

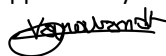
PROJECT ASSURE  
DIAMOND VERIFICATION INSTRUMENT STANDARD  
TEST RESULTS

Assessment Report for: Unimec SA \_ SSEF / ASDI-500




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Testing ID Number: 2024-04  
Report Date: May 28<sup>th</sup>, 2024  
Approved by:



Quinten Van Avondt  
Lab Manager

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 <b>Universiteit Antwerpen</b>	Unimec SA / SSEF      ASDI-500	
	<b>Date:</b> May 28 <sup>th</sup> , 2024	<b>Testing ID:</b> 2024-04

**DIAMOND VERIFICATION INSTRUMENT**

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**Manufacturer’s Name:**      Unimec SA  
**Instrument Model:**      ASDI-500  
**Serial Number:**      6511000  
**Software Version:**      PLCv1.14 – HMIv1.10  
**Lab Manager:**      Quinten Van Avondt  
**Analyst/Operator :**      Cindy De Plukker

**Manufacturer stated diamond verification instrument description and features:**

- Automatic stone feed
- Automatic stone classification
- Automatic stone sorting

**Manufacturer stated diamond verification instrument limitations:**

- Loose stones
- Round brilliant stone shape
- Stone size from 0.50 mm to 3.80 mm
- D-J colour
- Difference in stone diameter within a test parcel may not exceed +/- 0.05mm

**INSTRUMENT PERFORMANCE ASSESSMENT**

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**ASSESSMENT CRITERIA**

The ASSURE testing methodology and performance metrics are dependent on the operational capabilities of the diamond verification instrument being tested. These are defined by the following three categories:

**Category 1- Screen diamonds from synthetic diamonds.** This category of device is intended for discrimination of diamonds from synthetic diamonds. It cannot distinguish diamonds from diamond simulants and therefore requires stones to be pre-screened to ensure no simulants are introduced into the device.

**Category 2 – Screen diamonds from synthetic diamonds and diamond simulants.** This category of device is intended for discrimination of diamonds from synthetic diamonds and diamond simulants. This device cannot distinguish synthetic diamonds from diamond simulants.

**Category 3 – Screen diamond from synthetic diamonds from diamond simulants.** This category of device is intended for discrimination of diamonds, synthetic diamonds and diamond simulants from each other. This device can distinguish synthetic diamonds from diamond simulants.

Instrument performance for classifying the different kinds of stones was assessed against:

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- Diamond Verification Instrument Standard Part 1 – Diamond Verification Instrument for Screening Diamonds from Synthetic Diamonds (18 03 2024)
- Diamond Verification Instrument Standard Part 2 – Diamond Verification Instrument for Screening Diamonds from Synthetic Diamonds and Diamond Simulants (18 03 2024)
- Diamond Verification Instrument Standard Part 3 – Diamond Verification Instrument for Screening Diamonds, Synthetic Diamonds, and Diamond Simulants (18 03 2024)

as referenced in sections 7.3 and 7.4 of the Diamond Verification Instrument Standard – General Requirements for Evaluation Diamond Verification Instruments (18 03 2024). Any deviations from the Standard are noted below:

Notes: The ASDI-500 has an upper size limit of 3.8 mm . Stones with greater diameter than 3.8 mm (30 out of 500) were removed from the PRIMARY sample set prior to conducting performance testing.




DEFINITIONS:

