308 --- Q200903310002
Scientific Notebook No. 907: I580 Bridge Collapse (09/28/2007 through 08/07/2008)

LABORATORY NOTEBOOK

GEOSCIENCES & ENGINEEING DIVISION

Controlled

SCIENTIFIC
NOTEBOOK
907

~~20.06003.06.067~~ AHC 3/28/2009
20.14004.01.601

NOTEBOOK NO. _____

ISSUED TO DARRELL DUNN / ASAD CHOWDHURY

ON 9/28 **20**07

DEPARTMENT CNWRA

RETURNED 3/28 **20**09

DARRELL DUNN DD

Brian K. Deeby BKD

Title: I580 Bridge Collapse
(Continued from Scientific Notebook 884)

SCIENTIFIC NOTEBOOK COMPANY
2831 LAWRENCE AVENUE
STEVENSVILLE, MICHIGAN 49127
(800) 537-3028 - http://www.snco.com

Abbreviation Table

Abbreviation	Definition

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Initial Scientific Notebook Entry

I580 Bridge Collapse

Original: 6/12/07

Title: I580 Bridge Collapse

Tests Preformed by: Darrell S. Dunn (18), Byron Chapa (18) Brian Deeby (18)

Objectives: Collect samples and information on the I580 bridge collapse and estimate temperature of fire and the affected structures after the accident.

Special Training or Qualification: None

Equipment: Samples will be collected by contractor with metal cutting capability. Care will be exercised to prevent heating of the samples to temperatures that may affect properties and microstructures. Analysis of samples will be performed in Division 18 standard metallurgical microstructural analysis capabilities including Optical Microscopy, X-Ray Diffraction and Scanning Electron Microscopy with Energy Dispersive Spectroscopy (SEM-EDS) and hardness testing. For thermally treated specimens, furnace temperatures will be recorded with a calibrated thermocouple and thermocouple meter.

Materials: ASTM A7 Steel from the bridge structure and associated welds on the box and plate girders. Hardware such as bolts and rivets may also be used

Specimen specifications: Samples will be identified at time of collection.

Controlled Parameters: Sample location and preparation methods. If thermal processing is performed to duplicate microstructures observed, the temperature of the specimens and time of exposure will be controlled

Measurement Parameters: Location of material samples. In addition the following parameters may be measured, temperature of the specimen during thermal exposure (lab tests), hardness, composition.

Required level of accuracy: Temperature +/- 10 °C.

Uncertainty and Sources of Error: To be determined

Project No. _____

Book No. _____ TITLE _____

Thermally Aged Procedure

Quanity/Specimens = (1) NRC 9-9

OVEN= Lindberg model # 51333 SN# 909172

OVEN SETPOINT= 905°C

OVEN TEMPERATURE= 938.6°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH22

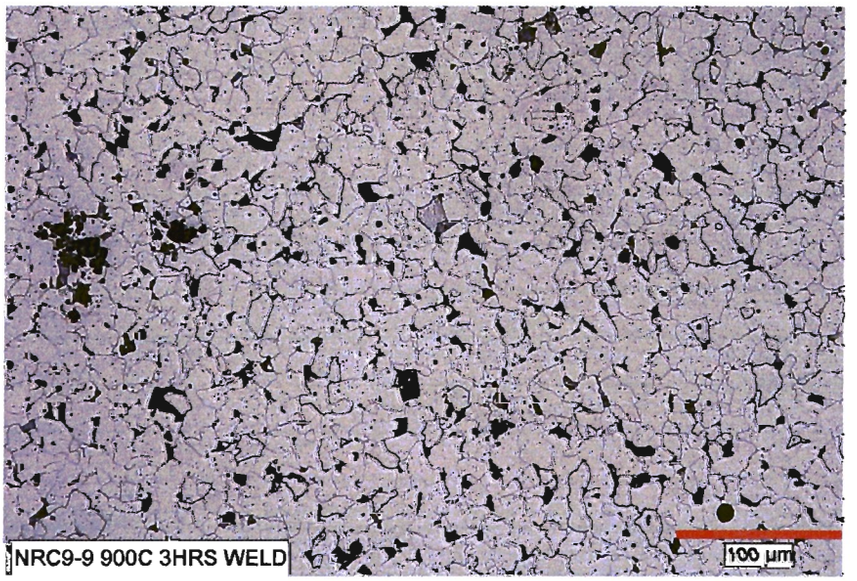
	SN#=	T 94140	**CAL=** 4/26/07	**DUE=**	10/26/07
Thermocouple	**SN#=**	329	**CAL=** 8/3/07	**DUE=**	2/3/08

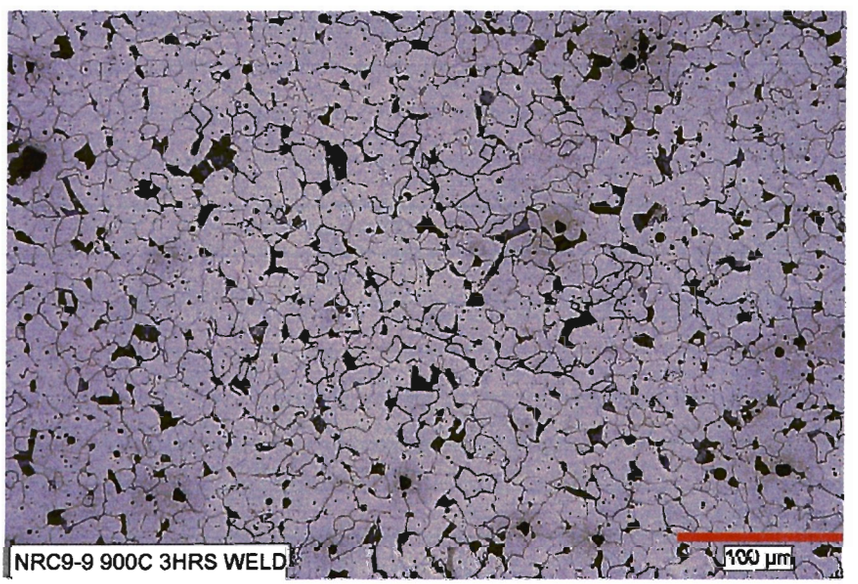
AMOUNT OF TIME = 3 hrs.

DETAILS= Placed Specimen In Oven for 3 hrs. Removed from Oven then Air Cooled To Room Temperature

9/25/07

Recorded by:	Date	Verified by:	Date
	9/28/07		





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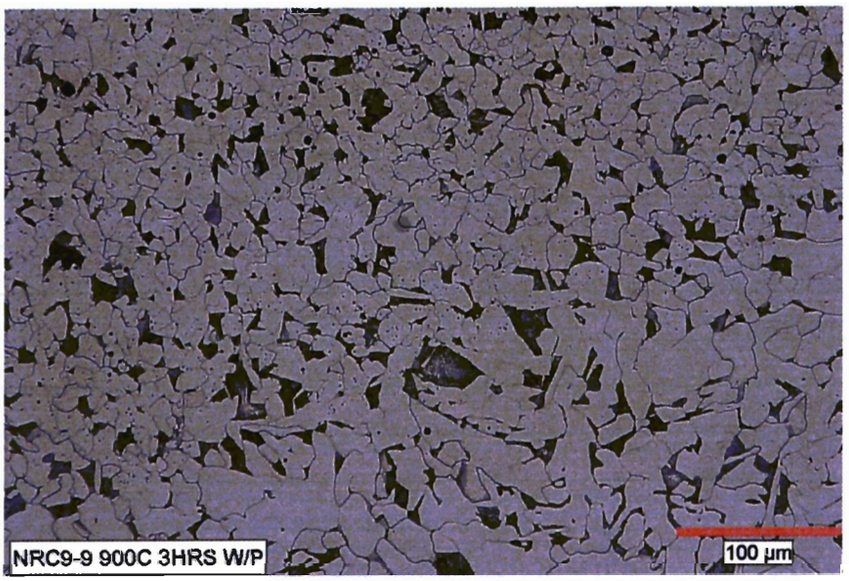
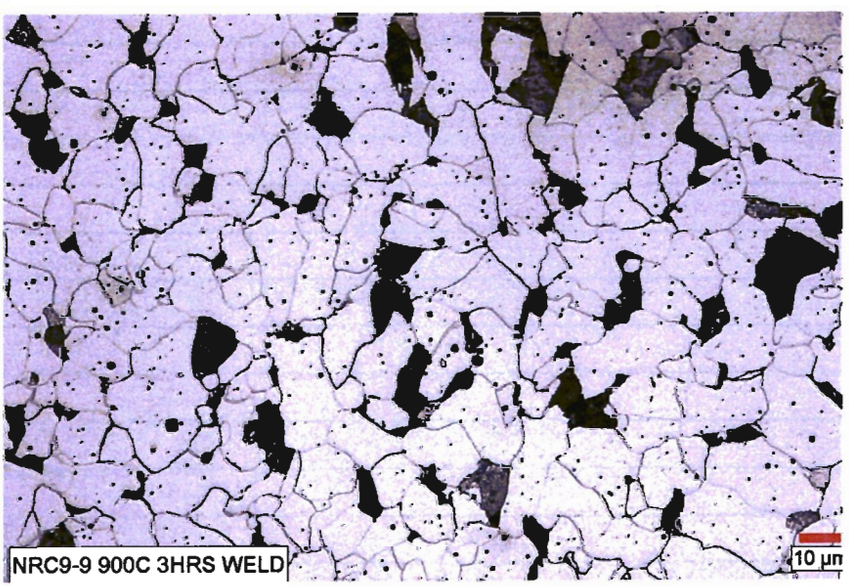
	9/26/07		

Project No. _____

Book No. _____ TITLE _____





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[signature]	9/28/07		

Recorded by:	Date	Verified by:	Date
	9/28/07		

Requisition: **07036687**
Requisitioner: Dunn, Darrell S.
Req Organization: 1.18.03.08
Phone: (210) 522-6090

SOUTHWEST RESEARCH INSTITUTE

Suggested Supplier: Body cote
City/State: Glendale Heights IL
Contact: Jennifer Caruso
Phone: 630 221 0385

Date Printed: 09/26/2007
Date Created: 09/11/2007
Requisition Date: 09/18/2007

Special Instructions: Email test results to ddunn@swri.org Identify samples as either Plate or Weld

Line #	Item / Description	U/M	Need By Date	Requested Qty	Est Unit Cost	Estimated Costs
1	Chemical analysis of ASTM A7 Steel for Fe, Cr, Ni, Cu, Mn, C, Si, Al, P, S Deliver To: D.Dunn Building 128 Account: 704-000 Organization: 1.20.01.55 Project: 06003.06.061 Allocation Pct: 100.00	EA	10/5/2007	1.00	80.00	80.00
2	Chemical analysis of weld on ASTM A7 Steel for Fe, Cr, Ni, Cu, Mn, C, Si, Al, P, S Deliver To: D.Dunn Building 128 Account: 704-000 Organization: 1.20.01.55 Project: 06003.06.061 Allocation Pct: 100.00	EA	10/5/2007	1.00	80.00	80.00
					Total Estimated Cost:	$160.00

Government Project?: YES Property Type: G1 Is Govt. Property being sent to supplier?: NO

ASL Required: YES

Quality Assurance?: YES Costpoint QC Inspection Required: NO

Sourcing Explanation: The only vendor on the ASL for this service. Note that this is formerly Stavely Services.

Is this requisition for or does this requisition include a service (other than a repair)?: YES
Is the service to be performed on or off campus: OFF

Approvals: Requestor: Darrell S Dunn 9/11/2007 4:02:20 PM
Department/Division Management: Asadul H Chowdhury 9/12/2007 5:58:11 PM David R Turner 9/17/2007 9:55:10 AM
Quality Assurance: Robert D Brient 9/13/2007 8:30:18 AM

Requisition: **07036687**
Requisitioner: Dunn, Darrell S.
Req Organization: 1.18.03.08
Phone: (210) 522-6090

SOUTHWEST RESEARCH INSTITUTE

Suggested Supplier: Body cote
City/State: Glendale Heights IL
Contact: Jennifer Caruso
Phone: 630 221 0385

Date Printed: 09/26/2007
Date Created: 09/11/2007
Requisition Date: 09/18/2007

Line #	Item / Description	U/M	Need By Date	Requested Qty	Est Unit Cost	Estimated Costs

Submitted By: Lori L Salas 9/18/2007 11:04:33 AM

CERTIFIED INSPECTION/TEST DATA IS REQUIRED WITH SHIPMENT OF PARTS, MATERIALS, AND FOR SERVICES.

Your organization will provide goods or services in accordance with the requirements of your quality system or that of the Geosciences and Engineering Division Quality Assurance Manual. Technical and quality assurance procedures required in the performance of your staff members' work will be identified in procurement documents. Documentation requirements shall be specified in the purchase order and will be supplied with the product. If scientific notebooks are utilized, they are subject to periodic submittal and review and must be returned at the conclusion of work to the Geosciences and Engineering Division Quality Assurance or payment will be withheld. Your organization's product will be accepted based on an evaluation by Geosciences and Engineering Division staff and will be returned for rework at Seller's expense if the product does not meet requirements. Additionally, there shall be "right of access" to your facility to confirm effective implementation of the quality requirements with the possibility of audits, source inspections, or surveillances. The Seller shall notify Geosciences and Engineering Division Quality Assurance of any nonconformance to the requirements of this purchase order; further work shall not be done unless directed by Geosciences and Engineering Division Quality Assurance. If there are any Quality Assurance-related questions, please call the Director of Quality Assurance at (210) 522-5537.

A SWRI APPROVED SUPPLIERS LIST (ASL) VENDOR IS REQUIRED FOR
THIS PURCHASE ORDER.

Purchase requisition for Chemical analyses of samples

Recorded by: Date 9/26/07 Verified by: Date

Bodycote TESTING GROUP
Staveley Services Materials Testing - A New Bodycote Company
Certificate # 286.01
Certificate # 286.02
Glendale Heights Materials Testing Division
194 Internationale Blvd.
Glendale Heights, IL 60139
Tel: (800)537-4012
Fax: (630)871-5520
www.bodycote.com
www.bodycotetesting.com

Test Report

SOUTHWEST RESEARCH INST. 7010
6220 CULEBRA RD
P.O. DRAWER 28510
SAN ANTONIO TX 78284
DARRELL DUNN

P.O.# 787898J

DESCR 09/20/07
ASTM A7 STEEL

REPORT DATE: 09/28/2007

LAB NO: 0927-024 / 02 RECEIVED DATE: 09/27/2007 JOB NO:

SAMPLE "NRC 5" WELD (AREAS IDENTIFIED)

CHEMICAL ANALYSIS

Si	.19	Mn	1.02	C	.21
P	.010	S	.014	Ni	.07
Cr	.01	Cu	.12	Al	.01
Fe	REMAINDER				

TEST METHODS: ASTM E-415-05* ;

AUTHORIZED REPRESENTATIVE

ALL CHEMICAL TEST RESULTS ARE REPORTED IN WEIGHT PERCENT UNLESS OTHERWISE NOTED.

SAMPLE RESULTS RELATE ONLY TO THE SAMPLE TESTED

Recorded by: _____ Date 9/28/07 Verified by: _____ Date _____

Bodycote TESTING GROUP

Staveley Services Materials Testing - A New Bodycote Company

Test Report

ACCREDITED
Certificate # 286.01
Certificate # 286.02

Accredited Nadcap
Glendale Heights Materials Testing Division

194 Internationale Blvd.
Glendale Heights, IL 60139
Tel: (800)537-4012
Fax: (630)871-5520
www.bodycote.com
www.bodycotetesting.com

SOUTHWEST RESEARCH INST. 7010
6220 CULEBRA RD
P.O. DRAWER 28510
SAN ANTONIO TX 78284
DARRELL DUNN

P.O.# 787898J

DESCR 09/20/07
ASTM A7 STEEL

REPORT DATE: 09/28/2007

LAB NO: 0927-024 / 01 RECEIVED DATE: 09/27/2007 JOB NO:

SAMPLE "NRC 9" 1/2" THICK PLATE

CHEMICAL ANALYSIS

Si	.10	Mn	.35	C	.19
P	.004	S	.017	Ni	.03
Cr	<.01	Cu	.12	Al	<.01
Fe	REMAINDER				

TEST METHODS: ASTM E-415-05* ;

AUTHORIZED REPRESENTATIVE

ALL CHEMICAL TEST RESULTS ARE REPORTED IN WEIGHT PERCENT UNLESS OTHERWISE NOTED.

SAMPLE RESULTS RELATE ONLY TO THE SAMPLE TESTED

Recorded by: _____ Date 9/28/07 | Verified by: _____ Date

SAMPLE STORAGE

all samples obtained in this work were labeled, bagged and placed in boxes and relocated from the Met lab to the office of Darrel Dumas BLDG 128 RM 232

at the conclusion of the project, the final disposition of the samples will be made. Storage in BLDG 128 is just for temporary purposes and will not be permanent

Recorded by: Darrel Dumas Date 10/26/07 Verified by: Date

Sample ID	Description
Truck Sample 1	Front tire cord from left side of vehicle
Truck Sample 2	Tire cord from #5 axel on right side of vehicle
Truck Sample 3	Brake pad located near rear of vehicle
Truck Sample 4	Rim sample from #5 axel
Truck Sample 5	Spring located near rear of truck
Truck Sample 6	Large bolts (3) located on frame and near engine
Truck Sample 7	Grade 5 bolt located on frame
Truck Sample 8	Copper wire ground strap located on frame
Truck Sample 9	Copper wire battery cable
Truck Sample 10	Copper wire electrical system wiring located on frame
Truck Sample 11	Fitting with brass located on engine
Truck Sample 12	Bolt from engine passenger side with copper wire and aluminum
Truck Sample 13	Aluminum screen from radiator
Truck Sample 14	Aluminum rim from dual wheel axel
Truck Sample 15	Aluminum tank section
Truck Sample 16	Glass Mirror from passenger side
Truck Sample 17	Stainless steel mirror support bracket

SAMPLES COLLECTED FROM THE TANKER TRUCK INVOLVED IN THE APRIL 29, 2007 FIRE AND I-580 DAMAGE

SAMPLES WERE COLLECTED MARCH 19, 2008 IN OAKLAND, CA PRESENT WERE CHRIS BAJWA (NRC) EARL EASTON (NRC) AND DARREN DUNN (SWRI)

Recorded by: [signature]

Date 3/24/08

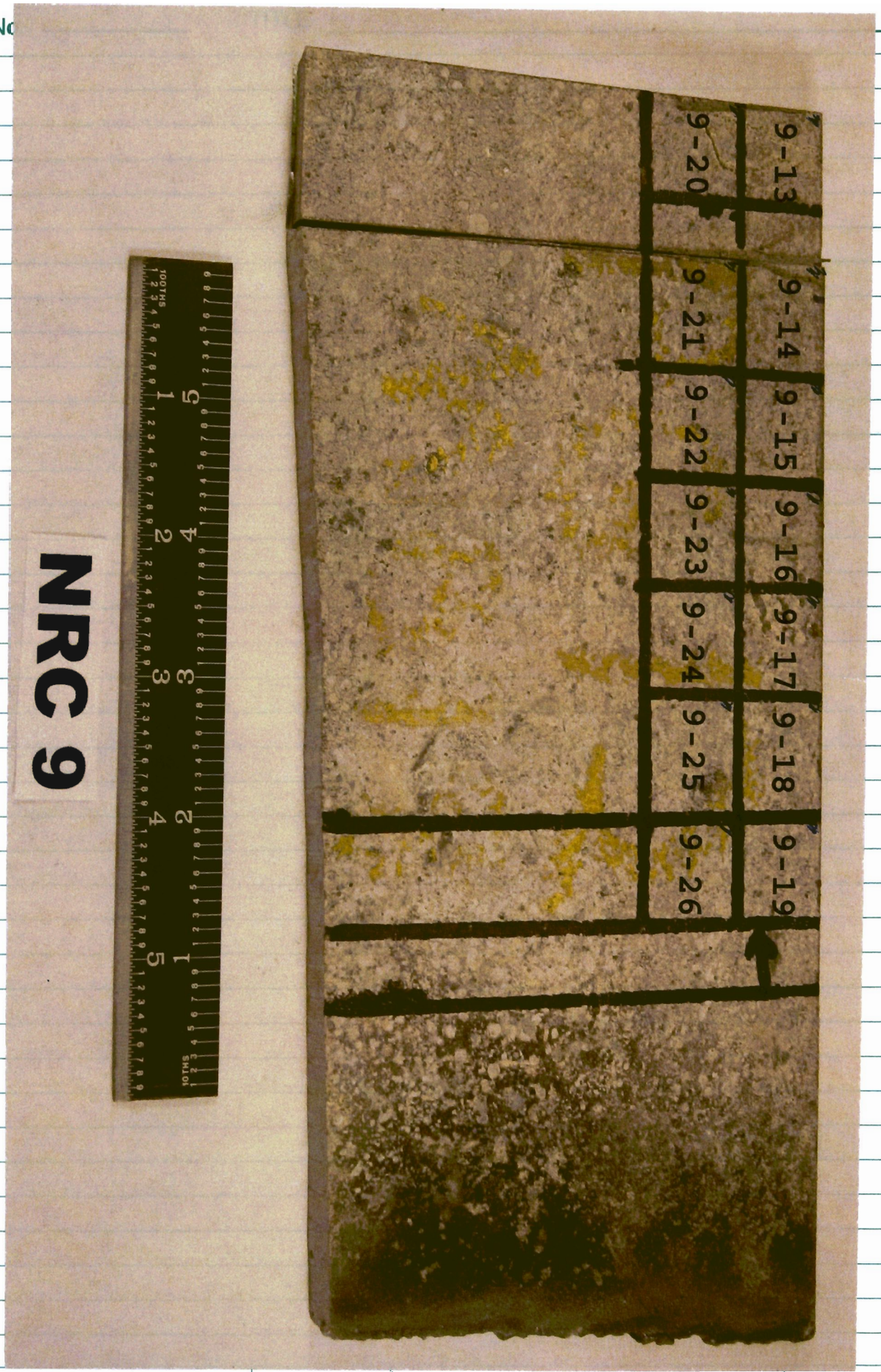
Verified by:

Date

TITLE _____ Book No. _____

Recorded by:	Date	Verified by:	Date
	6/24/08		

Book No



Recorded by: B-k D

Date 4/24/08

Verified by:

