PROJECT ASSURE
DIAMOND VERIFICATION INSTRUMENT STANDARD REPORT

Summary Report for: BiaoQi Optoelectronics Technology Development Co. Ltd. / GEM-3000

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Invid Number:	715370
Assessment Dates:	October 31, 2019 through November 6, 2019
Testing ID Number:	1917796S
Assessment Testing ID:	19177965
Report Issue Date:	November 15, 2019

Approval By:
Judith V Haber
Judith V. Haber
Technical Manager CRS

Manufacturer's Name: BiaoQi Optoelectronics Technology Development Co. Ltd.
Instrument Model: GEM-3000
Serial Number: FSY61B12H
Software Version: NA
Lab Manager: Winson Wong
Analyst/Operator: Charles Qin, Anthony Tedeschi

Overview

The stated instrument was evaluated to Diamond Verification Instrument Standard Part 3 – Diamond Verification Instrument for Screening Diamonds, Synthetic Diamonds, and Diamond Simulants (30 January 2019) as referenced by the Diamond Verification Instrument Standard – General Requirements for Evaluation Diamond Verification Instruments (30 January 2019)

Manufacturer's Claims for Instrument Capability

Sample Composition	
Type of Stones	Diamonds, Synthetic diamonds and Diamond simulants
Stone Size Range	All Sized
Stone Color Range	Stone Color D to J
Loose / Mounted	Loose and Mounted
Single / Batch Stone Testing	Single
Automated / Manual Feed	Manual Feed

Summary of Assessment

The instrument has been verified to be able to screen loose, round brilliant cut diamonds, synthetic diamonds and simulant diamonds size range of 0.86 to 3.7 mm (0.003 to 0.2 ct.) and D to J color range.

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Results of Performance Testing to the Diamond Verification Instrument Standard

Test Stone Sets used to Assess Performance

Loose, Polished Stone Test Sets	Diamond	Synthetic Diamond	Diamond Simulant
Primary Set (>2.00 mm, D-J colour) 748 diamonds, 150 synthetic diamonds and 148 diamond simulants[1]	☒	☒	☒
Supp. Set A (>2.00 mm, D-J colour) 249 diamonds	☒		
Supp. Set AB (>2.00 mm, D-J colour) 50 synthetic diamonds, 47 diamond simulants[2]		☒	☒
Supp. Set B (>2.00 mm, K-Z colour) 250 diamonds	☐		
Supp. Set C (1.00-2.00 mm, D-J colour) 737 diamonds, 140 synthetic diamonds and 145 diamond simulants	☒	☒	☒
Supp. Set D (1.00-2.00 mm, D-J colour) 250 diamonds	☒		
Supp. Set DE (1.00-2.00 mm, D-J colour) 51 synthetic diamonds, 47 diamond simulants		☒	☒
Supp. Set E (0.10-2.00 mm, K-Z colour) 250 diamonds	☐		

Results of instrument stone assessment testing of Primary and A&AB Combined – Expert

Test Property	Results for Loose, Polished Stone Test Sets	
	Primary and A&AB Combined	C and D&DE Combined
Diamond accuracy (%)	96.8	91.5
Synthetic diamond accuracy (%)	82.9	99.0
Diamond simulant accuracy (%)	99.5	100.0
Diamond referral rate (%)	2.4	0.0
Synthetic diamond referral rate (%)	10.6	0.0
Diamond simulant referral rate (%)	0.5	0.0
Diamond false positive rate (%)	3.3	0.5
Synthetic diamond false positive rate (%)	0.0	1.4
Diamond simulant false positive rate (%)	0.7	5.8
Diamond false negative rate (%)	0.8	8.5
Synthetic diamond false negative rate (%)	6.5	1.0
Diamond simulant false negative rate (%)	0.0	0.0

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Results of instrument stone assessment testing of Primary and A&AB Combined – Novice

Test Property	Results for Loose, Polished Stone Test Sets	
	Primary and A&AB Combined	C and D&DE Combined
Diamond accuracy (%)	94.8	90.1
Synthetic diamond accuracy (%)	61.3	72.3
Diamond simulant accuracy (%)	67.9	69.2
Diamond referral rate (%)	4.1	7.6
Synthetic diamond referral rate (%)	36.2	25.7
Diamond simulant referral rate (%)	29.6	31.8
Diamond false positive rate (%)	0.3	0.0
Synthetic diamond false positive rate (%)	0.6	0.0
Diamond simulant false positive rate (%)	1.1	2.3
Diamond false negative rate (%)	1.1	2.3
Synthetic diamond false negative rate (%)	2.5	2.1
Diamond simulant false negative rate (%)	2.6	0.0

Notes:
None

Results of instrument testing speed assessment - Expert

Rate of Testing Speed Test Method	Average Test Result
☐ Test Method A: Fixed number of stones ☒ Test Method B: Fixed time frame ☐ Test Method C: Reduced number of stones	565 stones per hour

Results of instrument testing speed assessment - Novice

Rate of Testing Speed Test Method	Average Test Result
☐ Test Method A: Fixed number of stones ☒ Test Method B: Fixed time frame ☐ Test Method C: Reduced number of stones	440 stones per hour

