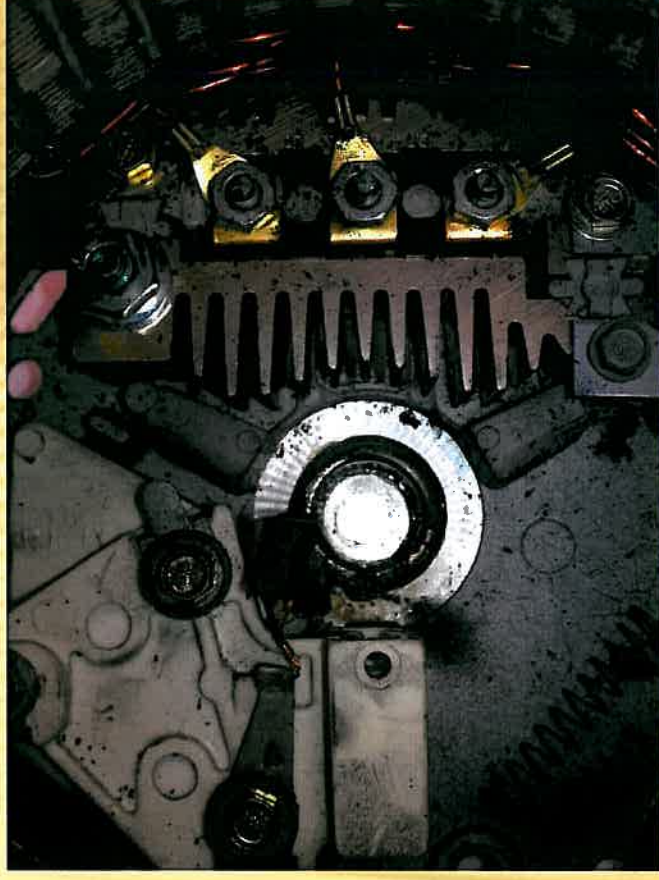
- ✗ Rectification Losses 2nd largest
- + Unlikely this will vary between alternators of similar design, unless the following differ:
 - ✗ Forward bias diode efficiency improvement

EQUIVALENCE - RECTIFICATION LOSS

- ✘ 6 rectifier diodes appear similar



91571



1105360

EQUIVALENCE - FINDINGS

- ✗ Mechanical, Magnetic, Windage losses
 - + Friction/windage losses greatest at high RPMs
 - ✗ 2500 RPM (low end) makes these losses negligible
 - + Magnetic losses
 - ✗ Unless materials or design of claw-pole/iron core drastically change losses shouldn't vary significantly

EQUIVALENCE - CONCLUSION

- ✗ Currently it appears that the 91751 alternator would be equivalent to the 1105360 alternator
 - + Based off likely hood that major “loss contributors” don’t change
 - + Developed from conversations with Delco-Remy that support mechanical/electrical equivalence
 - ✗ Same parts, same places
- ✗ η Alternator \uparrow , τ Gear set \downarrow
 - + Efficiencies of 91751 \approx 1105360
 - + Torque loading equivalent too

EQUIVALENCE - CONCLUSION

- ✘ Product availability
- + Non-binding comments from Remy indicate 91571 Alternator will be produced for the foreseeable future

CANDIDATE ALTERNATOR - PATH FORWARD

- ✘ Take efficiency analysis further and quantify how they change with new alternator
 - + Develop mathematical model
- ✘ Develop basic efficiency test stand