<b>Diamond Accuracy</b>	<i>Diamond test stones correctly classified as Diamond.</i>
<b>Synthetic Diamond Accuracy</b>	<i>Synthetic Diamond test stones correctly classified as Synthetic Diamond.</i>
<b>Diamond Simulant Accuracy</b>	<i>Diamond Simulant test stones correctly classified as Diamond Simulant.</i>
<b>Diamond Referral Rate</b>	<i>Diamond test stones classified as Referral.</i>
<b>Synthetic Diamond Referral Rate</b>	<i>Synthetic diamond test stones classified as Referral</i>
<b>Simulant Referral Rate</b>	<i>Diamond simulant test stones classified as Referral</i>
<b>Diamond False Positive Rate</b>	<i>Synthetic diamonds /diamond simulants test stones incorrectly classified as Diamond.</i>
<b>Synthetic Diamond False Positive Rate</b>	<i>Diamonds/ Diamond simulants test stones incorrectly classified as Synthetic Diamond.</i>
<b>Diamond Simulant False Positive Rate</b>	<i>Diamonds /Synthetic Diamonds test stones incorrectly classified as Diamond Simulants.</i>
<b>Diamond False Negative Rate</b>	<i>Diamonds test stones incorrectly classified as Synthetic Diamonds or Diamond simulants.</i>
<b>Synthetic Diamond False Negative Rate</b>	<i>Synthetic Diamonds test stones incorrectly classified as Diamonds or Diamond simulants</i>
<b>Diamond Simulant False Negative Rate</b>	<i>Diamond Simulant test stones incorrectly classified as Diamonds or Synthetic Diamonds</i>
<b>Testing Speed</b>	<i>The average speed at which the diamond verification instrument evaluates the stones in the PRIMARY loose sample set , including set-up time (if any)</i>
<b>Operating Speed</b>	<i>For auto-loading diamond verification instruments only,the average speed at which stones are evaluated once the instrument achieves a steady-state.does not include set-up time.</i>

TEST STONE SETS USED FOR EVALUATION

<b>Loose, Polished Stone Test Sets</b>	<b>Diamond</b>	<b>Synthetic Diamond</b>	<b>Diamond Simulant</b>
Primary Sample Set (>2.0 mm, D-J color)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Supplementary Smalls Sample Set (1.0-2.0 mm, D-J color)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Supplementary Ultra Smalls Sample Set (0.5mm > , < 1.0mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Mounted, Polished Stone Test Sets</b>	<b>Diamond</b>	<b>Synthetic Diamond</b>	<b>Diamond Simulant</b>
Primary Sample Set (>2.0 mm, D-J color)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Supplementary Smalls Sample Set (1.0-2.0 mm, D-J color)	<input type="checkbox"/>	<input type="checkbox"/>	

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	<b>Date:</b> May 28 <sup>th</sup> , 2024	<b>Testing ID:</b>	2024-04

Notes: In Primary loose sample set, stones greater than 3.8 mm diameter were excluded from testing due to upper size limit for this instrument. This instrument cannot test mounted jewelry.

**CLEANING PROCEDURE OF STONES PRIOR TO TESTING**

Test stones sets are cleaned in an ultrasonic bath of isopropanol for 2 minutes and dried prior to testing to reduce grease and electrostatic charge, as per Section 8 of ASSURE Standard.

**LABORATORY CONDITIONS AT TIME OF ASSESSMENT**


Condition	Requirement	Actual
Temperature (°C)	18 to 25°C	24 °C
Humidity (%)	50 to 65%	54 %

**RESULTS OF INSTRUMENT PERFORMANCE ASSESSMENT – LOOSE STONES**

Performance Metric	Primary <sup>[1]</sup>	Uncertainty <sup>[2]</sup>	Smalls	Uncertainty <sup>[2]</sup>	Ultra-Smalls <sup>[4]</sup>
Diamond accuracy (%)	87.2	1.3	85.0	1.8	84.0
Synthetic diamond accuracy (%)	0.0 <sup>[3]</sup>	0.0	0.0 <sup>[3]</sup>	0.0	0.0
Diamond simulant accuracy (%)	100.0	0.0	100.0	0.0	100.0
Diamond referral rate (%)	12.8	1.3	15.0	1.8	15.7
Synthetic diamond referral rate (%)	100.0 <sup>[3]</sup>	0.0	100.0 <sup>[3]</sup>	0.0	100.0
Diamond simulant referral rate (%)	0.0	0.0	0.0	0.0	0.0
Diamond false positive rate (%)	0.0	0.0	0.0	0.0	0.0
Synthetic diamond false positive rate (%)	0.0	0.0	0.0	0.0	0.0
Diamond simulant false positive rate (%)	0.0	0.0	0.0	0.0	0.2
Diamond false negative rate (%)	0.0	0.0	0.0	0.0	0.3
Synthetic diamond false negative rate (%)	0.0	0.0	0.0	0.0	0.0
Diamond simulant false negative rate (%)	0.0	0.0	0.0	0.0	0.0