Date

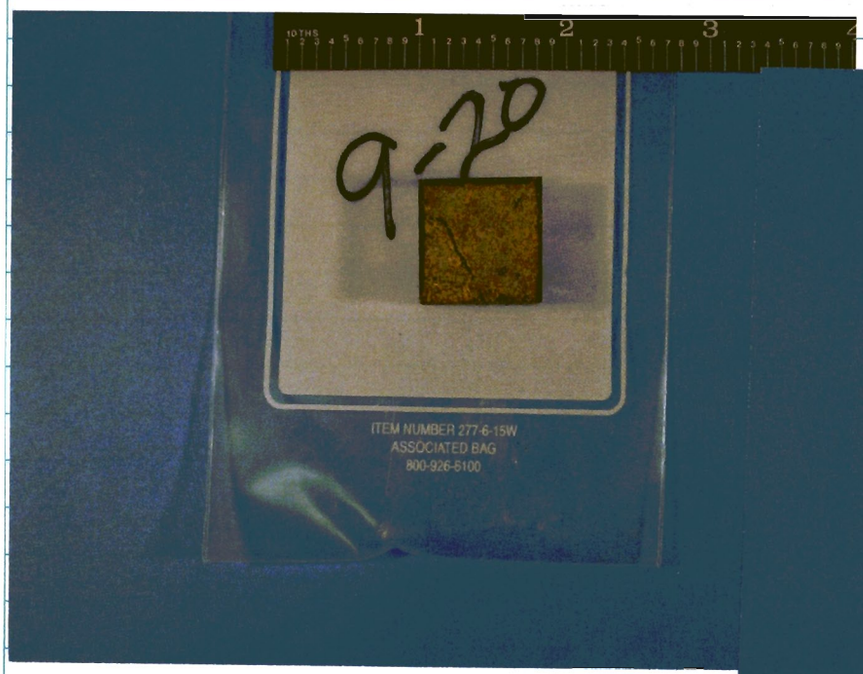
Thermal Age Specimen Identification

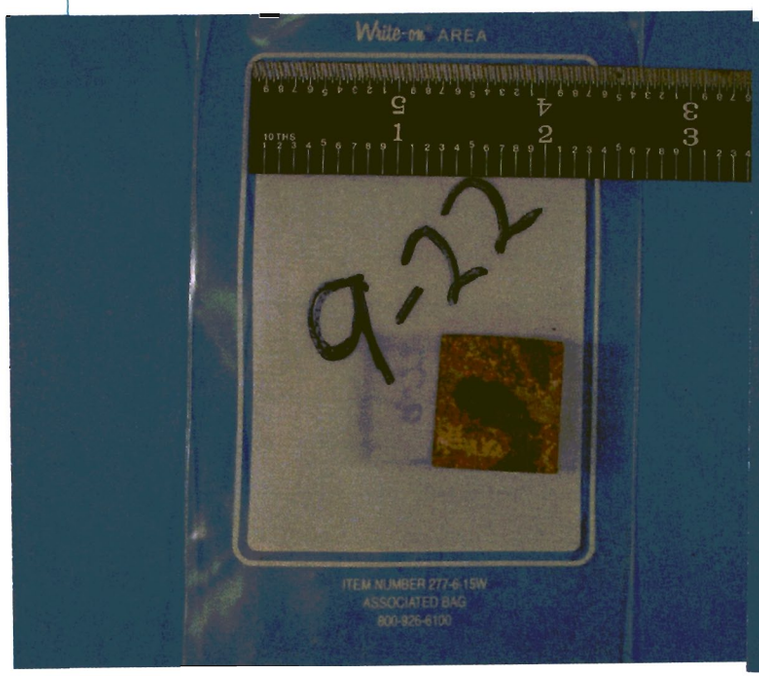
Sample	Thermal Exposure	Analysis
NRC 3-1 Stiffener	none	Hardness, microstructure, grain size
NRC 3-2 Stiffener	850 °C for 3 hours	Hardness, microstructure, grain size
NRC 3-3 Stiffener	900 °C for 3 hours	Hardness, microstructure, grain size
NRC 3-4 Stiffener	925 °C for 3 hours	Hardness, microstructure, grain size
NRC 3-5 Stiffener	950 °C for 3 hours	Hardness, microstructure, grain size
NRC 3-6 Stiffener	975 °C for 3 hours	Hardness, microstructure, grain size
NRC 3-7 Stiffener	1000 °C for 3 hours	Hardness, microstructure, grain size
NRC 9-13 Stiffener	none	Hardness, microstructure, grain size
NRC 9-14 Stiffener	850 °C for 3 hours	Hardness, microstructure, grain size
NRC 9-15 Stiffener	900 °C for 3 hours	Hardness, microstructure, grain size
NRC 9-16 Stiffener	925 °C for 3 hours	Hardness, microstructure, grain size
NRC 9-17 Stiffener	950 °C for 3 hours	Hardness, microstructure, grain size
NRC 9-18Stiffener	975 °C for 3 hours	Hardness, microstructure, grain size
NRC 9-19 Stiffener	1000 °C for 3 hours	Hardness, microstructure, grain size

Sample	Thermal Exposure	Analysis
NRC 9-20 Stiffener	none	Base sample paint
NRC 9-21 Stiffener	100 °C for 3 hours	Paint degradation, photograph
NRC 9-22 Stiffener	200 °C for 3 hours	Paint degradation, photograph
NRC 9-23 Stiffener	300 °C for 3 hours	Paint degradation, photograph
NRC 9-24 Stiffener	TBD - 400°C 3hrs	" "
NRC 9-25 Stiffener	TBD - 500°C 3hrs	" "
NRC 9-26 Stiffener	TBD - 600°C 3hrs	" "
NRC 9-35	700°C 3hrs	" "
NRC 9-36	800°C 3hrs	" "

Recorded by: [signature] Date 6/24/06 Verified by: Date

Pre Exposure Photos of Specimens 9-20 thru 9-26
See thermally Age Procedure on pg # 13





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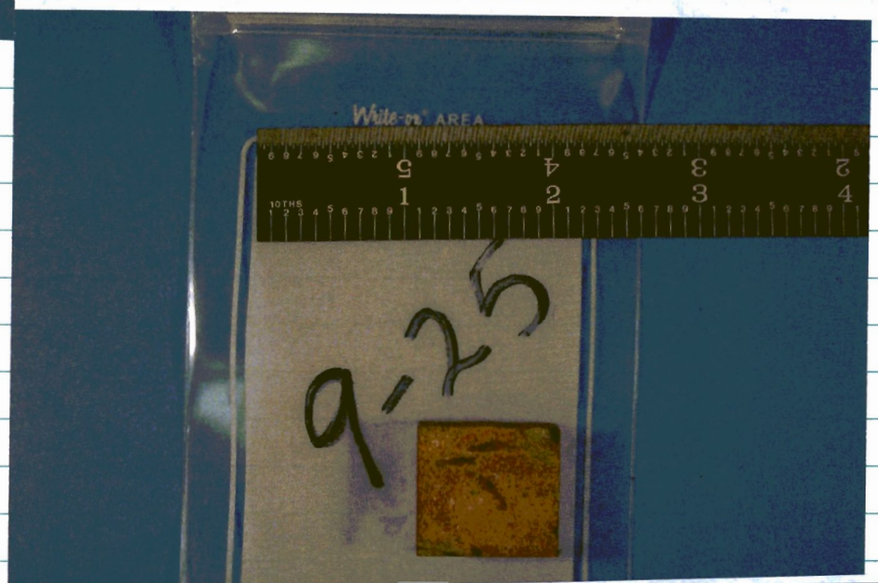
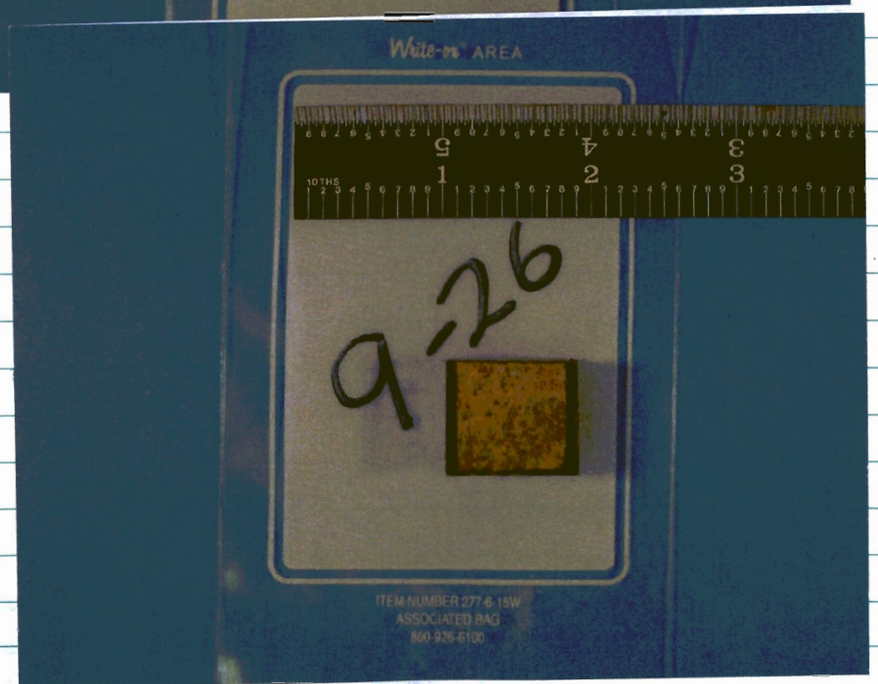




Recorded by: _____ 6/24/08 Date _____

Thermally Aged Procedure

Quanity/Specimens = (1) 9-14 Specimen (1) 3-2 Specimen

OVEN= Lindberg Model #51333 SN# 909172

OVEN SETPOINT= 855°C

OVEN TEMPERATURE= 860.7°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T-94140 CAL= 4/14/08 DUE= 10/14/08

Thermocouple= #329 Cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME = 3hr.

DETAILS= Placed both Specimen Into Oven
Spaced 2" Apart held At Oven
Set point for 3 hrs.
Removed Specimens And Air Cooled
Back To Room Temperature

6/25/08

Recorded by:	Date	Verified by:	Date
	6/25/08		

Thermally Aged Procedure

Quanity/Specimens = (1) 3-3 Specimen (1) 9-15 Specime

OVEN= Linoberg model # 51333 SN# 909172

OVEN SETPOINT= 905°C

OVEN TEMPERATURE= 912.8°C Highest stable @ 908.8°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T-94140 CAL= 4/14/08 DUE= 10/14/08

Thermocouple= #329 cal: 2/12/08 Duc: 8/12/08

AMOUNT OF TIME = 3 hrs.

DETAILS= Placed both Specimen Into Oven

Spaced 1" Apart held At Oven
Set point for 3hrs
Removed Specimens And Air Cooled
Back To Room Temperature

6/26/08

Recorded by:	Date	Verified by:	Date
	6/26/08		

Thermally Aged Procedure

Quanity/Specimens = (1) 3-4 Specimen (1) 9-16 Specimen

OVEN= Lindberg model #51333 SN# 909172

OVEN SETPOINT= 915°C

OVEN TEMPERATURE= 928.6°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22

Thermocouple= SN#= T-94140 CAL= 4/14/08 DUE= 10/14/08
#329 cal: 2/12/08 due: 8/12/08

AMOUNT OF TIME = 3 hrs.

DETAILS= placed both Specimens In Oven
Spaced 2" Apart Held At oven
Set point for 3 hrs
Removed Specimens And Air Cooled
Back To Room Temperature

Recorded by: _____ Date 6/26/08 Verified by: _____ Date _____

Thermally Aged Procedure

Quanity/Specimens = (1) 3.5 specimen (1) 9-17

OVEN= Linoberg model # 51333 SN# 909172

OVEN SETPOINT= 945°C

OVEN TEMPERATURE= 952.6°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T-94140 CAL= 4/14/08 DUE= 10/14/08
Thermocouple= #329 cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME = 3 hrs

DETAILS= Placed both Specimens In Oven
Spaced 2" Apart held At Oven
Setpoint for 3hrs
Removed Specimens And Air Cooled
Back To Room Temperature

6/27/08

Recorded by: _____ Date 6/27/08 Verified by: _____ Date

Thermally Aged Procedure

Quanity/Specimens = (1) 3·6 Specimen (1) 9·18 Specimen

OVEN= Linoberg model #51333 SN# 909172

OVEN SETPOINT= 970 °C

OVEN TEMPERATURE= 976.6°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T·94140 CAL= 4/14/08 DUE= 10/14/08

Thermocouple= #329 Cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME = 3 hrs

DETAILS=

placed both Specimens In Oven
Spaced 2" Apart held At Oven
Set point for 3hrs
Removed specimens And Air Cooled
Back to Room Temperature

Recorded by:	Date	Verified by:	Date
	6/27/08		

Thermally Aged Procedure

Quanity/Specimens = (1) 3-7 specimen (1) 9-19 Specime

OVEN= Lindberg model # 51333 SN# 909172

OVEN SETPOINT= 1002°C

OVEN TEMPERATURE= 1008.6°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T-94140 CAL= 4/14/08 DUE= 10/14/08

Thermocouple= #329 cal: 2/12/08 due: 8/12/08

AMOUNT OF TIME = 3 hrs.

DETAILS= placed both specimens in oven spaced 2" apart held at oven setpoint for 3hrs removed specimens and air cooled back to room temperature

Recorded by:	Date	Verified by:	Date
	6/30/08		

Thermally Aged Procedure

Quanity/Specimens = (1) 9-21 Specimen

OVEN= Fisher Isotemp SN# 507N6024

OVEN SETPOINT= 100 °C

OVEN TEMPERATURE= 100.9 °C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T-94140 CAL= 4/14/08 DUE= 10/14/08
Thermocouple= #329 cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME = 3 hrs.

DETAILS= Placed Specimen #9-21 Into Oven At center point were calibrated TC Took Temperature Measurement helo At Set point for 3hrs Removed Specimen And Air Cooled Back To Room Temperature

6/25/08

Recorded by: Date 6/25/08 Verified by: Date

Thermally Aged Procedure

Quanity/Specimens = (1) 9-22 Specimen

OVEN= Fisher Isotemp SN# 507N00824

OVEN SETPOINT= 200°C

OVEN TEMPERATURE= 201.2°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T-94140 CAL= 4/14/07 DUE= 10/14/08
Thermocouple= #329 Cal: 2/12/07 Due: 8/12/07

AMOUNT OF TIME = 3 hrs.

DETAILS= 9-22 Specimen Placed Into Oven
At Center point were Calibrated
TC took Temperature Measurement
Held At set point Temperature
3 hrs Removed And Air Cooled
To Room Temperature

Recorded by: _____ Date 6/26/07 Verified by: _____ Date

 Project No. _____

Book No. _____ TITLE _____

Thermally Aged Procedure

Quanity/Specimens = (1) 9-23 Specimen

OVEN= Fisher Isotemp SN# 507N0024

OVEN SETPOINT= 300 °C

OVEN TEMPERATURE= 302.2 °C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T-94140 CAL= 4/14/08 DUE= 10/14/08
Thermocouple= #329 Cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME = 3 hrs.

DETAILS= 9-23 Specimen placed Into Oven
At Center point were Calbeated TC
Took Temperature Measurement Helo
At set point Temperature for
3 hrs Removed Specimen And
Allowed To Air Cool Back
To Room Temperature

Recorded by:	Date 6/24/08	Verified by:	Date
	~~6/24/08~~	6/24/08	

Thermally Aged Procedure

Quanity/Specimens = (1) 9-24 Specimen

OVEN= Lindberg model #51333 SN# 905172

OVEN SETPOINT= 404°C

OVEN TEMPERATURE= 407.6°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T 94140 CAL= 4/14/08 DUE= 10/14/08
Thermocouple= # 329 Cal: 2/12/08 Due: 8/12/08

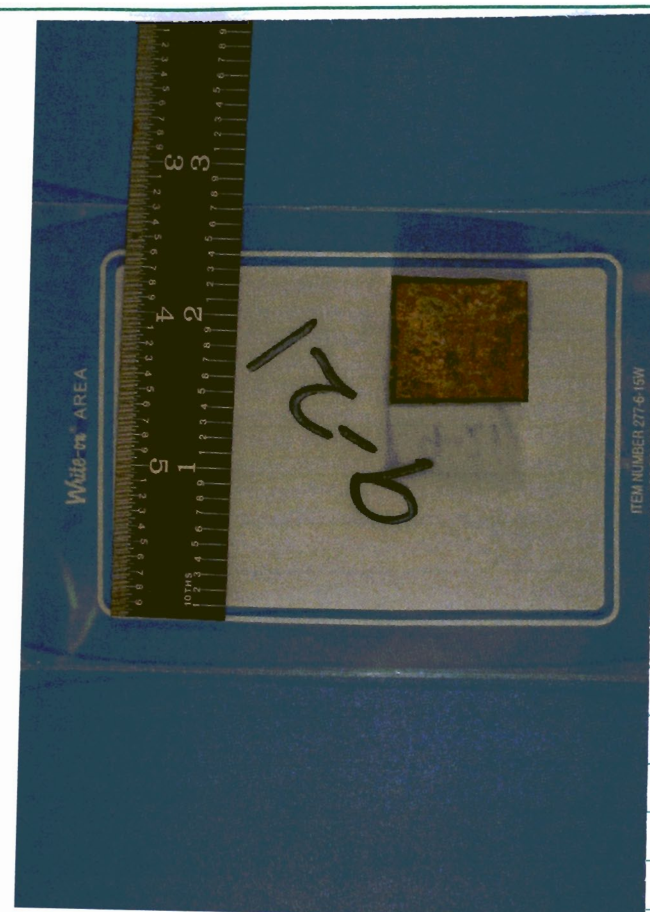
AMOUNT OF TIME = 3hrs

DETAILS= 9-24 Specimen placed Into Oven At Center point Calibrated TC Took Temperature Measurement hole At Set point Temperature for 3hrs Removed Specimen And Allowed To Air Cool Back To Room Temperature

Recorded by:	Date	Verified by:	Date
[signature]	7/1/08		

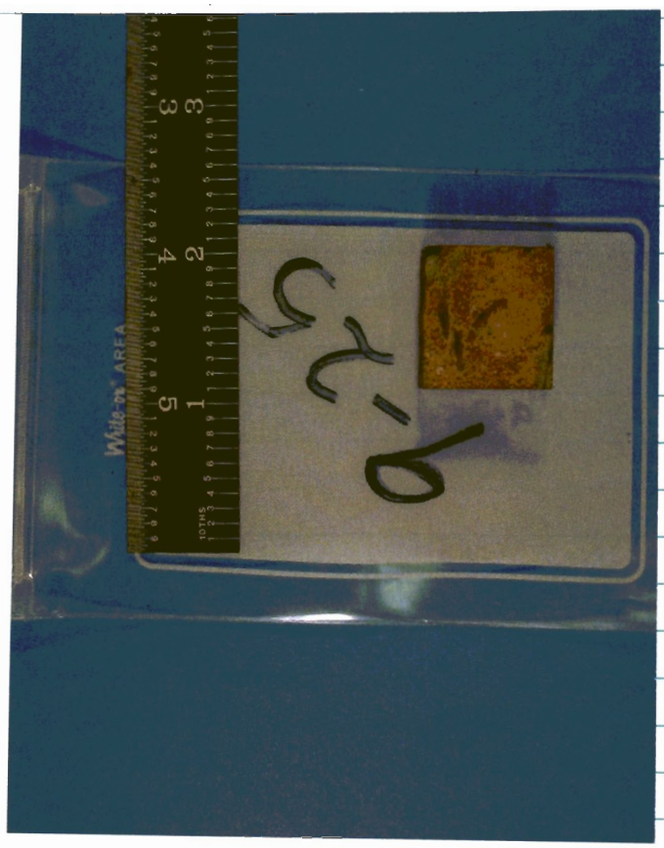
Project No. ____________

Book No. ____________ TITLE ____________



Pre shots Before thermally Aged Procedure (Same Pic frames #14 & 15

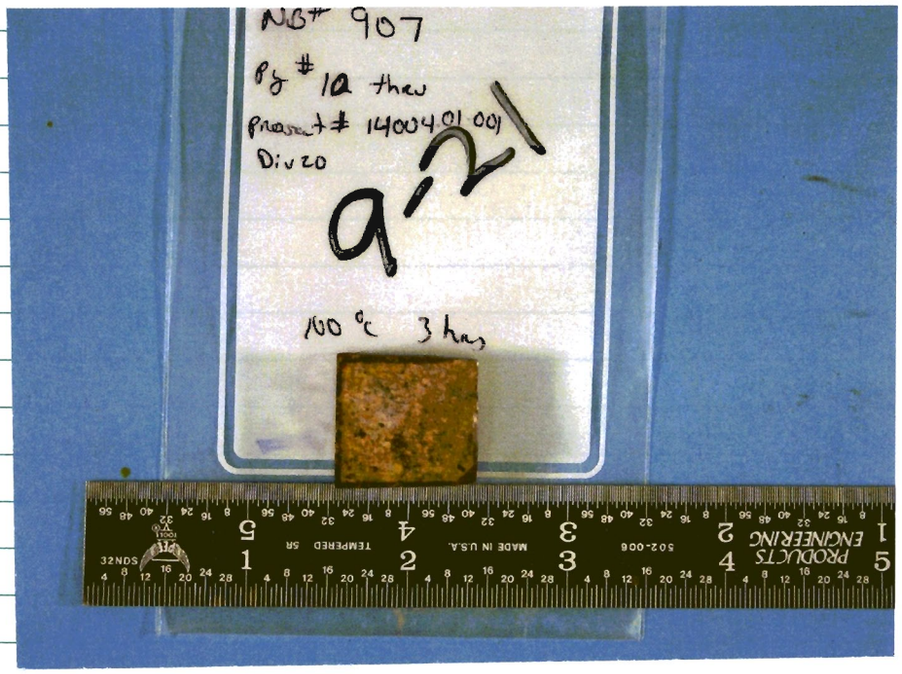
Recorded by: [signature]	Date 7/1/08	Verified by:	Date



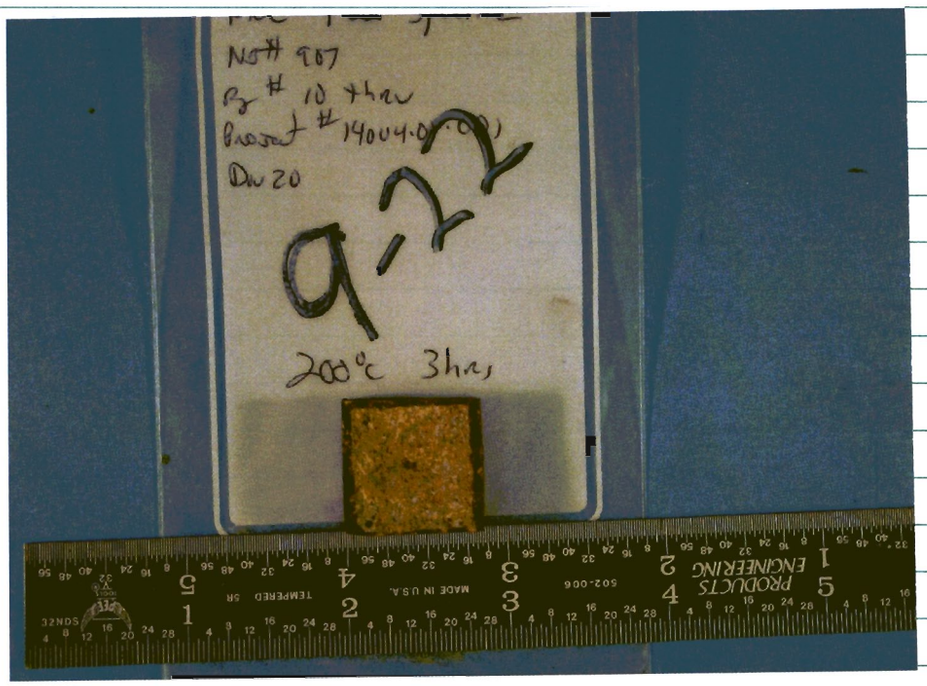
Same Pre photos of specimen before thermally Age Procedure from pg # 14 & 15

To Be Use for A Comparison To the photos on following pages that were thermally Aged.