APPENDIX A

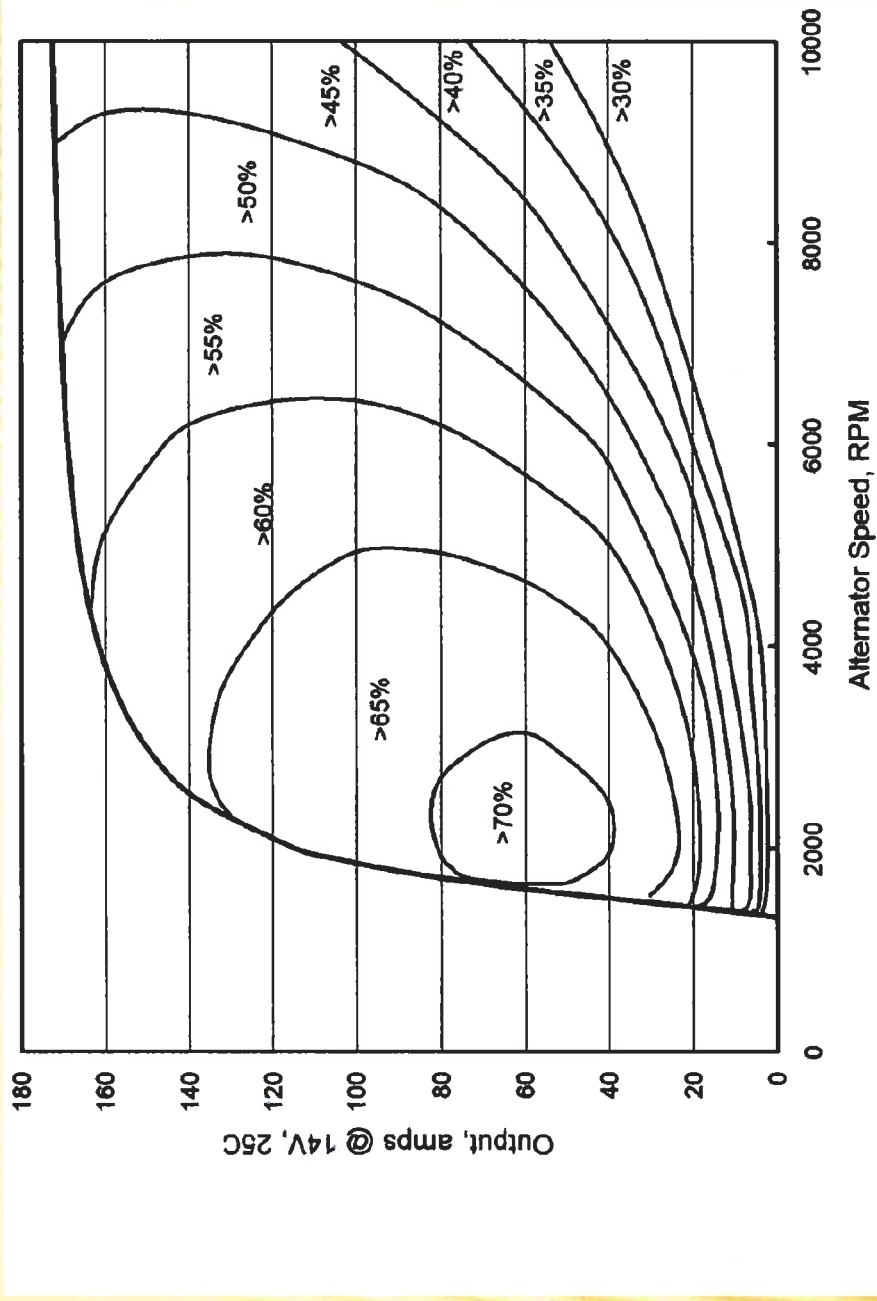
