

**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY TEMPLATE**

A. 510(k) Number:

k061005

B. Purpose for Submission:

New product

C. Measurand:

Amphetamine, Barbiturates, Benzodiazepines, Cocaine, Marijuana, Morphine, Methamphetamine, Methadone, Phencyclidine, and Nortriptyline

D. Type of Test:

Qualitative lateral flow immunochromatographic test

E. Applicant:

Applied DNA Technologies Inc.

F. Proprietary and Established Names:

ACCUSTEP Single and Multi-Strip Cassette/Dipstick DOA Screen Panels

G. Regulatory Information:

1. Regulation section:

21 CFR §862.3100: Test System, Amphetamine

21 CFR §862.3150: Test System, Barbiturate

21 CFR §862.3170: Enzyme Immunoassay, Benzodiazepine

21 CFR §862.3250: Enzyme Immunoassay, Cocaine and Cocaine Metabolites

21 CFR §862.3870: Enzyme Immunoassay, Cannabinoids

21 CFR §862.3640: Morphine test system

21 CFR §862.3610: Test System, Methamphetamine

21 CFR §862.3620: Methadone test system

21 CFR §862.3100: Test System, Amphetamine (Phencyclidine)

21 CFR §862.3910: Tricyclic Antidepressant Drugs Test System

2. Classification:

Class II

3. Product code:

DKZ, DIS, JXM, DIO, LDJ, DNK, DJC, DJR, LCM, LFG

4. Panel:

Toxicology (91)

H. Intended Use:

1. Intended use(s):

See Indications for Use.

2. Indication(s) for use:

The Applied DNA Technologies ACCUSTEP DOA Panels are rapid chromatographic immunoassays for the qualitative and simultaneous detection of one to ten of the following drugs in a variety of combinations in human urine. The designed cutoff concentrations and direct calibrator for these drugs are as follows:

Analyte	Abbreviation	Calibrator	Cutoff Concentration
Amphetamine	AMP	Amphetamine	1000 ng/ml
Barbiturate	BAR	Secobarbital	300 ng/ml
Benzodiazepines	BZO	Benzodiazepine	300 ng/ml
Cocaine	COC	Benzoyllecgonine	300 ng/ml
Marijuana	THC	11-nor- Δ^9 -THC9-COOH	50 ng/ml
Methamphetamine	MET	Methamphetamine	1000 ng/ml
Methadone	MTD	Methadone	300 ng/ml
Morphine	MOR	Morphine	2000 ng/ml
Phencyclidine	PCP	Phencyclidine	25 ng/ml
Nortriptyline	NOR	Nortriptyline	1000 ng/ml

These test kits are intended for health care professional use only.

This assay provided only a preliminary analytical test result. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. Gas Chromatography / Mass Spectrometry (GC/MS) or Liquid Chromatography / Mass Spectrometry (LC/MS) are the preferred confirmatory method.

Clinical consideration and professional judgment should be applied to any drug of abuse test result, particularly when preliminary positive results are indicated.

3. Special conditions for use statement(s):

For professional prescription use only.

This assay provides only a preliminary analytical test result. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. GC/MS or LC/MS are the preferred confirmatory methods.

4. Special instrument requirements:

Not applicable, as the devices are visually-read single-use devices.

I. Device Description:

The ACCUSTEP DOA test has two formats: cassette and dipstick. These two formats are manufactured with the same formulation, components, and manufacturing processes. The Cassette contains a testing in a plastic housing with a specimen well and a window to read the test results. A specimen pipette is included with the Test Device, but a specimen collection container is not included with either test format.

J. Substantial Equivalence Information:

1. Predicate device name(s):
ACON One Step Multi-Drug Multi-Line Screen Test Card/Device
2. Predicate 510(k) number(s):
k020313, k023946
3. Comparison with predicate:
The device is similar to or the same as to the previously cleared predicate(s) in the following ways: test principles, indication for use, cut-off concentration(s), use in a professional setting, sample matrix, endpoint, and test time.

The devices differ by manufacturer, specific monoclonal antibodies used, and the proposed device is not cleared for use in point-of-care settings.

K. Standard/Guidance Document Referenced (if applicable):

None referenced by the manufacturer.

L. Test Principle:

The devices employ lateral flow immunochromatographic technology and are based on the principle of competitive binding. Drug, if present in concentrations below the cutoff level, will not saturate the binding sites of antibody-coated particles in the device. The antibody-coated particles will then be captured by immobilized drug-specific conjugate and a colored line will appear in the test line region. A line will not form if the sample contains drug in excess of the cutoff level because the drug will saturate all the binding sites of the drug-specific antibody. Each strip in the device contains a procedural control. Formation of a line in the control line region indicates that the proper volume of urine has been added and membrane wicking has occurred. If a line does not form in the control region then the test is not valid and users are cautioned to repeat the test. A 'presumptive positive' is determined by the appearance of a procedural control line AND no line appearing next to the test region.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:
 - a. *Precision/Reproducibility:*
Drug-free urine was spiked with drug to concentrations of 50%, 75%, 125%, 150%, and 300% of the cutoff; test strips from one lot and cassettes from one lot were tested in duplicate for 15 or 19 days respectively (n = 30 or 38 per format; 60 or 76 total). Results were read by three observers after five minutes as 'positive' or as 'negative'. There was no significant difference in precision between the two lots or between the readers:

