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## Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

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March 17, 2006

Reply to:

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ASTM D02.B0.03 L-37 Surveillance Panel

Members and Guests:

Attached for your review and comment are the unconfirmed minutes of the:

- o **February 8<sup>th</sup>, 2006 L-37 Surveillance Panel Meeting held at the PRI Headquarters in Warrendale, PA.**

Please direct any corrections or comments to my attention.

Sincerely,

Donald T. Bartlett, Chairman

L-37 Surveillance Panel

Attachments

**Report of Meeting**  
**L-37 Surveillance Panel**  
**PRI Headquarters, Apollo Room, Warrendale, Pa.**  
**February 8<sup>th</sup>, 2006**

**Sign-in/Review of Membership:** The meeting was called to order at 12:30 pm. The sign-in sheet is included as **Attachment 1**. Allen Comfort of Army Tacom-Tardec and Salvatore Rae, Infinium requested to join the L-37 Panel as voting members. The modified voting membership is included as **Attachment 2**.

**Meeting Agenda:** The meeting agenda was reviewed and is included as **Attachment 3**.

**Approval of Meeting Minutes:**

- ✓ August 24, 2005 Panel Meeting
- ✓ January 4, 2006 Telecom Meeting
- ✓ January 20, 2006 Telecom Meeting

**Motion 1** ⇒ Mr. Lind, Second Mr. Koehler - That we approve the minutes of the August 24, 2005, January 4, 2006, and January 20, 2006 meeting minutes as written. The motion passed unanimously with a vote of 6, 0, 0.

- ✓ Hardware TF visits to Ft. Wayne and Lugoff facilities - The hardware TF meeting minutes documenting the facility visits for the 2005 P4L792/ V1L417 Non-Lubrited hardware batch are complete and available on the TMC website for review/reference by Panel members.

**Summary of Action Items:**

- Don Kreinbring is working on finding a supplier of the specific heat code needed for the L-37 prints and a Dana quote.
- The Panel is looking for volunteers to provide a fail reference fluid to replace TMC 127. Second attempt. If so, please contact Mr. Lind at the ASTM TMC.
- Don Bartlett was tasked to follow up with Mr. Sanchez, Chairman of the GO RTF to seek further clarification and more specific details to meet the Panel request of the raters.

**Summary of Motions:**

- Motion 1 - We approved the minutes of the August 24, 2005 and the January 4, 2006 and January 20, 2006 meeting minutes with no corrections.
- Motion 2 - With respect to the P4L792/V1L47 2005 non-lubrited hardware, Phase 3 of the hardware approval matrix is that the four labs are to conduct 1 additional standard test each on TMC 152 and TMC 153. Also, the four labs to complete 1 additional Canadian test each on TMC 152 and TMC 153. The Chairman will convene a teleconference to review the results.

- Motion 3 - On behalf of the Panel, the TMC was directed to contact the company's of the 2 most consistent raters to rate the pinions only from the P4L792/V1L417 44-test hardware approval matrix. The laboratories were directed to send all of the pinions to the TMC. Phase 1 and 2 are to be sent now.
- Motion 4 - When using T758A/L247 Lubrited gear batch in the Canadian version of the L-37 test, correction factors will be in place for the pinion only to correct a ridging value of 6 to an 8 and a spitting value of 8 to a 9.3.
- Motion 5 - the T758A/L247 lubrited hardware gear batch is approved for Canadian L-37 testing, effective 2/8/06.
- Motion 6 - Effective immediately, for all approved gear batches, assign TMC 155 in place of TMC 151-3. The 1<sup>st</sup> two tests on the respective gear batch will use the TMC 151 targets. If any of the 1<sup>st</sup> two tests fail, TMC is to keep the result but the lab needs to repeat another reference on TMC 151-3. The failed TMC 155 tests are not charted until 3 valid tests on TMC 155 are available. Once the 1<sup>st</sup> three tests are gathered on TMC 155 for a gear batch, calculate a new mean using TMC 155 but use the standard deviation from TMC 151-3. After 10 tests, the mean and standard deviation for TMC 155 would be used until targets are once again updated at 20, and 30 tests.

### Summary of Meeting Discussions

- 2006 Lubrited Hardware Order Placement - the following laboratory tentative hardware order was identified.

Parc	⇒	220
SwRI	⇒	275
Afton	⇒	250
Lubrizol	⇒	<u>250</u>
<b>Count</b>		995

Binding PO's are tentatively targeting March 1<sup>st</sup>. Don Kreinbring is working on finding a supplier of the specific heat code needed for the L-37 prints. The SP agreed that another task force trip to Dana Ft. Wayne and Lugoff would be a good idea.

- 2005 Green Hardware Matrix Update P4L792/V1L417 Non-Lubrited gear batch -

The chairman shared that the yield from the P4L792/V1L417 Non-Lubrited gear batch was approximately 68 axles short of the original order of 1370. Besides the normal need for blanks to confirm the development process by Dana, some of the shortage was also due to the labs directing Dana to not include axles that didn't pass quality checks due to flaws such as surface dents on gears, excessive cutting marks, etc., requiring rework. The minutes detailing the Hardware TF are documented and posted on the TMC website.

The Chairman reviewed the action items for the laboratory to complete an industry 44-test hardware approval matrix. To date, the four labs have completed 1 test each on TMC 127 (Phase 1) and 1 test each on TMC 151-3 (Phase 2). Each of the 4 labs will equally participate in the full 44-test matrix to evaluate the 2005 Non-Lubricated hardware batch. Attachment 4 details the approval matrix initially approved by the Panel, and led us into a discussion on TMC 127, TMC 151-3 and a proposal based on the August 2005 Panel meeting action item to be discussed later in this section of our meeting.

Mr. Lind presented the current results as compared to historical gear batches. The data and charts are included as Attachments 5, and 6, and 7.

TMC conclusions from testing on TMC 127 and TMC 151-3 to date:

#### **TMC 127**

- Wear appears to be directionally milder.
- Ridging appears to be directionally milder.
- Rippling appears to be on target.
- Spitting appears to be on target.

When considering all of the data set, 3 of the 4 tests failed.

#### **TMC 151-3**

- Wear appears to be on target.
- Ridging appears to be on target.
- Rippling appears to be directionally milder.
- Spitting appears to be on target.

Attachment 7 is a 1 to 1 comparison of the TMC 127 and TMC 151-3 results on V1L417/P4L792 2005 hardware gear batch. With the limited data set, all distress levels show the oils to adequately separate at varying levels.

**Motion 2** ⇒ Mr. Lind, Second Mr. Koehler - Phase 3 of the hardware approval matrix is that the four labs are to complete 1 additional standard test each on TMC 152 and TMC 153. Also, the four labs to complete 1 additional Canadian test each on TMC 152 and TMC 153. The Chairman will convene a teleconference to review the results. The motion passed unanimously with a vote of 6, 0, and 0.

The TMC again mentioned that we only have enough TMC 127 oil for conducting a few tests on upcoming discrimination tests on new gear batches. Mr. Lind indicated that the supplier of the oil cannot make a re-blend. The Chairman reminded the Panel that an additive supplier tried unsuccessfully to develop a new fail oil in the 2004 timeframe. The Panel ended up dropping this action item during prior meetings. The subject is still of concern and the panel is again asking, are there any volunteers to provide a fail reference fluid? If so, please contact Mr. Lind at the TMC

- **Most consistent/least variable rater action item from August 2005 meeting**

The Chairman asked the TMC to share the action item request from the September Panel meeting where the Panel requested that the TMC identify the most consistent/least variable rater based on the data in the L-37 RCMS system. Mr. Lind indicated that there are possibly three raters that would fall into this category. The criteria for choosing the most consistent rater was that the rater has yet to fail the LTMS bands and that the rater never varied on a pinion rating by more than 1 merit number. See Attachment 8 for discussion purposes of one example, rater coded as "B".

At the moment, we have raters in the system that appears to be quite variable as well. The Panel went into detailed discussion on whether we wanted to use the most consistent rater philosophy to certify the mean on the P4L792/V1L417 2005 hardware batch. The disadvantages of this work are obviously time and cost. The Panel identified positive advantages for moving forward with the proposal:

- Helps establish as best as you ever could how oils perform relative to each other.
- Would possibly show better discrimination between TMC 127 and 153 on the new non-lubricated hardware batch.
- Would eliminate rater variability when we are evaluating a new batch of hardware.
- Would further identify what the source of variability is, i.e., hardware, rating, etc.
- Would help us define what the right target is for the various reference fluids currently being used by getting a better mean.
- Would provide the Panel with an understanding of the human variation of one part of the process.
- Would provide us with more a more accurate hardware target.

Mr. Farber shared that in his opinion that getting the targets right is extremely important because a lot of decisions hinge on the initial targets. The outcome is that the Panel wishes to understand the uncertainty that the human rating plays into the over-all error of the test. The data from the P4L792/V1L417 should be used for this study.

**Motion 3** ⇒ Mr. Sullivan, Second Mr. Schenkenberger - On behalf of the Panel, the TMC will ask the company's of the 2 most consistent raters to rate the pinions only from the P4L792/V1L417 44-test hardware matrix. The laboratories were directed to send all of the pinions to the TMC. Phase 1 and 2 can be sent now. The motion carried with 6 votes in favor, 0 no votes, and 2 abstentions.

➤ **2003 Lubrited T758A/L247 Severity Investigation**

Mr. Sullivan previously presented a test summary of data (see January 4, 2005 Panel meeting minutes, attachment 4), expressing his concerns that this gear batch may be problematic to some fluids on the Standard version of D6121. His summary included data on tests he had recently completed on a well know, commercially available, OEM approved SAE 75W-140 fluid. An outcome of the January 4 meeting was that TMC was instructed to release TMC 152 and 153 to other test sponsors who might wish to evaluate this gear batch performance on other 75Wxx fluids currently being used by OEM's.

Mr. Gropp shared in this discussion by presenting a summary of all testing data (TMC 152, and 153 standard testing at two labs plus the OEM approved SAE 75W-140 previously reported by Mr. Sullivan). The data is included as *Attachment 9*. As can be seen, only 1 of the 9 tests passed the standard L-37.

Mr. Bartlett commented that the T758A/L247 hardware batch was produced and lubrited at the Dana Glasgow facility (only batch to be done at this facility) and was initially qualified in 2004 for standard testing only with TMC 128 and TMC 151 with no correction factors or obvious flaws.

Mr. Sullivan again summarized that he couldn't get through the standard tests with some 75W-XX formulations (such as the OEM approved SAE 75W-140 mentioned above). He further stated that this fluid is used by OEM's for severe use in light duty applications on hardware durability. Yet, as he pointed out, it cannot get through this test. The pedigree for the 75W-140 is unquestionable. With respect to the recent Canadian test matrix (TMC 152 & 153), it suggests a definite need for a correction factor of some kind. Mr. Sullivan stated that all of this data has made him rethink our overall process for running and qualifying gear batches. His points include:

- We (the industry) currently buy small 2-year batch/lot orders.
- Most batches involve some form of results corrections so the hardware can be used.
- Generating the necessary test data to qualify a batch is expensive and time consuming.
- Maybe in the future when we see these sort of results, we either invest a lot of time into the development of correction factors or maybe we should consider altering the test conditions to yield acceptable results on these industry reference fluids.
- If the major stakeholders could accept correction factors or altering test conditions, the industry could proceed with ordering much larger hardware batches to reduce development costs.

Mr. Follis agrees that this test is more of a gear fatigue test than a lubricant test.

Mr. Gropp stated that the Panel should, at a minimum, address the following questions today:

1. Should we develop a different correction for use for this hardware in the standard test?
2. Do we need to develop a correction factor for use of this hardware in the Canadian version of the test (assuming that we approve this hardware for use in this test)?

After great discussion and review of the data from attachments 9, the Panel decided to look at the Lubrited Low Temperature matrix action item (phase 6) on the same lubrited hardware gear batch that the labs have been attempting to complete since the June 2005 meeting.

➤ **2003 L247/T758A Lubrited Low Temperature Matrix**

The chairman briefly reviewed that the Panel has made it through Phase 6 of testing with the exception of one test on TMC 152 from Lab D.

Mr. Lind presented the data generated to date for low temperature L247/T758A tests that is included as Attachment 10. Phase 6 was aimed at determining the need and magnitude of correction factors with TMC 152 and TMC 153. The Panels initial motion in August 2005 was for the three labs that purchased the hardware to conduct 3 tests each on TMC 152 & 153 (a total of 9 tests on each oil).

TMC conclusions:

- Wear and Rippling are predominantly passes for both oils.
- Most of the T MC 152 tests fail on ridging. Most of the tests on TMC 153 passed.
- Pitting/Spalling was seen with both oils.

Lab D indicated that they would not be able to complete the last run on TMC 152. There just simply isn't enough hardware in their lab.

At this point, having now reviewed all the data on TMC 152 & 153 on the T758A/L247 lubrited hardware matrix testing on both Standard and Canadian procedures (again refer to attachments 9 and 10), ensuing discussion began on whether a correction factor was warranted.

Attachment 11 details testing on the lubrited P4L626A/V1L686 gear batch matrix with TMC 152. There was discussion and concern shared by some that the last two batches (P4L626A/V1L686 and T758A/L247) have yielded poor results on TMC 152 and 153. These are the oils which are considered high quality OEM factory fill oils.

Mr. Gropp shared his thoughts on correcting ridging distress by 1 unit that would provide a pass on TMC 152 only 50% of the time. He felt that this is still unacceptable based previous Panel expectations that TMC 152 and TMC 153 should each yield acceptable results a significant percentage of the time.

Mr. Lind stated he had reservations issuing a correction factor when there are differences in oils and the results show crossovers.

Mr. Sullivan stated that the industry expectations about these oils must be consistent and that both TMC 152 and 153 should yield acceptable results in this test. Any correction factor has got to take both of these oils to passing the majority of the time. -The purpose of this test is to allow formulators to develop an oil to put into the field. There is field data behind these oils. The OEM's have also done a battery of their own testing before accepting these oils for factory fill. These are good field performance proven oils.

Mr. Lind commented that he hasn't been able to procure the proper documentation from the OEM's to clarify the pedigree of TMC 152 & 153. After further discussion, the following motions came forth.

**Motion 4** ⇒ Mr. Sullivan, Second Mr. McGlone - When using T758A/L247 Lubrified gear batch in the Canadian L-37 test, correction factors will be in place for the pinion only to correct a ridging value of 6 to an 8 and a spitting value of 8 to a 9.3. The motion passed with a vote of 6, 0, and 2.

**Motion 5** ⇒ Mr. Sullivan, Second Mr. McGlone - the T758A/L247 lubrified hardware gear batch is approved for Canadian L-37 testing, effective 2/8/06. The motion passed with a vote of 6, 0, and 2.

➤ **Developing Industry Matrix for Setting Targets for TMC 155 (replacing TMC 151-3)**

The Chairman introduced the topic (see *Attachment 12*) asking the Panel how they wanted to go about introducing TMC 155 which is a replacement for TMC 151-3. There are several different gear bathes, lubrified and non-lubrified, remaining in laboratory inventories. The TMC 151-3 supply is getting low.

The TMC, at previous Panel meetings this week (L-33-1, Cyclic Durability) shared the testing data on the TMC 151-3 replacement fluid and is included as *Attachment 13*. Mr. Lind commented that that TMC 151 could not be re-blended because the original base stocks are no longer available.

Mr. Farber shared a couple of techniques we could use to bring the new oil in:

- Use the TMC 151-3 bands for the 1<sup>st</sup> 3 tests, calculate a new mean using 155 and use it for the new test oil, but use the standard deviation for the old oil (151-3).
- A 2<sup>nd</sup> option is to adjust reference frequency bands to generate targets quicker.'

**Motion 6** ⇒ Mr. Gropp, Second Mr. Koehler - Effective immediately, for all approved gear batches, assign TMC 155 in place of TMC 151-3. The 1<sup>st</sup> two tests on the respective gear batch will use the TMC 151 targets. If any of the 1<sup>st</sup> two tests fail, TMC is to keep the result but the lab needs to repeat another reference on TMC 151-3. The failed TMC 155 tests are not charted until 3 valid tests on TMC 155 are available. Once the 1<sup>st</sup> three tests are gathered on TMC 155 for a gear batch, calculate a new mean using TMC 155 but use the standard deviation from TMC 151-3. After 10 tests, the mean and standard deviation for TMC 155 would be used until targets are once again updated at 20, and 30 tests. The motion passed with a vote of 8, 0, and 1.



➤ **Other Test Improvement Efforts -**

**Panel Memo/Request to GO RTF**

The chairman quickly reviewed the letter that the L-37 Panel submitted to the GO RTF for its request to hear their thoughts on improving the L-37 test from a rating perspective. The chairman also shared the response from the GO RTF. They are included as *Attachments 14 & 15.*

**Action Item:** Don Bartlett was tasked to follow up with Mr. Sanchez, Chairman of the GO RTF to seek further clarification and more specific details to meet the Panel request of the raters.

The last item on the agenda "Other Test Improvement Efforts" was not discussed as there was not enough time. It is included as *Attachments 16* which will be deferred to the next meeting.

The meeting was adjourned at 5:12 pm on a motion by Mr. Koglin and a second by Mr. Gropp.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Donald T. Bartlett".