Recorded by: _____ Date 7/1/05 Verified by: _____ Date _____



After Pics of Thermally Aged Specimen



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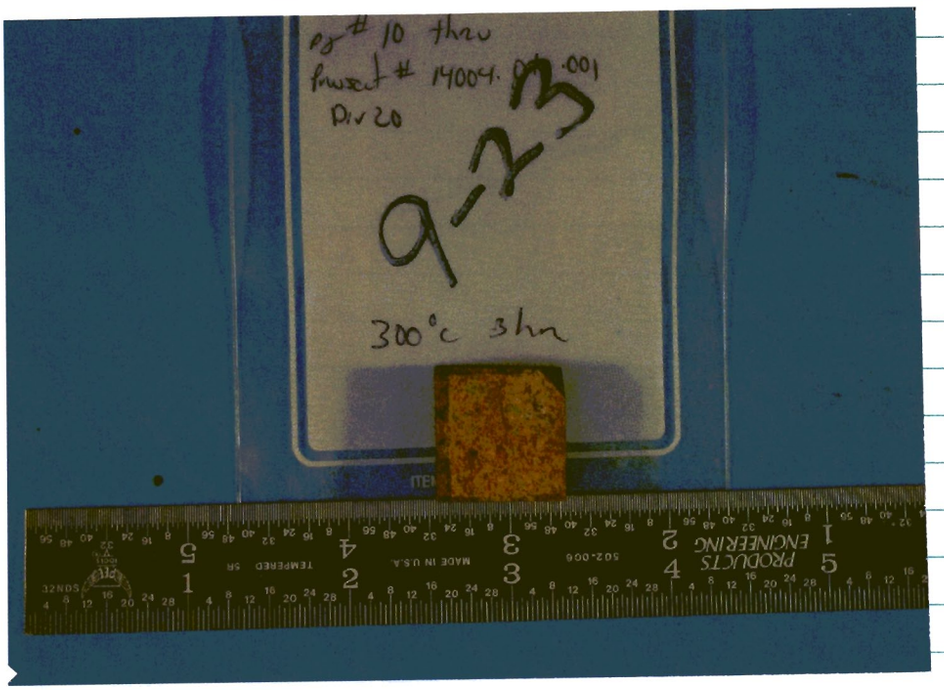
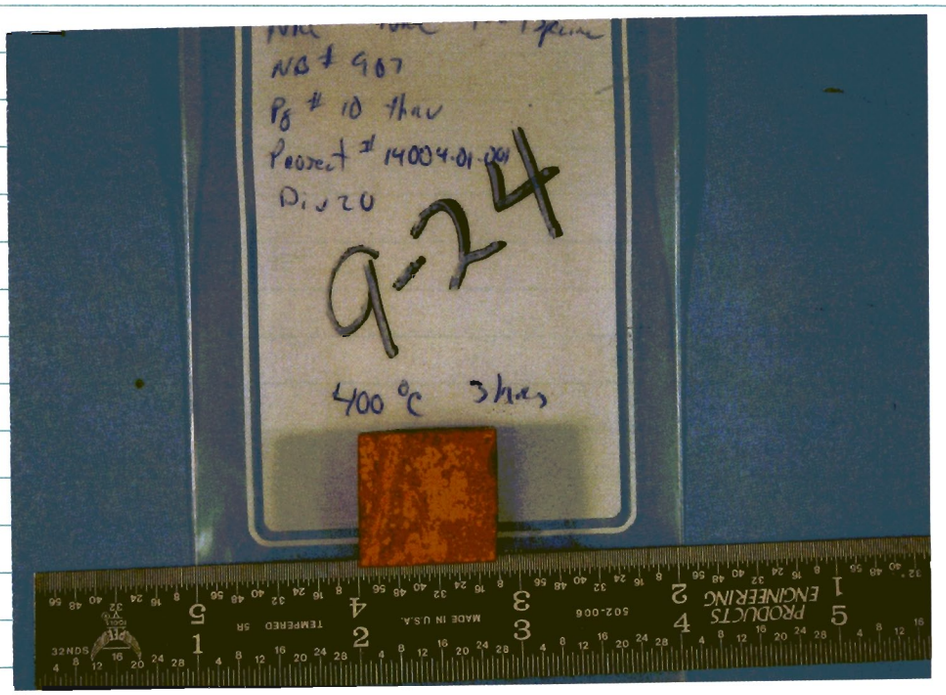
[signature]	7/1/08		



After Pics of Thermally Aged Specimens



Recorded by:	Date	Verified by:	Date
[signature]	7/1/07		

Thermally Aged Procedure

Quanity/Specimens = (1) 9-25 Specimen

OVEN= Lindberg model # 51333 SN# 909177

OVEN SETPOINT= 496°C

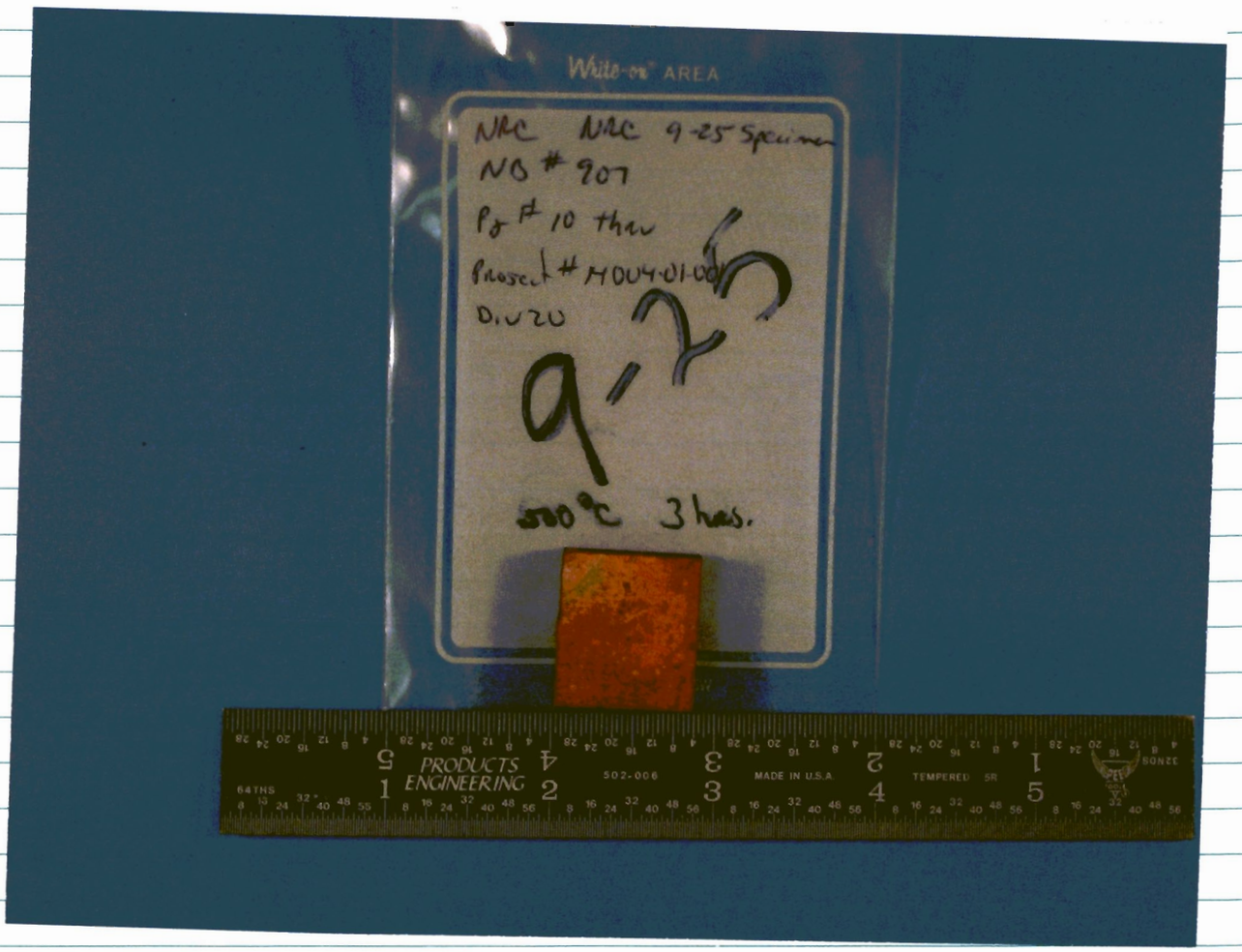
OVEN TEMPERATURE= 506.2°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T 94140 CAL= 4/14/08 DUE= 10/14/08
Thermocouple= #329 Cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME = 3hrs.

DETAILS= 9-25 Specimen places Into Oven At Oven set point Temperature for 3hrs. Removes Specimen And Allowed To Air Cool Back To Room Temperature

Date 9/02/08 Verified by: Date



Recorded by:	Date	Verified by:	Date
	7/7/08		

 Project No. _____

Book No. _____ TITLE _____

Thermally Aged Procedure

Quanity/Specimens = (1) 9-26 Specimen

OVEN= Lindberg model #51333 SN# 909177

OVEN SETPOINT= 595°C

OVEN TEMPERATURE= 607.8°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH22
SN#= T 94140 **CAL=** 4/14/08 **DUE=** 10/14/08

Thermocouple= #329 cal: 2/12/08 due: 8/12/08

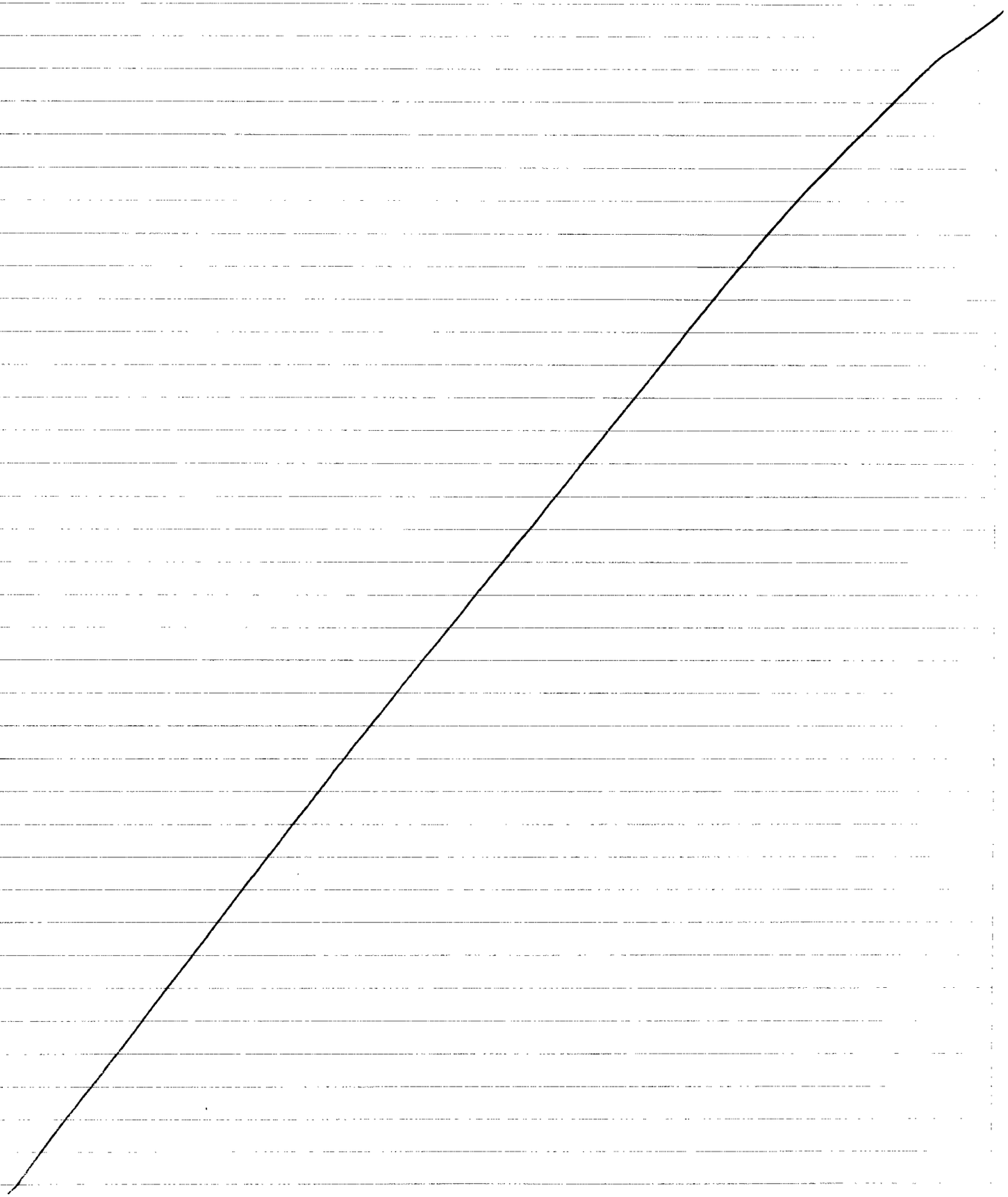
AMOUNT OF TIME = 3hrs

DETAILS=

9-26 Specimen placed Into Oven
At Oven Set point Temperature
for 3hrs
Removed Specimen And Allowed
To Air Cool Back To Room
Temperature

Recorded by:	Date	Verified by:	Date
	7/8/08		

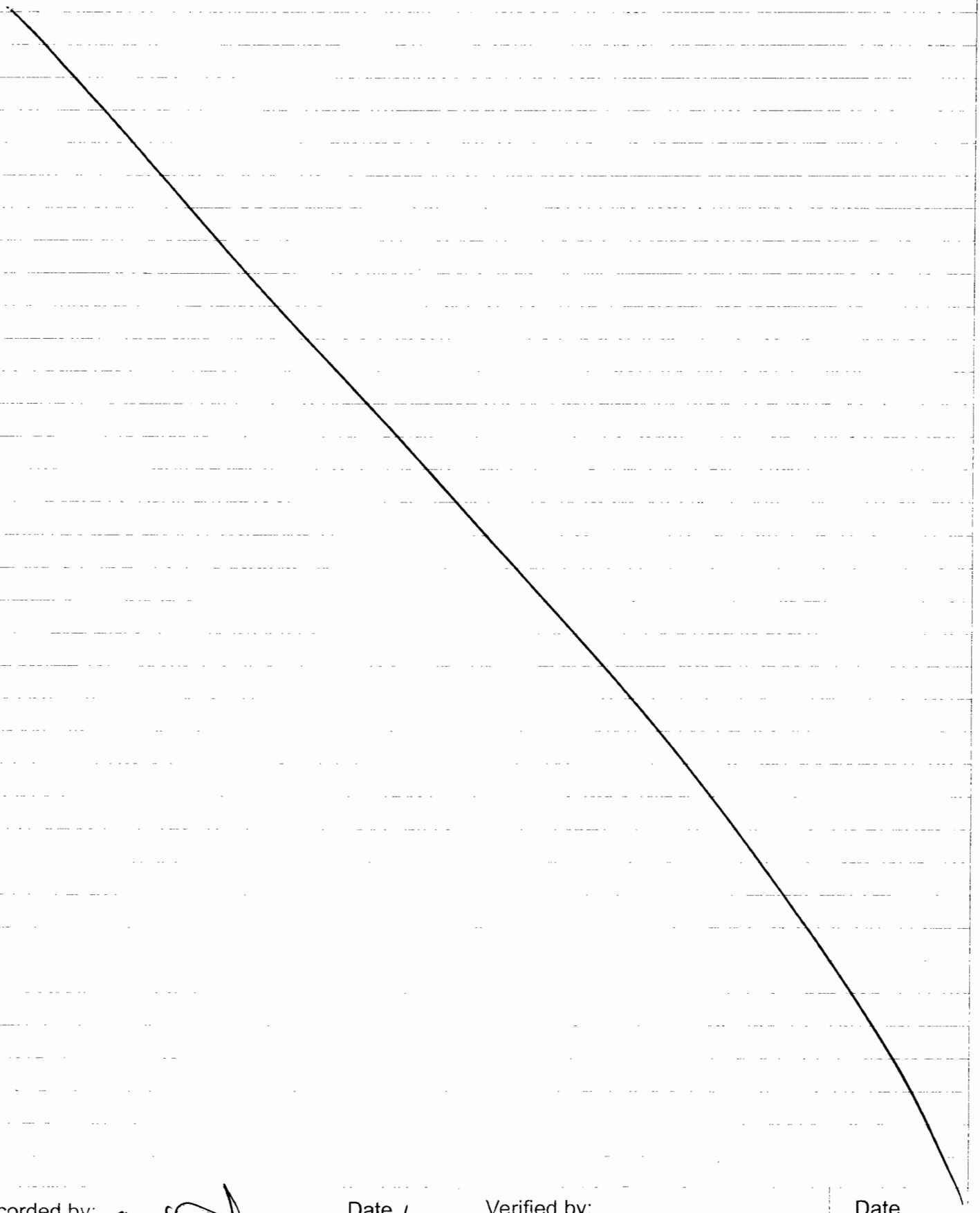
TITLE _____ Book No. _____



Recorded by:	Date	Verified by:	Date

Project No. _____

Book No. _____ TITLE _____



Recorded by: _____ Date 7/9/08 Verified by: _____ Date _____

Sample	Thermal exposure	Cooling	Analysis
NRC 9-27	700 C for 2 hours	Oven cool (turn off oven and let cool overnight)	Microstructure Grain size Hardness
NRC 9-28	800 C for 2 hours	750 C for 1 hour 700 C for 1 hour Oven cool	Microstructure Grain size Hardness
NRC 9-29	900 C for 2 hours	850 C for 1 hour 800 C for 1 hour 750 C for 1 hour 700 C for 1 hour Oven cool	Microstructure Grain size Hardness
NRC 9-30	1000 C for 2 hours	900 C for 1 hour 850 C for 1 hour 800 C for 1 hour 750 C for 1 hour 700 C for 1 hour Oven cool	Microstructure Grain size Hardness

NRC 9-31 1100°C for 2hrs 900°C 1hr
850°C 1hr
800°C 1hr
750°C 1hr
700°C 1hr
Oven Cool

Pg # 44

NRC 9-32 1200°C for 2hrs 900°C 1hr
850°C 1hr
800°C 1hr
750°C 1hr
700°C 1hr
Oven Cool

Pg # 45

Recorded by: [signature] Date 7/9/08 Verified by: Date

Thermally Aged Procedure

Quanity/Specimens = (1) 9-27 Specimen

OVEN= Lindberg model #51333 SN#909177

OVEN SETPOINT= 695°C

OVEN TEMPERATURE= 702.6°C

Measurement taken with **OMEGA MICROPROCESSOR THEMOMETER** **MODEL#** HH22
SN#= T94140 **CAL=** 4/14/08 **DUE=** 10/14/08

Thermocouple= #329 Cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME = 2hrs @ Oven Set point
Oven Cooled

DETAILS=

9-26 Specimen placed Into Oven
At oven set point Temperature
for 2hrs. the Oven WAS
then shutdown And Allowed
to Cool overnight Back To
Room Temperature

shut off oven @ 4:00 pm To Cool
7:00 AM oven Temperature 93.6°C Removed Specimen

Recorded by:	Date	Verified by:	Date
	7/9/08		

TITLE ______ Book No. ______

Thermally Aged Procedure

Quanity/Specimens = (1) 9-28

OVEN= Lindberg model # 51333 SN# 909177

OVEN SETPOINT= 795 °C

OVEN TEMPERATURE= 806.2 °C

Measurement taken with **OMEGA MICROPROCESSOR THEMOMETER** **MODEL#** HH22
SN#= 7 94140 **CAL=** 4/14/08 **DUE=** 10/14/08
Thermocouple= #329 Cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME =
800°C 2 hrs
750°C 1 hr
700°C 1 hr.

9-28 Specimen places Into Oven
At oven Set point Temperature
for 2hrs then Uses Previous
oven Setpoint Temperatures
to Lower Temperature then At
final Set point oven was shut off

Recorded by: [signature] Date 7/10/08 Verified by: Date

Thermally Aged Procedure

Quanity/Specimens = (1) 9.29

OVEN= Lindberg model #51333 SN#909177

OVEN SETPOINT= 895°C

OVEN TEMPERATURE= 908.2°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH22
SN#= T94140 **CAL=** 4/14/08 **DUE=** 10/14/08
Thermocouple= #329 Cal = 2/12/08 Due = 8/12/08

AMOUNT OF TIME = 900°C 2hrs 750°C 1hr
850°C 1hr 700°C 1hr
800°C 1hr

DETAILS=

9-29 Specimen placed Into Oven
At Oven Set point Temperature
Held there for 2 hrs. then
Used Previous Oven set point Temperature
To Lower Temperature then At
final Set point held for 1 hr
then Shut off Oven
temperature In Oven when Removed was 104°C
7/11/08

Recorded by:	Date 7/10/08	Verified by:	Date

TITLE

Thermally Aged Procedure

Quanity/Specimens = (1) 9-30 Specimen

OVEN= Lindberg model # 51333 SN# 909177

OVEN SETPOINT= 1002

OVEN TEMPERATURE= 1009.6°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH22
SN#= T94140 **CAL=** 4/14/08 **DUE=** 10/14/08

Thermocouple= #329 Cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME = 1000 C for 2hrs. 750C 1hr
900 C 1 hr 700 C 1hr.
850 c 1 hr oven off
DETAILS= 800C 1 hr. Oven Cool overnight

9-30 Placed Specimen In Oven
At Oven set point Temperatures
Used Previous Information for
Oven Set point Temperatures
During Testing Procedure for
thermally Aged Specimen Held
At Set Temperatures Above After
Final set Point Shut oven off
Temperature In Oven when Specimen was
Removed 7/10/08 was 93°C

Recorded by:	Date	Verified by:	Date
	7/10/08		

 Project No. _____

Book No. _____ TITLE _____

Thermally Aged Procedure

Quanity/Specimens = (1) 9-35

OVEN= Lindberg model # 51333 SN# 909177

OVEN SETPOINT= 695°C

OVEN TEMPERATURE= 703.6 °C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH22

SN#= T 94140 **CAL=** 4/14/08 **DUE=** 10/14/08

Thermocouple= # 329 Cal = 2/12/08 Due = 8/12/08

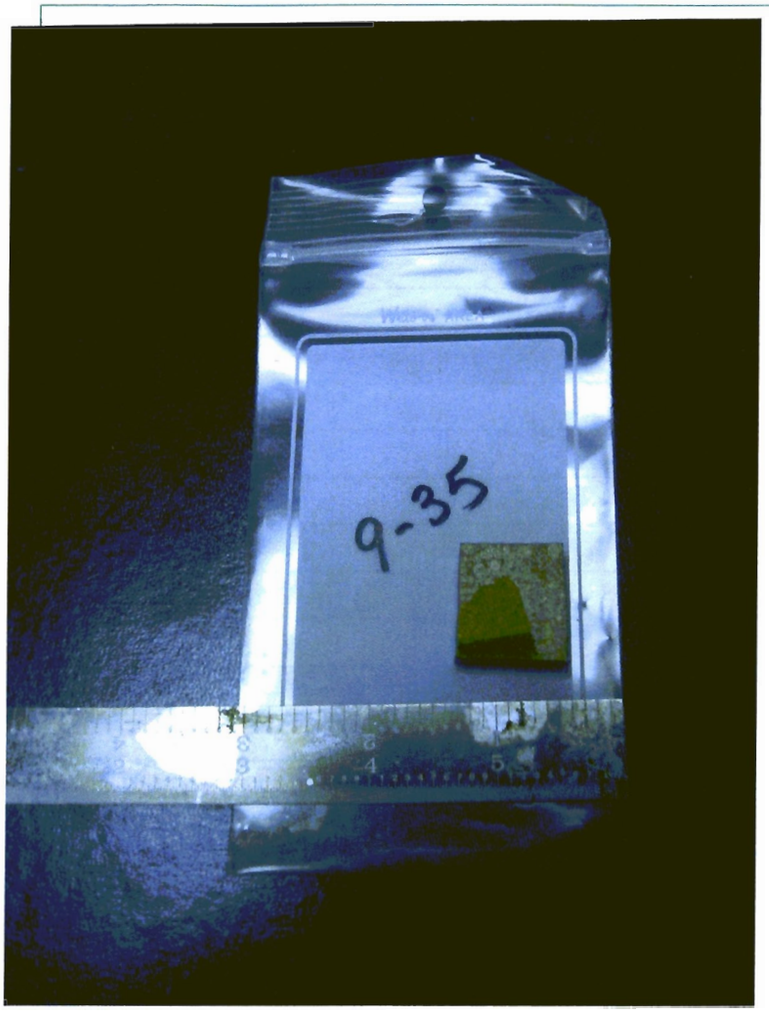
AMOUNT OF TIME = 3 hrs. @ Oven Set point