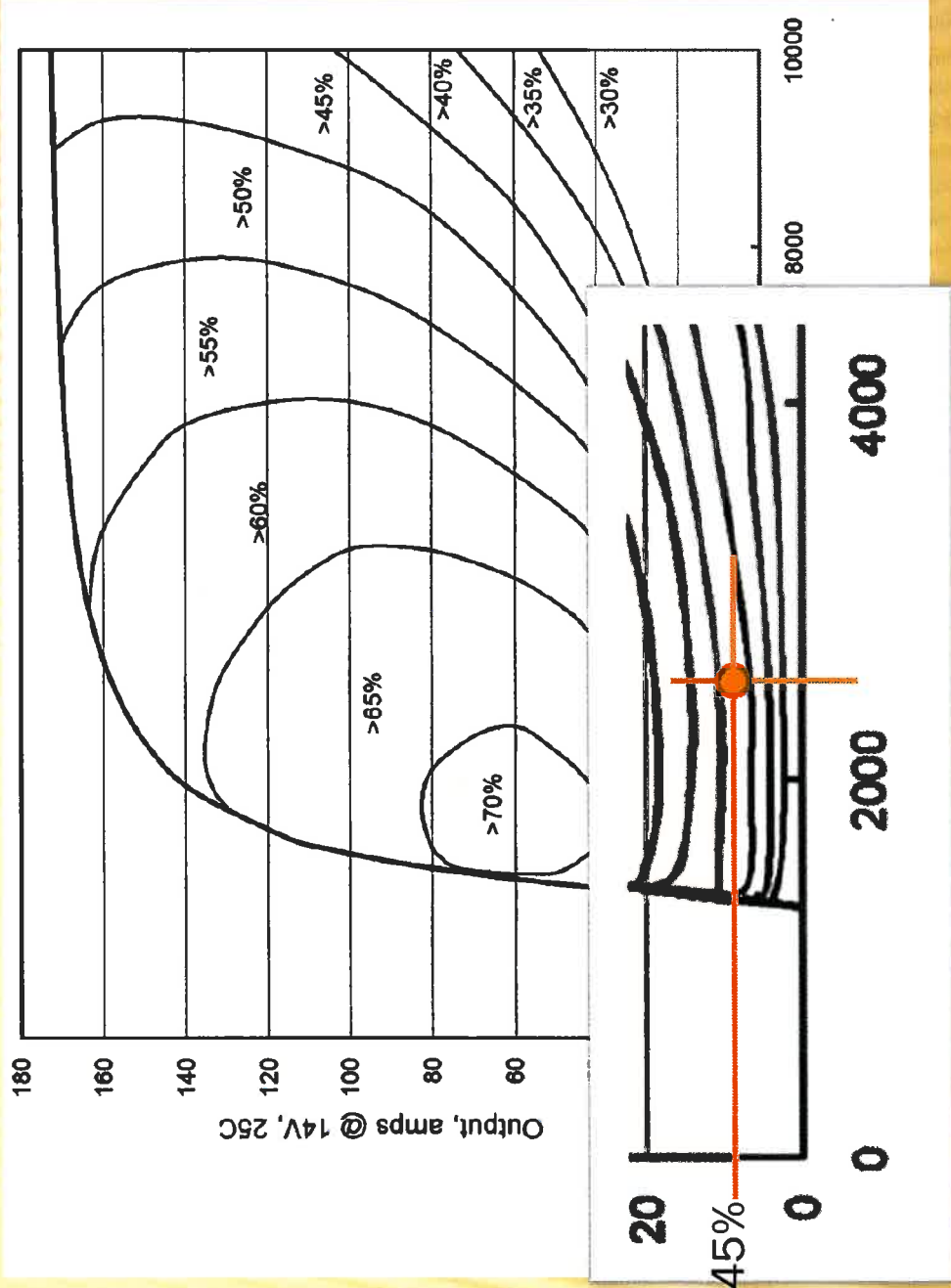