Donald T. Bartlett  
L-37 Surveillance Panel Chairman

ASTM L-37 Surveillance Panel Membership/Mailing List

Meeting Date: February 8, 2005


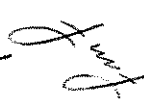
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Attendance /  
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\* Initial to indicate attendance at subject meeting

# ASTM L-37 Surveillance Panel Membership/Mailing List

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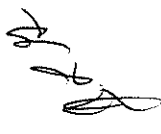


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Meeting Date: February 8, 2005

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Meeting Date: February 8, 2005



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Meeting Date: February 8, 2005

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Attachment /  
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ASTM L-37 Surveillance Panel Membership/Mailing List

Meeting Date: February 8, 2005

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WTS	Sullivan, Bill	Voting	ExxonMobil Chemical Company P. O. Box 3140 Edison, New Jersey 08818	Phone: 732-321-3354 Fax: 732-321-6064 E-Mail: william.t.sullivan@exxonmobil.com
	Tschirhart, Garland	Non Voting	Southwest Research Institute PO Drawer 28510 San Antonio, Texas 78228-0510	Phone: 210-522-3445 Fax: 210-680-1777 E-Mail: gtschirhart@swri.edu
	Vermilya, Denise	Non Voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-4681 Fax: 440-347- E-Mail: drc@lubrizol.com
	Vettel, Paula	Voting	D. A. Stuart Company 4580 Weaver Parkway Warrenville, Illinois 60555	Phone: 630-393-8859 Fax: 630-393-8577 E-Mail: pvettel@dastuart.net

\* Initial to indicate attendance at subject meeting

Attachment /  
Page Page 7 of 8  
Reference 2/8/06



ASTM L-37 Surveillance Panel Membership/Mailing List

Meeting Date: February 8, 2005

Initials*	Name	Voting Status	Company Name & Address	Phone/Email Info
	Whitton, Claire	Non Voting	Afton Chemical PO Box 2158, 500 Spring St. Richmond, VA 23218	Phone: 804-788-5052 Fax: 804-788-6243 E-Mail: Claire_Whitton@aftonchemical.com
	Yanchar, Paul	Non Voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-3474468 Fax: 440-347-9011 E-Mail: pij@lubrizol.com
	Zakarjian, Jack	Non Voting	Chevron Products 100 Chevron Way Richmond, CA 94802	Phone: 510-242-3595 Fax: 510-242-3758 E-Mail: jaza@chevron.com
SR	Rea, Salvatore	Voting	Engineum USA, L.P. 1900 E. Wenden Ave. Linden, NJ 07036	Phone: (908) 474-6602 Fax: -3597 E-Mail: salvatore.rea@engineum.com
pk	KANGA, PERCY	Non Voting	Exxon Mobil Res. & Eng'g. 600 Billingsport Rd. Paulsboro, NJ 08066	Phone: 856-224-2094 Fax: 856-224-3613 E-Mail: percy.r.kanga@exxonmobil.com

\* Initial to indicate attendance at subject meeting

## L-37 Surveillance Panel Voting Members

Donald Bartlett	The Lubrizol Corporation (Chairman)
Tom Bryson	Volvo Powertrain Corporation
Juan Buitrago	Chevron Oronite Company
Allen Comfort	AMSTA-TR-D/210 US Army Tacom-Tardec
John Dharte	American Axle & Manufacturing
Brian Koehler	Southwest Research Institute
Cory Koglin	Afton Chemical Company
Don Kreinbring	Dana Corporation
Don Lind	ASTM Test Monitoring Center
Jim Linden	GMR Research and Development
Thelma Marougy	Eaton Corporation
Bruce McGlone	ArvinMeritor Materials Engineering
Salvatore Rea	Infineum
Dale Smith	PARC Technical Services
William Sullivan	ExxonMobil Chemical Company
Paula Vettel	D.A. Stuart Company

Attachment	<u>2</u>
Page	<u>1061</u>
Reference	<u>218106</u>

**L-37 Surveillance Panel**  
**PRI/ Headquarters, Apollo Room - Warrendale, PA**  
**February 8<sup>th</sup>, 2006**

**AGENDA**

- I. Call to Order & Membership Review
- II. Approval of Panel Minutes
  - ✓ August 24, 2005 Panel Meeting
  - ✓ January 4, 2006 Telecom Meeting
  - ✓ January 20, 2006 Telecom Meeting
  - ✓ Hardware TF visits to Ft. Wayne and Lugoff facilities
- III. Chairman's Comments
- IV. 2006 Lubrited Hardware Order Placement- All
  - Tentative count - Labs to place binding PO's by March 1.
- V. 2005 Green Hardware Matrix Update – TMC
  - Most consistent/least variable rater – TMC
- VI. 2003 Lubrited T758A/L247 Severity Investigation
  - Standard Temperature Matrix –Sullivan/Gropp
- VII. 2003 Lubrited T758A (phase 6) Low Temp Matrix Decision – TMC
  - Action Item - TMC LTMS LT & STD Data on 247/758A & 626/686 - TMC
- VIII. Develop an Industry Matrix for Setting Targets for TMC 151/155 – TMC/All
- IX. Other Test Improvement Efforts – All
  - August Action Items
    - Panel Memo/Request to GO RTF –
    - 7-tooth rating experiment – TMC
  - January 11, 2006 Gear Rating Work Shop Update – TMC
  - L-37 RCMS System Check. Is it Doing What it Was Meant to do? Changes?
- X. New Business
- XI. Adjournment

Attachment	3
Page	141
Reference	2/8/06

## 2005 Non-Lubrited Hardware (P4L792/V1L417) Update

Each of the 4 labs will equally participate in a 44-test matrix to evaluate the 2005 non-lubrited hardware batch.

- 4-test on TMC 127 (standard)
  - TMC will assign each lab one test on TMC 127 and stop to review results (to insure that this oil has performed as expected). Targeted completion date is January 20, 2006.
- ✓ TMC 127 Runs, 1 test at each lab update (Phase 1) - TMC
- 8-tests on TMC 151-3 (standard)
  - TMC will assign each lab one test on TMC 151-3 and stop to review results (to insure that this oil has performed as expected). Targeted completion date is February 2, 2006.
- ✓ TMC 151-3, 1 test at each lab update (Phase 2)- TMC
- ✓ The Panel determines that there is discrimination at this point.
  - Continue with remaining tests on TMC 151-3 (standard)
  - 8-tests on TMC 152 (standard)
  - 8-tests on TMC 153 (standard)
  - 8-tests on TMC 152 (Canadian)
  - 8-tests on TMC 153 (Canadian)
- Question? Do we commence with the remainder of the matrix?
- Proposal by Chairman for panel to consider: After the matrix is completed:
  - Have all ring and pinions sent to the TMC.
  - TMC to code and send the pinions only to the two L-37 RCMS "Most consistent raters" for rating.
  - TMC to report the results at a future meeting.
  - TMC may choose to participate in the rating exercise.
  - Schedule a 'Special' panel meeting to review the data and evaluate correction factor & hardware targets, etc.

Attachment	<u>4</u>
Page	<u>14/1</u>
Reference	<u>2/8/06</u>

V1L417/P4792 Non-Lubricated Hardware Matrix Data

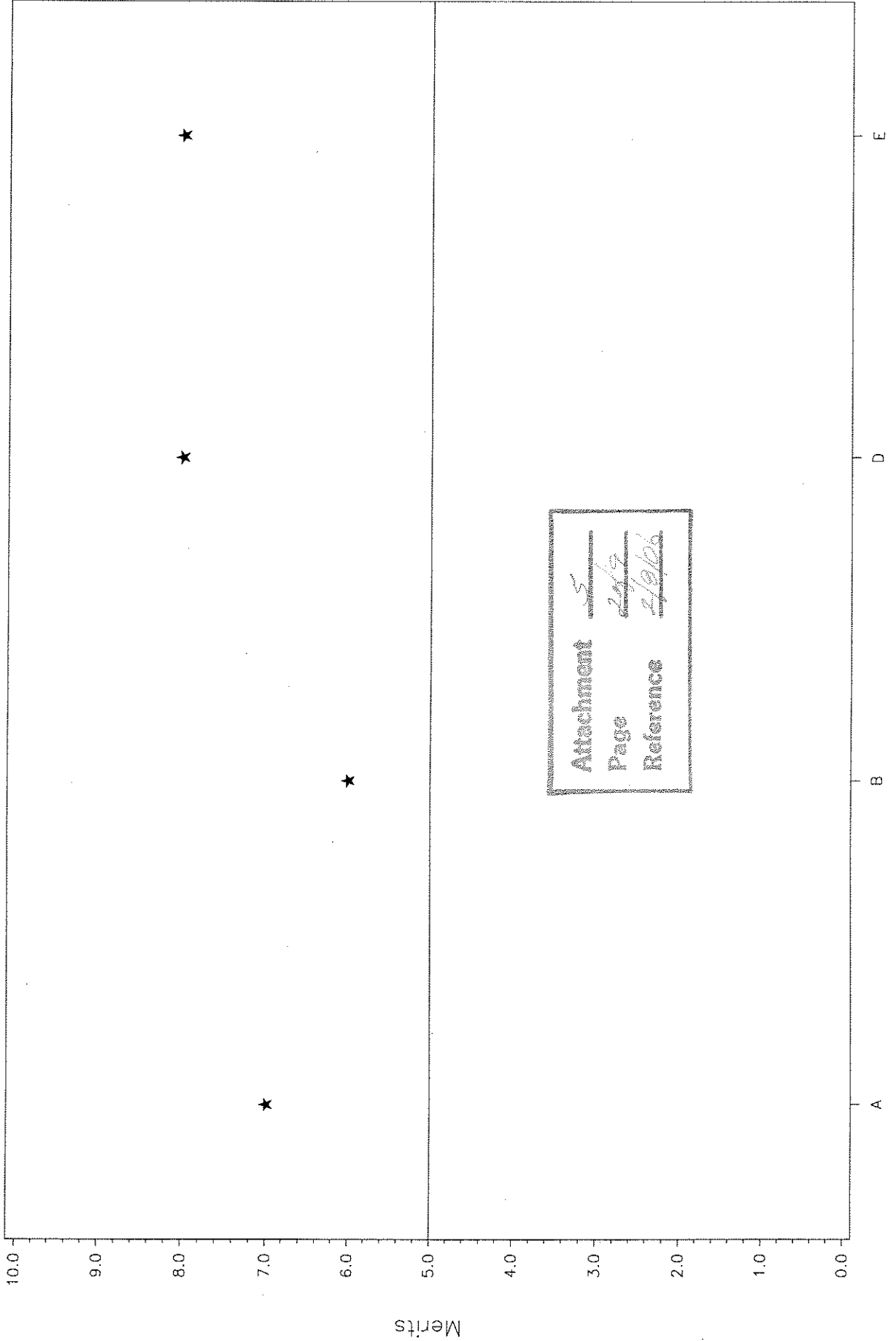
CMIR	Lab	STD	Run	Oil	PINBAT	RINGBAT	DTCOMP	Pwear	Pridg	Pripp	Pspit	Rwear	Rridg	Rripp	Rspit	fpccrat	lpcrat
46001	B	191	2263	127	V1L417	P4L792	20060107	6	4	8	9.5	7	5	9	9.9	0	2
44289	E	2	234	127	V1L417	P4L792	20060112	8	9	7	9.7	7	9	9	9.9	0	2
49554	A	2	2917	127	V1L417	P4L792	20060113	7	9	5	9.7	7	9	9	9.9	0	2
49503	D	3A	464	127	V1L417	P4L792	20060114	8	9	8	9.9	8	10	10	10	0	3