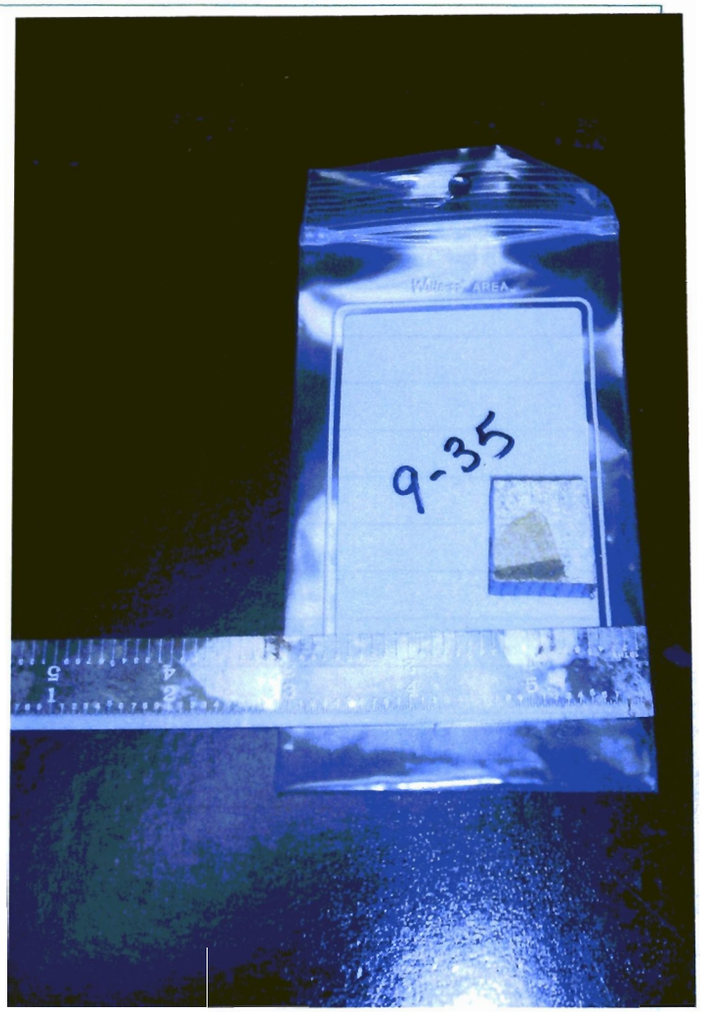
DETAILS=

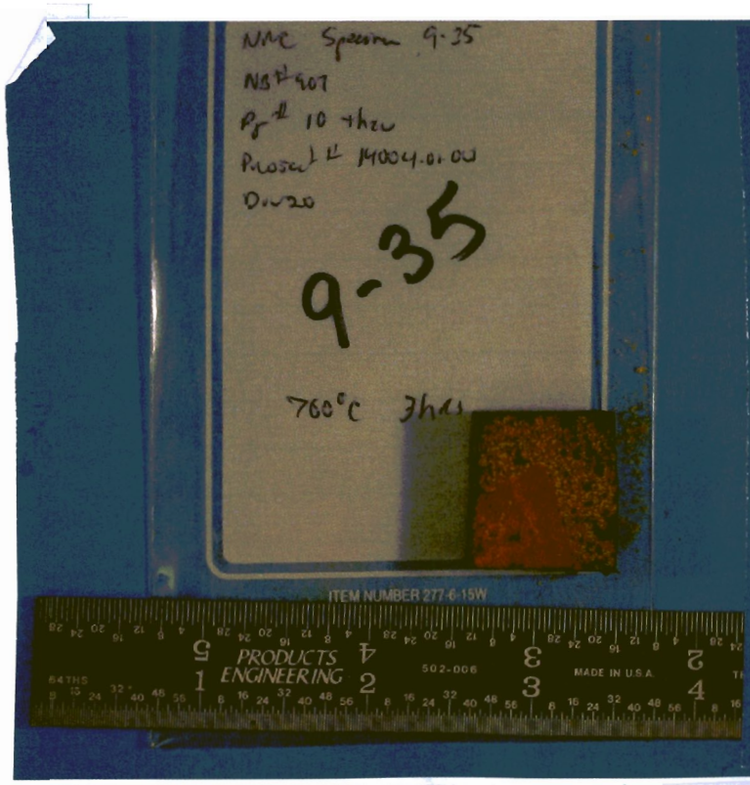
9-35 Specimen placed Into Oven At Oven set point Temperature for 3 hrs

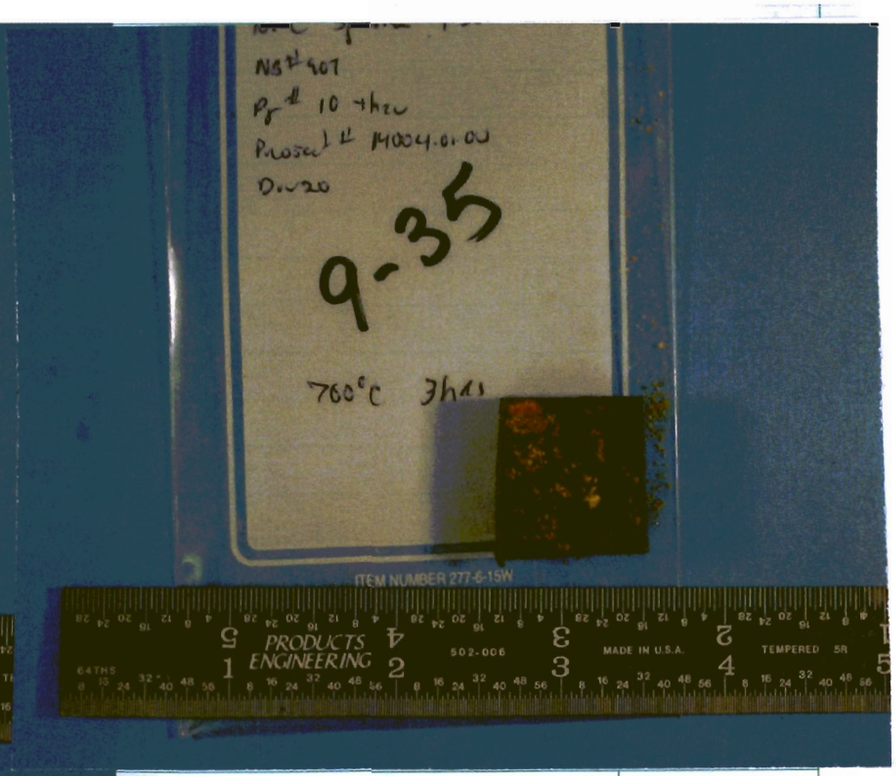
Removed Specimen And Allowed To Air Cool Back To Room Temperature

Recorded by:	Date	Verified by:	Date
	7/14/08		









Recorded by: _____ Date 7/14/00

Verified by: _____ Date _____

Thermally Aged Procedure

Quanity/Specimens = (1) 9-36

OVEN= Lindberg model # 51333 sn# 909177

OVEN SETPOINT= 795°C

OVEN TEMPERATURE= 805.8°C

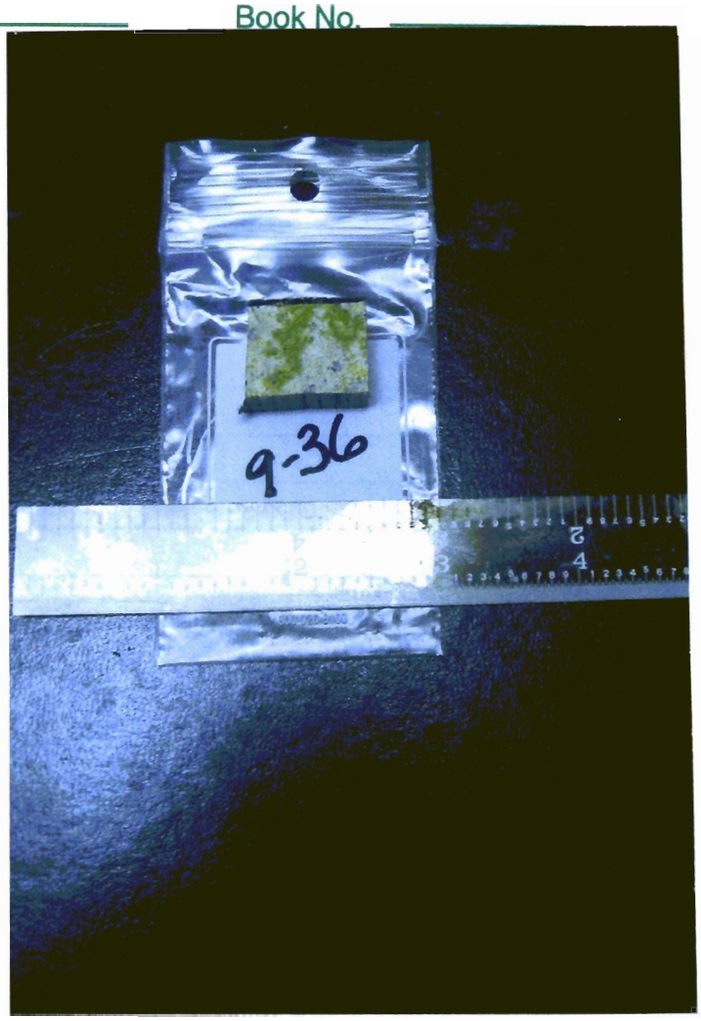
Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH12A
SN#= T 99140 **CAL=** 4/14/08 **DUE=** 10/14/08
Thermocouple= #329 cal = 2/12/08 due = 8/12/08

AMOUNT OF TIME = 3 hrs @ Oven Set point

DETAILS=

9-36 Specimen placed Into Oven
At Set point Temperature
for 3 hrs
Removed Specimen And Allowed
To Air Cool Back To Room
Temperature

Recorded by: _____ Date 7/15/08 Verified by: _____ Date _____



Recorded by:	Date	Verified by:	Date
[signature]	7/15/10		

Thermally Aged Procedure

Quanity/Specimens = (1) 9-31

OVEN= Lindberg model # 51333 SN# 909172

OVEN SETPOINT= 1092 °C

OVEN TEMPERATURE= 1104.6°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH22

Thermocouple= #329 **SN#=** T 94140 **CAL=** 4/14/08 **DUE=** 10/14/08
cal: 2/12/08 Duc: 8/12/08

AMOUNT OF TIME =

DETAILS=

1100 °C 2hrs
900 °C 1hr
850 °C 1hr
800 °C 1hr
750 °C 1hr
700 °C 1hr
Oven Cool

Placed 9-31 Specimen In Oven
helo At set point Temperature 2hrs
then Temperature Lowered Every
1 hrs Until oven WAS shut
off After the 700°C hold

Recorded by:	Date 7/18/08	Verified by:	Date

Thermally Aged Procedure

Quanity/Specimens = (1) 9-32

OVEN= Lindberg model # 51333 SN# 909172

OVEN SETPOINT= 1190°C

OVEN TEMPERATURE= 1206.8°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH22
SN#= T 94140 **CAL=** 4/14/08 **DUE=** 10/14/08

Thermocouple= #329 cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME =

DETAILS=

1200°C 2hrs
900°C 1hr
850°C 1hr
800°C 1hr
750°C 1hr
700°C 1hr
oven Cooled

Placed Specimen 9-32 In Oven
Held At oven Set point Temperature
2 hrs. then Temperature lowered
Every 1 hr. Until oven was
shut off After 200°C hold

* Oven was @ 122°C when Specimen Was pulled 7/18/08 @ 5:50Am

Recorded by:	Date	Verified by:	Date
	7/18/08		

Sample	Thermal exposure Temperature and time	Cooling	Analysis
Truck sample 6	400 °C for 2 hours	Air cool	Hardness
	500 °C for 2 hours	Oven cool to 400°C then Air cool
	600 °C for 2 hours	Oven cool to 400°C then Air cool
	700 °C for 2 hours	Oven cool to 400°C then Air cool
	800 °C for 2 hours	Oven cool to 400°C then Air cool
JH	400 °C for 2 hours	Air cool	Hardness
	500 °C for 2 hours	Oven cool to 400°C then Air cool
	600 °C for 2 hours	Oven cool to 400°C then Air cool
	700 °C for 2 hours	Oven cool to 400°C then Air cool
	800 °C for 2 hours	Oven cool to 400°C then Air cool
TY	400 °C for 2 hours	Air cool	Hardness
	500 °C for 2 hours	Oven cool to 400°C then Air cool
	600 °C for 2 hours	Oven cool to 400°C then Air cool
	700 °C for 2 hours	Oven cool to 400°C then Air cool
	800 °C for 2 hours	Oven cool to 400°C then Air cool
WT	400 °C for 2 hours	Air cool	Hardness
	500 °C for 2 hours	Oven cool to 400°C then Air cool
	600 °C for 2 hours	Oven cool to 400°C then Air cool
	700 °C for 2 hours	Oven cool to 400°C then Air cool
	800 °C for 2 hours	Oven cool to 400°C then Air cool

Truck sample 6 is a grade 8 bolt collected from the tanker truck. Bolts JH, TY, & WT are commercial off the shelf hardware obtained for comparison.

7/21/08

Recorded by: _____ Date 7/21/08 Verified by: _____ Date _____

Thermally Aged Procedure

Quanity/Specimens = (1) Truck Bolt (1) JH Bolt (1) TY Bolt (1) Nut Bolt

OVEN= Lindberg model #51333 SN#909172

OVEN SETPOINT= 398 °C

OVEN TEMPERATURE= 405.7 °C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH22
SN#= TG4140 **CAL=** 4/14/08 **DUE=** 10/14/08
Thermocouple= #329 Cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME = 2 hrs @ 400 °C

DETAILS= Air Cooled

Placed All Specimens Into Oven At oven set point held for 2 hrs Removed from oven And Air Cooled To Room Temperature

Recorded by:	Date	Verified by:	Date
[signature]	7/22/08		

Thermally Aged Procedure

Quanity/Specimens = (1) Truck Bolt (1) JH Bolt (1) TY Bolt (1) wt Bolt

OVEN= Lindberg model #51333 SN# 909172

OVEN SETPOINT= 494°C

OVEN TEMPERATURE= 503.6°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH22
SN#= T 94140 **CAL=** 4/14/08 **DUE=** 10/14/08
Thermocouple= #329 cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME = 2hrs @ 500°C

DETAILS= Temperature Dropped To 400°C
Air Cooled

Placed All samples Into Oven At oven Set point Temperature held for 2 hrs Lowered Set point To 400°C Achieved 400°C In 48mins Removed Specimens To Air Cool Back To Room Temperature

Recorded by:	Date	Verified by:	Date
	7/22/08		

Thermally Aged Procedure

Quanity/Specimens = (1) Teuch Bolt (1) JH Bolt (1) TY Bolt (1) wt Bolt

OVEN= Lindberg model #51333 sn#909172

OVEN SETPOINT= 593 °C

OVEN TEMPERATURE= 611.2 °C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH22

SN#= T94140 **CAL=** 4/14/08 **DUE=** 10/14/08

Thermocouple= #329 Cal: 2/12/08 Duc: 8/12/08

AMOUNT OF TIME = 2 hrs. @ 600 °C

DETAILS= Temperature Dropped To 400 °C
Air Cooled

Placed All samples Into Oven At set point
Temperature held there for 2 hrs Lowered
set point To 400 °C · Achieved 400 °C In 1hrs 10min
Temperature Removed Specimens To Air Cool

Recorded by:	Date	Verified by:	Date
	7/22/08		

Thermally Aged Procedure

Quanity/Specimens = (1) Truck Bot (1) JH Bolt (1) TY Bolt (1) wt Bolt

OVEN= Lindberg model # 51333 SN# 909172

OVEN SETPOINT= 695°C

OVEN TEMPERATURE= 708.2°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH22

Thermocouple= SN#= T94140 CAL= 4/14/08 DUE= 10/14/08
#329 Cal: 2/12/08 Due 8/12/08

AMOUNT OF TIME = 2 hrs @ 700°C
Temperature Dropped To 400°C
Air Cooled

DETAILS=

Placed All specimens Into Oven At Set point Temperature held for 2hrs. Lowered Set point To 400°C Achieves 400°C In 2hrs 36min Removes Specimens from Oven To Air Cool Back To Room Temperature

Recorded by:	Date	Verified by:	Date
[signature]	7/23/08		

Thermally Aged Procedure

Quanity/Specimens = (1) Truck Bolt (1) JH Bolt (1) TY Bolt (1) wt Bolt

OVEN= Lindberg model# 51333 SN# 909172

OVEN SETPOINT= 795°C

OVEN TEMPERATURE= 808.6

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER **MODEL#** HH22

SN#= T94140 **CAL=** 4/14/08 **DUE=** 10/14/08

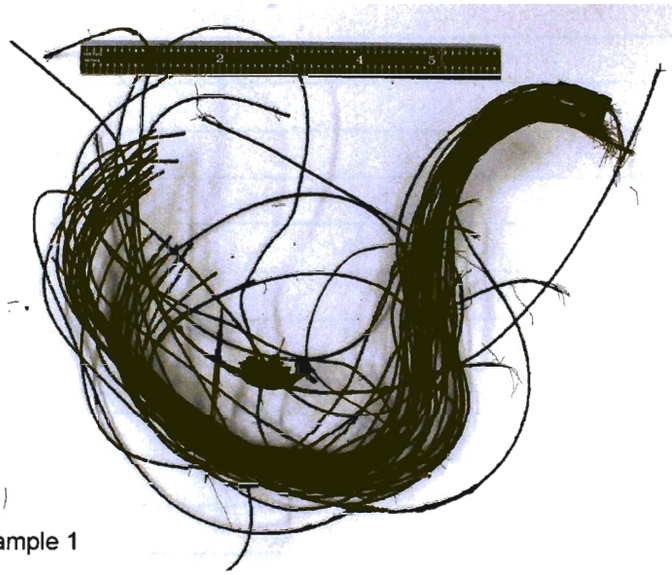
Thermocouple= #329 cal: 2/12/08 Due: 8/12/08

AMOUNT OF TIME = 2 hrs @ 800°C

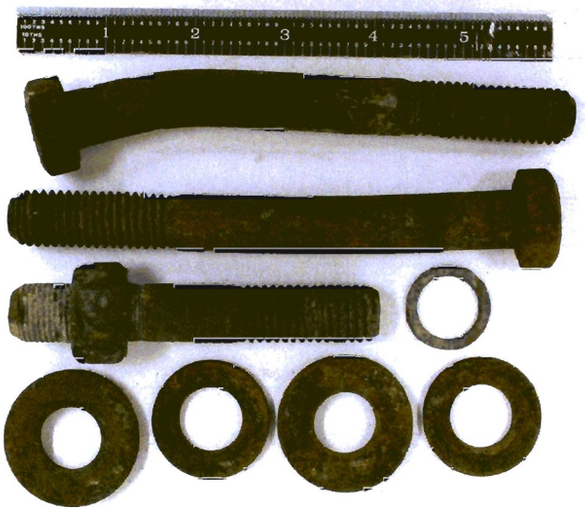
DETAILS= Temperature Dropped To 400°C
Air Cooled

Placed All Specimens Into Oven At Set point Temperature held for 2 hrs. Lowered Set point To 400°C. Achieved 400°C In 3 hrs 19 min Removed Specimens from Oven To Air Cool Back To Room Temperature

Recorded by: [signature] Date 2/23/08 Verified by: Date

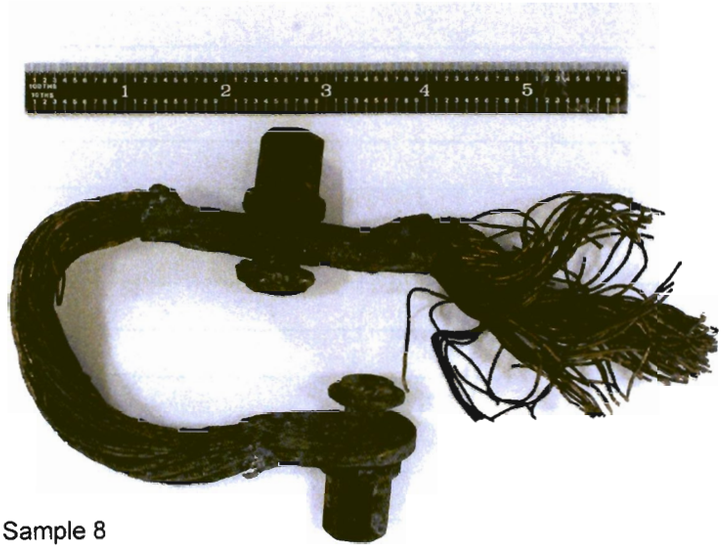


Truck Sample 1

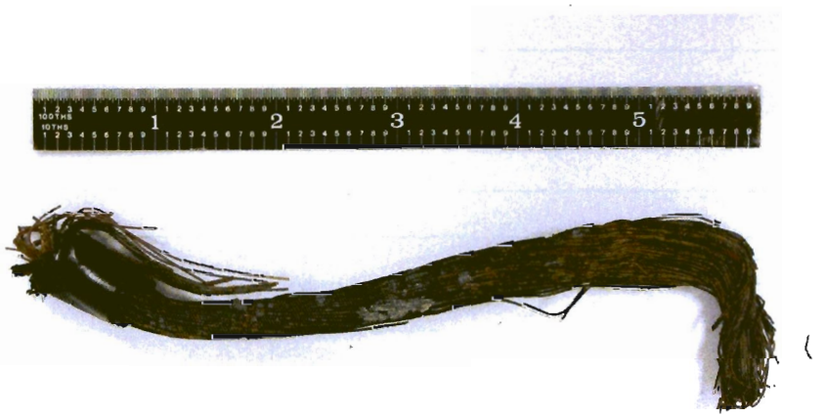


Truck Sample 6

Recorded by:	Date	Verified by:	Date
[signature] 8/6/08			

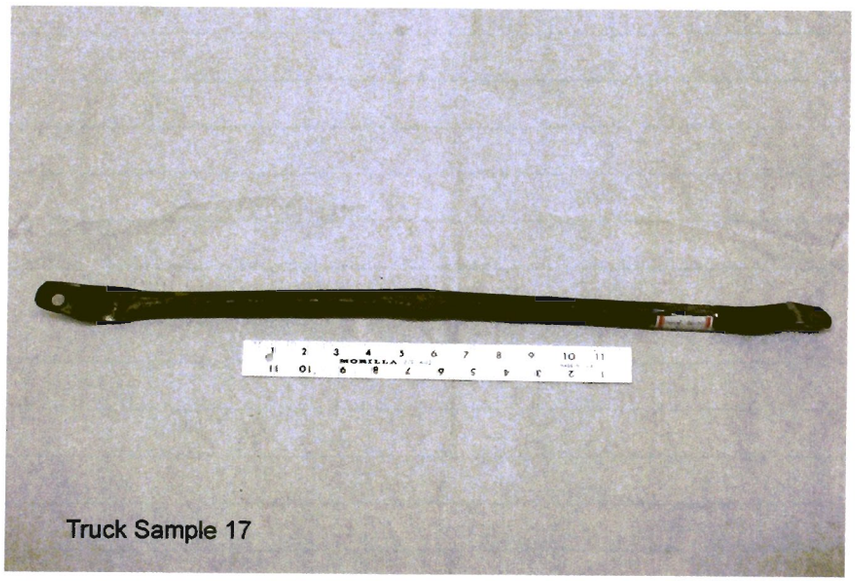


Truck Sample 8



Truck Sample 9

Recorded by:	Date	Verified by:	Date
[signature]	8/6/08		



Truck Sample 17

Truck Sample 11

Recorded by:	Date	Verified by:	Date
[signature]	8/6/09		

File: C:\SIGMA\QUASAR\CW31.RPT

[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: CW31
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 2.93
Analysis Date	: 27-JUN-2008
Microscope	: SEM
Comments	: Truck Sample 8

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 150.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 0.0 Degrees
TakeOff Angle	: 35.0 Degrees
Solid Angle*BeamCurrent	: 0.8

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Cu	Ka	100.00	1.0000	547.94	100.00
Total		100.00			

Truck Sample 8 Copper wire ground strap that was connected to the Tanker Truck frame

Recorded by: [signature] Date 8/5/08 Verified by: Date

[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: CW32
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 4.77
Analysis Date	: 27-JUN-2008
Microscope	: SEM
Comments	: Truck Sample 9

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 150.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 0.0 Degrees
TakeOff Angle	: 35.0 Degrees
Solid Angle*BeamCurrent	: 0.8

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Cu	Ka	100.00	1.0000	554.85	100.00
Total		100.00			