Figure 28. Alternator efficiency map

✘ Remy, Inc. (2008). *Improving Alternator Efficiency Measurably Reduces Fuel Costs*. Retrieved from www.delcoremy.com/documents/high-efficiency-white-paper.aspx

APPENDIX A

14-15 Volts
8.3 – 8.7 Amps



Alternator Efficiency ~40-45%

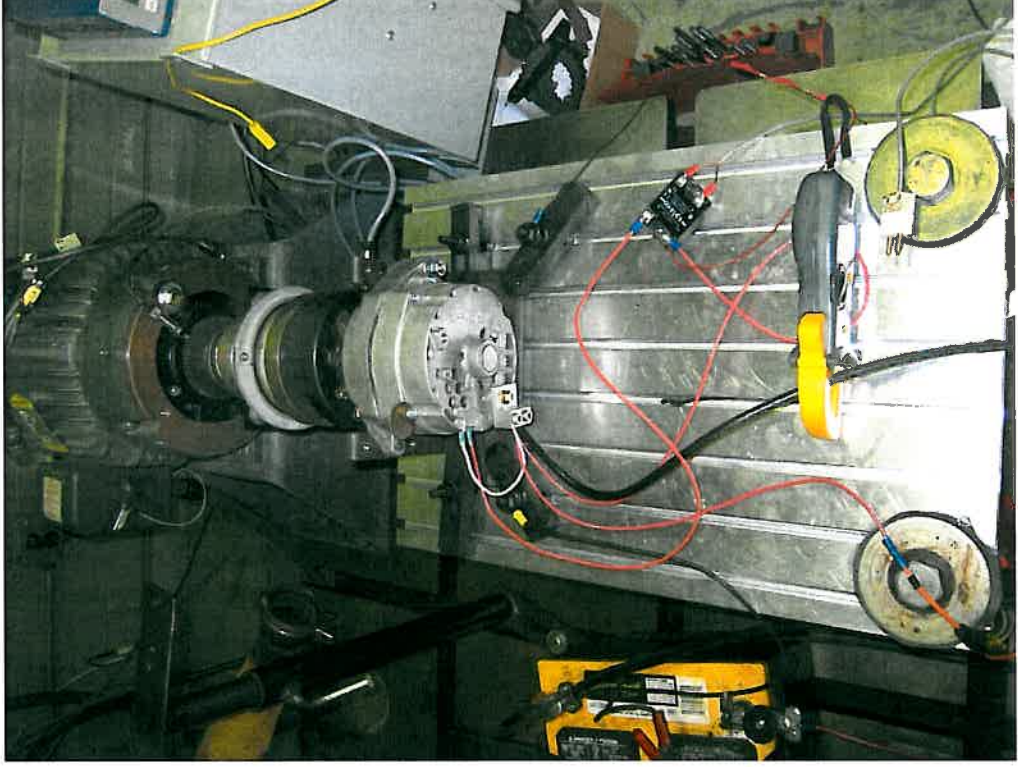