Attachment	5
Page	10/9
Reference	2/1/06

# L-37 Reference Oil Performance by LTIMSLAB

Wear - NON-LUBRITED

Reference Oil 127

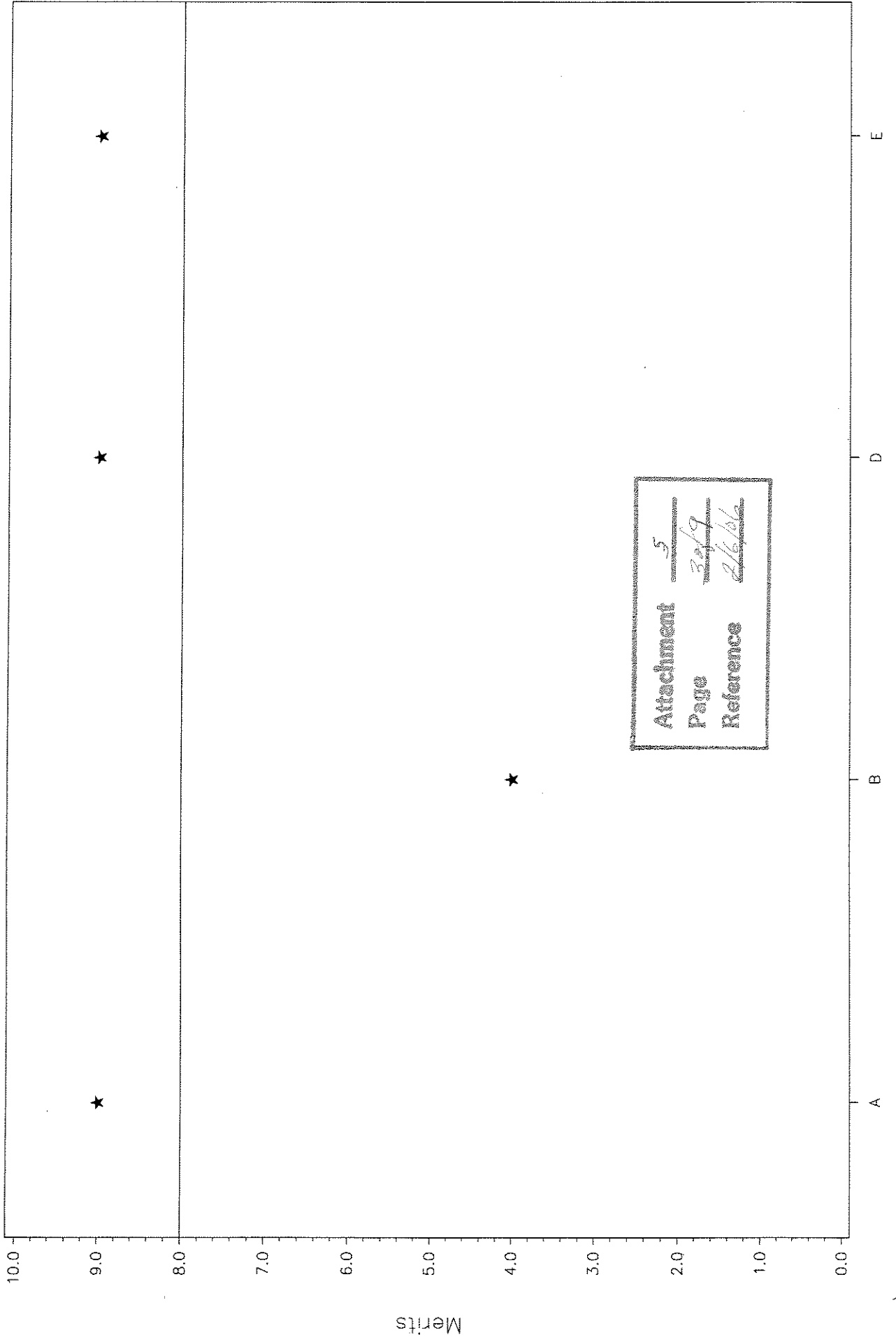


Attachment 5  
Page 2 of 5  
Reference 2/10/16

# L-37 Reference Oil Performance by LTMSLAB

Ridging - NON - LUBRITED

Reference Oil 127

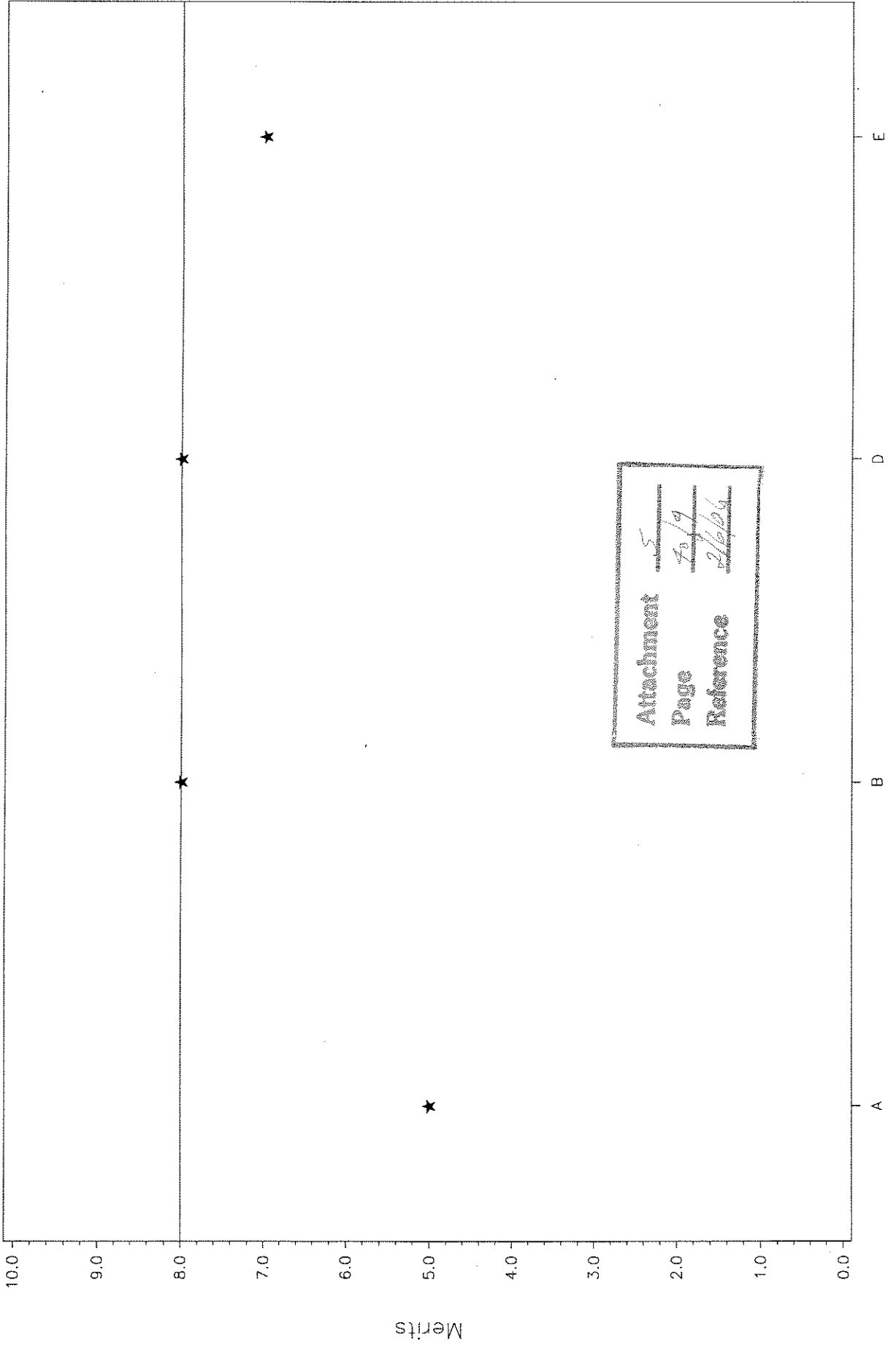


Attachment 5  
Page 3 of 9  
Reference 2/6/16

# L-37 Reference Oil Performance by LTMSLAB

Rippling -- NON-LUBRITED

Reference Oil 127



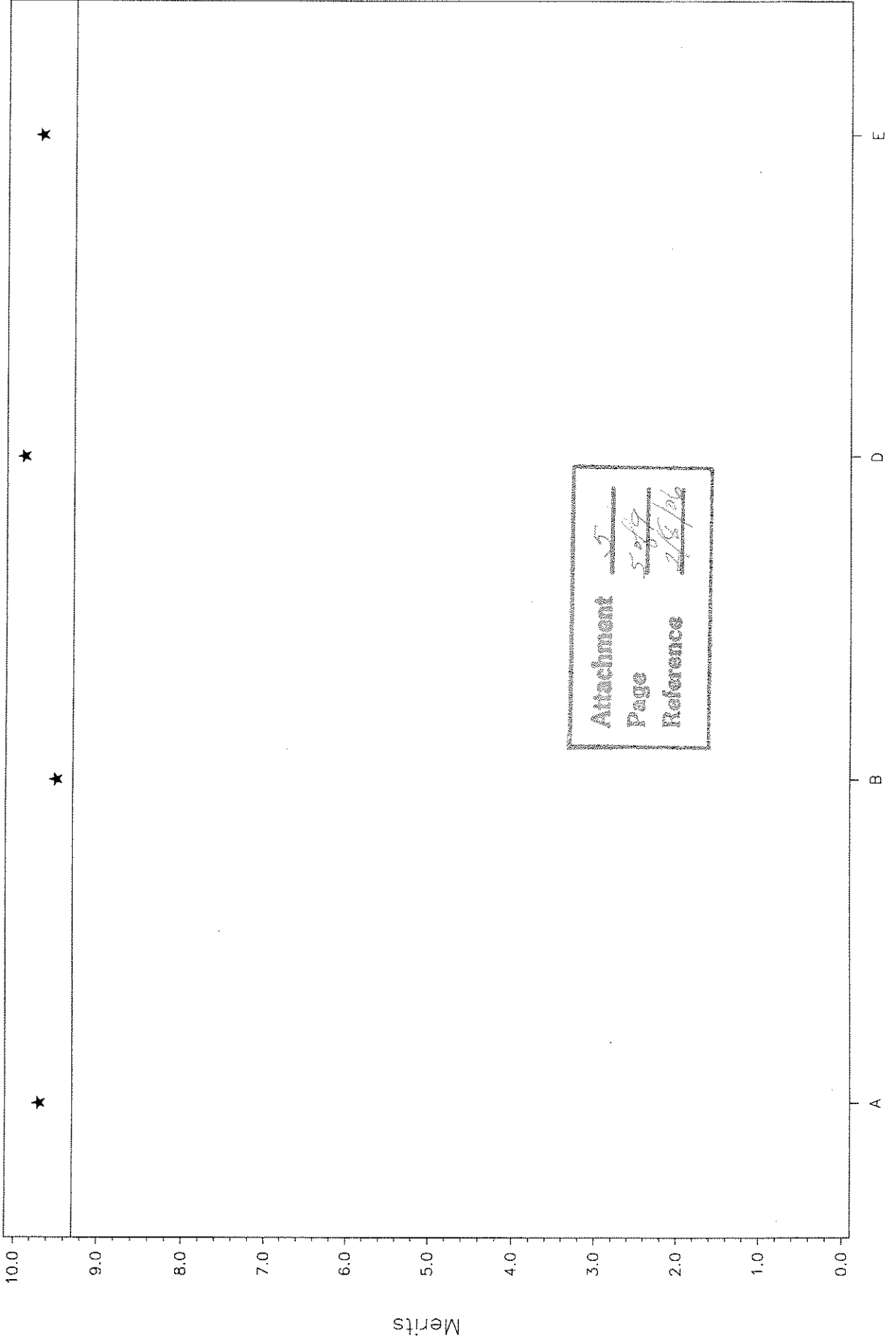
Attachment 5  
Page 40/9  
Reference 2/6/64



# L-37 Reference Oil Performance by LTMSLAB

Spitting - NON-LUBRITED

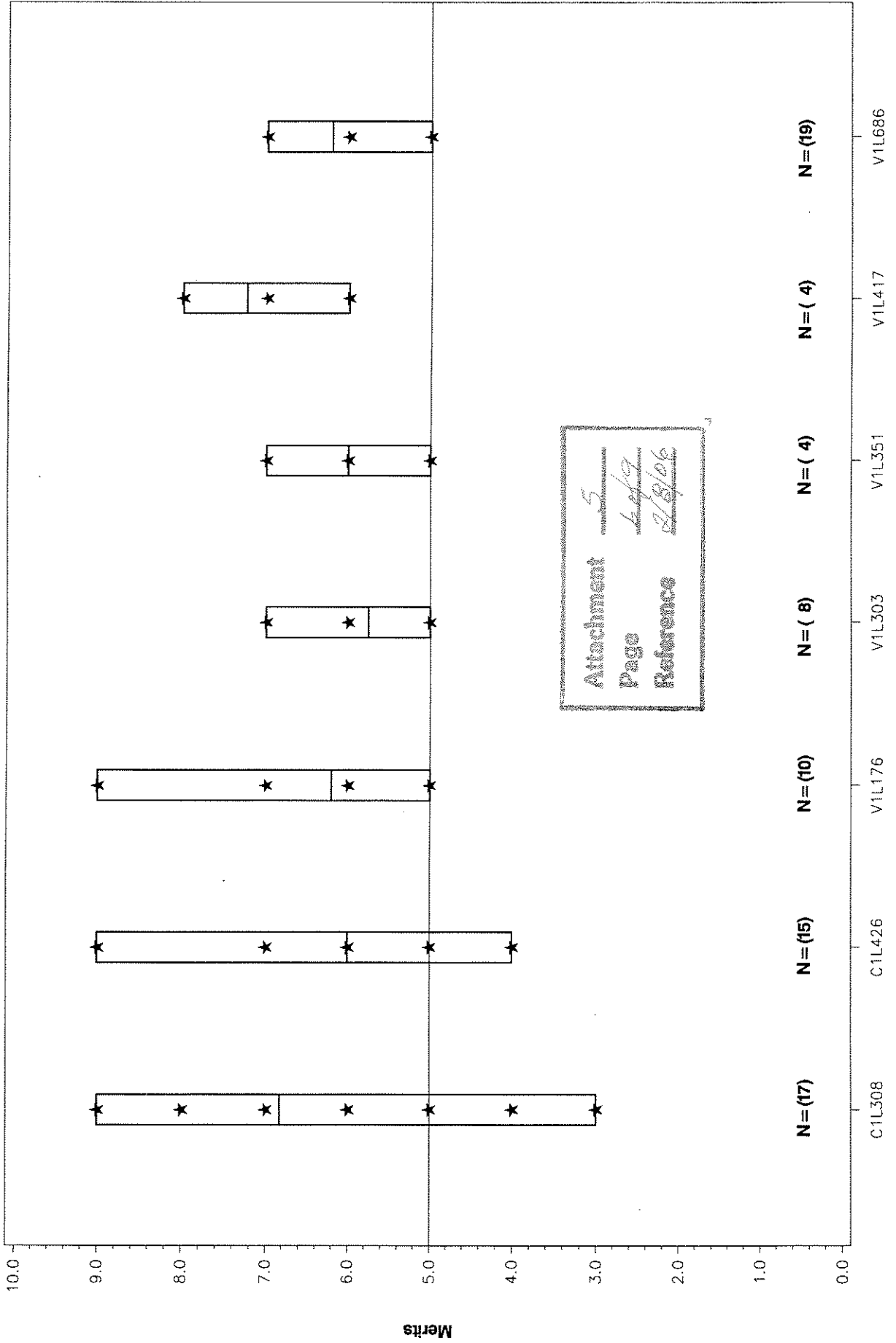
Reference Oil: 127



Attachment 5  
Page 5 of 9  
Reference 2/8/16

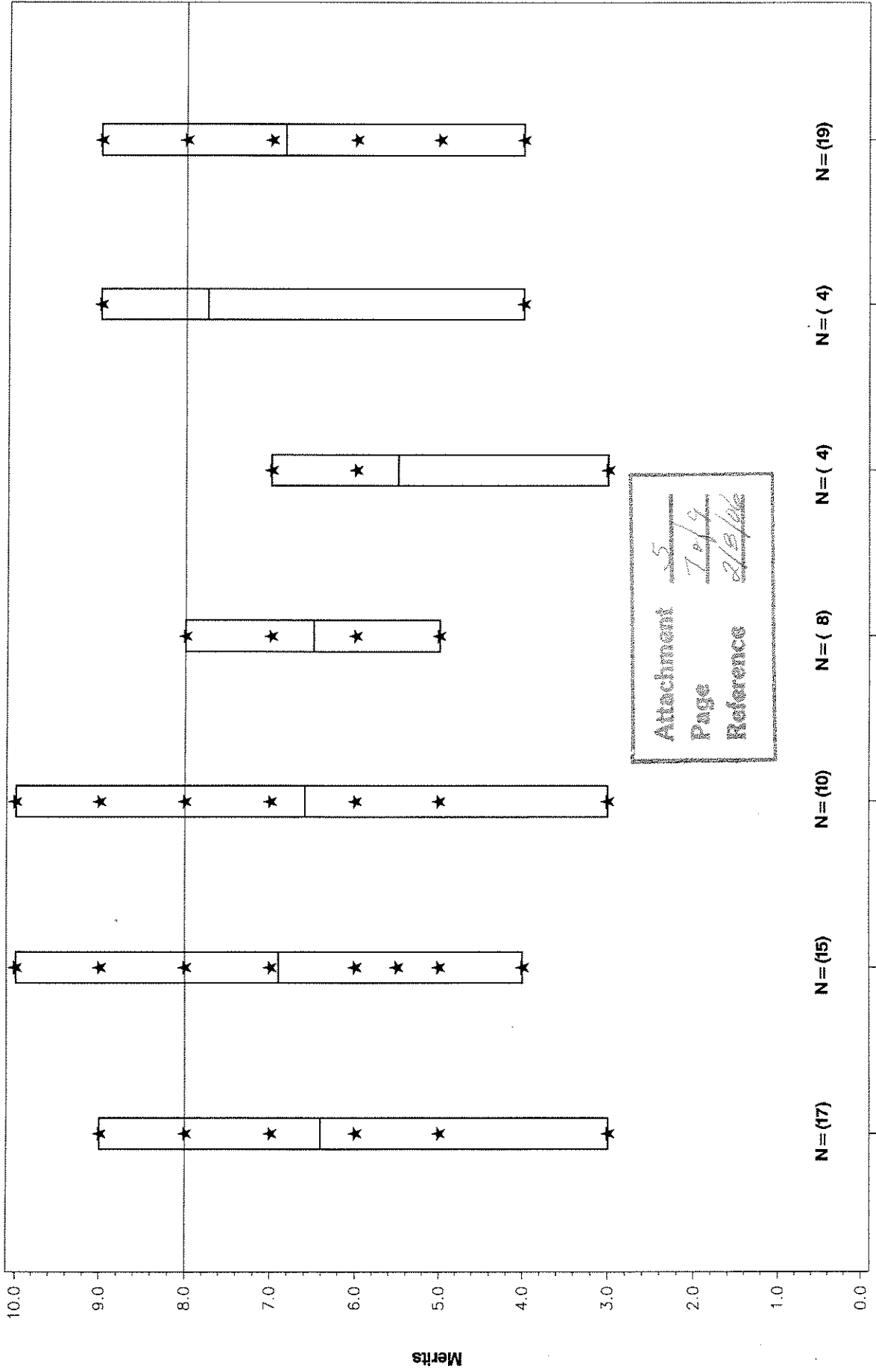
# L-37 Reference Oil Performance by Pinion Batch