Truck Sample 9 Copper wire in engine compartment - likely a battery cable

Recorded by: [signature] Date 8/6/08 Verified by: Date

[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: CW33
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 4.78
Analysis Date	: 27-JUN-2008
Microscope	: SEM
Comments	: Truck Sample 10

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 150.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 0.0 Degrees
TakeOff Angle	: 35.0 Degrees
Solid Angle*BeamCurrent	: 0.8

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Si	Ka	0.18	0.0008	1.87	0.41
Cu	Ka	99.82	0.9979	538.96	99.59
Total		100.00			

Truck sample 10 Copper wire found on tanker truck frame. Sample also had aluminum from another component that melted

Recorded by: Date 8/6/08 Verified by: Date

[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: CW34
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 2.33
Analysis Date	: 27-JUN-2008
Microscope	: SEM
Comments	: Truck Sample 11

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 150.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 0.0 Degrees
TakeOff Angle	: 35.0 Degrees
Solid Angle*BeamCurrent	: 0.8

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Fe	Ka	0.23	0.0028	2.38	0.27
Cu	Ka	61.81	0.6245	325.79	63.41
Zn	Ka	35.72	0.3599	154.72	35.62
Pb	Ma	2.24	0.0145	12.24	0.71
Total		100.00			

Truck Sample 11 Brass fitting on passenger side of tanker truck engine

Recorded by: [signature] Date 8/6/08 Verified by: Date

bc1632.txt
[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: BC1632
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 11.42
Analysis Date	: 29-JUL-2008
Microscope	: SEM
Comments	: TRUCK SAMPLE 10

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 150.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 0.0 Degrees
TakeOff Angle	: 35.0 Degrees
Solid Angle*BeamCurrent	: 0.8

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Al	Ka	68.08	0.4134	2641.33	81.52
Si	Ka	3.87	0.0147	92.49	4.45
Ca	Ka	0.06	0.0005	2.10	0.04
Fe	Ka	0.64	0.0063	14.32	0.37
Cu	Ka	22.65	0.2076	291.94	11.52
Zn	Ka	3.55	0.0326	37.75	1.75
Mo	La	0.49	0.0029	6.13	0.17
Ag	La	0.06	0.0004	0.91	0.02
Sn	La	0.61	0.0047	8.87	0.17
Total		100.01			

Truck sample 10 aluminum found on copper wire

Recorded by: Daniel Date 8/6/08 Verified by: Date

File: C:\BIGHIT\QUANT\CW36.RPT

[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: CW36
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 6.23
Analysis Date	: 30-JUN-2008
Microscope	: SEM
Comments	: Truck Sample 15

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 150.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 0.0 Degrees
TakeOff Angle	: 35.0 Degrees
Solid Angle*BeamCurrent	: 0.8

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Mg	Ka	5.26	0.0521	129.56	5.83
Al	Ka	93.44	0.8272	2177.72	93.41
Si	Ka	0.27	0.0009	2.42	0.26
Mn	Ka	0.59	0.0052	5.57	0.29
Fe	Ka	0.44	0.0040	3.70	0.21
Total		100.00			

Truck Sample 15 Section of aluminum Tank that had melted

Recorded by: [signature] Date 8/6/08 Verified by: Date

File: C:\SIGMA\QUASAR\CW35.RPT

[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: CW35
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 35.58
Analysis Date	: 30-JUN-2008
Microscope	: SEM
Comments	: Truck Sample 14

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 150.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 0.0 Degrees
TakeOff Angle	: 35.0 Degrees
Solid Angle*BeamCurrent	: 0.8

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Mg	Ka	2.29	0.0234	67.04	2.53
Al	Ka	97.47	0.9293	2815.62	97.24
Si	Ka	0.24	0.0008	2.45	0.23
Total		100.00			

Truck Sample 14 aluminum wheel from dual axel wheel. most of the wheel had melted.

Recorded by:	Date	Verified by:	Date
[signature]	7/6/08		

[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: CW29
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 10.26
Analysis Date	: 27-JUN-2008
Microscope	: SEM
Comments	: Truck Sample 4

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 150.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 0.0 Degrees
TakeOff Angle	: 35.0 Degrees
Solid Angle*BeamCurrent	: 0.8

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Al	Ka	73.01	0.6463	1867.01	75.79
Si	Ka	22.08	0.0915	260.43	22.02
Fe	Ka	0.74	0.0068	6.96	0.37
Cu	Ka	2.63	0.0234	14.86	1.16
Zn	Ka	1.53	0.0136	7.14	0.66
Total		99.99			

Truck Sample 4 aluminum wheel or Component. Sample showed signs of melting

Recorded by: [signature] Date 8/6/08 Verified by: Date

File: C:\SIGMA\QUASAR\CW28.RPT

[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: CW28
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 4.54
Analysis Date	: 30-JUN-2008
Microscope	: SEM
Comments	: Truck Sample 1

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 150.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 0.0 Degrees
TakeOff Angle	: 35.0 Degrees
Solid Angle*BeamCurrent	: 0.8

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Si	Ka	0.29	0.0015	5.14	0.58
Mn	Ka	0.53	0.0054	7.71	0.53
Fe	Ka	99.18	0.9915	1238.96	98.89
Total		100.00			

Truck sample 1 Tire cord from front left side of vehicle

Recorded by:	Date	Verified by:	Date
[signature]	8/6/08		

[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: CW37
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 6.42
Analysis Date	: 30-JUN-2008
Microscope	: SEM
Comments	: Truck Sample 17

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 150.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 0.0 Degrees
TakeOff Angle	: 35.0 Degrees
Solid Angle*BeamCurrent	: 0.8

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Si	Ka	0.38	0.0020	5.91	0.75
Cr	Ka	19.24	0.2197	308.68	20.39
Fe	Ka	71.48	0.6951	753.17	70.52
Ni	Ka	8.89	0.0803	64.07	8.34
Total		99.99			

Truck sample 17 stainless steel mirror support

Recorded by:	Date	Verified by:	Date
[signature]	8/6/08		

bc1623.txt
[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: BC1623
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 3.70
Analysis Date	: 16-JUL-2008
Microscope	: SEM
Comments	: TRUCK SAMPLE 6 BOLT

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 1000.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 2.7 Degrees
TakeOff Angle	: 38.1 Degrees
Solid Angle*BeamCurrent	: 6.1

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Si	Ka	0.46	0.0024	13.04	0.91
Cr	Ka	0.30	0.0038	9.55	0.32
Mn	Ka	0.85	0.0087	19.14	0.87
Fe	Ka	98.01	0.9790	1871.60	97.69
Mo	La	0.38	0.0029	5.27	0.22
Total		100.00			

Truck Sample 6 SAE grade 8 bolt

Recorded by:	Date	Verified by:	Date
[signature]	8/6/08		

bc1621.txt
[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: BC1621
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 3.34
Analysis Date	: 16-JUL-2008
Microscope	: SEM
Comments	: BOLT TY

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 1000.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 2.7 Degrees
TakeOff Angle	: 38.1 Degrees
Solid Angle*BeamCurrent	: 6.1

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Al	Ka	0.08	0.0003	1.67	0.17
Si	Ka	0.37	0.0020	9.79	0.74
Cr	Ka	1.04	0.0134	30.70	1.11
Mn	Ka	0.77	0.0079	15.94	0.78
Fe	Ka	97.33	0.9710	1711.17	96.96
Mo	La	0.41	0.0031	5.20	0.24
Total		100.00			

Bolt SAE GRADE 8 TY STAMP

Commercial off-the-shelf

Recorded by: _____ Date 8/6/08 Verified by: _____ Date _____

bc1622.txt
[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: BC1622
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 2.94
Analysis Date	: 16-JUL-2008
Microscope	: SEM
Comments	: BOLT WT

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 1000.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 2.7 Degrees
TakeOff Angle	: 38.1 Degrees
Solid Angle*BeamCurrent	: 6.1

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Si	Ka	0.27	0.0014	7.38	0.53
Cr	Ka	0.98	0.0127	30.64	1.05
Mn	Ka	0.71	0.0073	15.51	0.72
Fe	Ka	97.75	0.9756	1808.69	97.53
Mo	La	0.28	0.0021	3.83	0.17
Total		99.99			

SAE GRADE 8 Bolt WT STAMP

Recorded by: _____ Date 8/6/08 Verified by: _____ Date _____

bc1620.txt
[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: BC1620
File Version	: 1
Background Method	: Fit
Decon Method	: Gaussian
Decon ChiSquared	: 3.89
Analysis Date	: 16-JUL-2008
Microscope	: SEM
Comments	: BOLT JH

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 1000.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 2.7 Degrees
TakeOff Angle	: 38.1 Degrees
Solid Angle*BeamCurrent	: 6.1

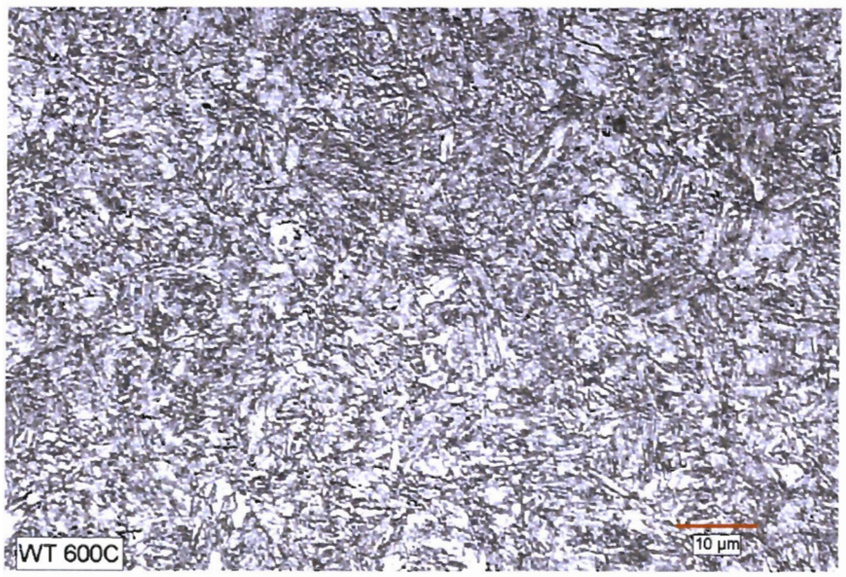
Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Si	Ka	0.32	0.0017	9.62	0.64
Cr	Ka	1.08	0.0140	36.67	1.15
Mn	Ka	0.73	0.0075	17.33	0.74
Fe	Ka	97.87	0.9766	1972.26	97.47
Total		100.00			

GRADE 8 Bolt JH STAMP

Recorded by:	Date	Verified by:	Date
[signature]	8/6/08		

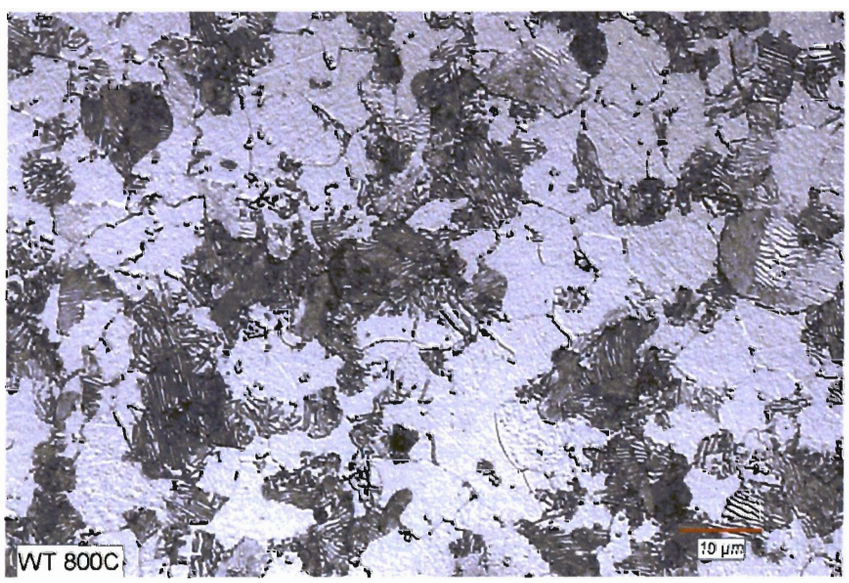
Truck sample 6 microstructure
some pearlite is observed.

Recorded by:	Date	Verified by:	Date
[signature]	8/6/08		



Both WT as received and after heating to 600°C for 2 hours see Page 46

Recorded by:	Date	Verified by:	Date
[signature]	8/6/06		



Both WT after exposure at 700 and 800c for 2 hours see page 46

Recorded by:	Date	Verified by:	Date
[signature]	8/6/08		

 Project No. _____

Book No. _____ TITLE _____

WILSON TUKON MICROHARDNESS TEST
Model #TU220
Ser. No. 932527

Project No. -14004.01.001 Date: 7 / 1 / 08

SAMPLE I.D. Truck Sample LOAD 500, 300g

VICKERS (HV) ✓ KNOOP (HK) ✓ OBJECTIVE 50, 20 X

DROP	MICRONS	HK	HV	HRB		
#6						
1.			201	91.72		
2.			193	90.17		
3.			196	90.73		
#8						
1.		76		15		
2.		80		20		
3.		68		3		
#9						
1.		89		31		
2.		73		11		
3.		78		17.5		

CALIBRATION TEST

TEST BLK. S/N	V or K	HARDNESS	TEST1	TEST2	TEST3
525L	Vickers	681 ± 26	675		
545K	Knoop	675 ± 27	676		

NOTES:

Hardness data for truck samples 6, 8 & 9

Recorded by: Date 8/6/08 Verified by: Date

WILSON TUKON MICROHARDNESS TEST
Model #TU220
Ser. No. 932527

Project No. -14004.01.001 Date: 7/1/08

SAMPLE I.D. Truck Sample LOAD 500, 300 g

VICKERS (HV) ✓ KNOOP (HK) ✓ OBJECTIVE 50, 20 X

DROP	MICRONS	HK	HV	HRB		
#10						
1.		64		1		
2.		72		10		
3		65		15		
#11						
1.		90		33		
2.		82		23		
3.		82		23		

CALIBRATION TEST

TEST BLK. S/N	V or K	HARDNESS	TEST1	TEST2	TEST3
528R	Vickers	687±26	675		
54JR	Knoop	675±27	676		

NOTES:

Hardness data for truck samples 10 & 11

Recorded by: _____ Date 8/6/08 Verified by: _____ Date _____

SOUTHWEST RESEARCH INSTITUTE
San Antonio, Texas 78228-0510

Page: 1

Project 14004.21.001

SAMPLE	TEMP	TEST1	TEST2	TEST3	TEST4	TEST5	Rockwell SCALE
	°C						
TS6	400	89.1	88.9	89.6	88.0	88.8	HRB
	500	87.6	87.7	88.3	88.7	88.3	HRB
	600	87.6	87.8	88.4	88.6	88.4	HRB
	700	86.3	86.9	88.5	86.7	87.9	HRB
	800	80.1	82.1	84.0	82.9	83.0	HRB
JH	400	37.4	37.4	37.3	37.4	37.8	HRC
	500	33.8	34.3	33.9	34.0	33.4	HRC
	600	25.7	26.1	25.6	25.8	24.6	HRC
	700	95.5	95.0	95.0	94.3	94.5	HRB
	800	85.5	84.6	85.0	82.4	84.6	HRB
TY	400	34.6	35.4	35.4	35.9	36.3	HRC
	500	36.0	36.2	36.3	35.7	36.0	HRC
	600	29.9	29.9	30.1	29.8	29.1	HRC
	700	95.3	95.8	95.4	95.4	94.5	HRB
	800	85.2	85.0	85.3	83.4	83.0	HRB
WT	400	37.7	38.0	37.9	38.4	38.2	HRC
	500	36.9	37.5	37.2	37.3	36.6	HRC
	600	30.3	30.3	29.7	29.6	29.8	HRC
	700	96.1	96.3	96.4	96.0	95.7	HRB
	800	84.9	84.6	86.3	86.4	85.4	HRB

CAL

TEST BLOCK NUMBER	SCALE	HARDNESS	TEST1	TEST2	TEST3
05A71475	HRB	91.7 ± 1.25	90.4	90.8	90.9
01G10214	HRC	26.86 ± 1.5	26.1	26.1	26.3

Hardness data for thermally exposed Bolts

Recorded by: [signature] Date 8/6/08 Verified by: Date

Initial Scientific Notebook Entry

Tanker Truck Sample Analyses

Original: 8/6/2008

Title: Tanker Truck Sample Analyse

Tests Preformed by: Darrell S. Dunn (18), Byron Chapa (18) Brian Derby (18) Chris Wolfe (18)

Objectives: Collect samples of the tanker truck and analyze the samples to determine exposure temperature.

Special Training or Qualification: None

Equipment: Analysis of samples will be performed in Division 18 standard metallurgical microstructural analysis capabilities including Optical Microscopy, X-Ray Diffraction and Scanning Electron Microscopy with Energy Dispersive Spectroscopy (SEM-EDS) and hardness testing. For thermally treated specimens, furnace temperatures will be recorded with a calibrated thermocouple and thermocouple meter.

Materials: Various samples collected. In addition to the Tanker Truck Samples, 3 new Grade 8 bolts were purchased for comparison to the bolts collected for the truck.

Specimen specifications: Samples will be identified at time of collection.

Controlled Parameters: Sample location and preparation methods. If thermal processing is performed to duplicate microstructures observed, the temperature of the specimens and time of exposure will be controlled

Measurement Parameters: Location of material samples. In addition the following parameters may be measured, temperature of the specimen during thermal exposure (lab tests), hardness, composition.

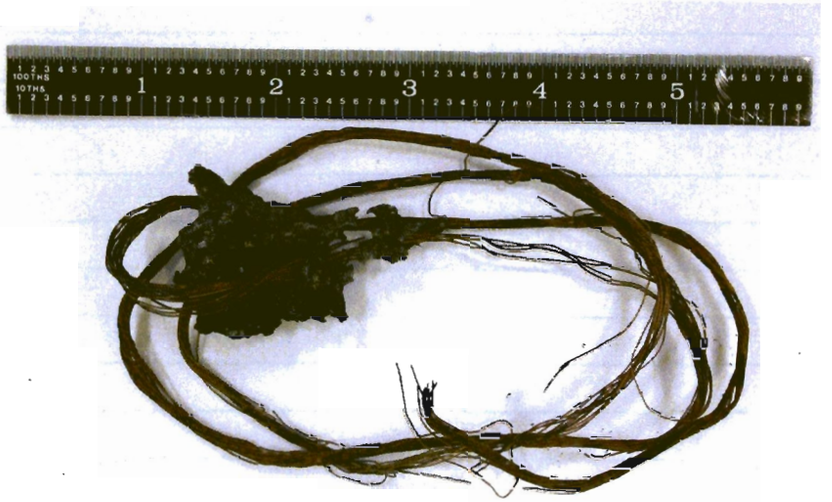
Required level of accuracy: Temperature +/- 10 °C.

Uncertainty and Sources of Error: To be determined

For Tanker truck samples described on Pages 46 TO 74

Recorded by:	Date	Verified by:	Date
[signature]	8/6/08		

Sample ID	Description
Truck Sample 1	Front tire cord from left side of vehicle
Truck Sample 2	Tire cord from #5 axel on right side of vehicle
Truck Sample 3	Brake pad located near rear of vehicle
Truck Sample 4	Rim sample from #5 axel
Truck Sample 5	Spring located near rear of truck
Truck Sample 6	Large bolts (3) located on frame and near engine
Truck Sample 7	Grade 5 bolt located on frame
Truck Sample 8	Copper wire ground strap located on frame
Truck Sample 9	Copper wire battery cable
Truck Sample 10	Copper wire electrical system wiring located on frame
Truck Sample 11	Fitting with brass located on engine
Truck Sample 12	Bolt from engine passenger side with copper wire and aluminum
Truck Sample 13	Aluminum screen from radiator
Truck Sample 14	Aluminum rim from dual wheel axel
Truck Sample 15	Aluminum tank section
Truck Sample 16	Glass Mirror from passenger side
Truck Sample 17	Stainless steel mirror support bracket



