WHITE PAPER

Opentrons Single Pipette GEN2

Written by
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SECTION 1

Introduction

This paper introduces technical specs, test methods, and data validation for the Opentrons Single GEN2 pipettes. Accuracy and precision of the pipette models is also shown.

Product Description

Opentrons Single-Channel GEN2 Pipettes are designed specifically for lab automation and optimized for use with the OT-2. These pipettes reliably conduct liquid transfers from 1 µL -1000 µl, featuring tip pickup and drop +/- 1mm of a successful seal when using **Opentrons tips**.

Opentrons Single GEN2 feature comparable specs to pipettes 10x as expensive. They also allow researchers to complete protocols using fewer pipettes due to a newly broadened volume range and any combination of two of those single- and 8-channel pipettes.

AVAILABLE RANGES

- P20 GEN2 (1 µl – 20 µl)
- P300 GEN2 (20 µl – 300 µl)
- P1000 GEN2 (100 µl – 1000 µl)

SECTION 2

Technical Data

FIGURE 1

Single-Channel GEN2 Pipette Specifications

MODEL	VOLUME	ACCURACY		PRECISION	
		%D	µL	%CV	µL
P20 GEN	1 µL	+/- 15%	0.15 µL	+/- 5 %	0.05 µL
	10 µL	+/- 2%	0.2 µL	+/- 1 %	0.1 µL
	20 µL	+/- 1.5%	0.03 µL	+/- 0.8 %	0.16 µL
P300 GEN2	20 µL	+/- 4%	0.08 µL	+/- 2.5%	0.5 µL
	150 µL	+/- 1%	1.5 µL	+/- 0.4%	0.6 µL
	300 µL	+/- 0.6%	1.8 µL	+/- 0.3%	0.9 µL
P1000 GEN2	100 µL	+/- 2%	2.0 µL	+/- 1%	1 µL
	500 µL	+/- 1%	5.0 µL	+/- 0.2%	1 µL
	1000 µL	+/- 0.7%	7.0 µL	+/- 0.15%	1.5 µL

SECTION 3

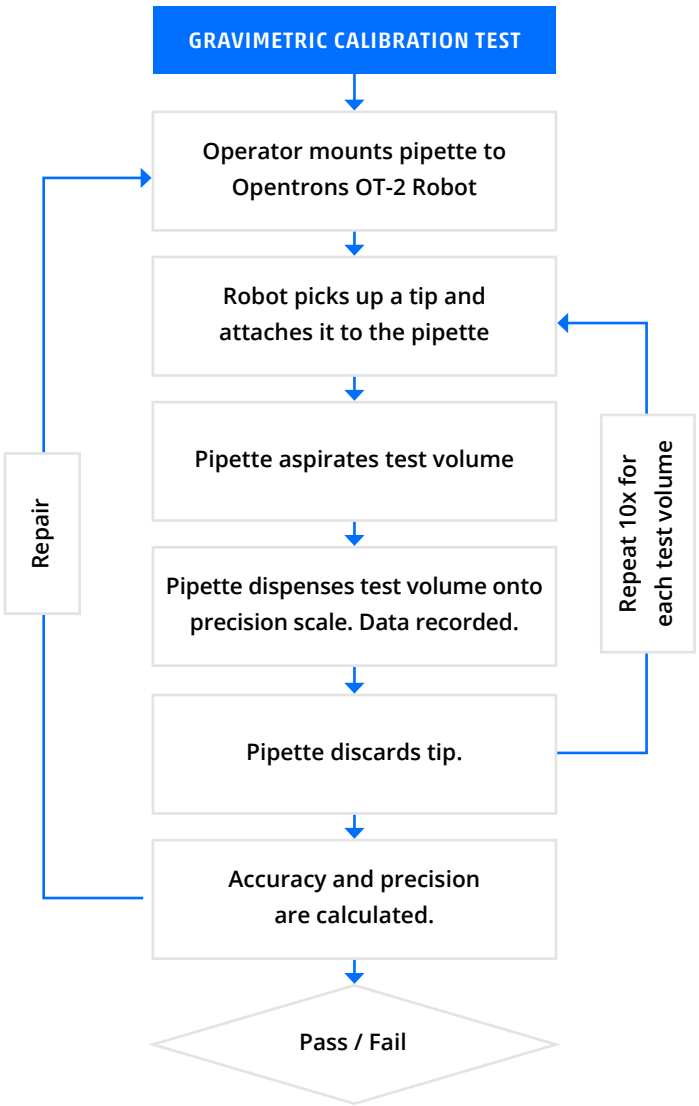
Test Methods

Gravimetric testing for the Opentrons Pipette GEN2 is holistic in that we test the entire system rather than just the individual pipette. Specifically, the Pipette GEN2 is tested with the OT-2 Robot, Opentrons Tips, and Opentrons API exactly as a customer would use it.