Wear - NON-LUBRITED  
Reference Oil 127



# L-37 Reference Oil Performance by Pinion Batch

Ridging - NON-LUBRITED  
Reference Oil 127

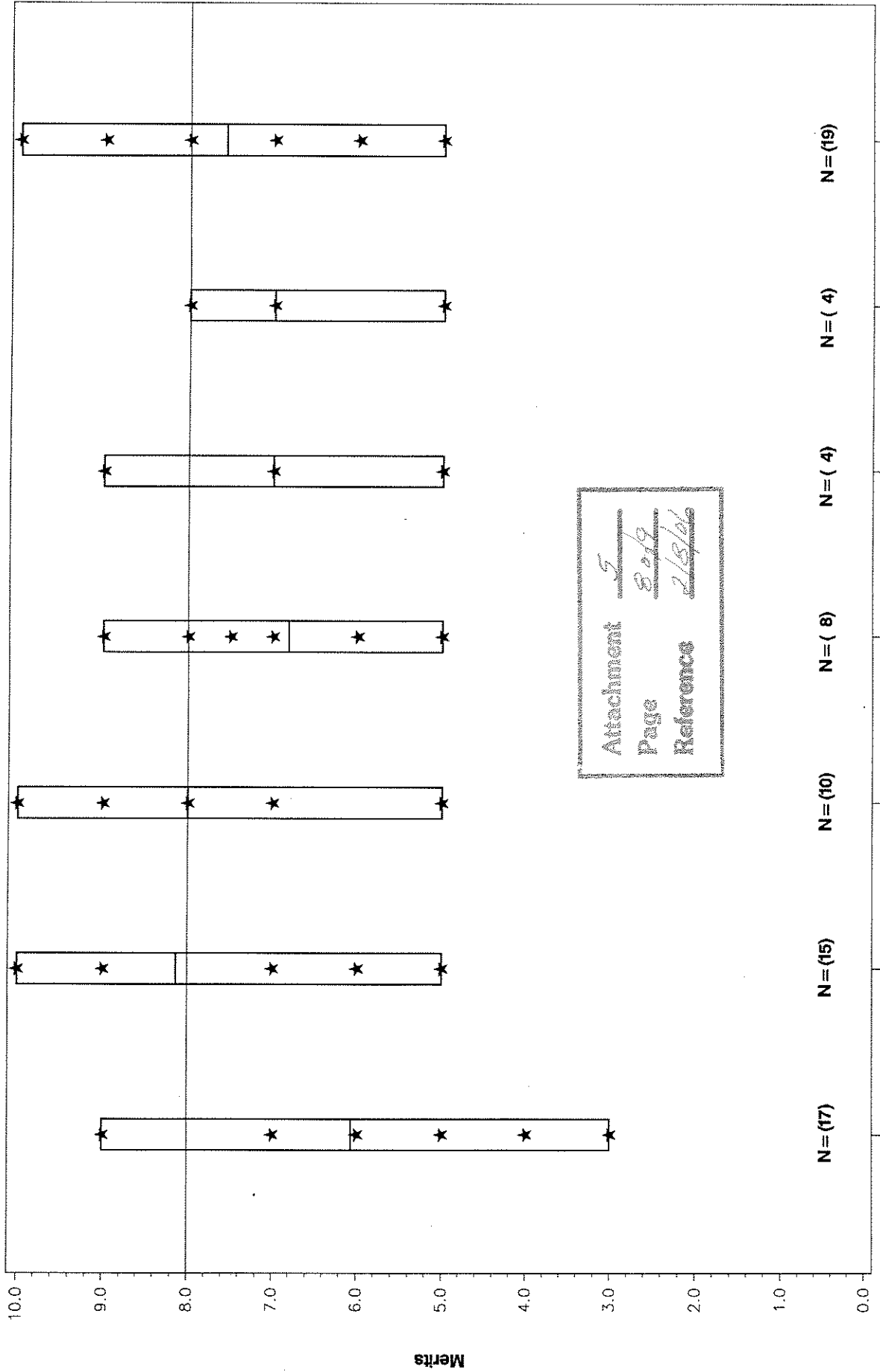


Attachment 5  
Page 7 of 9  
Reference 2/3/66

# L-37 Reference Oil Performance by Pinion Batch

Rippling - NON-LUBRITED

Reference Oil: 127

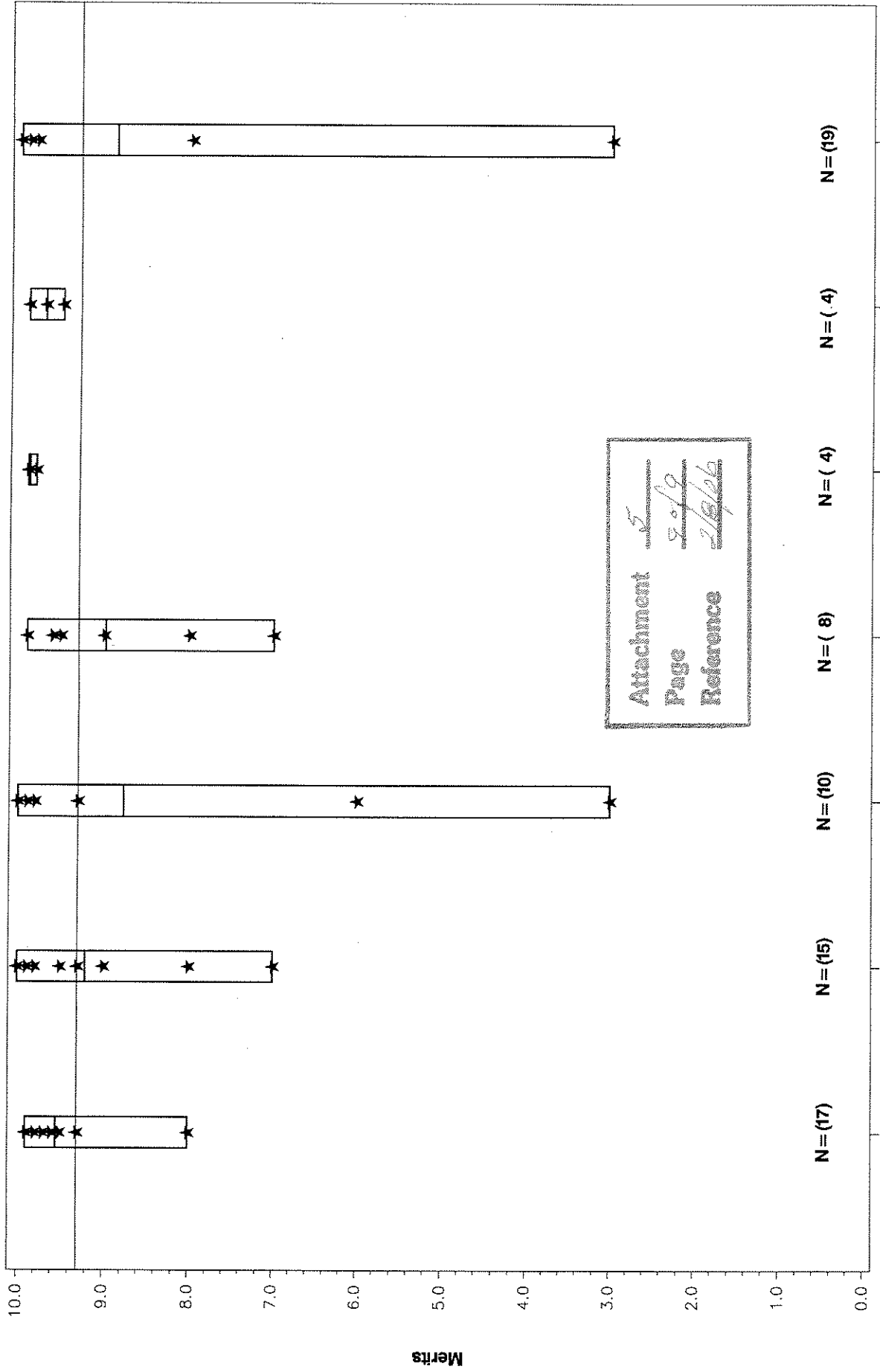


Attachment 5  
 Page 8 of 8  
 Reference 2/8/16

# L-37 Reference Oil Performance by Pinion Batch

Spitting - NON-LUBRICATED

Reference Oil 127



Attachment 5  
 Page 8 of 9  
 Reference 2/8/06

A2

Gear Batch V1L417/P4L792 Non-Lubricated Hardware Matrix Data

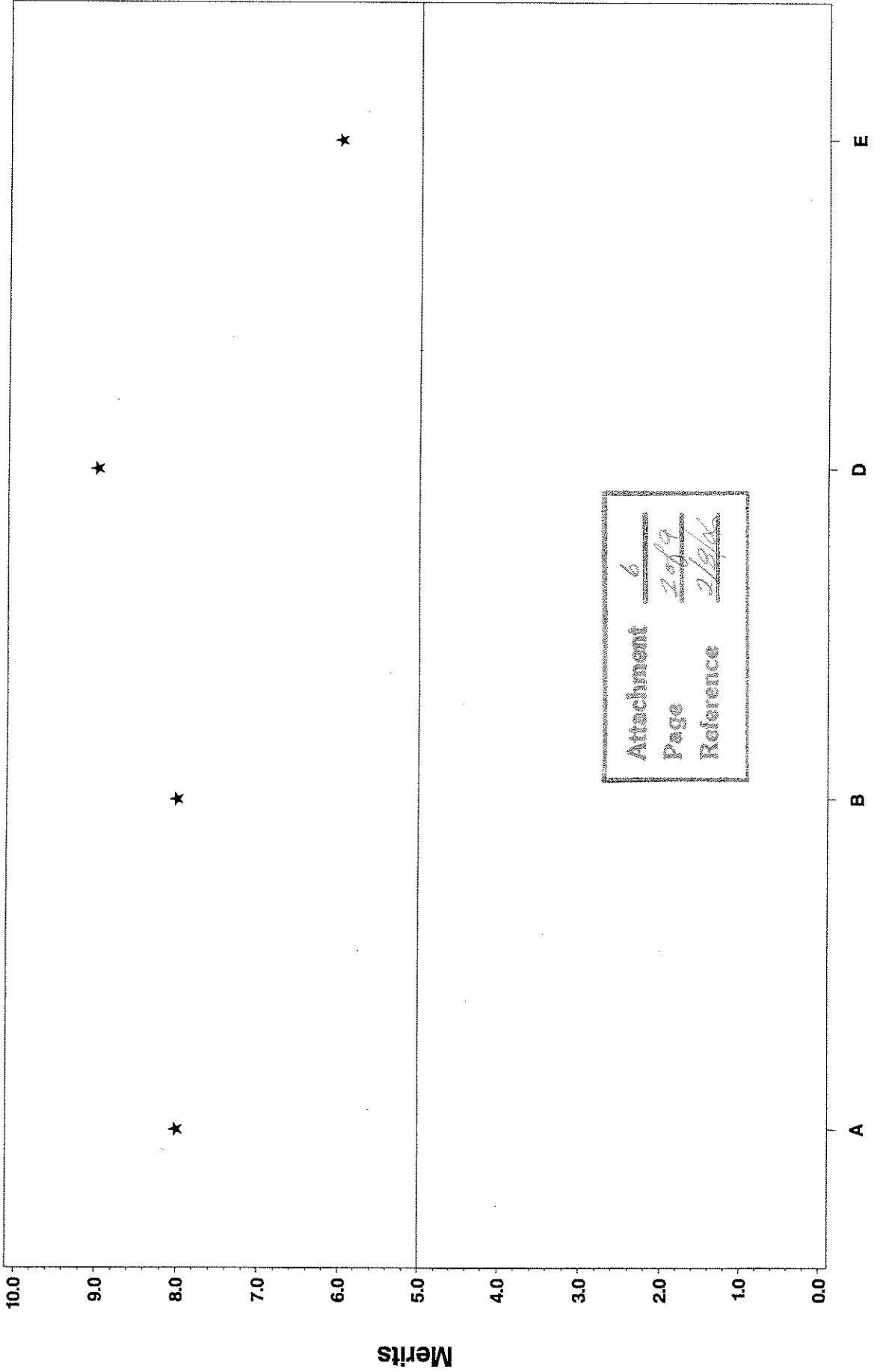
CMIR	Lab	Stand	Run	Oil	Pinbat	Ringbat	DTCOMP	Pwear	Pridg	Pripp	Pspit	Rwear	Rridg	Rripp	Rspit	fpccrat	lpcrat
49503	D	3A	464	127	V1L417	P4L792	20060114	8	9	8	9.9	8	10	10	10	0	3
46001	B	191	2263	127	V1L417	P4L792	20060107	6	4	8	9.5	7	5	9	9.9	0	2
44289	E	2	234	127	V1L417	P4L792	20060112	8	9	7	9.7	7	9	9	9.9	0	2
49554	A	2	2917	127	V1L417	P4L792	20060113	7	9	5	9.7	7	9	9	9.9	0	2
53444	D	3A	472	151-3	V1L417	P4L792	20060126	9	10	10	9.9	9	10	10	10	1	3
56556	B	191	2275	151-3	V1L417	P4L792	20060124	8	10	10	10	7	10	10	10	0	2
53460	E	2	240	151-3	V1L417	P4L792	20060124	6	9	8	9.9	7	10	9	9.9	0	2
50356	A	2	2926	151-3	V1L417	P4L792	20060128	8	10	9	9.9	8	10	9	9.9	1	-2