- Notes: <sup>[1]</sup> Primary stone set deviates from the standard as a reduced number of stones were analyzed. The Primary sample has a total of 500 mixed stones of which 470 stones were tested due to removal of stones greater than 3.8 mm diameter.
- <sup>[2]</sup> Uncertainty is expressed as absolute +/- range and reflects the consistency of the instrument’s classification of stones for each of the three trials performed with the ASSURE sample.
- <sup>[3]</sup> All Synthetic Diamonds reported as referral for this instrument
- <sup>[4]</sup> Ultra- smalls sample set only tested once

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**INSTRUMENT TESTING SPEED ASSESSMENT**

Testing Speed approximates the usage turnaround time that could be expected by a novice user of the diamond verification instrument and is determined by the time required to evaluate the performance of the diamond verification instrument on the Primary Loose stone test set:

- Testing Speed accounts for the time directly associated with stone assessment including loading stones, programming any applicable instrument measurement parameters, analyzing the stones, and segregating the analyzed stones into respective instrument classified groups.
- Testing Speed does not include the time to initially warm-up the diamond verification instrument (if applicable) nor the time to separate diamonds from synthetic diamonds for each of the instrument classified groups of analyzed stones.
- Testing Speed does not include time associated with interruptions to the testing process.

Diamond verification instruments that continuously load and analyze stones (i.e., autoloading diamond verification instruments) shall also be assessed for a steady-state Instrument Operating Speed.

Testing speed, and instrument operating speed if applicable, are measured in triplicate. The mean value is reported in the Speed Test Results table below. The Uncertainty reflects the absolute +/- range of the results measured over the three trials.

**SPEED TEST RESULTS (PRIMARY LOOSE SAMPLE)**

Category	Stones per hour	Uncertainty
Testing Speed (all devices)	727	16
Operating Speed (auto-loading devices)	868	8

Notes: none

**ADDITIONAL FINDINGS**

None

\*\*\*\*\* End of Report \*\*\*\*\*

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Date:

May 16<sup>th</sup>, 2024

Testing  
ID:

2024-04

### Introduction:

The Characterization Report appendix provides additional information about the physical characteristics for the PRIMARY and SMALLS loose sample sets that were either classified by the instrument as Referrals or that were mis-classified (eg. diamond stones incorrectly classified by the instrument as being synthetic diamond). This appendix is only provided to the instrument manufacturer to provide greater insight into instrument performance and will not be published to the ASSURE directory.

All referral stones or mischaracterized stones from the three trials are included in the data tables. If a data table is not included in this appendix, it means that either the instrument performed flawlessly for that category, or that the category was not tested. The stone count figures (shown in brackets) are the total number for the three trials.

### Data Table Definitions:

Diamond Referrals: Diamonds that were categorized as Referral.

Non-diamond Referrals: Synthetic Diamonds and Diamond Simulants categorized as Referral.

Diamond False Positive: Synthetic Diamonds and Diamond Simulants incorrectly categorized as Diamond.

Synthetic False Positive: Diamonds and Diamond Simulants incorrectly categorized as Synthetic Diamond.

Simulant False Positive: Diamonds and Synthetic Diamonds incorrectly categorized as Diamond Simulant.

### Notes:

Stone counts indicate the number of stones for a category from the three trials (for example, if a specific stone was referred in two of the three trials, it would contribute a stone count of 2 to the characterization table).

Percentage values indicate the corresponding weighted average proportion from the three trials.

Nitrogen Aggregation (% IaB) reflects the proportion of atomic nitrogen present as B-centers (a carbon vacancy surrounded by four substituted nitrogen atoms) for mischaracterized diamonds.