Further, Opentrons adheres to a slightly stricter version of ISO8655 for pipette gravimetric testing. The key difference is that Opentrons does not include a pre-wet test for each individual aspirate of the pipette. A graphical breakdown of the process is seen in Figure 2.

FIGURE 2

Gravimetric Calibration Test Process Diagram



Example Output from Gravimetric Testing

The standard output of this process is a series of measurements taken at the pipette's minimum, middle and maximum volumes. The data gathered is used to generate systematic and random error for each pipette.

Pipette Serial No: P20SV202019101717				**Time/Date:** 10/31/2019 10:48:00	
Min Vol CV Spec:	5	**Min Vol %D Spec:**	15	**Scale Serial No:**	NB-A-552550
Mid Vol CV Spec:	1	**Mid Vol %D Spec:**	2	**Temperature:**	22.3 C
Max Vol CV Spec	0.8	**Max Vol %D Spec:**	1.5	**Humidity:**	58% RH

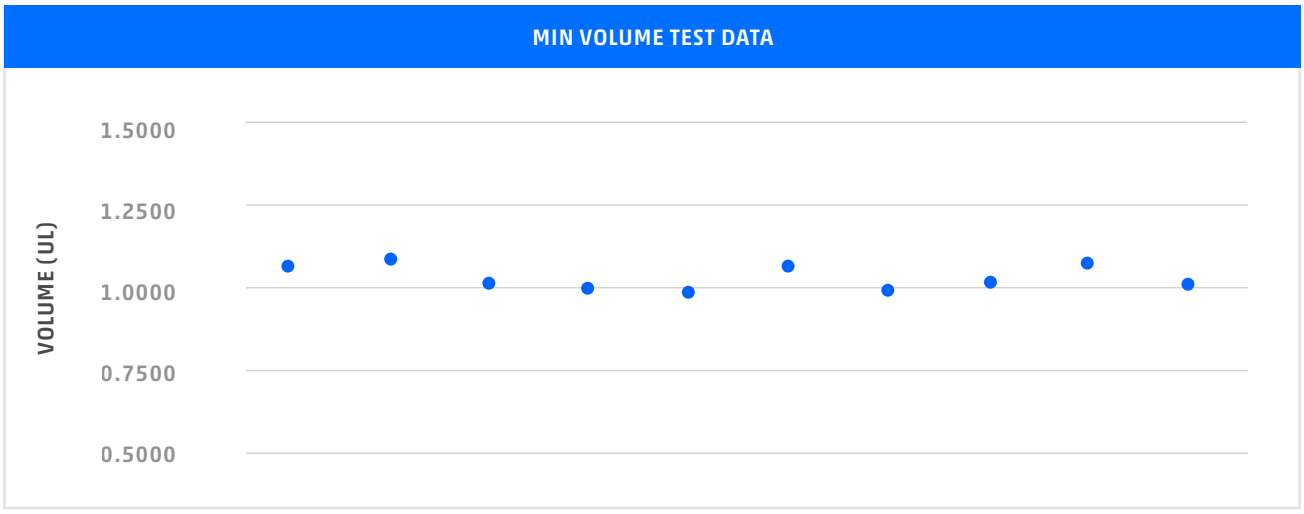
Pipette Calibration Testing

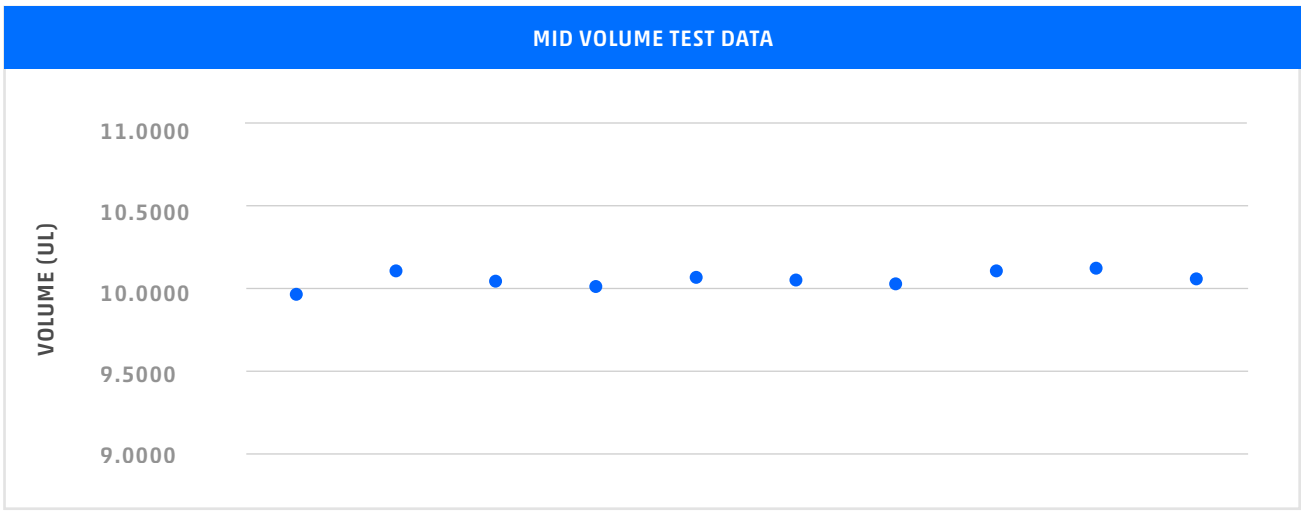
TEST VOLUME (UL)	TRIALS (UL)									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	1.052	1.0693	1.006	0.9899	0.982	1.052	0.982	1.0073	1.0599	1.00
10	9.948	10.078	10.016	9.988	10.04	10.028	10.012	10.0733	10.0866	10.0386
20	20.07	20.078	20.054	19.97	19.98	19.936	20.0473	20.092	20.068	19.976