Attachment	6
Page	10/19
Reference	2/3/06

# L-37 Reference Oil Performance by LTMSLAB

Wear - NON - LUBRICATED

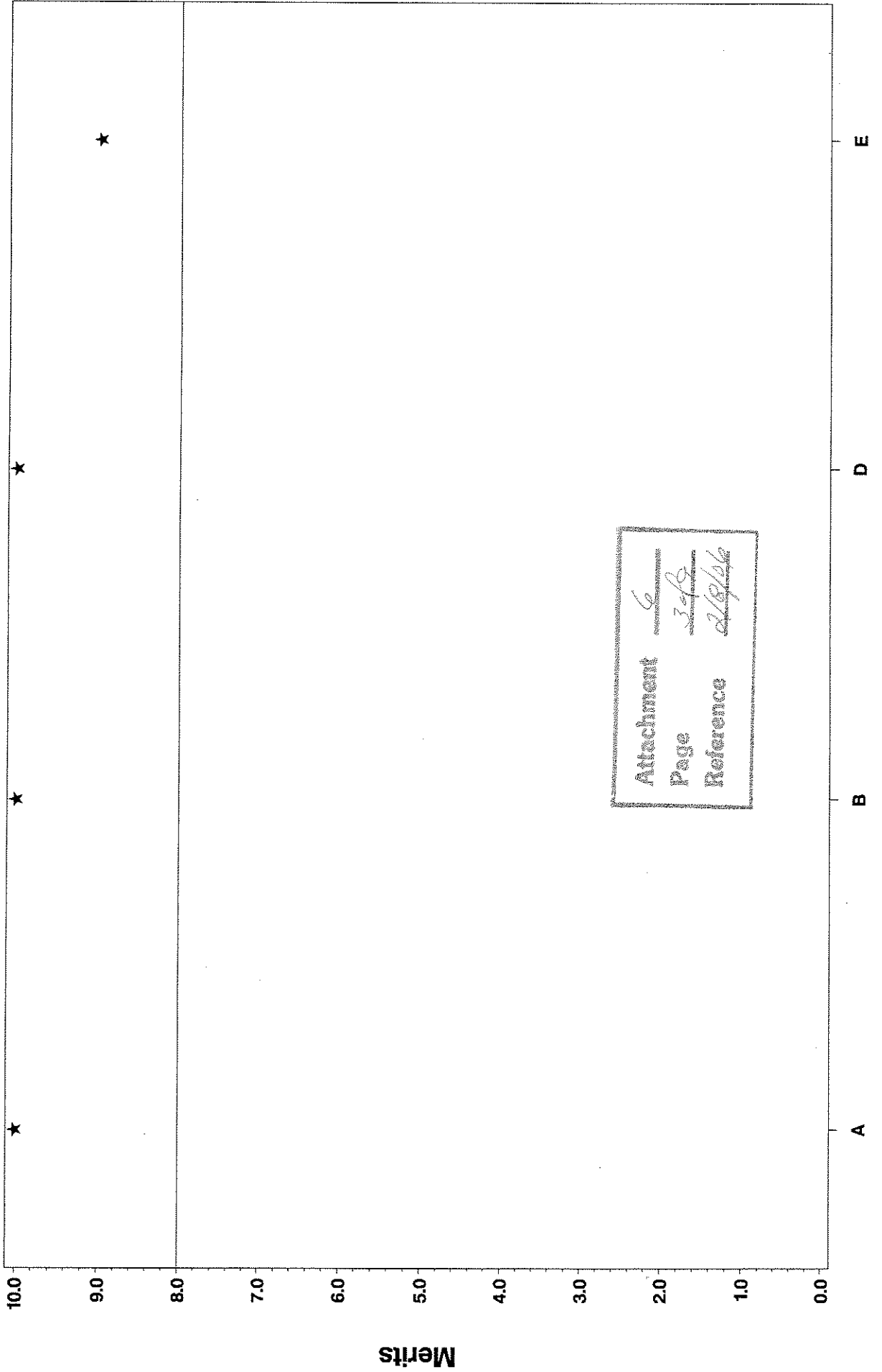
Reference Oil 151 - 3



# L-37 Reference Oil Performance by LTMSLAB

Ridging - NON-LUBRITED

Reference Oil 151-3

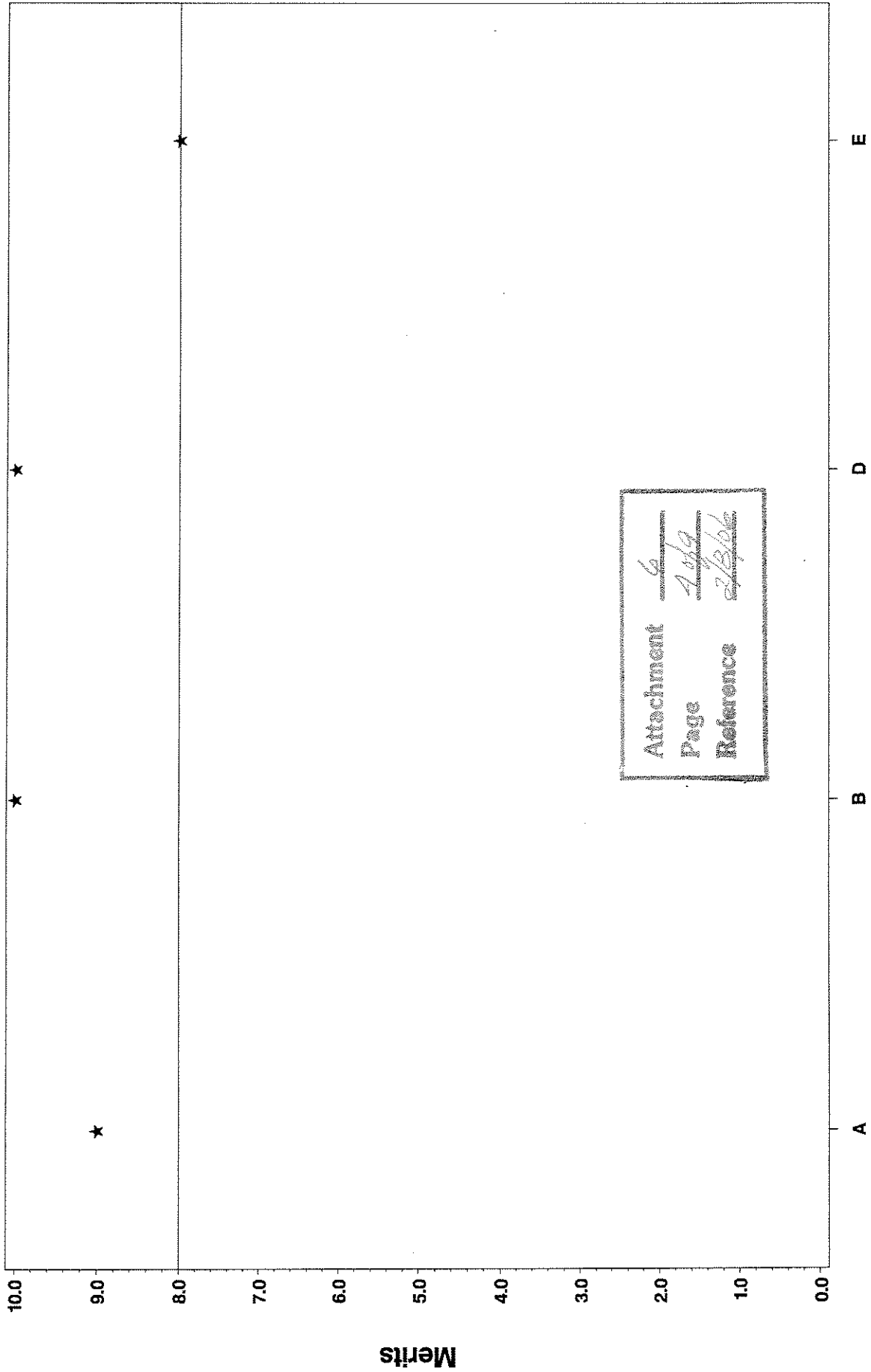


Attachment 6  
Page 3 of 8  
Reference 2/8/16



# L-37 Reference Oil Performance by LTMSLAB

Rippling - NON-LUBRICATED  
Reference Oil 151-3

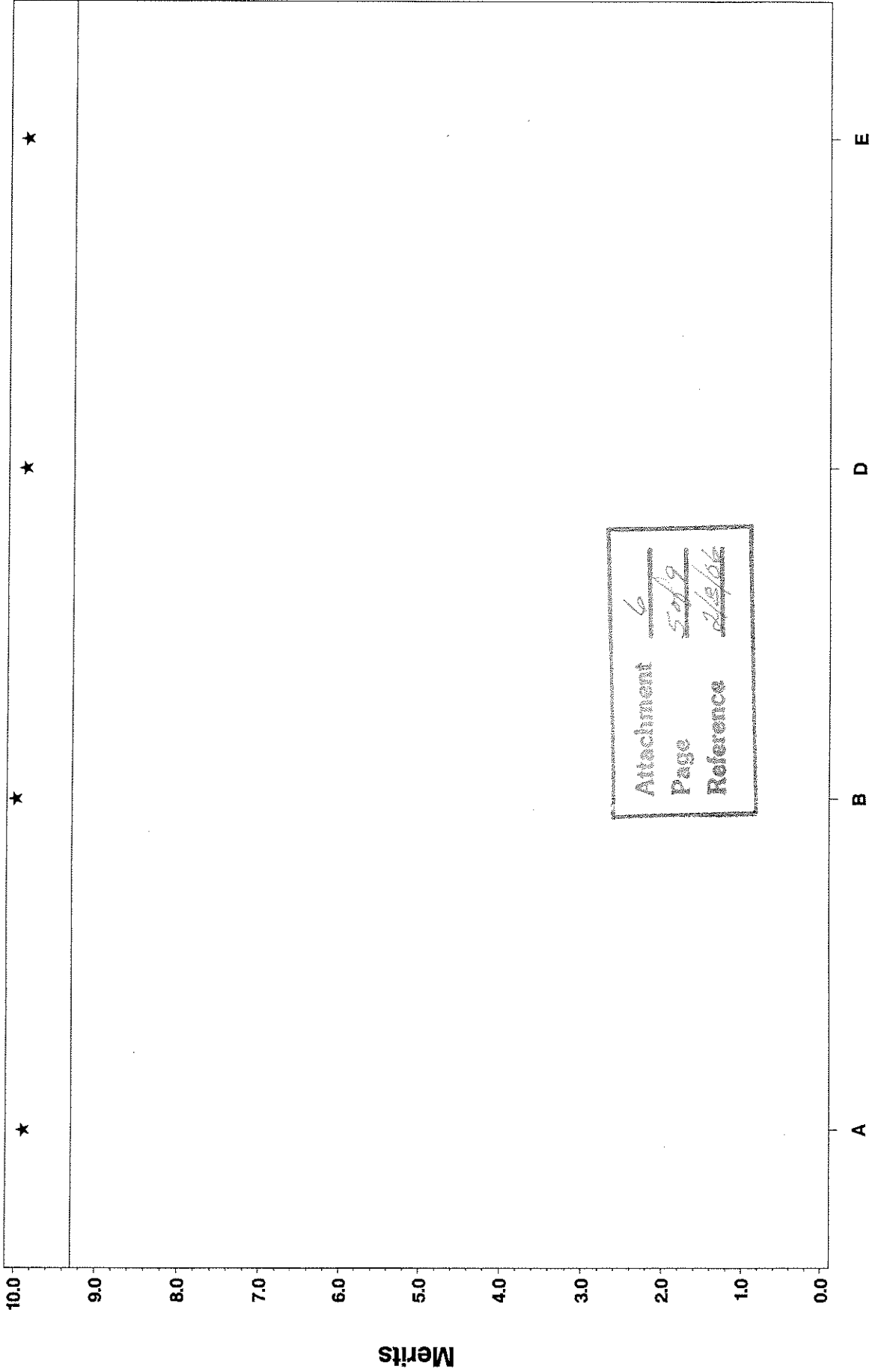


Attachment 6  
Page 4 of 9  
Reference 2/3/06

# L-37 Reference Oil Performance by LTMSLAB

Spitting - NON-LUBRITED

Reference Oil 151-3

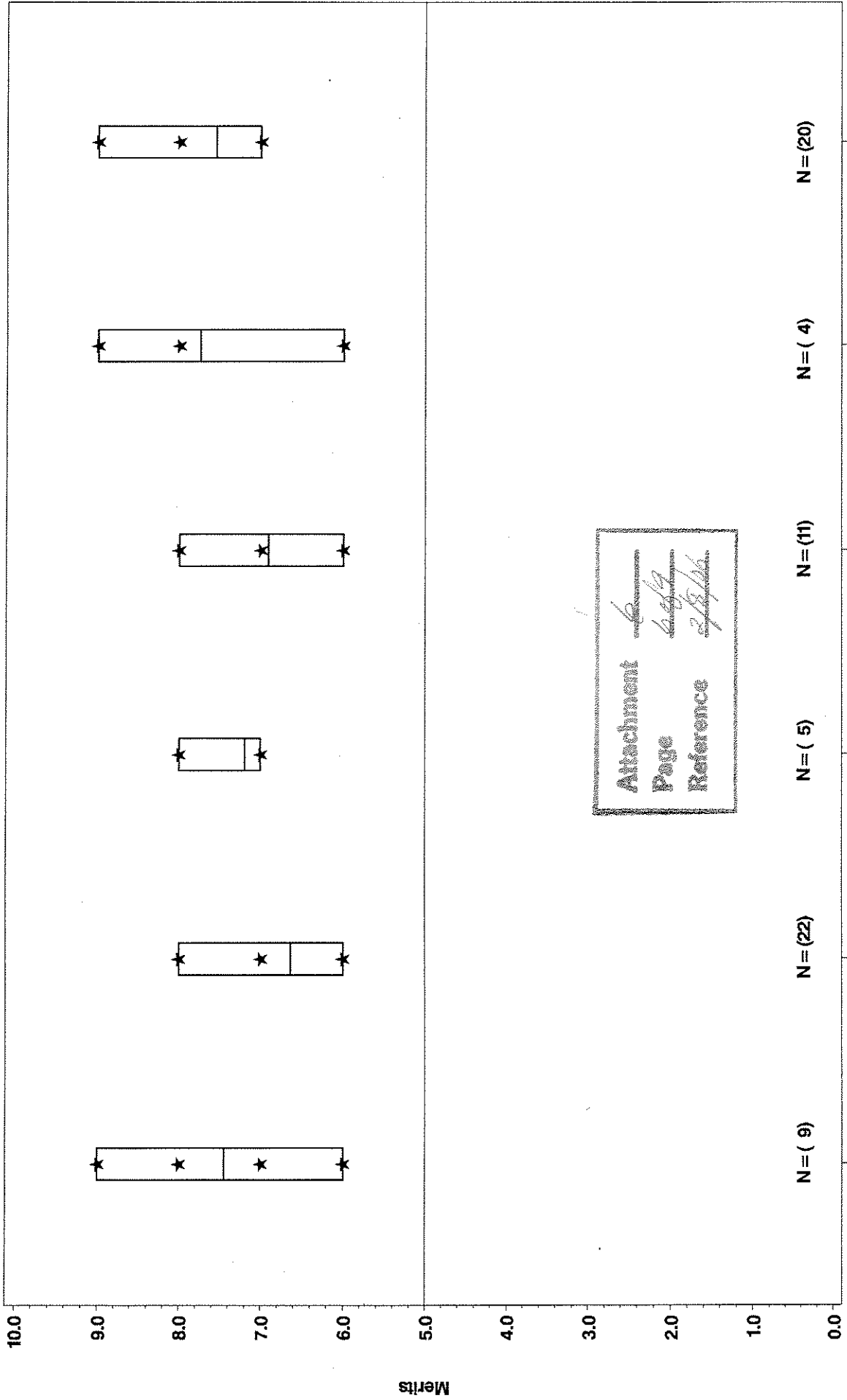


Attachment 6  
Page 5 of 9  
Reference 2/5/12

# L-37 Reference Oil Performance by Pinion Batch

Wear - NON - LUBRICATED

Reference Oil 151-2 & 151-3



Attachment *[Signature]*  
 Page *[Signature]*  
 Reference *[Signature]*

VIL686

VIL417

VIL351

VIL303

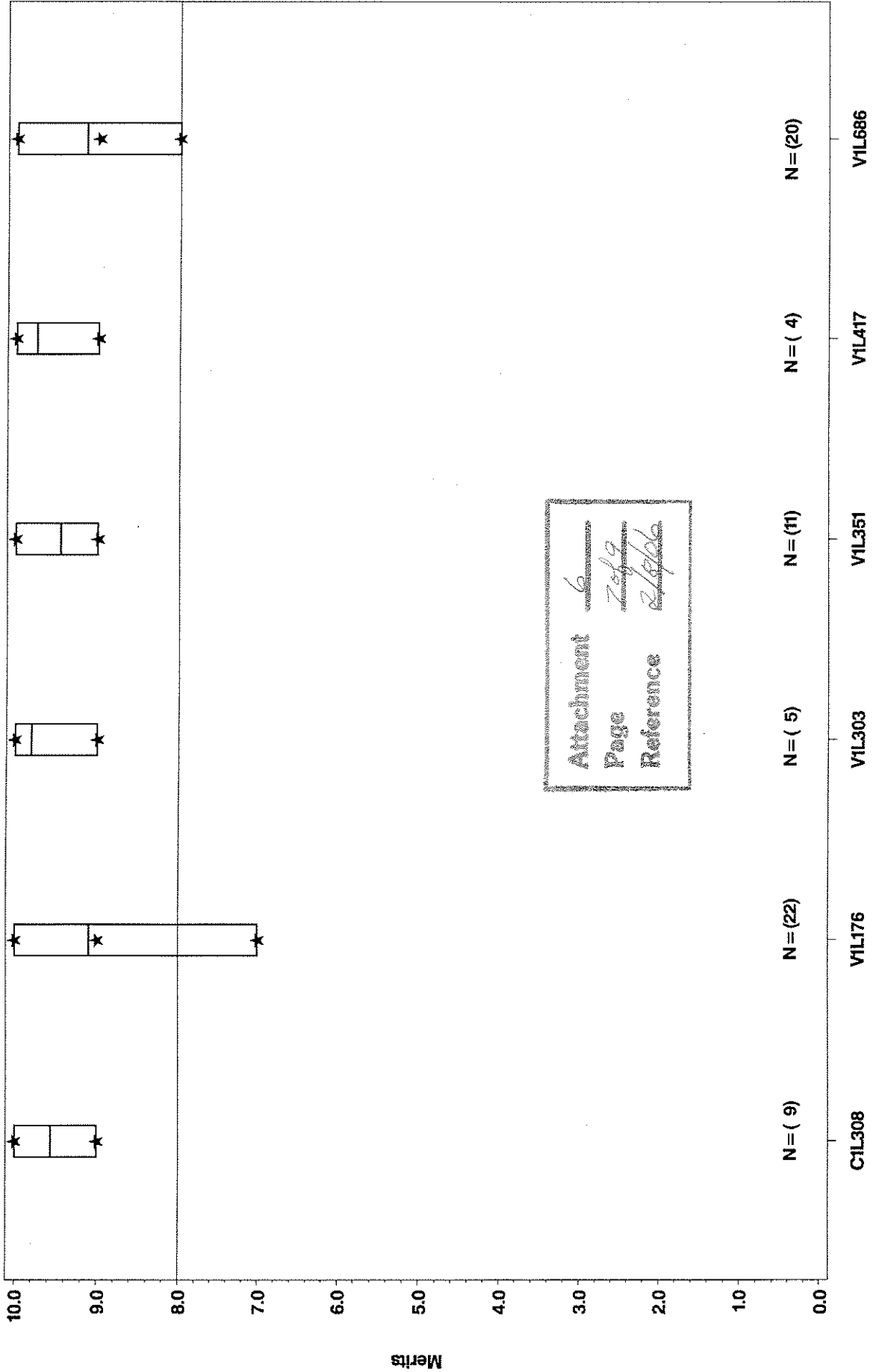
VIL176

CIL308

# L-37 Reference Oil Performance by Pinion Batch

Ridging — NON — LUBRITED

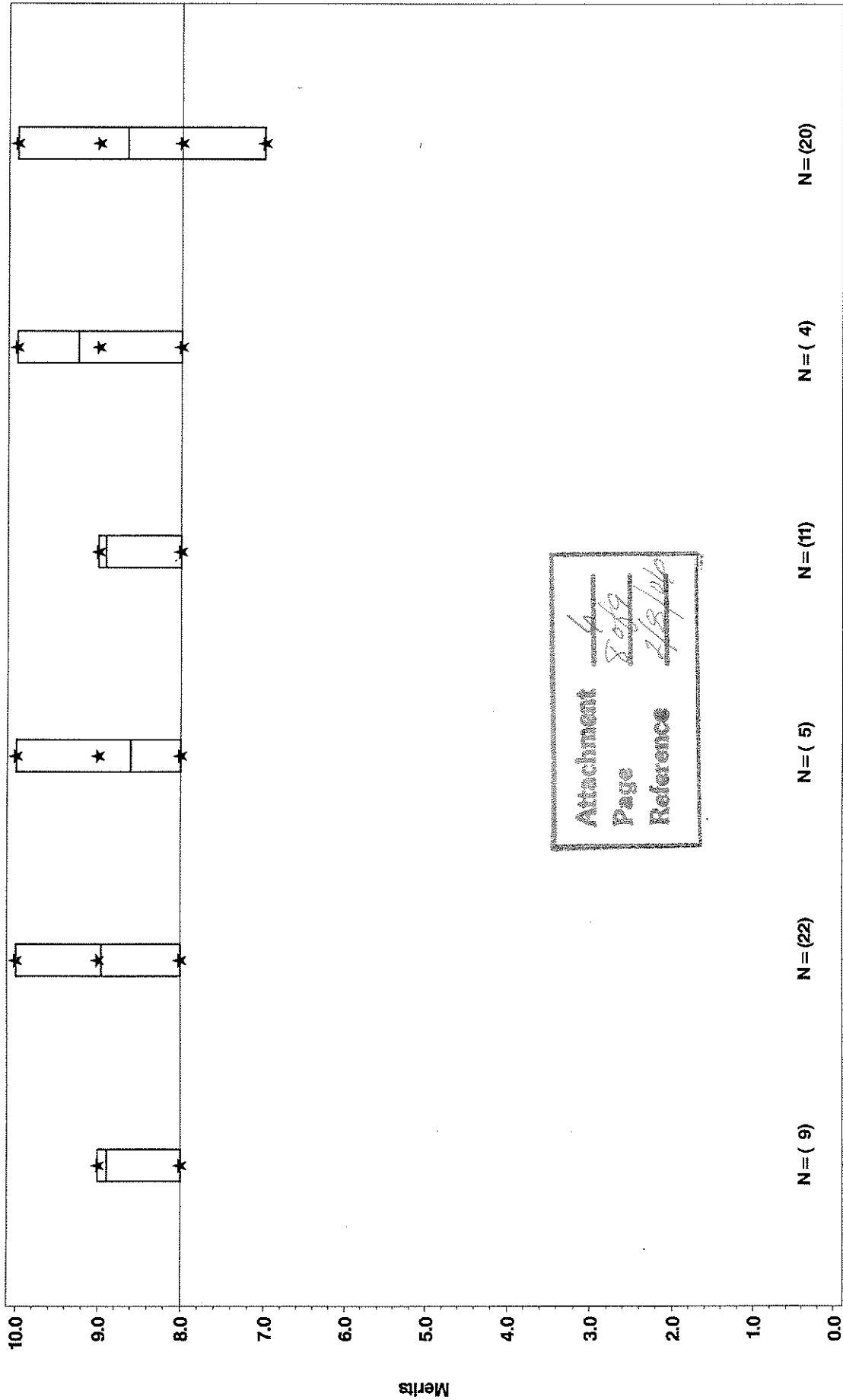
Reference Oil 151-2 & 151-3



# L-37 Reference Oil Performance by Pinion Batch

Rippling - NON-LUBRICATED

Reference Oil 151-2 & 151-3



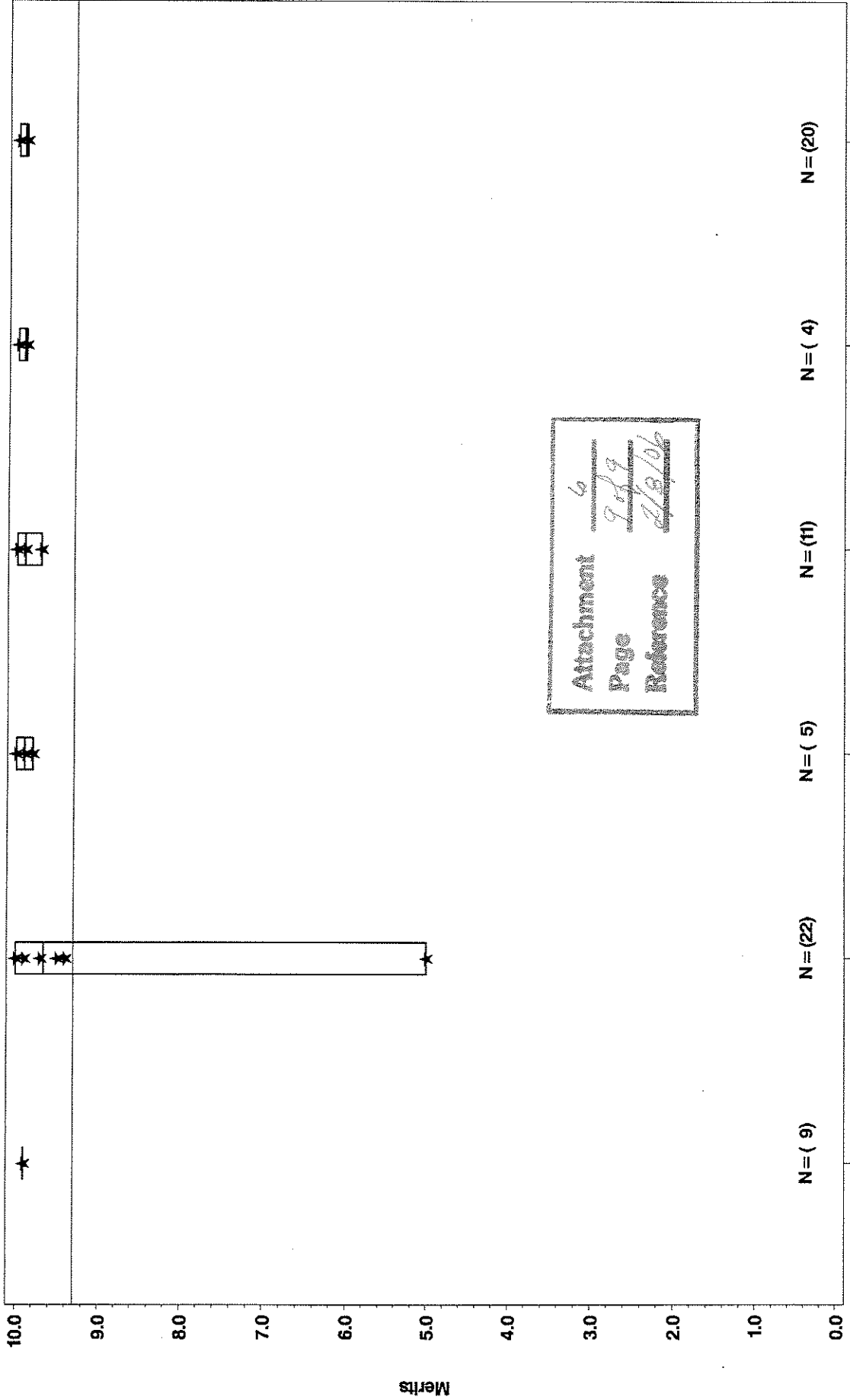
Attachment  
 Page  
 Reference

*4*  
*8019*  
*7/13/10*

# L-37 Reference Oil Performance by Pinion Batch

Spitting - NON-LUBRITED

Reference Oil 151-2 & 151-3



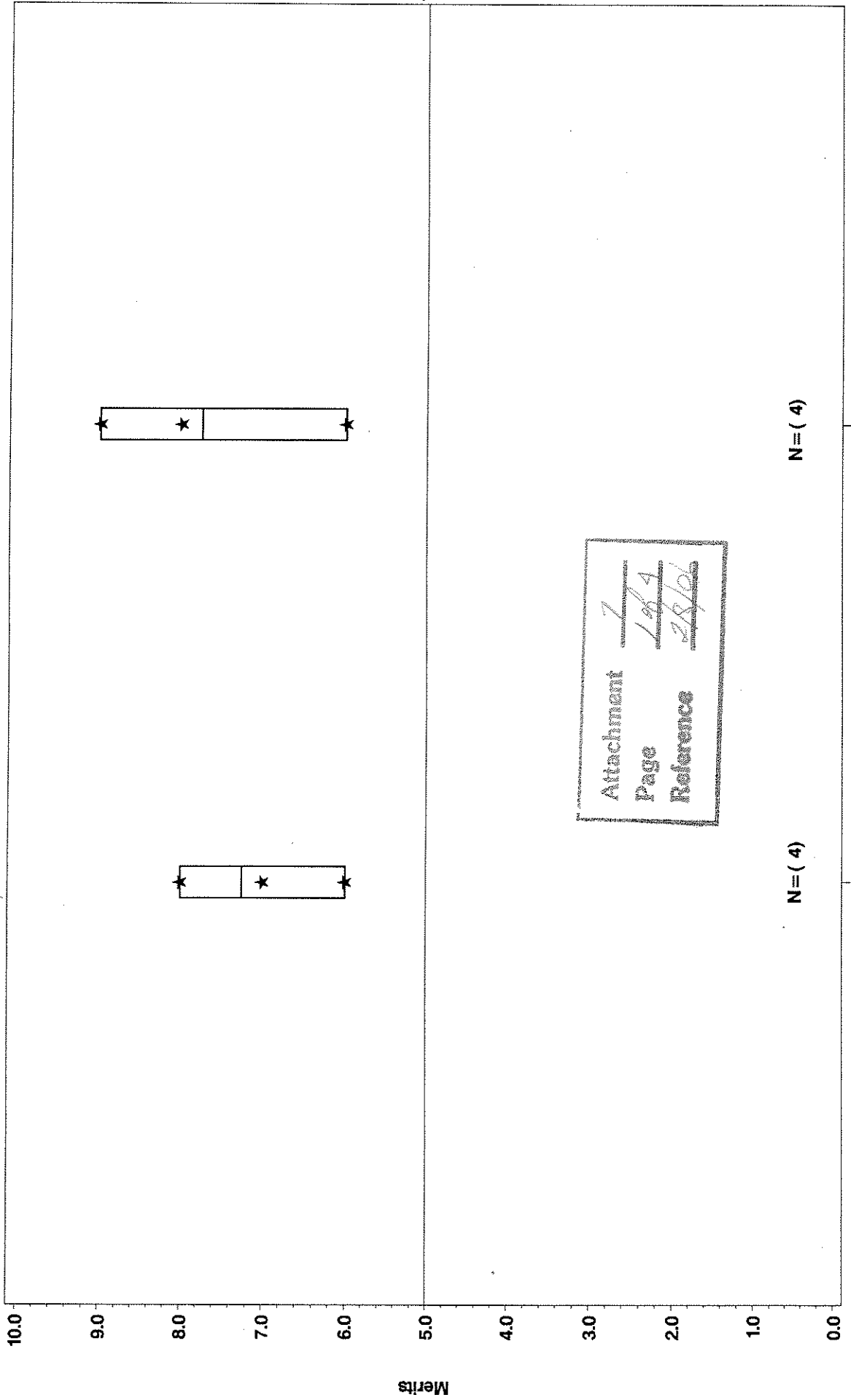
Attachment 6  
 Page 9 of 9  
 Reference 2/9/06