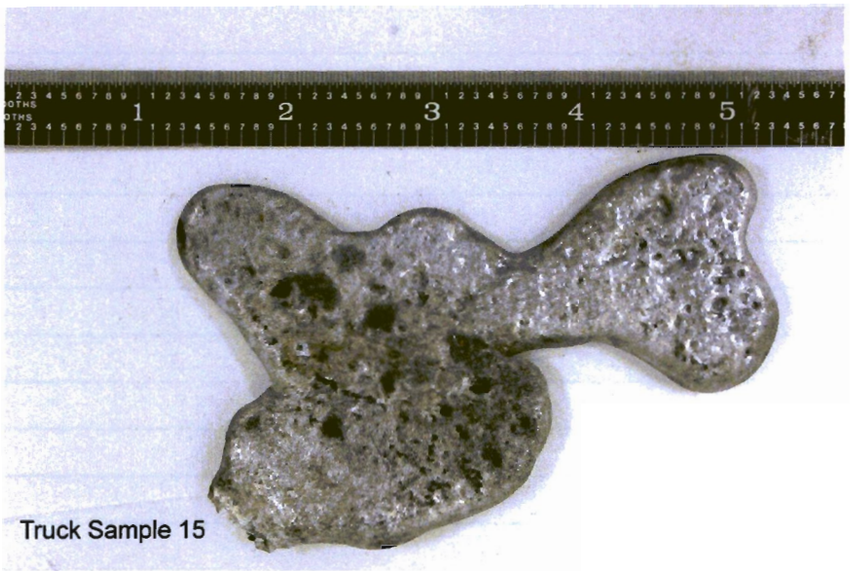
Truck Sample 10

Truck Sample 4

Photos of truck samples 4 & 10 as collected

Recorded by:	Date	Verified by:	Date
[signature]	8/7/08		

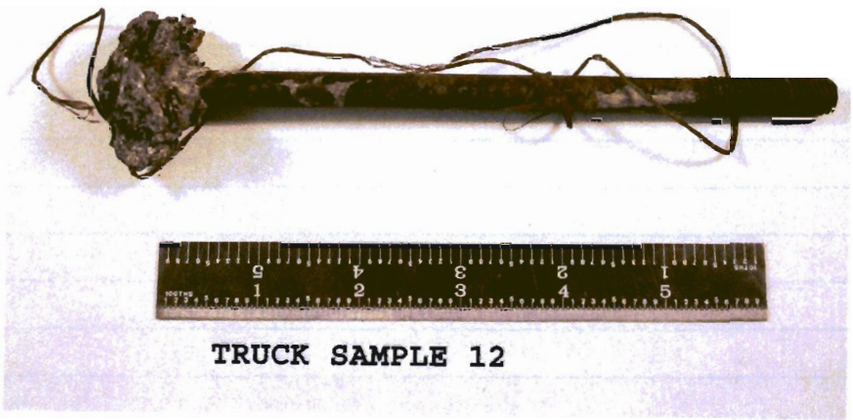
Truck Sample 14



Truck Sample 15

Photos of truck samples 14 & 15 as collected

Recorded by:	Date	Verified by:	Date
[signature]	8/7/08		



TRUCK SAMPLE 12

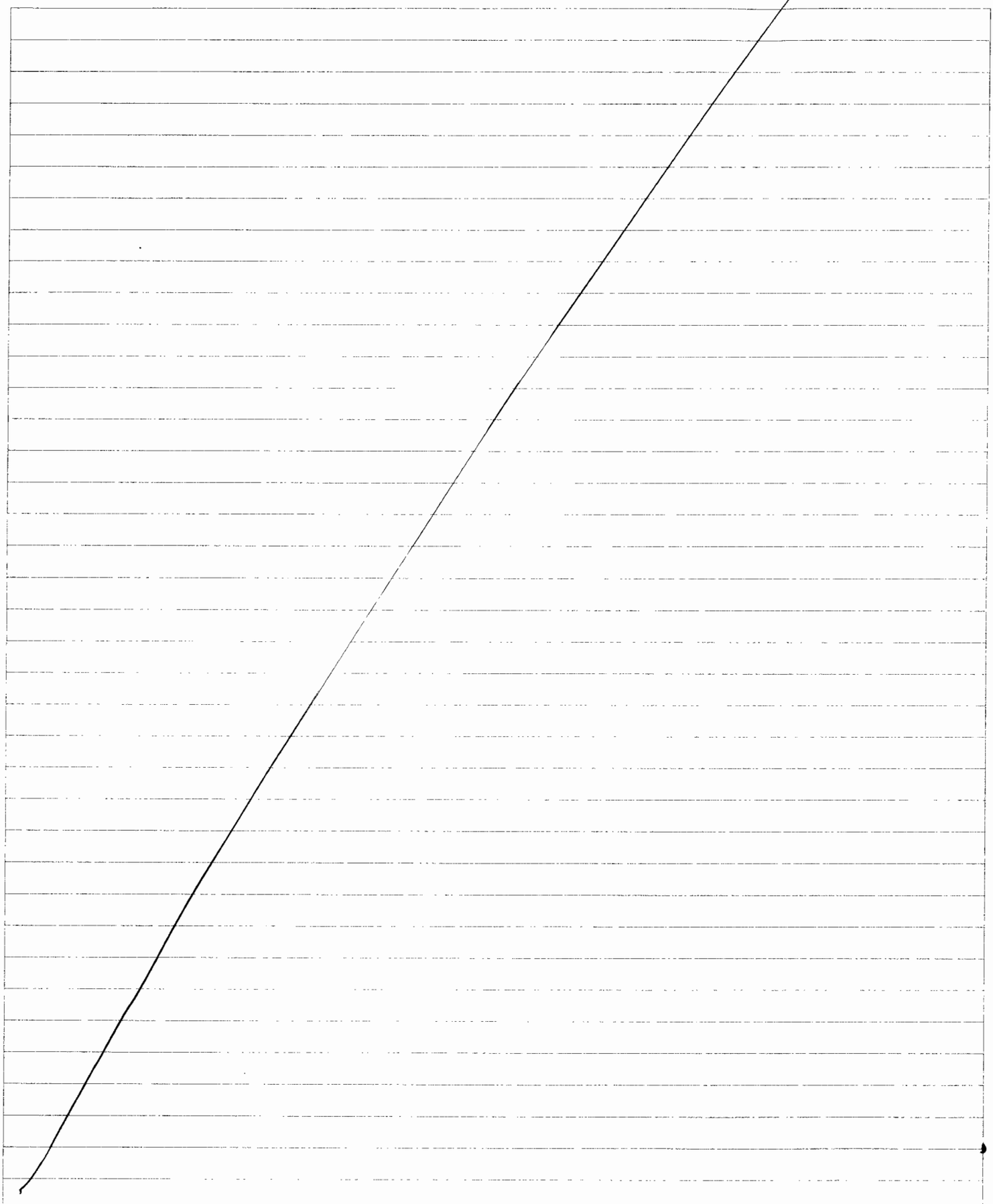
TRUCK SAMPLE 12

Photos of truck samples 12 as collected

Recorded by:	Date	Verified by:	Date
[signature]	8/7/08		

Project No. _____

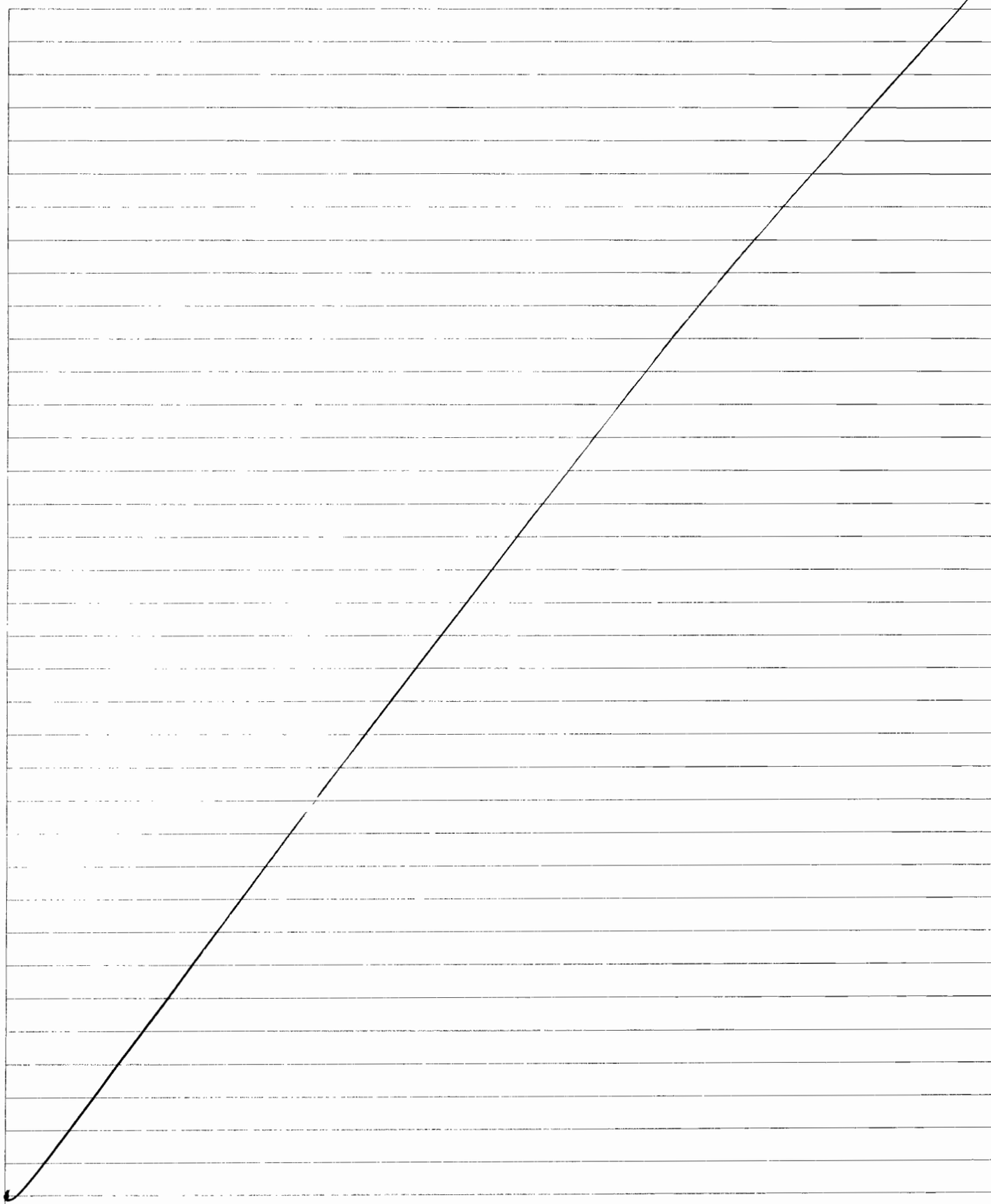
Book No. _____ TITLE _____



Recorded by:	Date	Verified by:	Date

Project No. _____

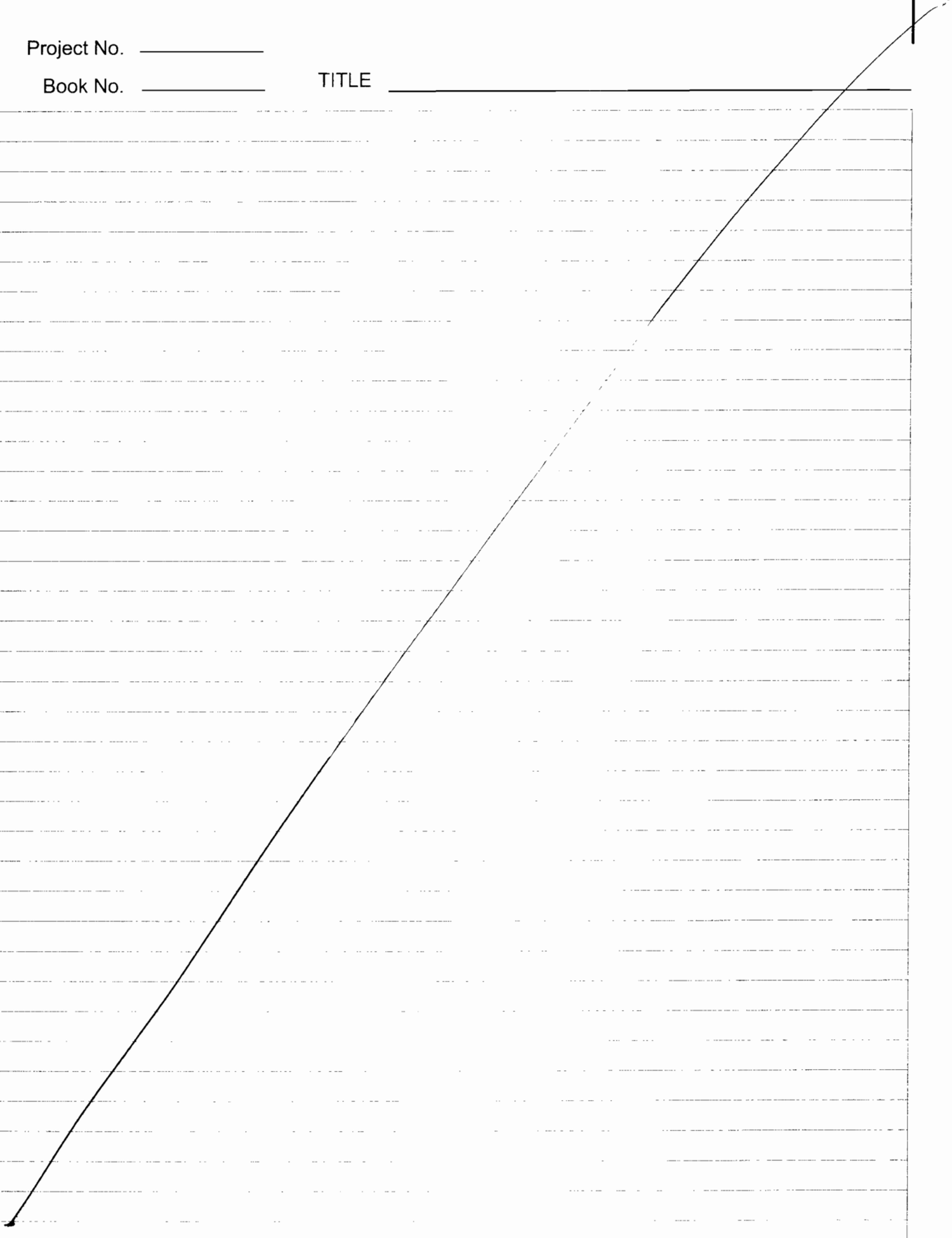
TITLE _____ Book No. _____



Recorded by:	Date	Verified by:	Date

Project No. _____

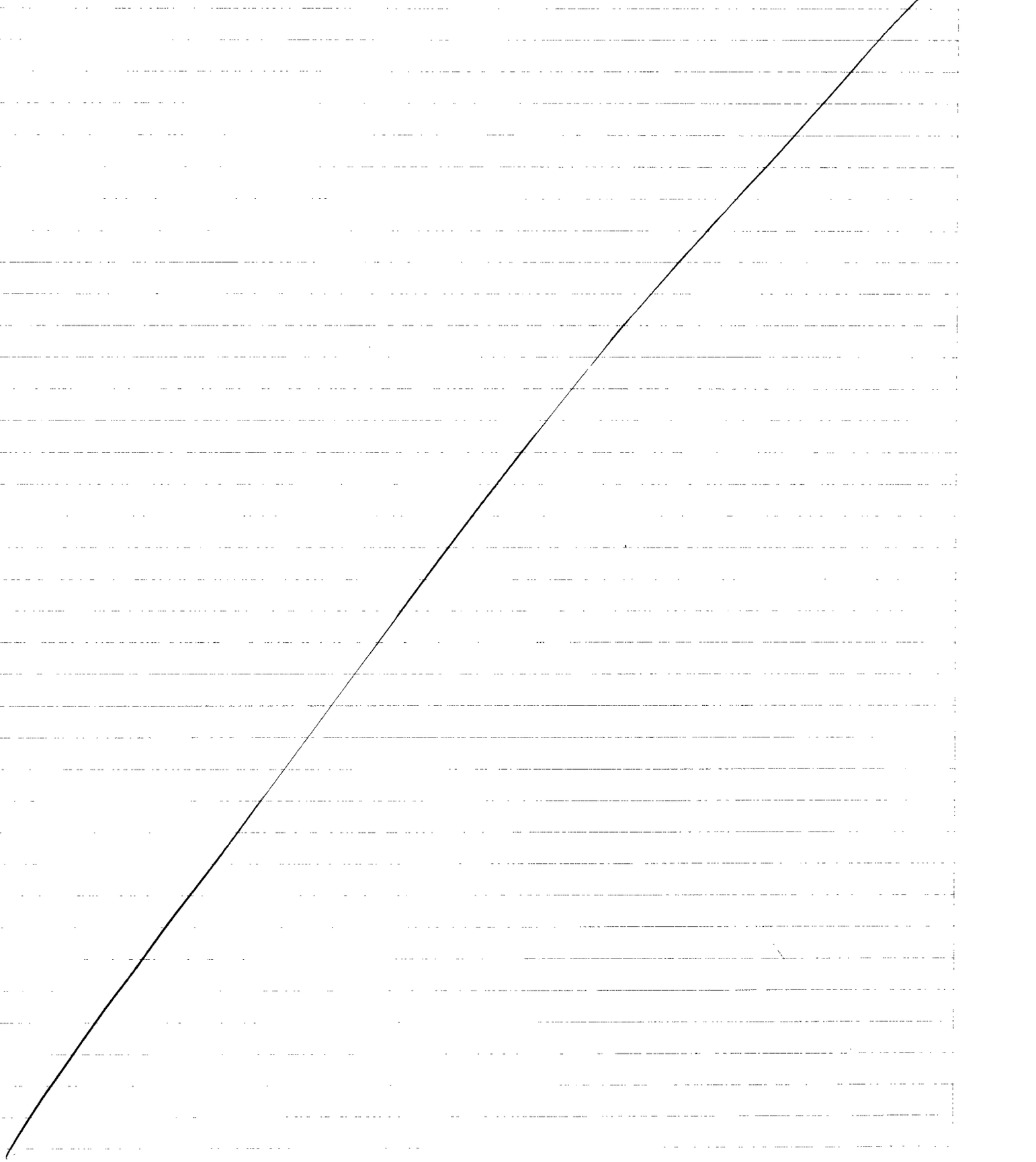
Book No. _____ TITLE _____



Recorded by:	Date	Verified by:	Date

Project No. _____

TITLE _____ Book No. _____



Recorded by:	Date	Verified by:	Date

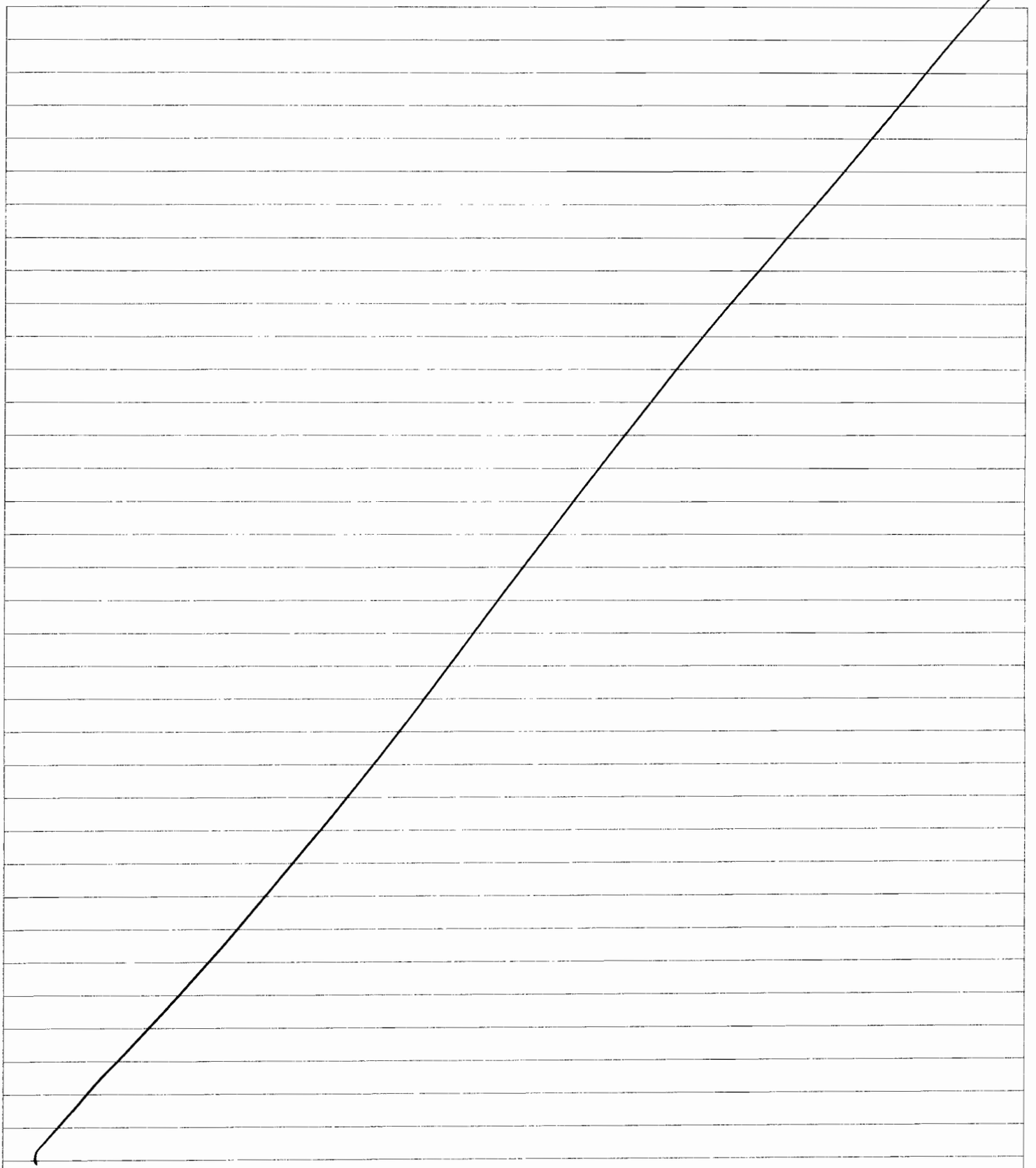
Project No. _____

Book No. _____ TITLE _____