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Results of instrument stone assessment testing of individual stone sets - Expert

Test Property	Results for Loose, Polished Stone Test Sets					
	Primary[1]	A & AB	B & AB	C[1]	D & DE[1]	E & DE
Diamond accuracy (%)	96.9	96.4	na	91.5	91.6	na
Synthetic diamond accuracy (%)	86.0	73.5	na	98.6	100.0	na
Diamond simulant accuracy (%)	100.0	97.9	na	100.0	100.0	na
Diamond referral rate (%)	2.1	3.2	na	0.0	0.0	na
Synthetic diamond referral rate (%)	7.3	20.4	na	0.0	0.0	na
Diamond simulant referral rate (%)	0.0	2.1	na	0.0	0.0	na
Diamond false positive rate (%)	3.4	3.1	na	0.7	0.0	na
Synthetic diamond false positive rate (%)	0.0	0.0	na	1.4	1.3	na
Diamond simulant false positive rate (%)	0.8	0.3	na	5.8	5.6	na
Diamond false negative rate (%)	0.9	0.4	na	8.5	8.4	na
Synthetic diamond false negative rate (%)	6.7	6.1	na	1.4	0.0	na
Diamond simulant false negative rate (%)	0.0	0.0	na	0.0	0.0	na

Results of instrument stone assessment testing of individual stone sets - Novice

Test Property	Results for Loose, Polished Stone Test Sets					
	Primary[1]	A & AB	B & AB	C[1]	D & DE[1]	E & DE
Diamond accuracy (%)	94.5	95.6	na	89.3	92.4	na
Synthetic diamond accuracy (%)	60.7	63.3	na	71.4	74.5	na
Diamond simulant accuracy (%)	69.6	62.5	na	69.7	63.8	na
Diamond referral rate (%)	4.3	3.6	na	7.6	7.6	na
Synthetic diamond referral rate (%)	37.3	32.7	na	25.7	25.5	na
Diamond simulant referral rate (%)	29.7	29.2	na	30.3	36.2	na
Diamond false positive rate (%)	0.3	0.0	na	0.0	0.0	na
Synthetic diamond false positive rate (%)	0.1	2.0	na	0.0	0.0	na
Diamond simulant false positive rate (%)	1.2	0.7	na	3.1	0.0	na
Diamond false negative rate (%)	1.2	0.8	na	3.1	0.0	na
Synthetic diamond false negative rate (%)	2.0	4.1	na	2.9	0.0	na
Diamond simulant false negative rate (%)	0.7	8.3	na	0.0	0.0	na

Notes:

na Not applicable per instrument manufacturer

[1] Primary Stone set, C Stone set and DE Stone set deviates from the standard as a reduced number of stones were analyzed; Primary Set deviation – the standard call for 748 diamonds to be tested, 747 diamonds were tested; Set C deviation – the standard calls for 900 mixed stones to be tested, 877 stones were tested; Set DE deviation – the standard calls for 52 synthetic stones to be tested, 51 stones were tested.

Additional Notes from Assessment Findings

Below is a summary of an additional findings from assessment:

- No additional comments

Definitions

Diamond Accuracy	Defined as the fraction of test stones correctly classified by the specific diamond verification instrument as diamond.
Synthetic Diamond Accuracy	Defined as the fraction of test stones correctly classified by the specific diamond verification instrument as synthetic diamond.
Diamond Simulant Accuracy	Defined as the fraction of test stones correctly classified by the specific diamond verification instrument as diamond simulant.
Diamond Referral Rate	Defined as the fraction of diamonds that could not be classified by the specific diamond verification instrument and requires further.
Synthetic Diamond Referral Rate	Defined as the fraction of synthetic diamonds that could not be classified by the specific diamond verification instrument and requires further testing.
Simulant Referral Rate	Defined as the fraction of diamond simulants that could not be classified by the specific diamond verification instrument and requires further testing.
Diamond False Positive Rate	Defined as the fraction of synthetic diamonds and/or diamond simulants incorrectly classified as diamond by the specific diamond verification instrument.
Synthetic Diamond False Positive Rate	Defined as the fraction of diamonds and/or diamond simulants incorrectly classified as synthetic diamonds by the specific diamond verification instrument.
Diamond Simulant False Positive Rate	Defined as the fraction diamond and/or synthetic diamonds incorrectly classified as diamond simulants by the specific diamond verification instrument.
Diamond False Negative Rate	Defined as the fraction of diamonds incorrectly classified as synthetic diamond and/or diamond simulant by the specific diamond verification instrument.
Synthetic Diamond False Negative Rate	Defined as the fraction of synthetic diamonds incorrectly classified as diamond and/or diamond simulant by the specific diamond verification instrument.
Diamond Simulant False Negative Rate	Defined as the fraction of diamond simulants incorrectly classified as diamond and/or synthetic diamond by the specific diamond verification instrument.
Rate of Testing Speed	Defined as the average speed at which the diamond verification instrument evaluates unknown stones.

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