A3  
Special Mean

# L-37 Reference Oil Comparison

Wear - NON - LUBRICATED

Gear Batch V1L417/P4L792



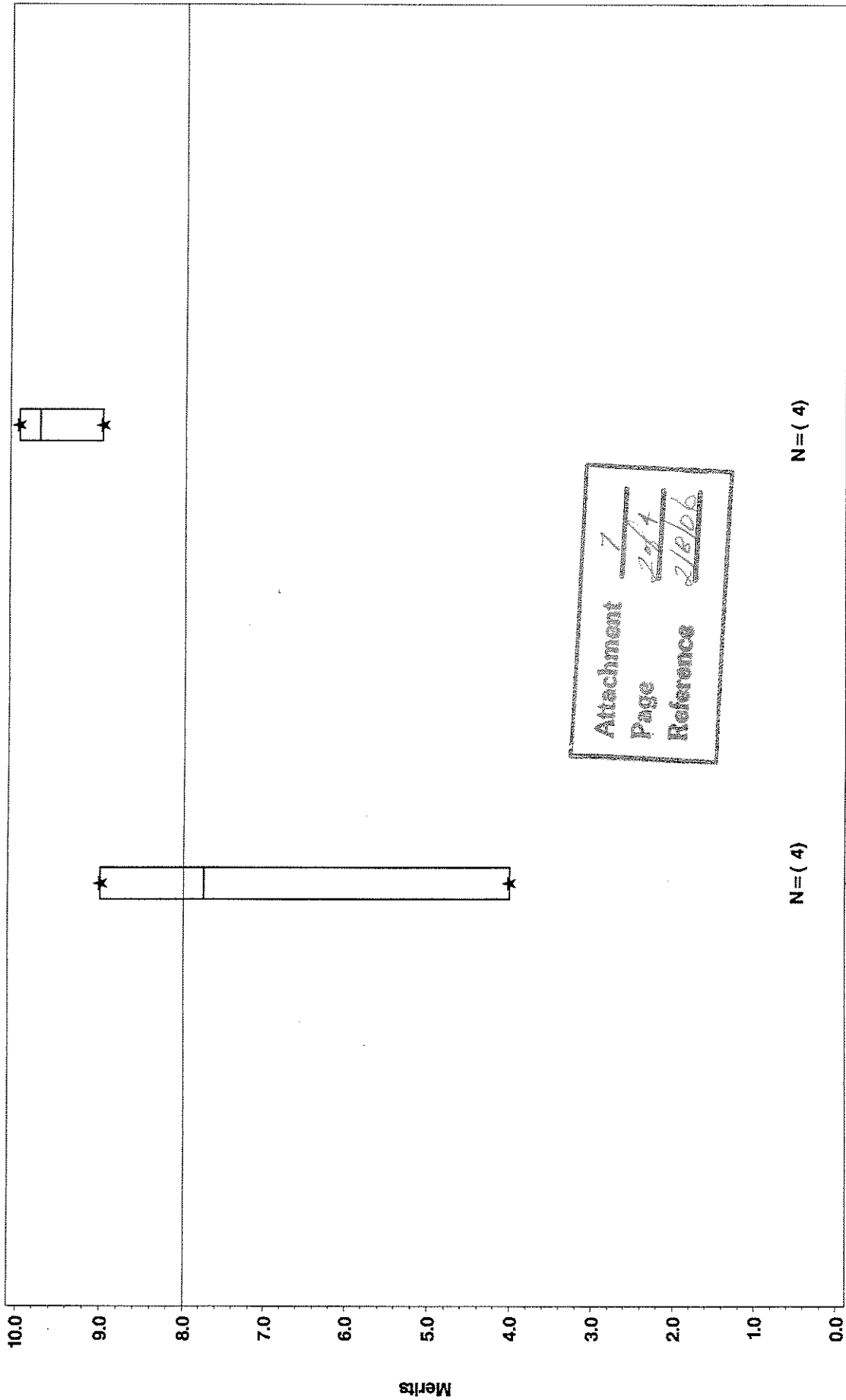
Attachment 7  
Page 1 of 4  
Reference 2/8/06

*Spencer 2/18/66*

# L-37 Reference Oil Comparison

Ridging - NON-LUBRICATED

Gear Batch V1L417/P4L792



N = ( 4)

N = ( 4)

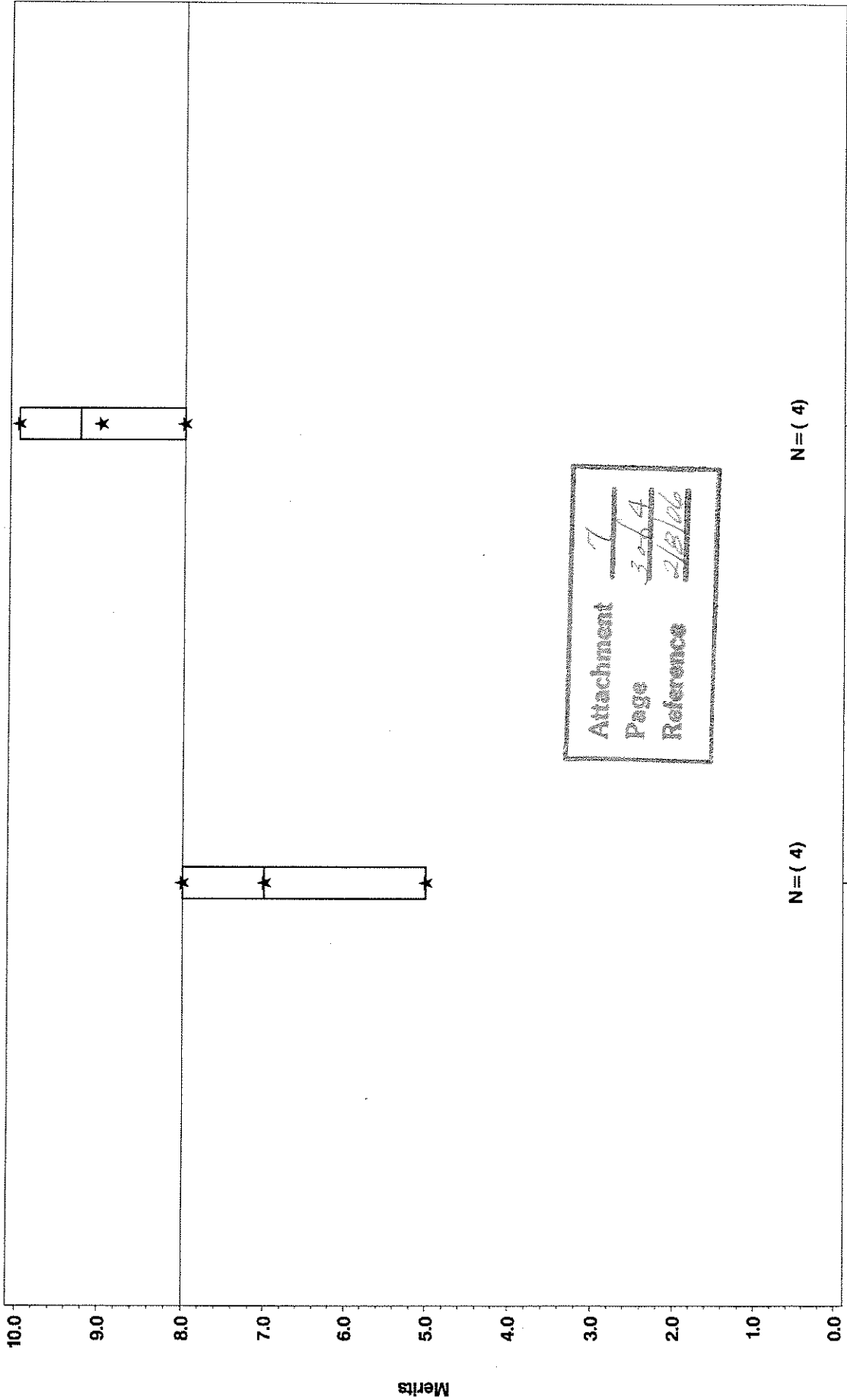


Separation gas

# L-37 Reference Oil Comparison

Rippling - NON - LUBRICATED

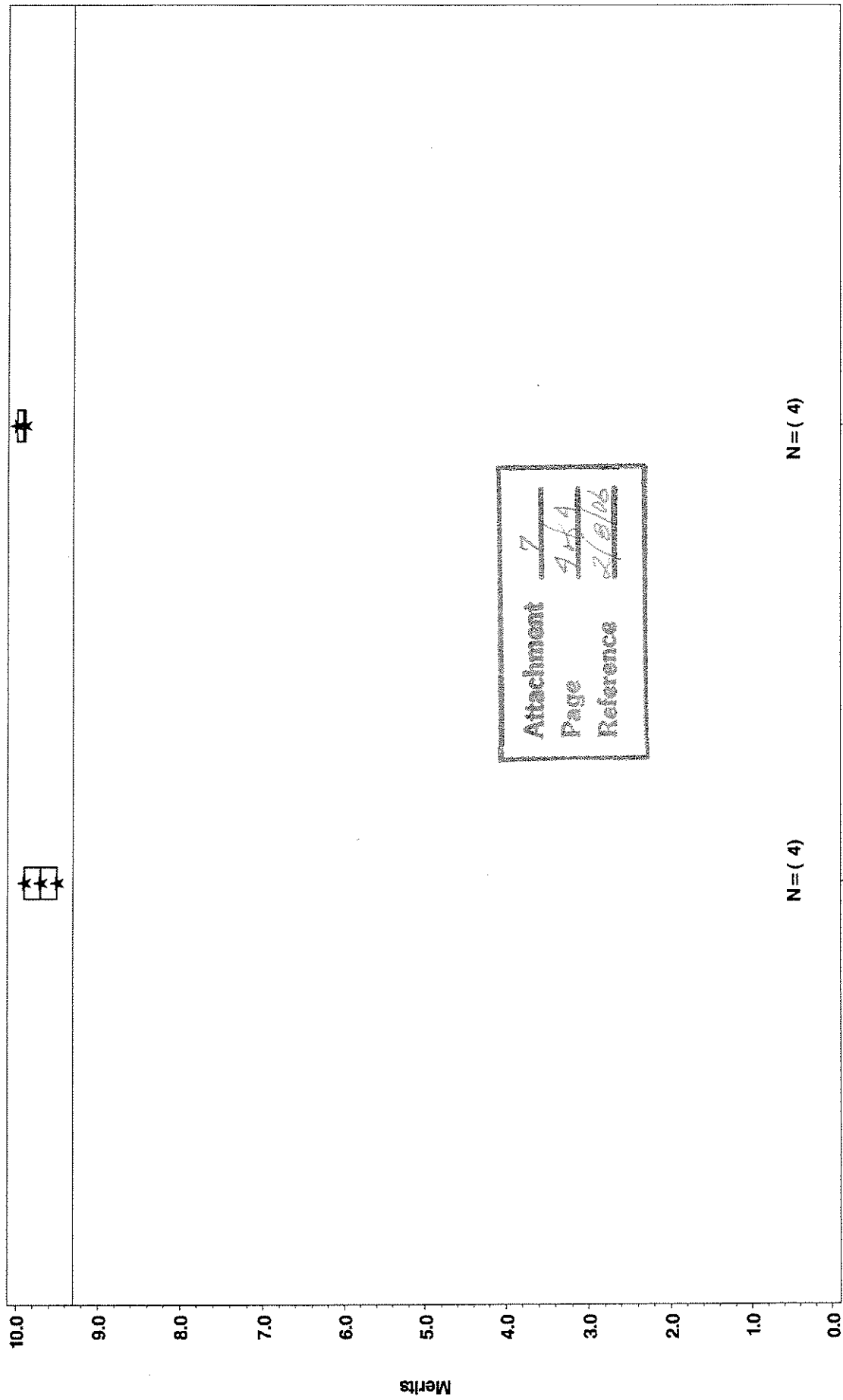
Gear Batch V1L417/P4L792



# L-37 Reference Oil Comparison

*separation - micron*

Spitting - NON - LUBRITED  
Gear Batch V1L417/P4L792



## Bartlett, Donald

---

**From:** Don Lind [dml@astmtmc.cmu.edu]  
**Sent:** Friday, September 23, 2005 7:46 AM  
**To:** Bartlett, Donald  
**Subject:** L37RC Rater Repeatability

**Attachments:** ripp.pdf; ridg.pdf; spit.pdf; wear.pdf



ripp.pdf (39 KB)



ridg.pdf (37 KB)



spit.pdf (41 KB)



wear.pdf (34 KB)

Don attached are pdf files of what I have determined is one of the better raters in industry. I believe this is what the panel had requested. The charts can also be found on the TMC web site at the path below. Please call me after you have reviewed the charts.

[ftp://ftp.astmtmc.cmu.edu/refdata/gear/l37rc/data/Rater\\_Repeatability/](ftp://ftp.astmtmc.cmu.edu/refdata/gear/l37rc/data/Rater_Repeatability/)

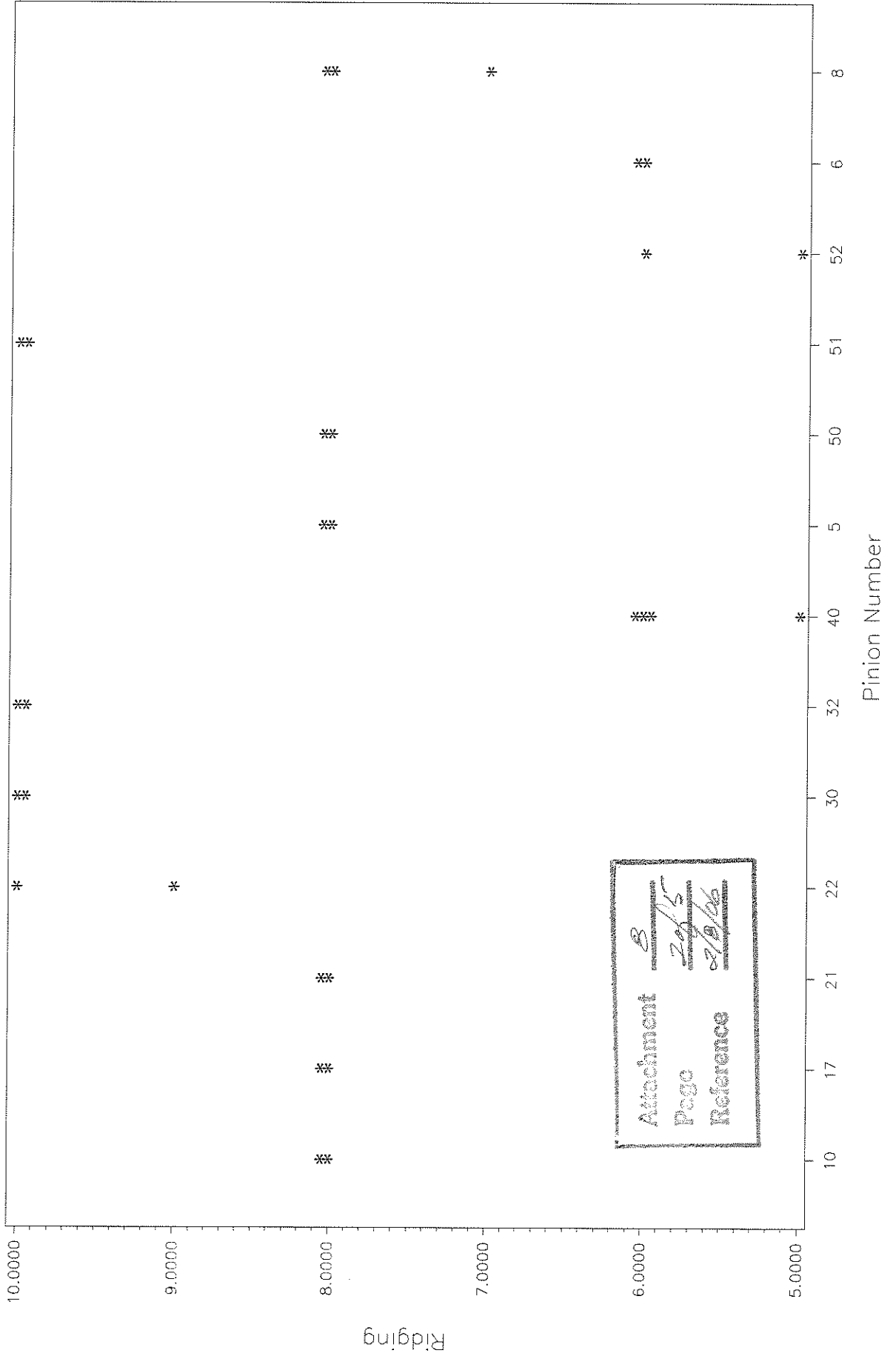
Don Lind  
Staff Engineer  
6555 Penn Avenue  
Pittsburgh, PA 15206  
Ph: 412-365-1034  
Fx: 412-365-1047  
Email: dml@astmtmc.cmu.edu