Recorded by:	Date	Verified by:	Date

Project No. _____

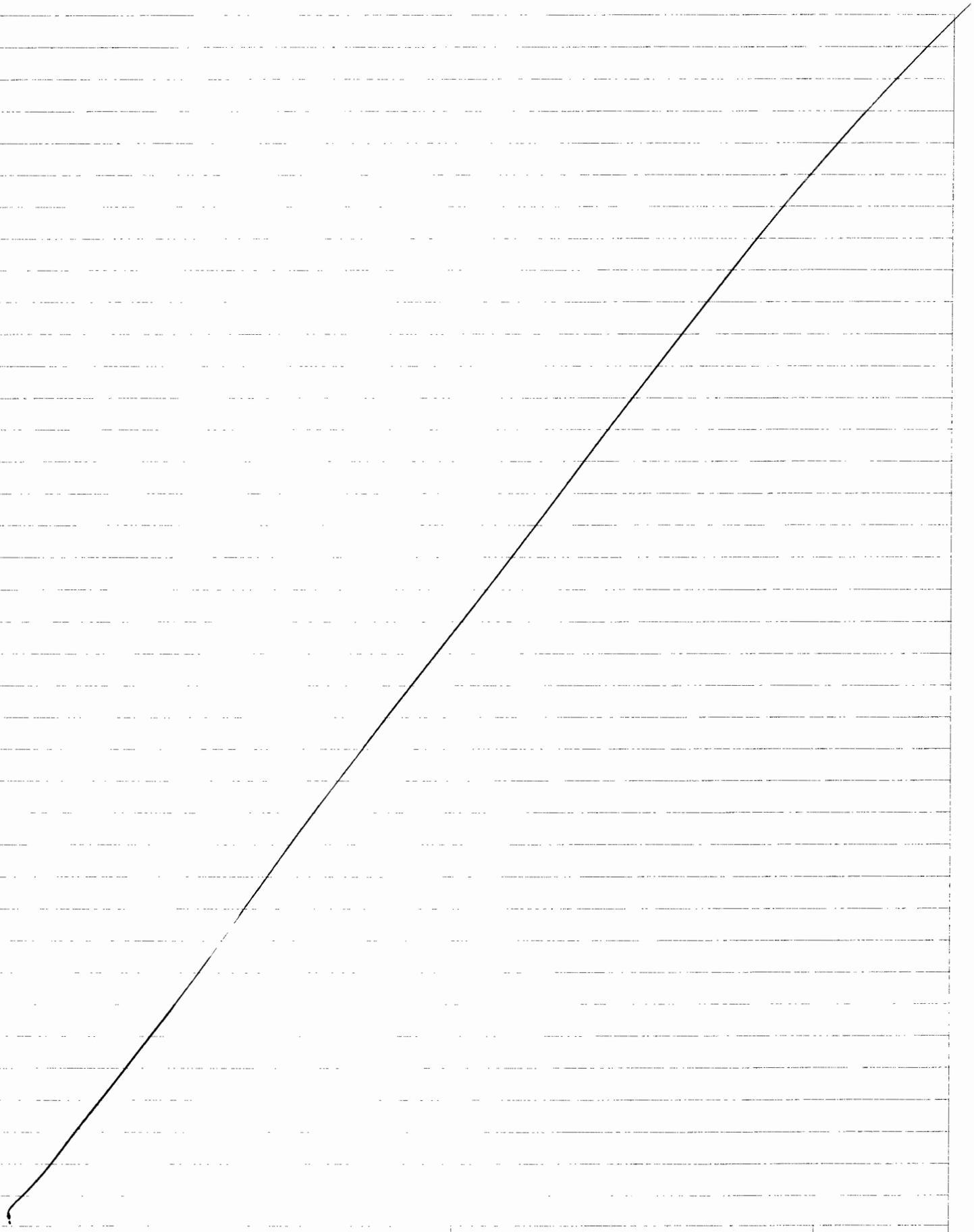
TITLE _____ Book No. _____



Recorded by:	Date	Verified by:	Date

Project No. _____

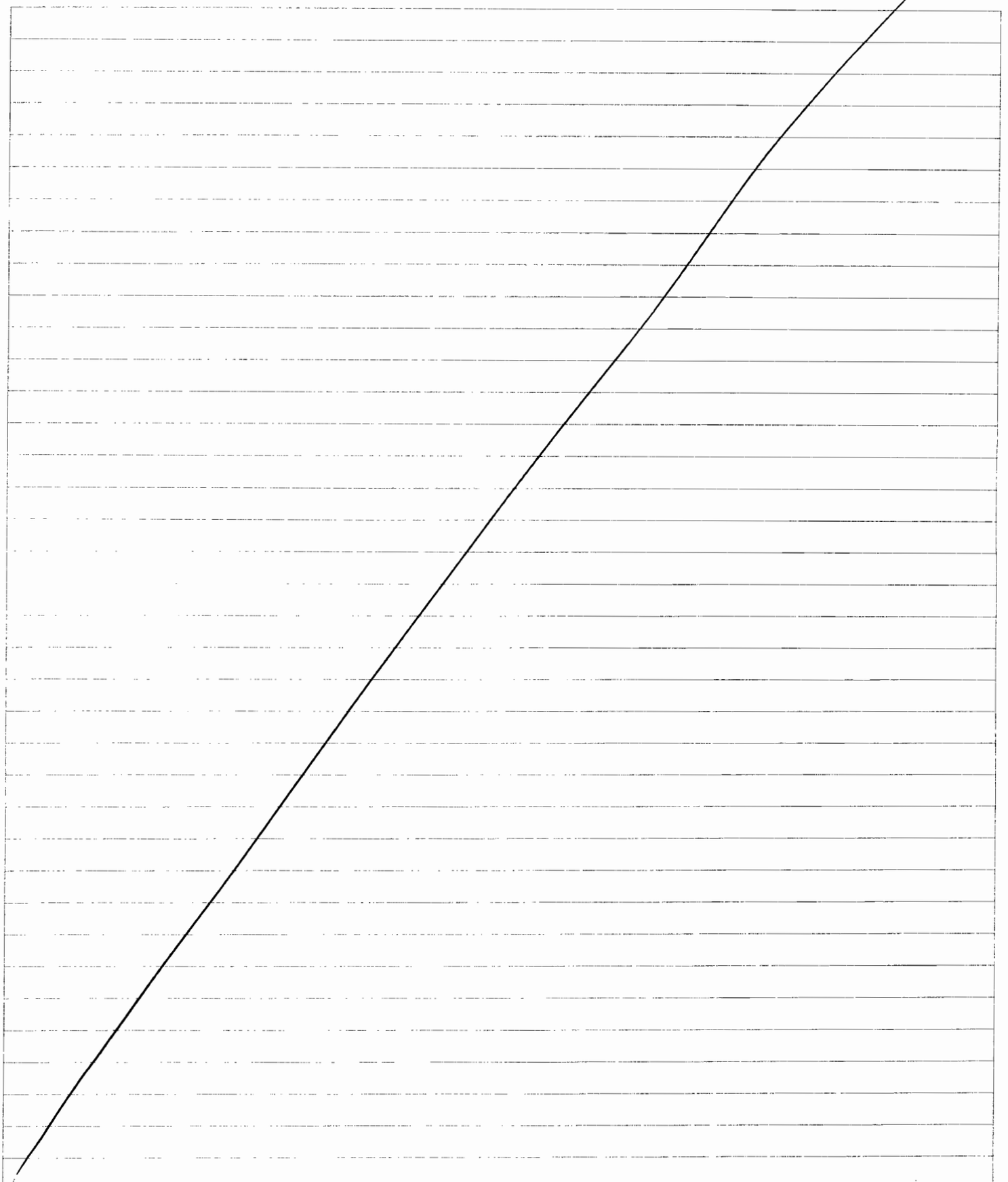
Book No. _____ TITLE _____



Recorded by:	Date	Verified by:	Date

Project No. _____

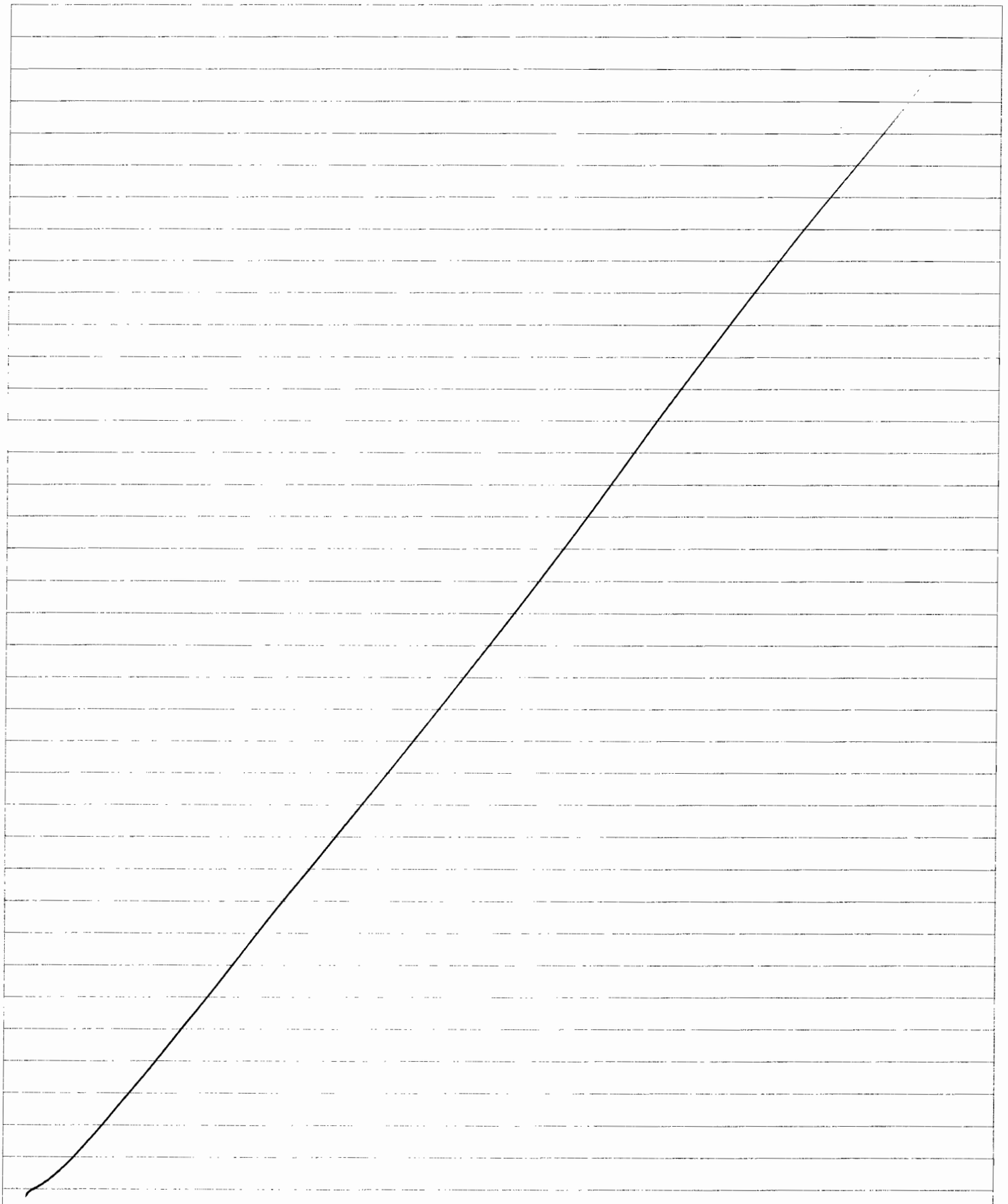
TITLE _____ Book No. _____



Recorded by:	Date	Verified by:	Date

Project No. _____

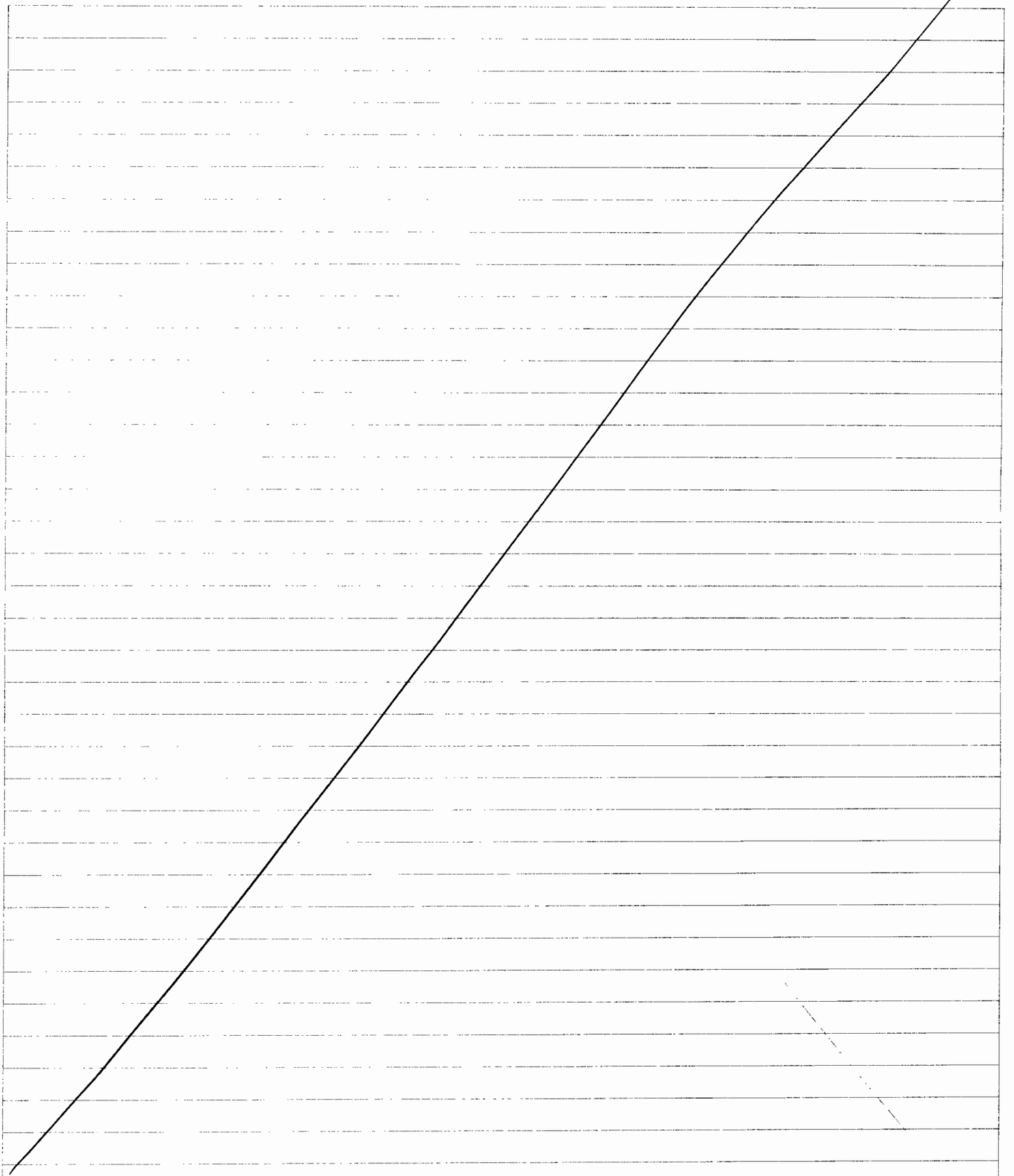
Book No. _____ TITLE _____



Recorded by:	Date	Verified by:	Date

Project No. _____

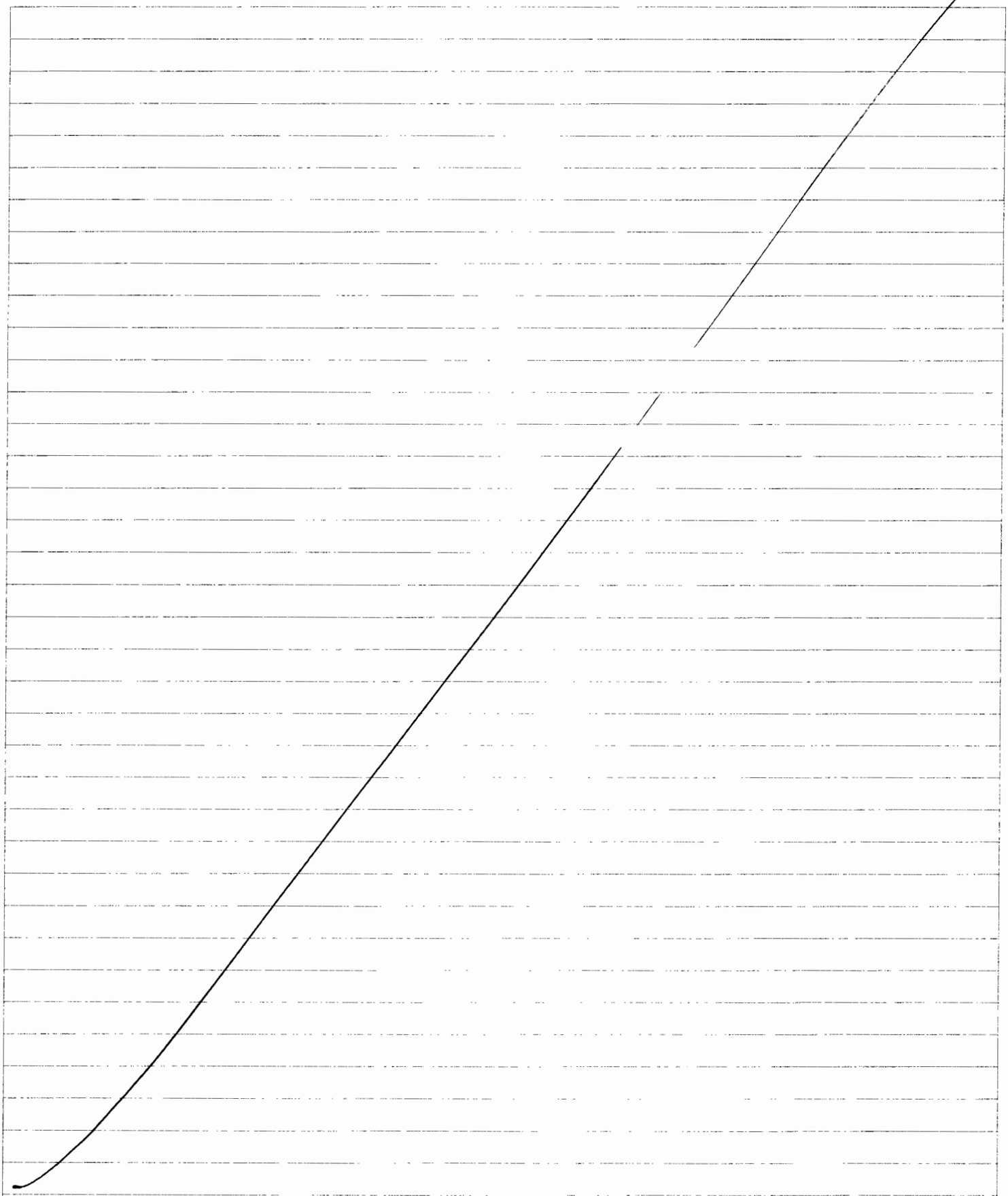
TITLE _____ Book No. _____



Recorded by:	Date	Verified by:	Date

Project No. _____

Book No. _____ TITLE _____



Recorded by:	Date	Verified by:	Date

Project No. _____

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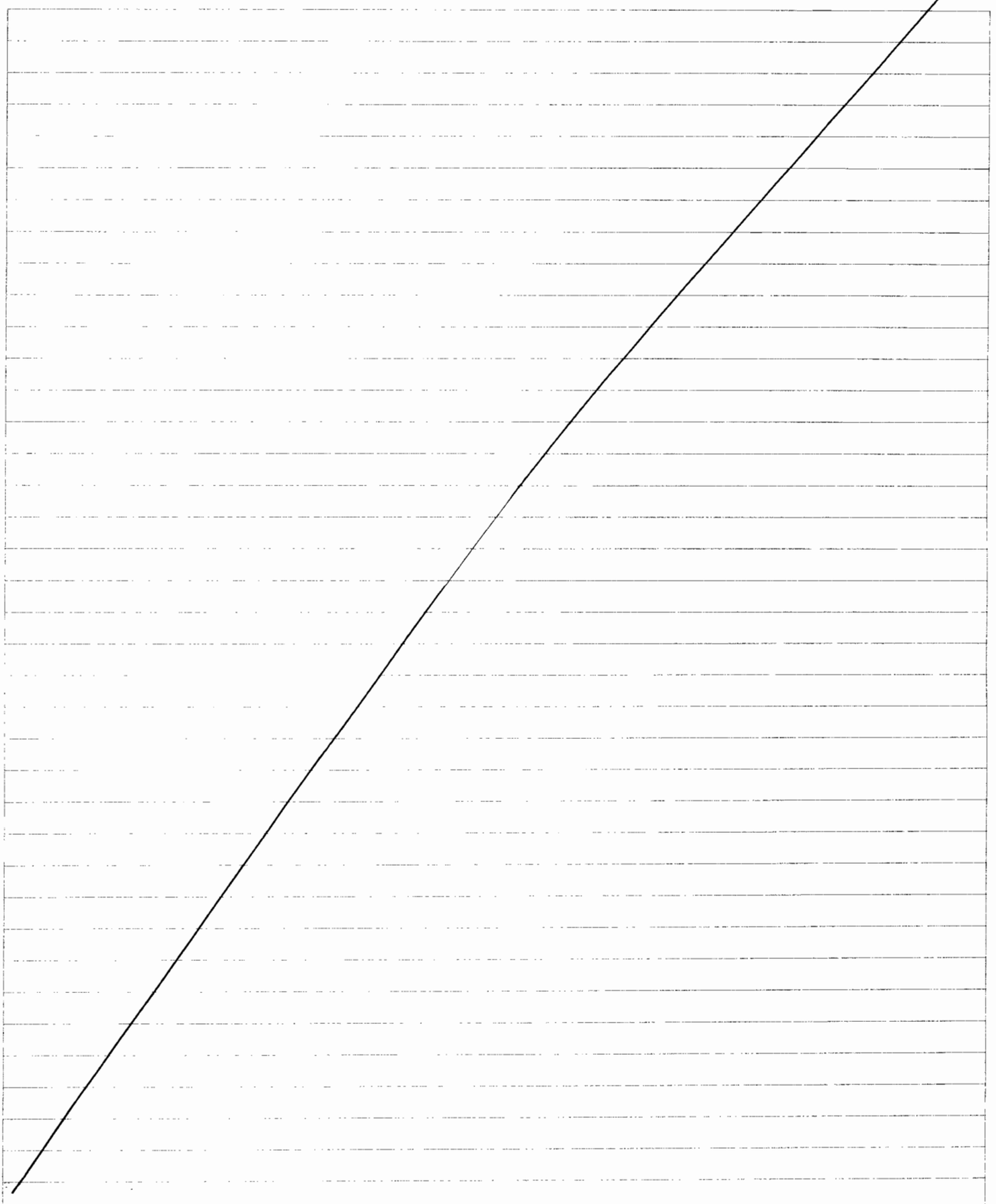

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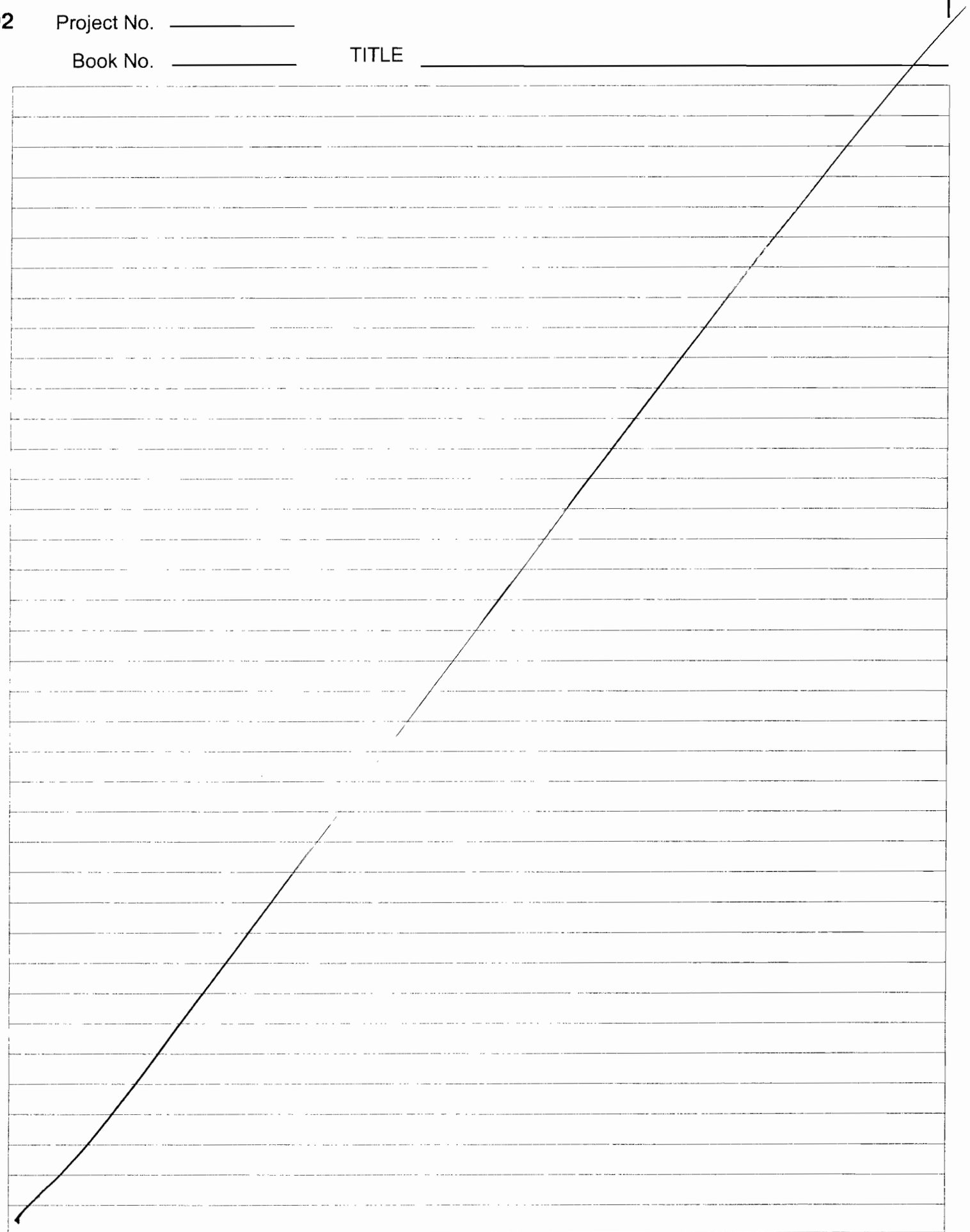

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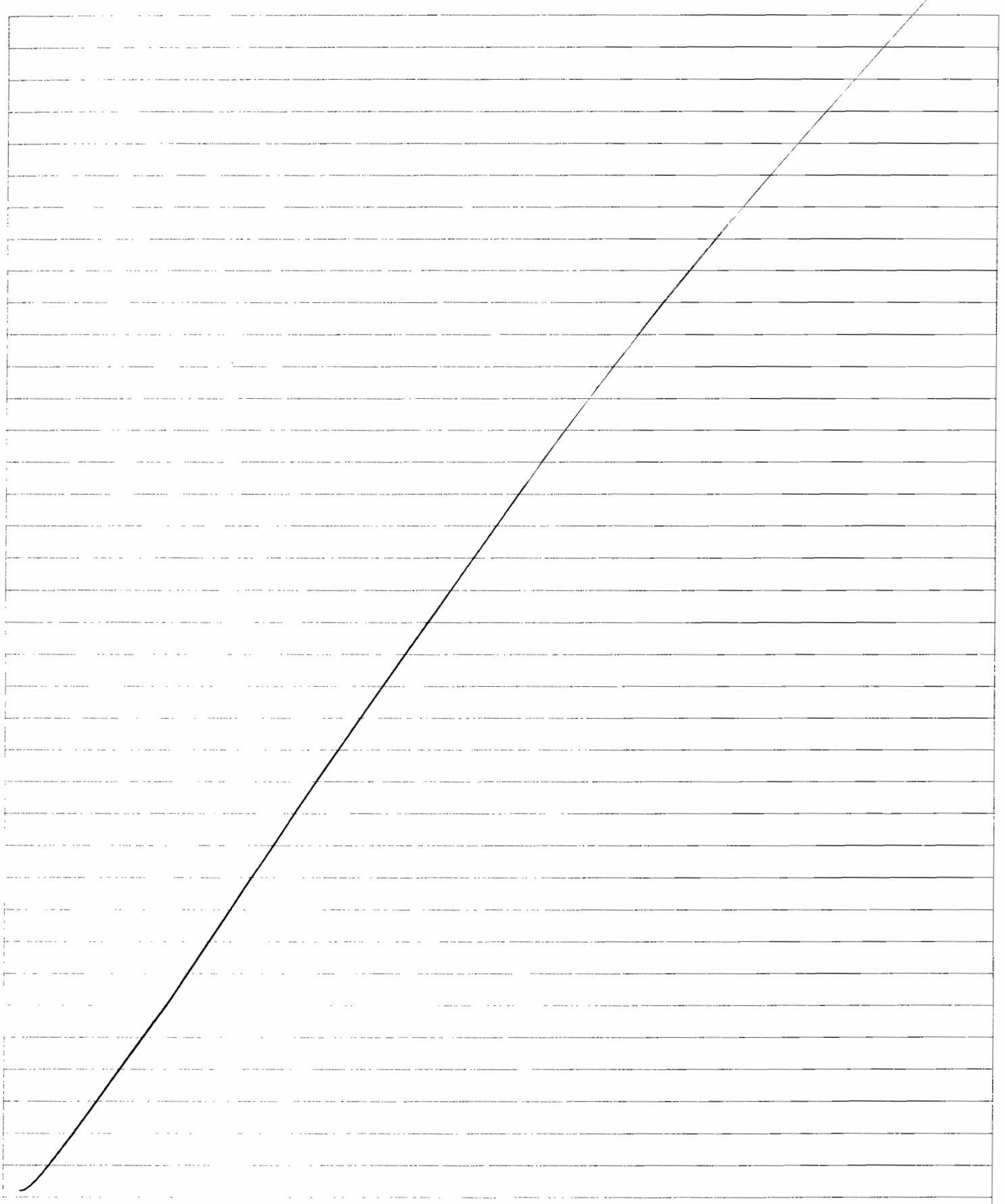