Intertek

ASTM D5704 L-60-1

Remy Alternator Option



Alternator Test Stand



Intertek

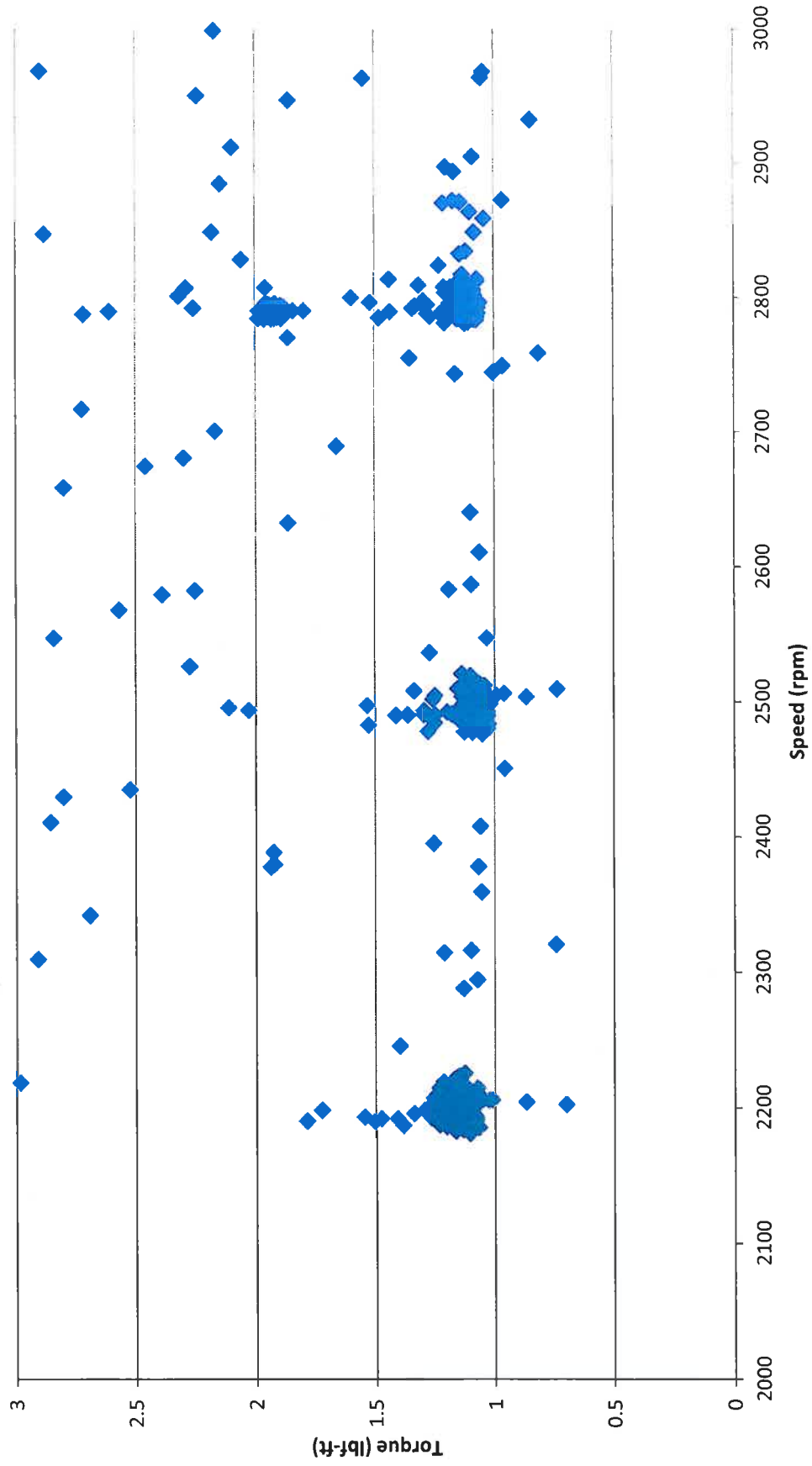
Alternator Test Stand





ASTM Specified

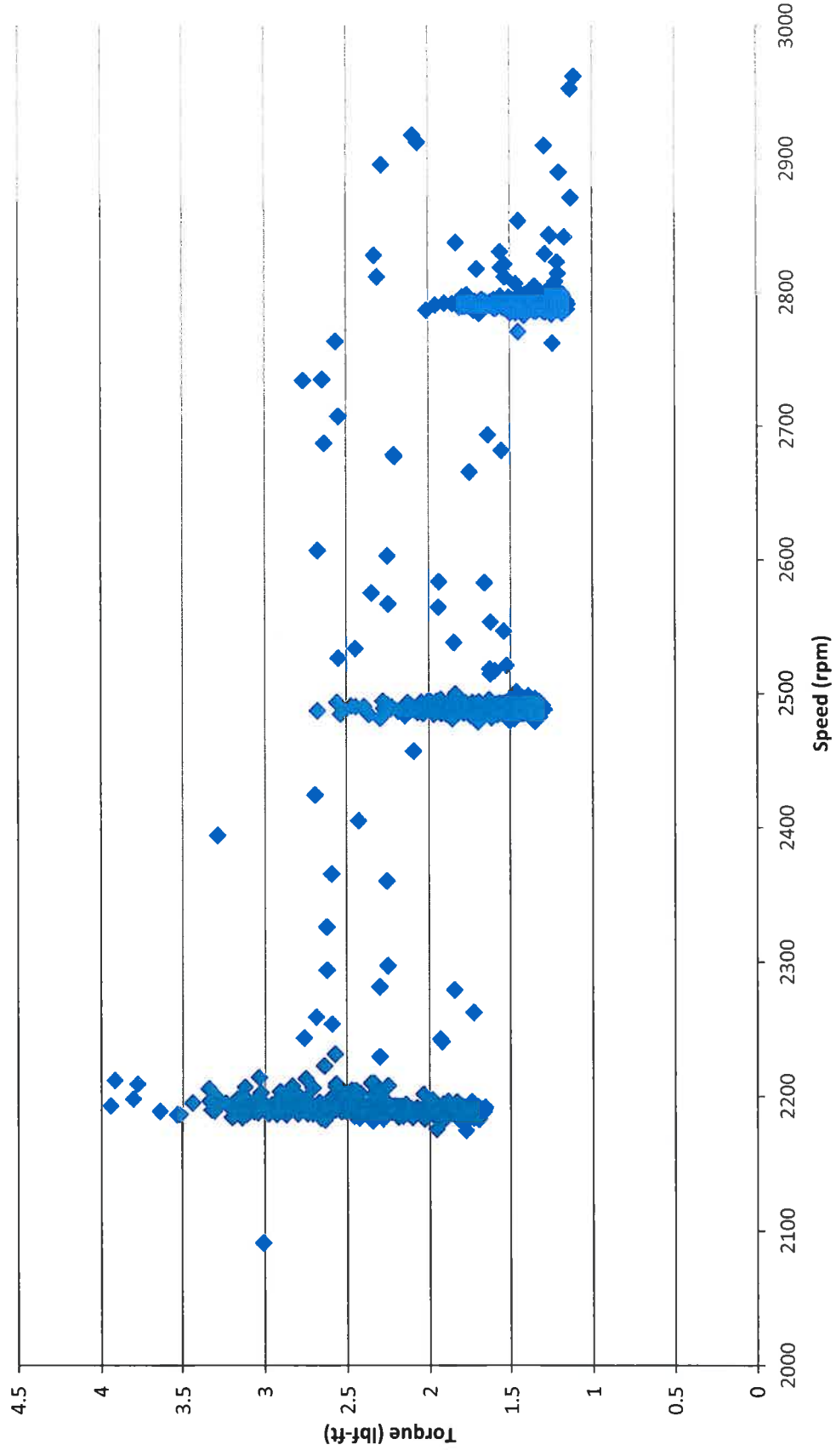
Specified Alternator Torque





Replacement Option