Attachment	<u>8</u>
Page	<u>1 of 5</u>
Reference	<u>2/8/06</u>

# L37 Rater Repeatability

Rater B

Ridging

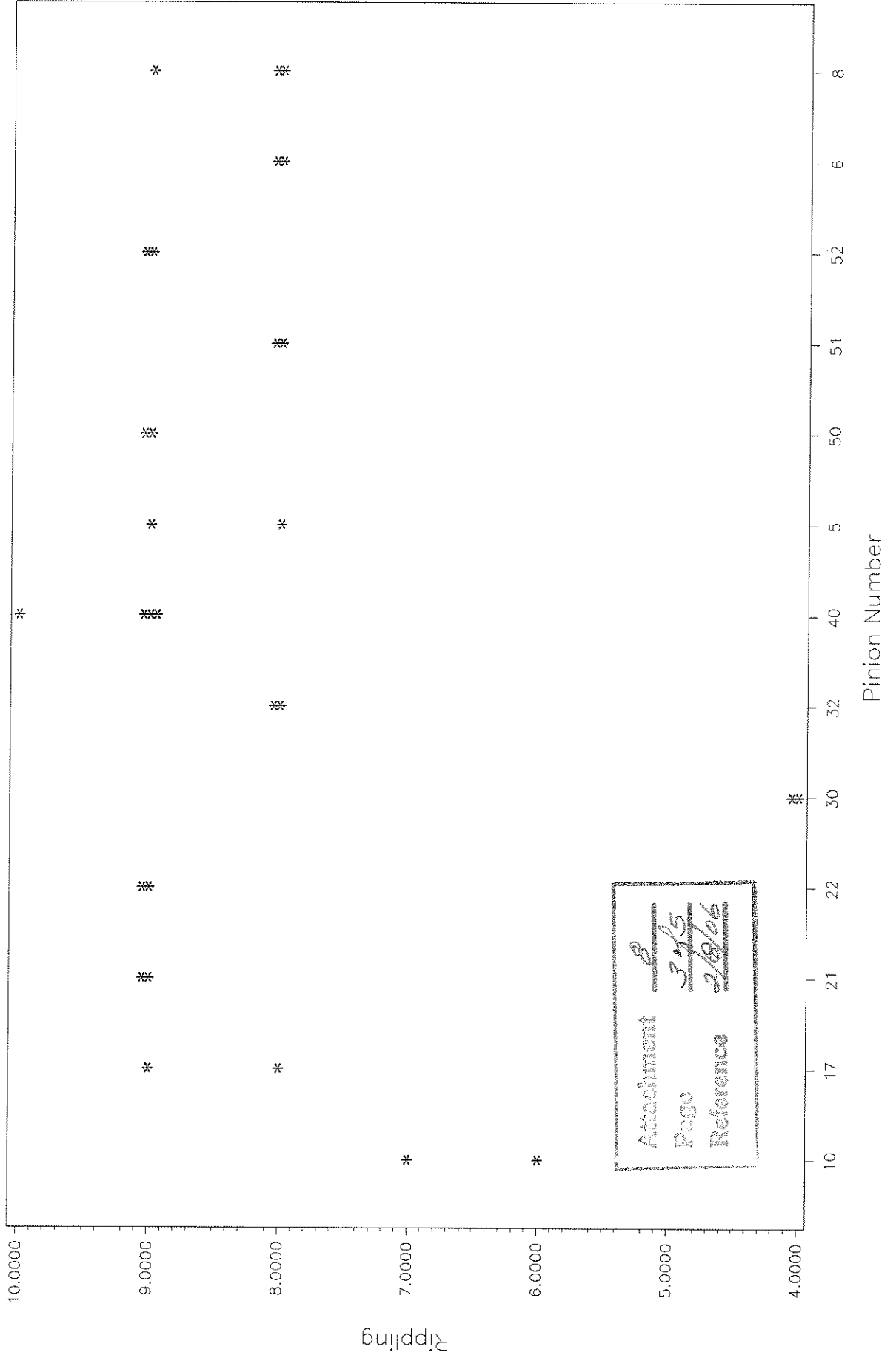


Attachment B  
Page 2 of 5  
Reference 2/19/06

# L37 Rater Repeatability

Rater B

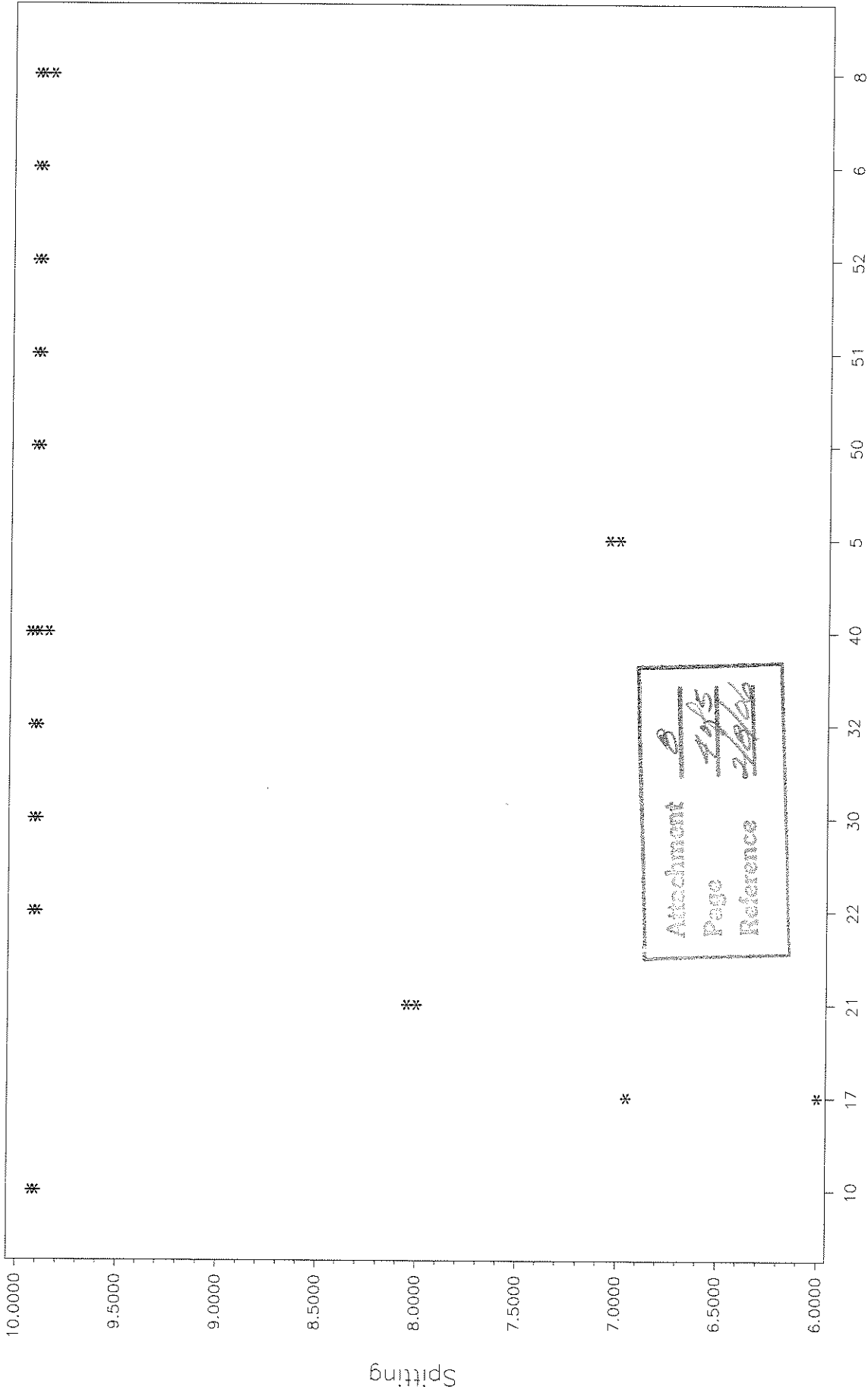
Rippling



# L37 Rater Repeatability

Rater B

Spitting



Attachment  
Page  
Reference

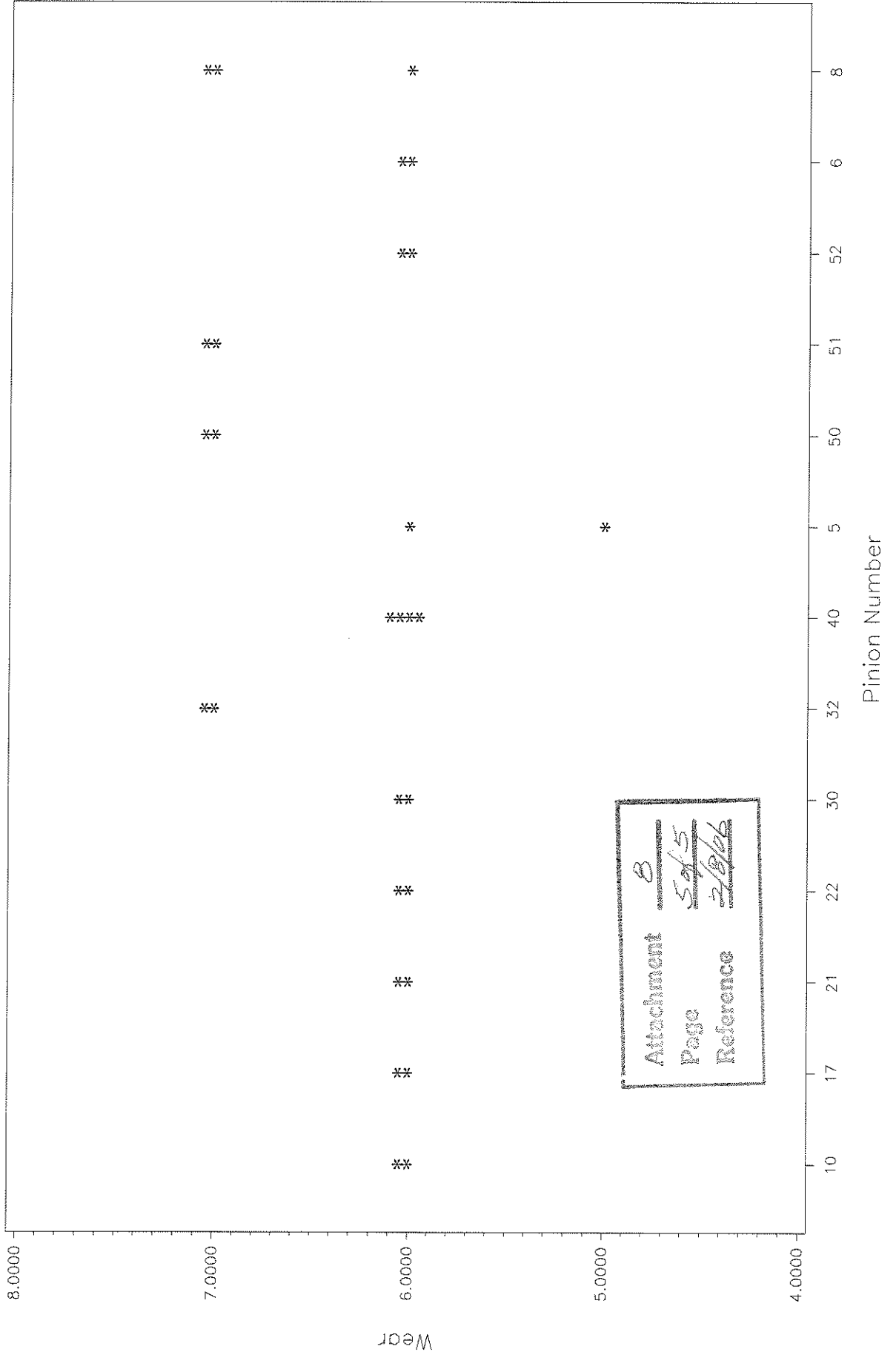
*B*  
*2/15*  
*2/20/06*

Pinion Number

# L37 Rater Repeatability

Rater B

Wear



Standard, lubricated L-37 test results using L247/T758A lubricated hardware  
 Fail areas shaded and bordered

Oil	Lab	Test#	Pinion Ratings					Ring Ratings				
			Wear	Rippling	Ridging	Pitting/ Spalling	Scoring	Wear	Rippling	Ridging	Pitting/ Spalling	Scoring
TMC 152	Lubrizol	191-2271	3	9	4	8	10	5	10	6	9.5	10
TMC 152	Lubrizol	191-2273	3	9	4	2	10	4	10	4	9.3	10
TMC 152	PARC	237	6	8	8	8	10	7	9	9	9.3	10
TMC 153	Lubrizol	191-2272	4	5	6	9.6	10	5	9	7	9.8	10
TMC 153	PARC	238	6	8	9	4	10	7	9	9	9.9	10
TMC 153	PARC	239	6	8	9	5	10	7	9	9	9.6	10
OEM 75W-140	PARC	?	6	8	7	2	-	7	9	9	9.9	-
OEM 75W-140	PARC	?	5	8	7	2	-	6	9	8	9.9	-
OEM 75W-140	PARC	?	6	8	8	9.4	-	7	9	9	9.9	-

Attachment 9  
 Page 1 of 1  
 Reference Alpha



**LUBRITED HARDWARE  
GEAR BATCH L247/T758A  
LOW TEMPERATURE, PHASE 6**

CMIR	Lab	STD	Run	Oil	Pinbat	Ringbat	DTCOMP	Pwear	Pridg	Pripp	Pspit	Rwear	Rridg	Rripp	Rspit	frcrat	lpcrat
53532	D	3A	381	152	L247	T758A	20050725	6	7	9	9.8	8	10	10	10	0	2
56534	D	3A	455	152	L247	T758A	20051231	5	6	8	7	9	8	9	9.9	-1	2
53541	B	191	2107	152	L247	T758A	20050317	5	6	8	8	7	7	9	9.4	0	2
53543	B	191	2156	152	L247	T758A	20050703	6	6	9	8	7	8	9	9.8	0	2
55381	B	191	2162	152	L247	T758A	20050711	6	6	9	8	8	8	10	9.5	0	2
53461	E	2	112	152	L247	T758A	20050426	6	7	9	8	7	8	9	9.8	0	2
53548	E	2	136	152	L247	T758A	20050715	6	8	8	7	7	9	9	9.4	0	2
53549	E	2	160	152	L247	T758A	20050825	6	8	8	9	7	9	9	9.6	1	2
53537	D	3A	375	153	L247	T758A	20050716	6	8	9	9.8	8	10	10	9.9	1	3
53539	D	3A	393	153	L247	T758A	20050810	6	8	8	9.9	9	10	10	10	0	2
53538	D	3A	394	153	L247	T758A	20050811	6	8	7	9	9	10	10	10	0	3
53544	B	191	2109	153	L247	T758A	20050319	6	8	7	8	8	9	10	9.9	1	2
53546	B	191	2158	153	L247	T758A	20050706	6	8	8	9	8	10	10	10	1	2
53547	B	191	2159	153	L247	T758A	20050707	6	9	8	7	8	10	10	10	0	2
53465	E	2	113	153	L247	T758A	20050427	6	9	8	9.6	7	9	9	9.9	0	2
53466	E	2	137	153	L247	T758A	20050719	6	9	8	9.7	7	9	9	9.9	0	2
53552	E	2	145	153	L247	T758A	20050729	6	9	8	9.9	7	9	9	9.9	0	2

**INVALID TESTS**

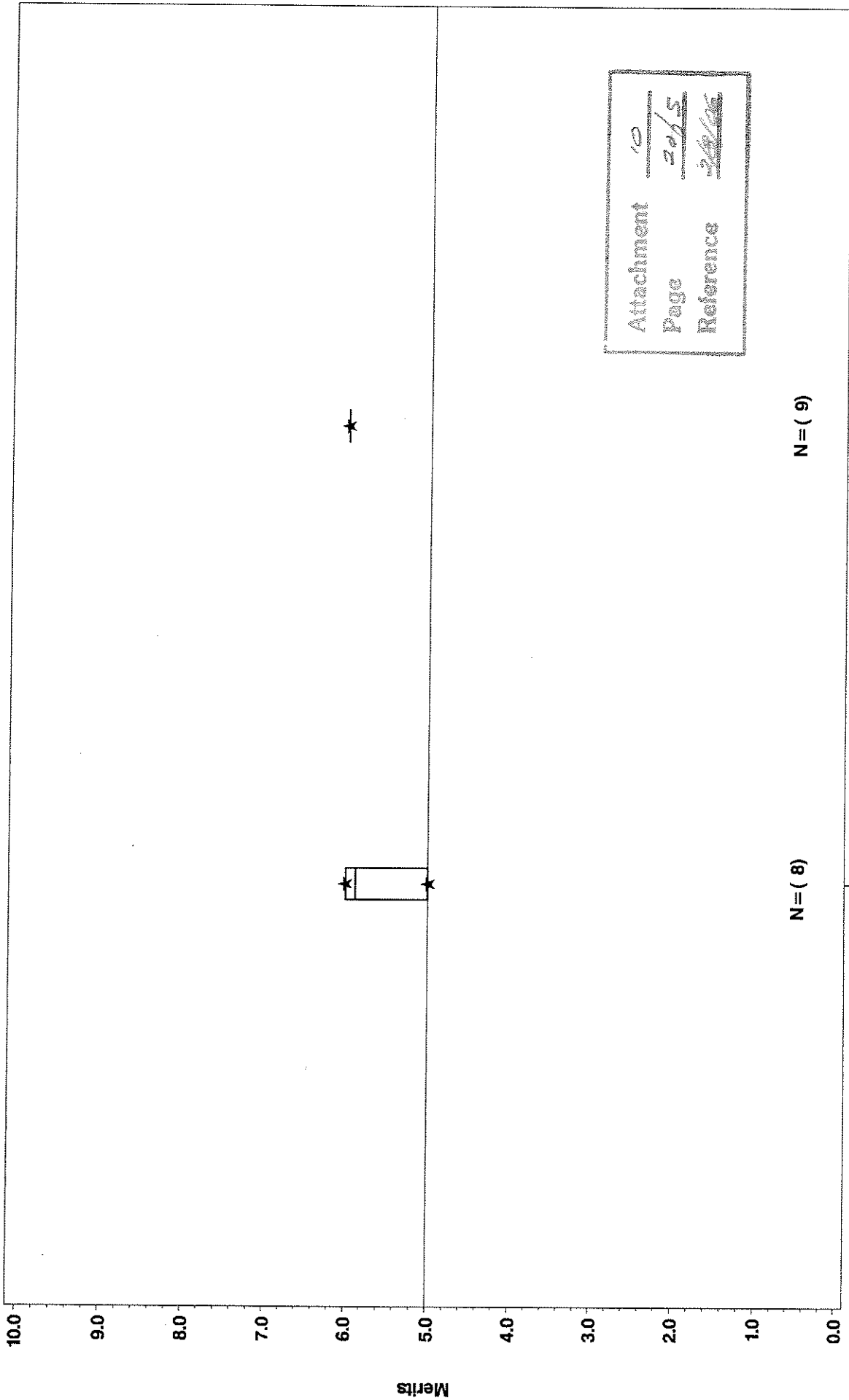
53530	D	3A	355	152	L247	T758A	20050604	6	8	9	9.8	9	9	10	9.9	0	3
53533	D	ABORTED															
53542	B	191	2155	152	L247	T758A	20050630	6	6	9	9.4	8	8	10	10	0	2
53462	E	2	133	152	L247	T758A	20050630	6	7	8	7	7	8	9	9.3	0	2