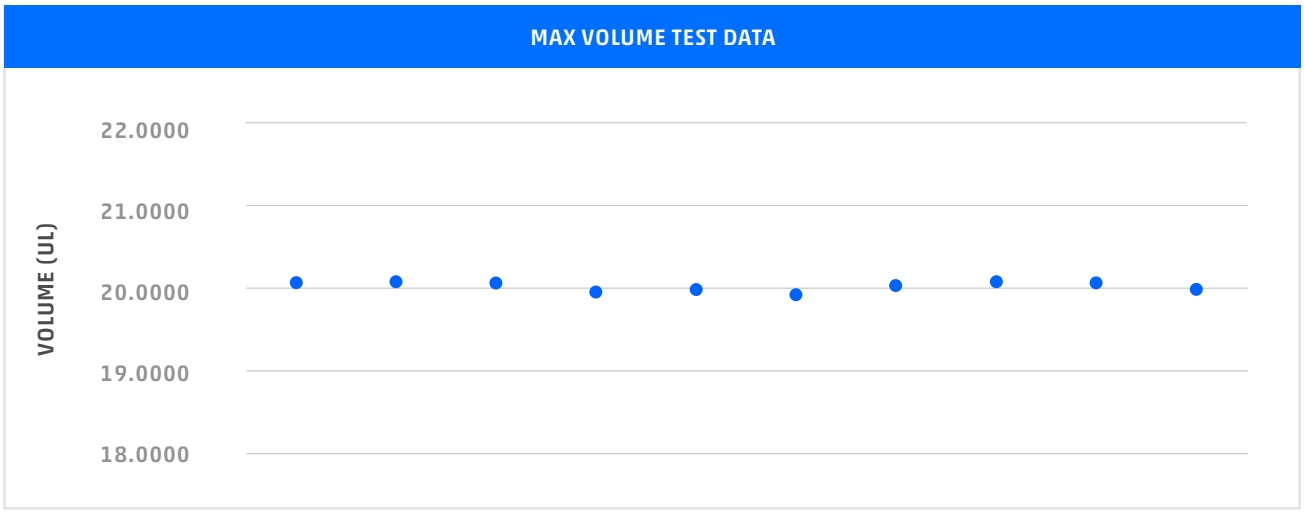
Pipette Calibration Results

TEST VOLUME (UL)	MEAN	STANDARD DEV	%CV	%D	RESULT
1	1.0201	0.0343611	3.369	2.0067	**PASS**
10	10.0309	0.0429114	0.428	0.3087	**PASS**
20	20.0271	0.0556160	0.287	0.1357	**PASS**

Test Data


MIN VOLUME TEST DATA
VOLUME (UL)
1.5000
1.2500
1.0000
0.7500
0.5000


MID VOLUME TEST DATA
VOLUME (UL)
11.0000
10.5000
10.0000
9.5000
9.0000


MAX VOLUME TEST DATA
VOLUME (UL)
22.0000
21.0000
20.0000
19.0000
18.0000

SECTION 4

Lifetime Testing

Opentrons performs lifetime testing on each pipette model to ensure customers will have reliable results for the lifetime of their pipette. Each pipette model is tested to 650+ hours of use: this equates to using 55,000 tips over 6 months with the robot pipetting 5 hours a day, 5 days a week.

There are two primary areas of wear Opentrons has addressed through lifetime testing. The first is the o-ring seal inside the pipette, and the second is the pipette nozzle that interacts with disposable tips. The o-ring seal is tested to 20-30 km of travel depending on the pipette model. The nozzle-to-tip interaction is tested for 100,000+ tip pickups and drops for each model. Gravimetric testing is performed at each ¼ life interval to ensure that the pipette is still in-spec.