**Date:** May 16<sup>th</sup>, 2024

**Testing  
ID:** 2024-04

Diamond Referrals - PRIMARY		Fluorescence	
Category	Stone Type	Strength	Colour
Diamond (134 of 1050) 100.0%	Type I (130 of 1032) 97.0%	None (102 of 870) 78.5%	Blue (8 of 48) 88.9% Red/Org (0 of 0) 0.0% Yellow (1 of 24) 11.1%
		Slight (9 of 72) 6.9%	Blue (6 of 33) 100.0% Red/Org (0 of 0) 0.0% Yellow (0 of 9) 0.0%
		Moderate (6 of 42) 4.6%	Blue (13 of 48) 100.0% Red/Org (0 of 0) 0.0% Yellow (0 of 0) 0.0%
		Strong (13 of 48) 10.0%	
	Type II (4 of 18) 3.0%	None (4 of 18) 100.0%	
		Slight 0.0%	
		Moderate 0.0%	
		Strong 0.0%	

Category	Stone Type	Nitrogen Characterization	
		Concentration (ppm)	Aggregation (%IaB)
Diamond (134 of 1050) 100.0%	Type I (130 of 1032) 97.0%	<100 (23 of 84) 17.7%	0 - 30 (22 of 81) 95.7% 30 - 70 (0 of 0) 0.0% >70 (1 of 3) 4.3%
		100 - 300 (69 of 651) 53.1%	0 - 30 (56 of 612) 81.2% 30 - 70 (6 of 9) 8.7% >70 (7 of 30) 10.1%
		300 - 600 (38 of 285) 29.2%	0 - 30 (24 of 165) 63.2% 30 - 70 (2 of 33) 5.3% >70 (12 of 87) 31.6%
		>600 (0 of 12) 0.0%	0 - 30 (0 of 12) 30 - 70 (0 of 0) >70 (0 of 0)
	Type II (4 of 18) 3.0%	<100 (4 of 18) 100.0%	0 - 30 (4 of 18) 100.0% 30 - 70 (0 of 0) 0.0% >70 (0 of 0) 0.0%





Date: May 16<sup>th</sup>, 2024

Testing ID: 2024-04

Diamond Referrals - SMALLS		Fluorescence	
Category	Stone Type	Strength	Colour
Diamond (158 of 1050) 100.0%	Type I (158 of 1032) 100.0%	None (150 of 891) 94.9%	Blue (1 of 18) 100.0% Red/Org (0 of 0) 0.0% Yellow (0 of 33) 0.0%
		Slight (1 of 51) 0.6%	Blue (5 of 51) 100.0% Red/Org (0 of 0) 0.0% Yellow (0 of 24) 0.0%
		Moderate (5 of 75) 3.2%	Blue (2 of 6) 100.0% Red/Org (0 of 0) 0.0% Yellow (0 of 9) 0.0%
		Strong (2 of 15) 1.3%	
	Type II (0 of 18) 0.0%	None (0 of 18)	
		Slight	
		Moderate	
		Strong	

Category	Stone Type	Nitrogen Characterization	
		Concentration (ppm)	Aggregation (%IaB)
Diamond (158 of 1050) 100.0%	Type I (158 of 1032) 100.0%	<100 (29 of 117) 0.0%	0 - 30 (29 of 114) 100.0% 30 - 70 (0 of 0) 0.0% >70 (0 of 3) 0.0%
		100 - 300 (71 of 633) 30.8%	0 - 30 (63 of 537) 88.7% 30 - 70 (0 of 0) 0.0% >70 (8 of 96) 11.3%
		300 - 600 (58 of 282) 36.7%	0 - 30 (58 of 243) 100.0% 30 - 70 (0 of 15) 0.0% >70 (0 of 24) 0.0%
		>600 (0 of 0) 0.0%	0 - 30 (0 of 0) 30 - 70 (0 of 0) >70 (0 of 0)
	Type II (0 of 18) 0.0%	<100 (0 of 18)	0 - 30 (0 of 18) 30 - 70 (0 of 0) >70 (0 of 0)