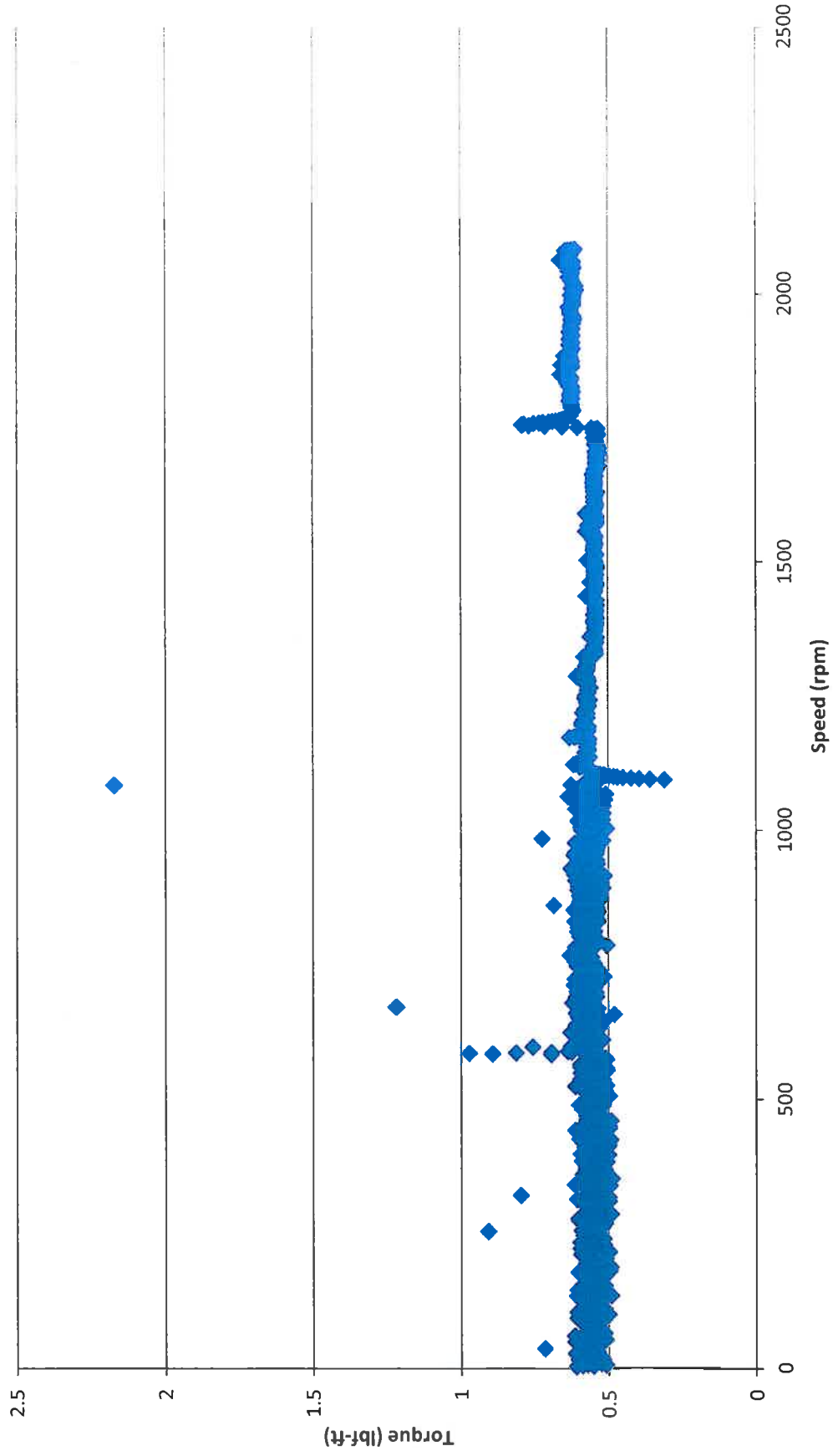
Alternator Torque





Questionable

Alternator Torque



Thank You

- **Angela Trader**
- **Sr. Project Engineer**
- **Intertek Automotive Research**
- **PH: 210-706-1533**
- **Fax: 210-684-6074**
- **www.intertek.com**
- **www.ar.intertek-cb.com**
- **8 August, 2012**