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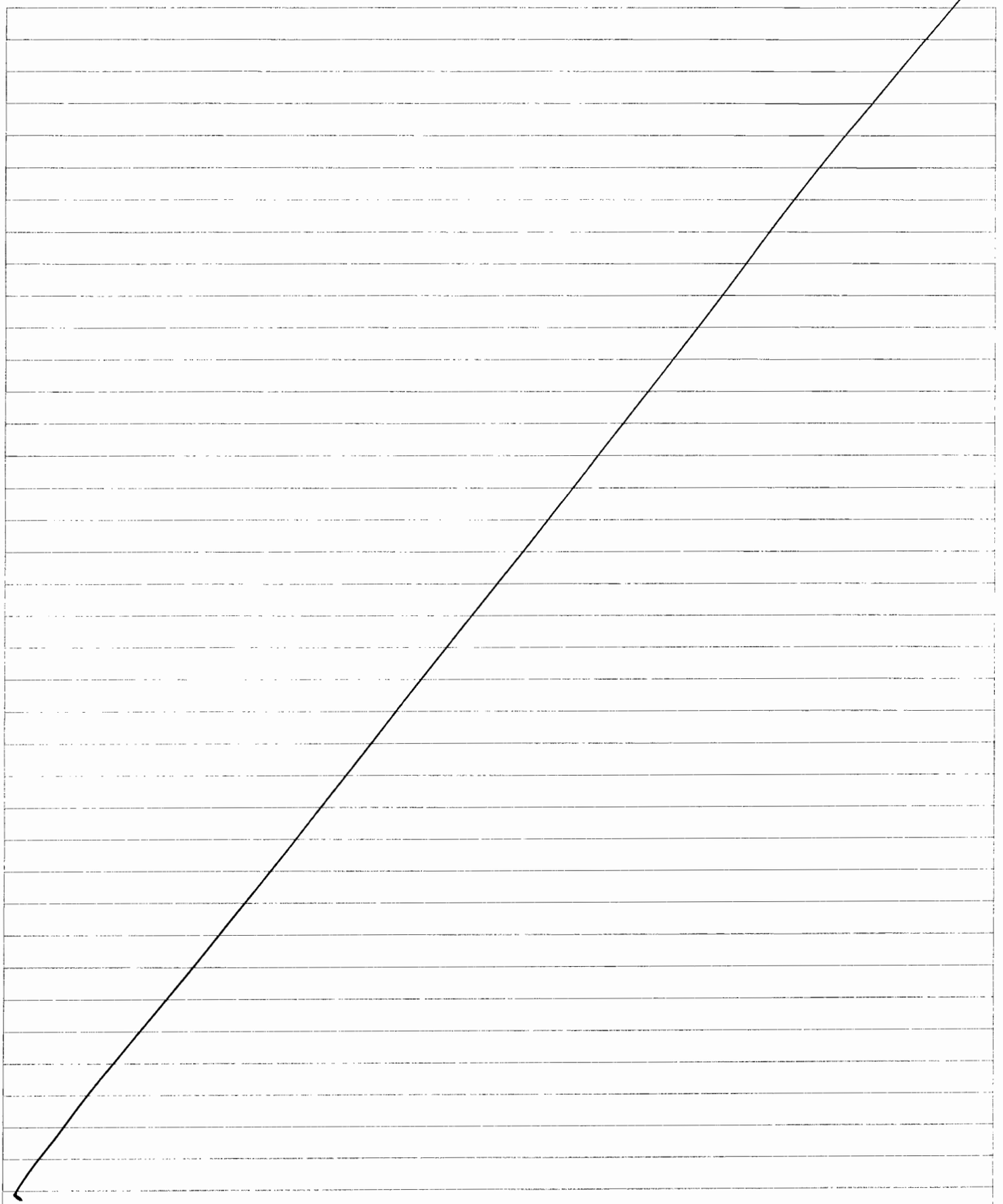

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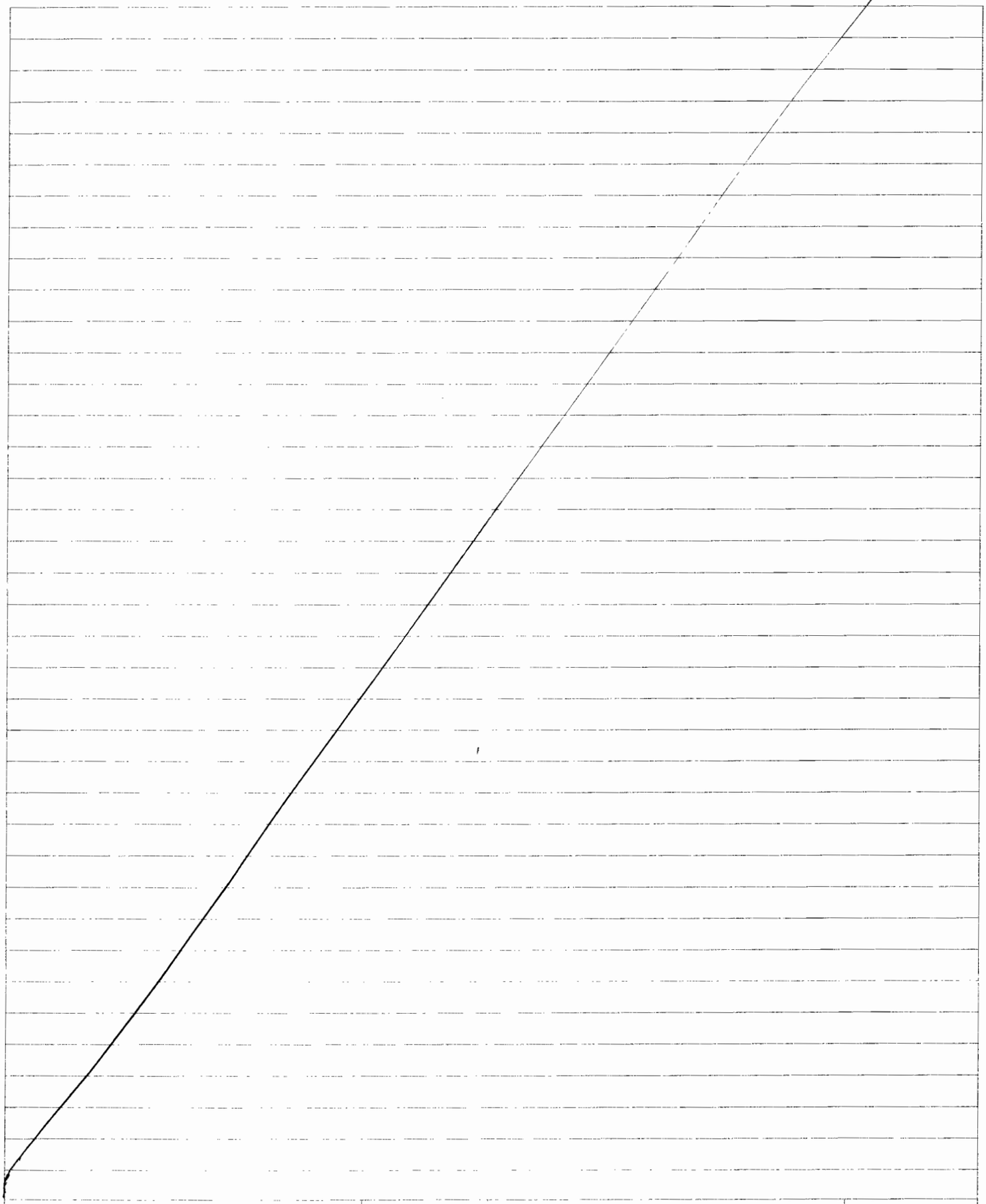

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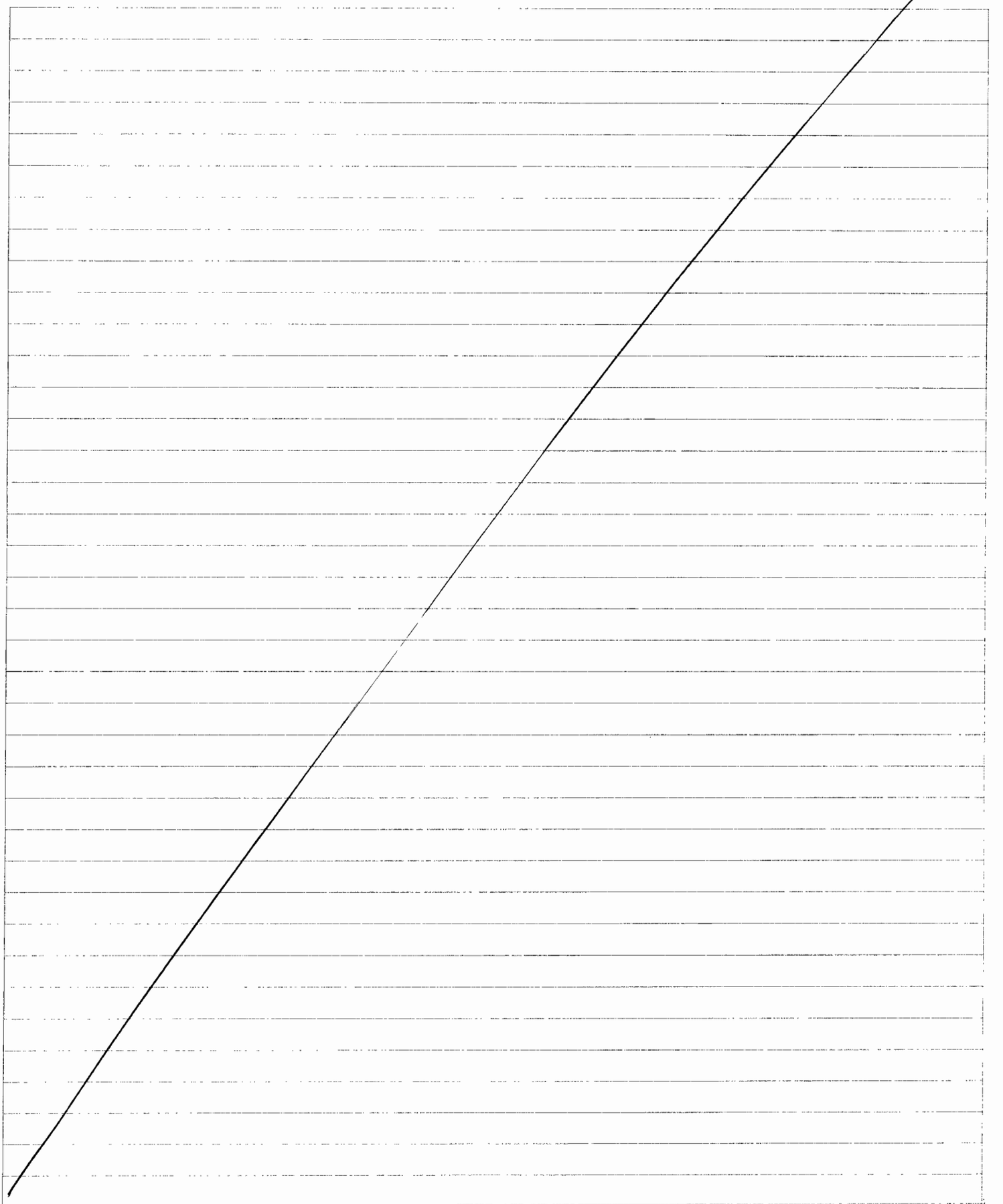

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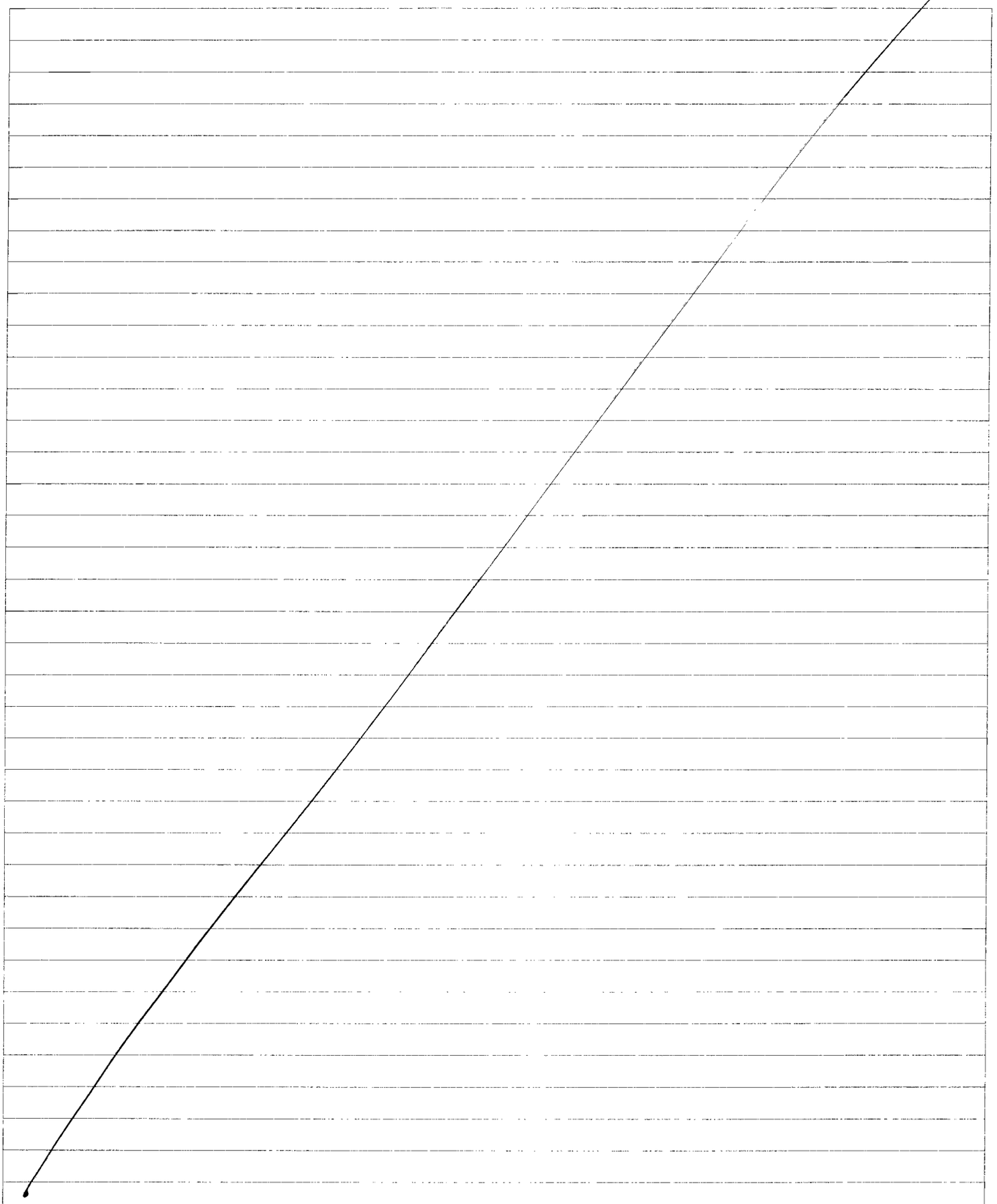

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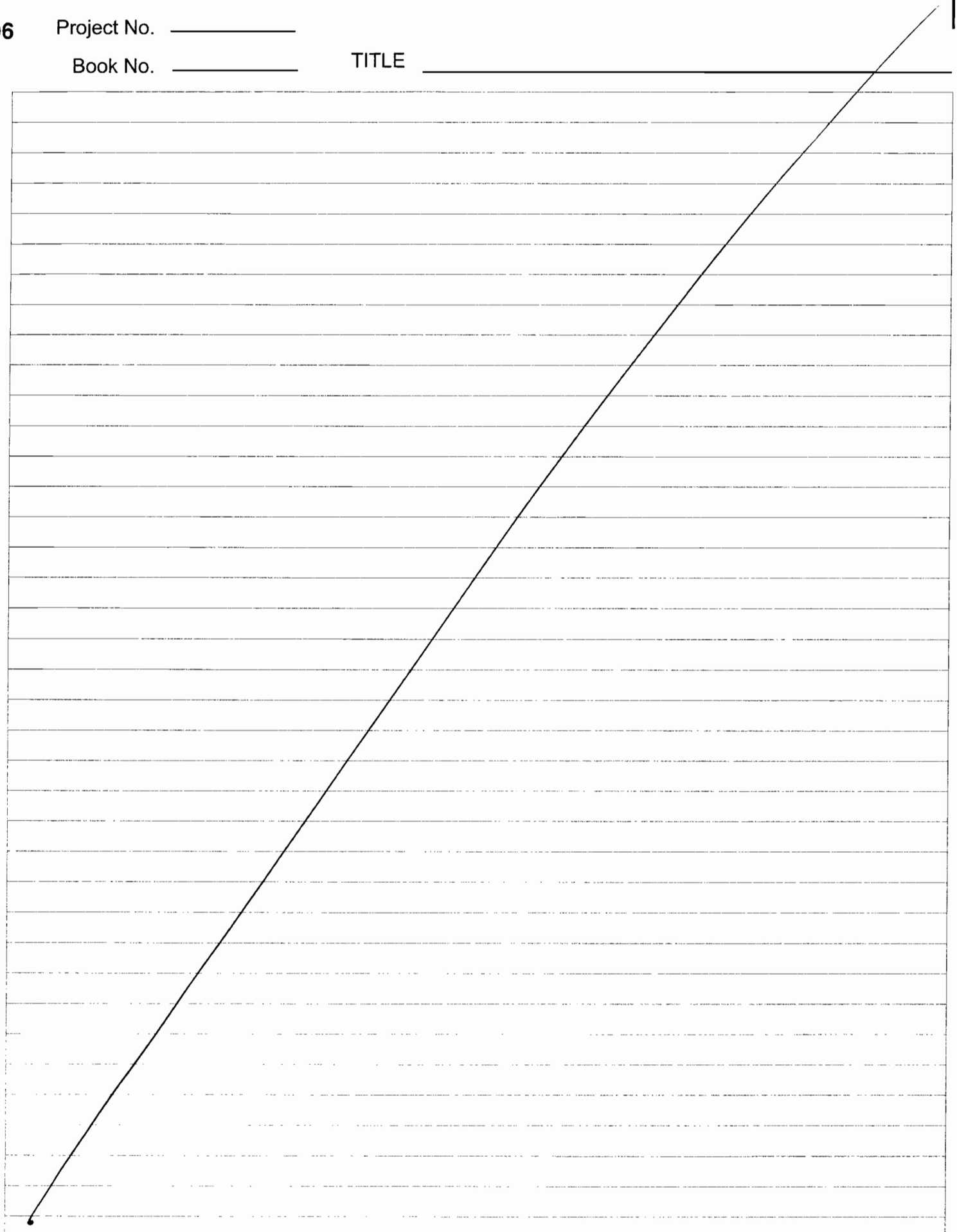

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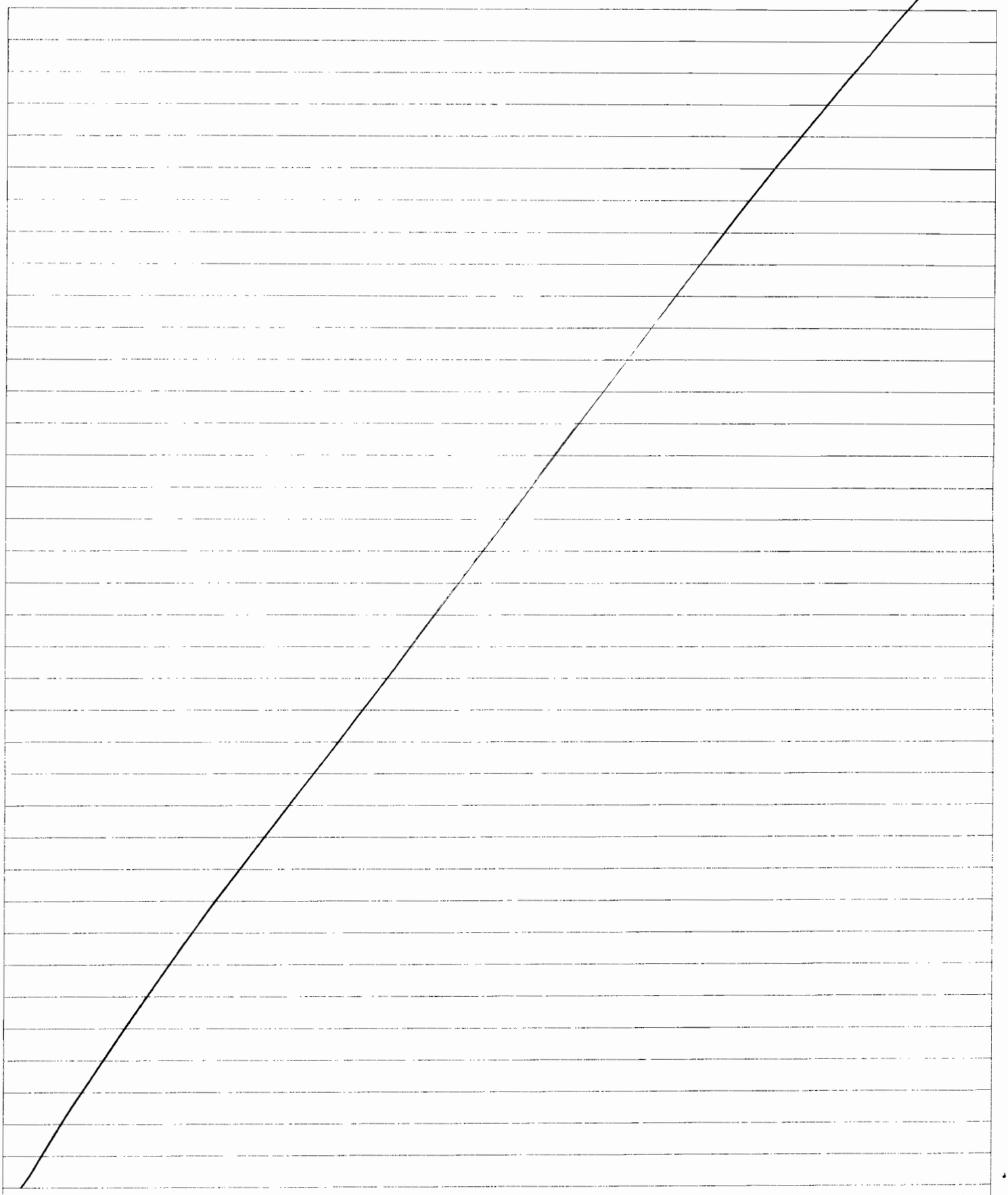

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