Attachment	<u>10</u>
Page	<u>1065</u>
Reference	<u>2/8/06</u>

# L-37 Reference Oil Comparison

Wear - LUBRITED -- Low Temperature

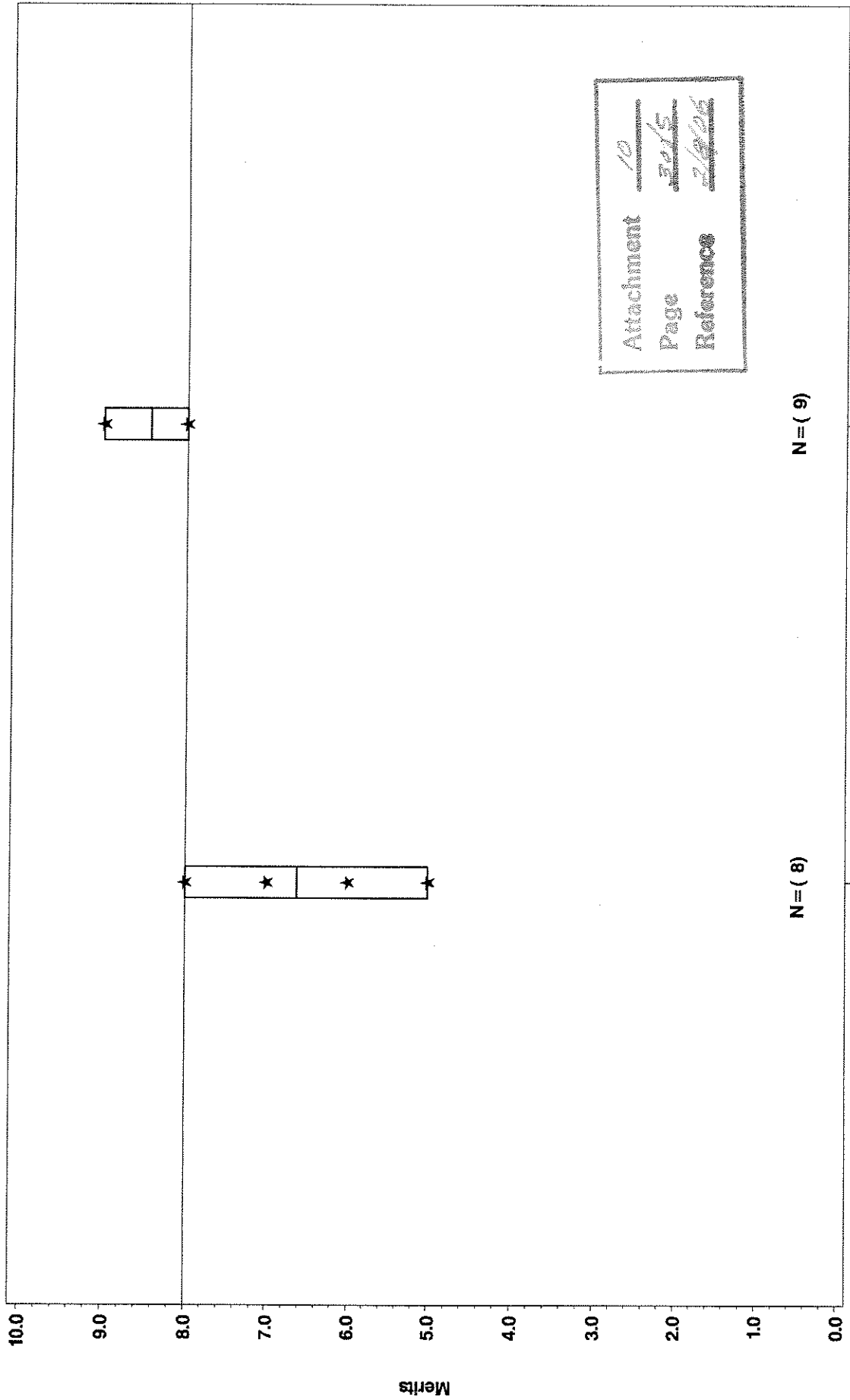
Gear Batch L247/T758A



Attachment 10  
Page 20/5  
Reference

# L-37 Reference Oil Comparison

Ridging - LUBRITED - Low Temperature  
Gear Batch L247/T758A



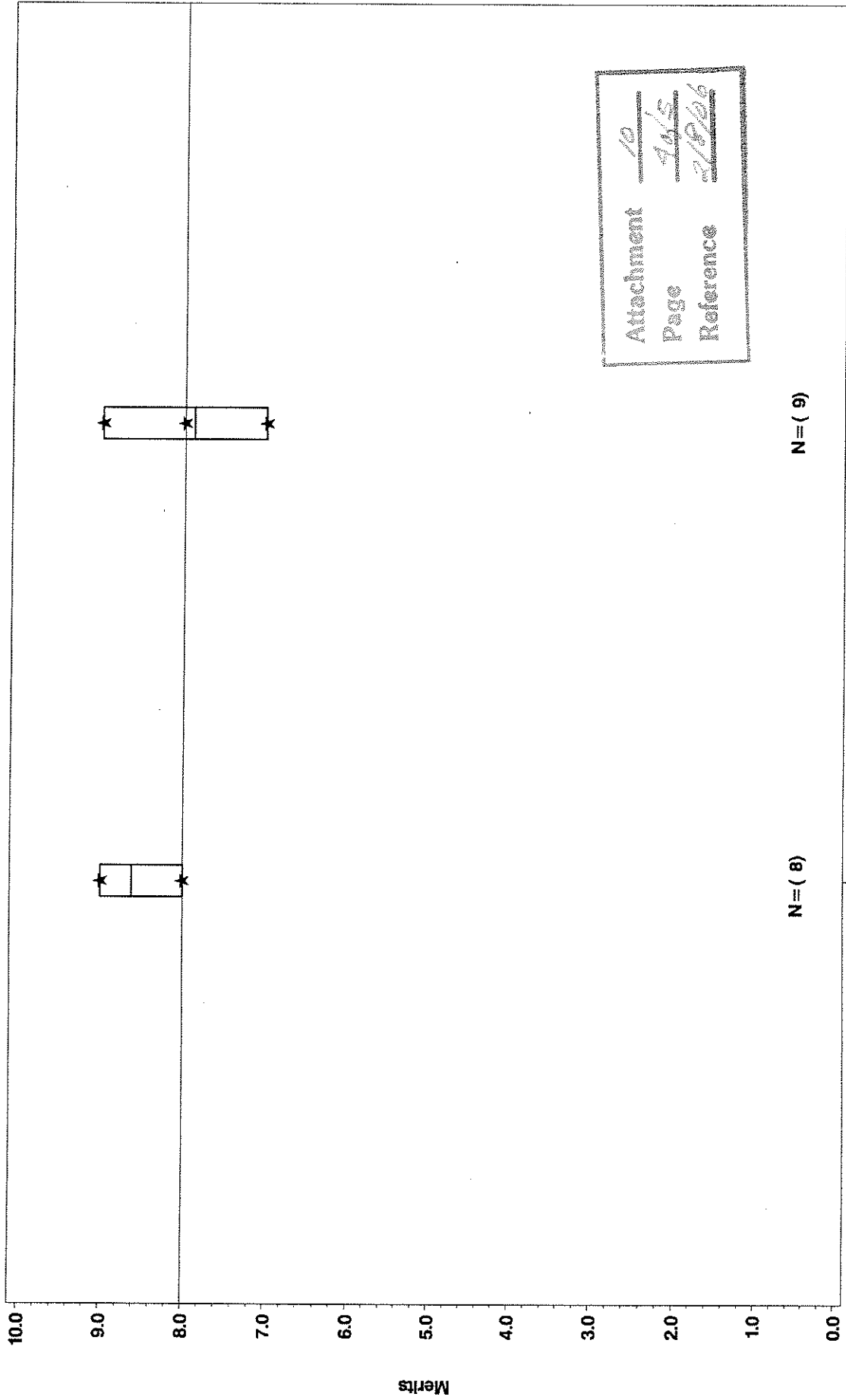
Attachment 10  
Page 30/5  
Reference 2/2/05

N = ( 9 )

N = ( 8 )

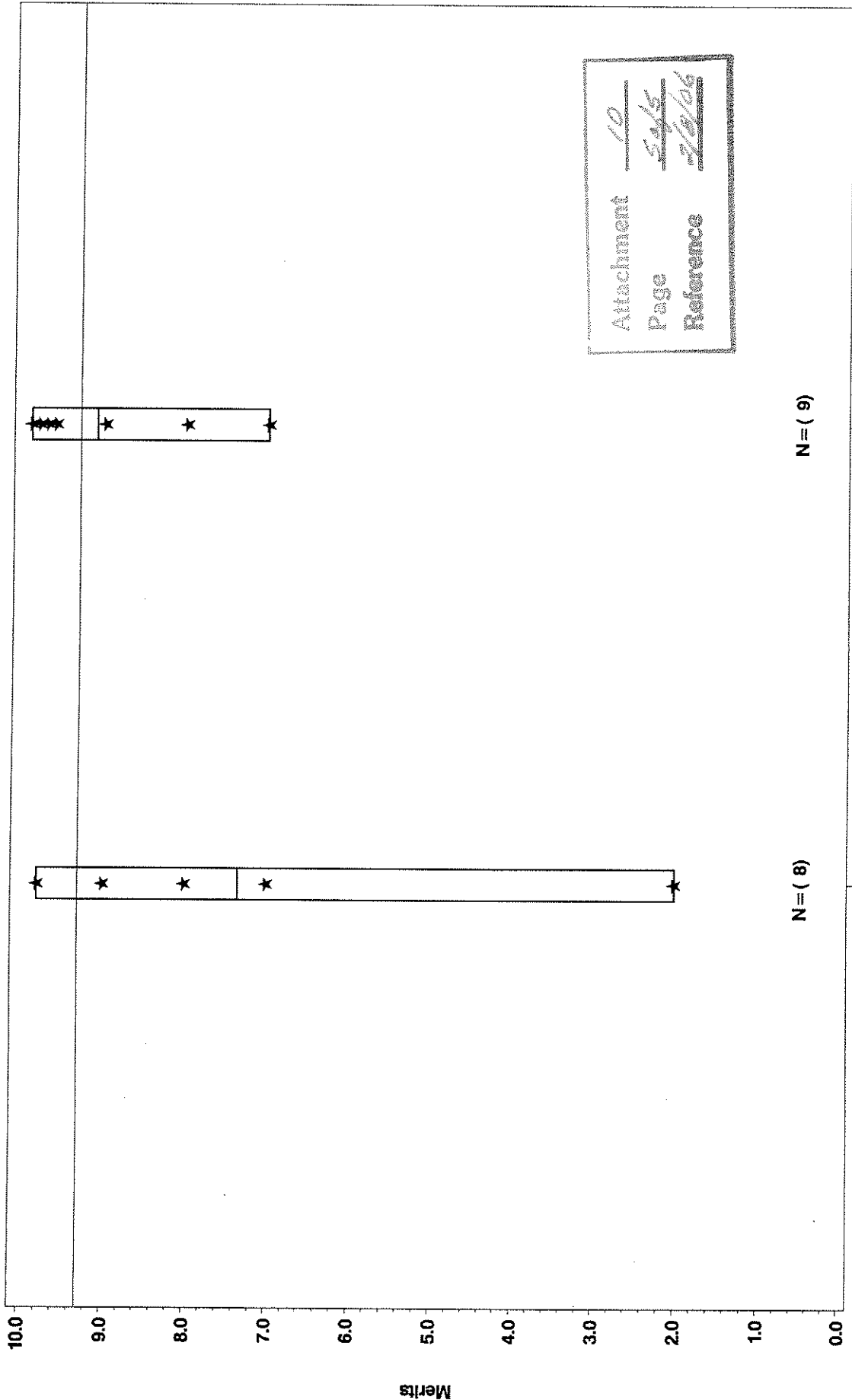
# L-37 Reference Oil Comparison

Rippling - LUBRITED - Low Temperature  
Gear Batch L247/T758A



# L-37 Reference Oil Comparison

Spitting - LUBRITED - Low Temperature  
Gear Batch L247/T758A



Attachment 10  
Page 54/5  
Reference 7/8/06

N = ( 9 )

N = ( 8 )

LTM\$IND	LTMSDATIVAL	RINGBAT	RIDG	RIPP	WEAR	SPIT	SPECIAL2	TVERSION
B	152 20041218 AC	P4L626A	5	8	6	9	LUBRITED	STANDARD
B	152 20050116 AC	P4L626A	5	8	6	9.6	LUBRITED	STANDARD
D	152 20050610 AC	P4L626A	5	8	7	9.8	LUBRITED	STANDARD
A	152 20050622 AC	P4L626A	6	9	6	9.7	LUBRITED	STANDARD
A	153 20051014 AC	P4L626A	5	8	6	9.6	LUBRITED	STANDARD

Attachment	<u>11</u>
Page	<u>141</u>
Reference	<u>2/2/06</u>

## TMC 151-3 Replacement Matrix

- TMC 151-3 Remaining Oil Inventory.
  
- Defining TMC 155 Matrix for Targets/Approval.
  - Do we set all TMC 151-3 aside for L-37 only because of the many gear batches?
  
  - What Gear Batch(s) do we include in Matrix
  
  - How many Tests?
  
  - Timing?

Attachment	<u>12</u>
Page	<u>1/1</u>
Reference	<u>2/8/06</u>

L-37

# 151-3 Replacement Oil Test Results

Parameter	Test Result	Yi	Current Target
Wear	6.0	-0.93	6.88
Rippling	9.0	-0.41	9.1
Ridging	9.0	-0.65	9.2
Spitting	9.9	0.08	9.88

Attachment 13  
Page 1 of 5  
Reference 2/8/06



2-60-1

Reference Oil 151-2 Targets

Viscosity Increase Mean	Pentane Insolubles Mean	Toluene Insolubles Mean	Average Carbon Varnish Mean	Average Sludge Mean
37.3	2.12	1.30	8.59	9.42

First Reference Oil 155 Test Result<sup>1</sup>

	Viscosity Increase	Pentane Insolubles	Toluene Insolubles	Average Carbon Varnish	Average Sludge
Original Units	30.17	1.54	1.28	9.24	9.53
Transformed Units	3.4068	0.4318	0.2469	2.4980	0.7550
Correction Factor	-0.1178	-0.4445	0.0000	0.0000	0.0000
Corrected Transformed Result	3.2890	-0.0127	0.2469	2.4980	0.7550
Severity Adjustment	0.0000	0.0000	0.0000	0.3042	0.0000
Final Transformed Result	3.2890	-0.0127	0.2469	2.8022	0.7550
Final Original Unit Result	26.82	0.99	1.28	9.43	9.53

Attachment	<u>13</u>
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Reference	<u>2-8-06</u>

L-60-1

### Second Reference Oil Test Result<sup>1</sup>

	Viscosity Increase	Pentane Insolubles	Toluene Insolubles	Average Carbon Varnish	Average Sludge
Original Units	33.02	1.41	1.05	8.80	9.56
Transformed Units	3.4971	0.3436	0.0488	1.9924	0.8210
Correction Factor	-0.1178	-0.4445	0.0000	0.0000	0.0000
Corrected Transformed Result	3.3793	-0.1009	0.0488	1.9924	0.8210
Severity Adjustment	0.0000	0.0000	0.0000	0.0000	0.0000
Final Transformed Result	3.3793	-0.1009	0.0488	1.9924	0.8210
Final Original Unit Result	29.35	0.90	1.05	8.80	9.56

<sup>1</sup> These test results were unofficial results on a pilot blend of oil.

Attachment	<u>13</u>
Page	<u>34/5</u>
Reference	<u>2/18/06</u>

HTCT  
151-3 Replacement Oil Test Results

Parameter	Test Result	Yi	Current Target
Cycles	71440	-0.76	80294

HTCT  
150-2 Replacement Oil Test Results

Parameter	Test Result	Yi	Current Target
Cycles	23174	-1.08	28932

Attachment	<u>13</u>
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Reference	<u>2/8/06</u>

L-33-1  
151-3 Replacement Oil Test Results

Parameter	Test Result	Yi	Current Target
RUST	9.66	0.24	9.64

Attachment	<u>13</u>
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Reference	<u>2/18/06</u>

**To: ASTM Gear Rating TF**

**Date: January 6, 2006**

Re: Action item expectation from the L-37 Surveillance Panel Meeting, August 24<sup>th</sup>, 2005. See meeting summary of the July 2005 Raters Workshop Review and Attachment # 7.

Stand, hardware and rating represent three major contributors that impart test severity levels in the L-37 test. The Gear Rating TF has a major ownership part of the rating process for L-37 testing. Because of that, we need your help and guidance in how to get to the precision level that we require.

The L-37 Surveillance Panel goal and expectation:

- For rating pinions and rings – The difference between the vast population of raters is that a rating for any distress should not be more than 1.
- The reproducibility of the number across the industry should be no worse than what it is where a lab has more than one rater.
- Examples prepared by TMC from L37 Rater Calibration Data, Date, December 22, 2005:
  1. Pinion 2, Rippling, discuss the spread? This is an example of not acceptable.
  2. Pinion 14, Rippling, Expectation is that the raters get it to the point that more often than not (as a population) they do not vary more than 1 unit, i.e., For a given tooth, Pinion 14, ratings are an 8 or 9. This is an example of acceptable.
  3. Pinion 14, Ridging is an example of poor reproducibility due to spread and an example of not acceptable.

We would appreciate your written comments and suggestions back to the panel from your meeting.

Best regards,

Don Lind  
Don Bartlett  
Bill Sullivan

Attachment	<u>14</u>
Page	<u>1061</u>
Reference	<u>2/8/06</u>



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January 31, 2006

To: Mr. Bill Sullivan, ExxonMobil  
 From: ASTM Gear Rating Task Force  
 Subject: L-37 LTMS Pinion Rater Certification Data

Don Lind presented the Gear Rating Task Force with L-37 LTMS pinion rater certification data provided by TMC at the Gear Rating Task Force meeting in Richmond, VA., January 10, 2006. After close review of the data, all raters were very concerned with the spread in the data. Since this was the first time this data was discussed with the raters, they were not aware of the variance in the data.

Raters feel making a valid effort to improve rater variance by discussing definitions, looking to improve or modify definitions, developing and discussing ideas for new or improved rating aides, and a close review and discussion of any variance in workshop data, will make a difference in producing better and acceptable data. The raters would also like the L-37 LTMS data presented to them more often to aid in keeping track of improvements, or negative changes in the data.

The Gear Rating Task Force as always, shares a great concern of any and all data produced by raters for L-37 LTMS pinions and all gear ratings in general, and is willing to do everything in their power to produce better and acceptable data.

Respectfully Submitted,

  
 Arthur Sanchez

ASTM Gear Rating Task Force Chairman

AS/cm

Attachment	<u>15</u>
Page	<u>1 of 1</u>
Reference	<u>2/8/06</u>

## Other Test Improvement Efforts - ALL

- August Action Items:
  - ✓ Panel Memo to Raters on Expectations – TMC
  
  - ✓ 7-tooth rating experiment – TMC
  
  - ✓ January 11, 2006 Gear Rating Work Shop Update – TMC
  
- L-37 RCMS System check. Is it Doing What it was Meant to do? Changes?

Discussion comments:

Attachment	<u>16</u>
Page	<u>1 of 1</u>
Reference	<u>2/8/06</u>