

**BUEHLER****CERTIFICATE OF CALIBRATION**

Indirect Verification

Buehler, a division of ITW
 41 Waukegan Road
 Lake Bluff, IL 60044
 1 847 295 6500

CUSTOMER SITE

ECHO INC.
 400 OAKWOOD ROAD

ECHO LAKE IL. 60047

Original Certificate # 9502-1**Date:** April 5, 2019

The following described machine has been verified in accordance with: ASTM E92-17
 Indirect Verification procedure, incorporating the requirements of ISO/IEC 17025.
 The test blocks used were standardised on verified testers in accordance with ASTM E-92/E384 with test forces, indenters and depth-measuring systems traceable to the International System of Units, through NIST.
 The reported uncertainty uses a coverage factor of 2, representing a confidence interval of 95%.

Model:	WILSON 1202	Location Calibrated:	Customer Site
Serial Number:	1202-02-0170	Condition of Equipment as Found:	Good
Asset # / PO #:	N/A / PH95015	Indenters:	Vickers # EV002873 Knoop # K1277

Environmental Conditions

Start	Finish
Temp (F.) 67.1 Humidity 43.5%	Temp (F.) 71.2 Humidity 34.5%

SUMMARY OF HARDNESS TESTER RESULTS

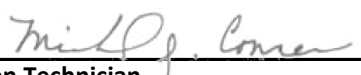
Test Block	Tol +/-	Readings as-found			Readings as-left			Uncertainty HV or HK
		Actual	Error %	Pass/Fail	Actual	Error %	Pass/Fail	
713HV0.3	31	722	0.50	Pass	722	0.50	Pass	14
464HV1	19	472	0.84	Pass	472	0.84	Pass	7
-	-	-	-		-	-		-
-	-	-	-		-	-		-

BUEHLER'S STANDARDIZED TEST BLOCK INFORMATION:

Serial Number	Test Block	Calibration Date	Load (gf)	Certified Diagonal	Certified Value	Permissible Error +/-
18SB06	713HV0.3	3-Oct-18	300	27.9 μ m	713 Vickers	31
18269	464HV1	17-Sep-18	1000	63.2 μ m	464 Vickers	19

COMMENTS:

Dwell time set for 10 seconds


 Calibration Technician



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Data Sheet (as-found)*Original Certificate # 9502-1*

Test Block # 1	18SB06
Hardness	713.0
Load (gf)	300
Indenter type	Vickers
Diagonals	27.90
Uncertainty	13.10
Resolution	0.10

	D ₂	D ₁	Average	Hardness	
1	27.6	28.0	27.80	720	
2	27.9	28.0	27.95	712	
3	27.8	27.6	27.70	725	
4	27.7	27.7	27.70	725	
5	27.6	27.7	27.65	728	
		Average	27.76	722	
		Error (μ)	0.14	Pass	
		Repeatability	1.08%	Pass	
		Result	Pass		
		Bias	8.8	Vickers	

Test Block # 2	18269
Hardness	464.0
Load (gf)	1000
Indenter type	Vickers
Diagonals	63.20
Uncertainty	5.70
Resolution	0.10

	D ₂	D ₁	Average	Hardness	
1	62.5	62.3	62.4	476	
2	62.9	62.8	62.9	469	
3	62.5	62.3	62.4	476	
4	62.8	62.3	62.6	474	
5	63.6	62.7	63.2	465	
		Average	62.7	472	
		Error (μ)	0.53	Pass	
		Repeatability	1.20%	Pass	
		Result	Pass		
		Bias	8.1	Vickers	

Test Block # 3	
Hardness	
Load (gf)	
Indenter type	
Diagonals	
Uncertainty	
Resolution	

	D ₂	D ₁	Average	Hardness	
1					
2					
3					
4					
5					
		Average			
		Error (μ)			
		Repeatability			
		Result			
		Bias			

Test Block # 4	
Hardness	
Load (gf)	
Indenter type	
Diagonals	
Uncertainty	
Resolution	

	D ₂	D ₁	Average	Hardness	
1					
2					
3					
4					
5					
		Average			
		Error (μ)			
		Repeatability			
		Result			
		Bias			



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Data Sheet (as-left)*Original Certificate # 9502-1*

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Hardness	713.0
Load (gf)	300
Indenter type	Vickers
Diagonals	27.90
Uncertainty	13.10
Resolution	0.10

	D ₂	D ₁	Average	Hardness	
1	27.6	28.0	27.80	720	
2	27.9	28.0	27.95	712	
3	27.8	27.6	27.70	725	
4	27.7	27.7	27.70	725	
5	27.6	27.7	27.65	728	
		Average	27.76	722	
		Error (μ)	0.14	Pass	
		Repeatability	1.08%	Pass	
		Result	Pass		
		Bias	8.8	Vickers	

Test Block # 2	18269
Hardness	464.0
Load (gf)	1000
Indenter type	Vickers
Diagonals	63.20
Uncertainty	5.70
Resolution	0.10

	D ₂	D ₁	Average	Hardness	
1	62.5	62.3	62.4	476	
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3	62.5	62.3	62.4	476	
4	62.8	62.3	62.6	474	
5	63.6	62.7	63.2	465	
		Average	62.7	472	
		Error (μ)	0.53	Pass	
		Repeatability	1.20%	Pass	
		Result	Pass		
		Bias	8.1	Vickers	

Test Block # 3	
Hardness	
Load (gf)	
Indenter type	
Diagonals	
Uncertainty	
Resolution	

	D ₂	D ₁	Average	Hardness	
1					
2					
3					
4					
5					
		Average			
		Error (μ)			
		Repeatability			
		Result			
		Bias			

Test Block # 4	
Hardness	
Load (gf)	
Indenter type	
Diagonals	
Uncertainty	
Resolution	

	D ₂	D ₁	Average	Hardness	
1					
2					
3					
4					
5					
		Average			
		Error (μ)			
		Repeatability			
		Result			



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