Drug/Test Conc	% Correct by Reader			Drug/Test Conc	% Correct by Reader		
AMP (n = 60)	1	2	3	MOR (n = 60)	1	2	3
Negative	100	100	100	Negative	100	100	100
50% c/o	100	100	100	50% c/o	100	100	100
75% c/o	83	83	82	75% c/o	87	88	88
125% c/o	83	83	83	125% c/o	88	92	97
150% c/o	100	100	100	150% c/o	100	100	100
300% c/o	100	100	100	300% c/o	100	100	100
BAR (n = 60)	1	2	3	MTD (n = 76)	1	2	3
Negative	100	100	100	Negative	100	100	100
50% c/o	100	100	100	50% c/o	100	100	100
75% c/o	88	88	87	75% c/o	100	100	100
125% c/o	82	80	82	125% c/o	100	100	99
150% c/o	100	100	100	150% c/o	100	100	100
300% c/o	100	100	100	300% c/o	100	100	100
BZO (n = 60)	1	2	3	PCP (n = 76)	1	2	3
Negative	100	100	100	Negative	100	100	100
50% c/o	100	100	100	50% c/o	100	100	100
75% c/o	85	87	85	75% c/o	100	100	100
125% c/o	83	83	85	125% c/o	100	100	100
150% c/o	100	100	100	150% c/o	100	100	100
300% c/o	100	100	100	300% c/o	100	100	100
COC (n = 76)	1	2	3	NOR (n = 60)	1	2	3
Negative	100	100	100	Negative	100	100	100
50% c/o	100	100	100	50% c/o	100	100	100
75% c/o	100	100	100	75% c/o	88	88	85
125% c/o	100	100	100	125% c/o	85	85	85
150% c/o	100	100	100	150% c/o	100	100	100
300% c/o	100	100	100	300% c/o	100	100	100
MET (n = 76)	1	2	3	THC (n = 60)	1	2	3
Negative	100	100	100	Negative	100	100	100
50% c/o	100	100	100	50% c/o	100	100	100
75% c/o	99	100	97	75% c/o	85	85	85
125% c/o	100	100	100	125% c/o	87	83	87
150% c/o	100	100	100	150% c/o	100	100	100
300% c/o	100	100	100	300% c/o	100	100	100

b. Linearity/assay reportable range:

Not applicable. The assay is intended for qualitative use.

- c. *Traceability, Stability, Expected values (controls, calibrators, or methods):*
 This device has internal process controls. A red line appearing in the control region confirms sufficient sample volume and adequate membrane wicking. Users are informed not to interpret the test if no line forms in the control region.

Control standards are not supplied with this device; however it is good laboratory practice to confirm the test procedure and to verify proper test performance. Users should follow all applicable guidelines for testing QC materials.

- d. *Detection limit:*

To test the analytical sensitivity of the devices, drug-free urine was spiked with drug to concentrations of 50%, 75%, 125%, 150%, and 300% of the cutoff; 25 test strips from one lot and 25 cassettes from one lot were tested. Drug concentrations were confirmed by GC/MS:

Amphetamine		Strip			Cassette		
Conc (ng/mL)	% of Cutoff	Reading		% Correct	Reading		% Correct
		Neg	Pos		Neg	Pos	
0	0	25	0	100	25	0	100
500	50%	25	0	100	25	0	100
750	75%	25	0	100	25	0	100
1000	Cutoff	7	18	72	9	16	64
1250	125%	0	25	100	0	25	100
1500	150%	0	25	100	0	25	100
3000	300 %	0	25	100	0	25	100

Barbiturates		Strip			Cassette		
Conc (ng/mL)	% of Cutoff	Reading		% Correct	Reading		% Correct
		Neg	Pos		Neg	Pos	
0	0	25	0	100	25	0	100
500	50%	25	0	100	25	0	100
750	75%	25	0	100	25	0	100
1000	Cutoff	5	20	80	6	19	76
1250	125%	0	25	100	0	25	100
1500	150%	0	25	100	0	25	100
3000	300 %	0	25	100	0	25	100

Benzodiazepines		Strip			Cassette		
Conc (ng/mL)	% of Cutoff	Reading		% Correct	Reading		% Correct
		Neg	Pos		Neg	Pos	
0	0	25	0	100	25	0	100
500	50%	25	0	100	25	0	100

Benzodiazepines		Strip			Cassette		
Conc (ng/mL)	% of Cutoff	Reading		% Correct	Reading		% Correct
		Neg	Pos		Neg	Pos	
750	75%	25	0	100	25	0	100
1000	Cutoff	9	16	64	8	17	68
1250	125%	0	25	100	0	25	100
1500	150%	0	25	100	0	25	100
3000	300 %	0	25	100	0	25	100

Cocaine		Strip			Cassette		
Conc (ng/mL)	% of Cutoff	Reading		% Correct	Reading		% Correct
		Neg	Pos		Neg	Pos	
0	0	25	0	100	25	0	100
500	50%	25	0	100	25	0	100
750	75%	25	0	100	25	0	100
1000	Cutoff	5	20	80	6	19	76
1250	125%	0	25	100	0	25	100
1500	150%	0	25	100	0	25	100
3000	300 %	0	25	100	0	25	100

Marijuana (THC)		Strip			Cassette		
Conc (ng/mL)	% of Cutoff	Reading		% Correct	Reading		% Correct
		Neg	Pos		Neg	Pos	
0	0	25	0	100	25	0	100
500	50%	25	0	100	25	0	100
750	75%	25	0	100	25	0	100
1000	Cutoff	10	15	60	7	18	72
1250	125%	0	25	100	0	25	100
1500	150%	0	25	100	0	25	100
3000	300 %	0	25	100	0	25	100

Methadone		Strip			Cassette		
Conc (ng/mL)	% of Cutoff	Reading		% Correct	Reading		% Correct
		Neg	Pos		Neg	Pos	
0	0	25	0	100	25	0	100
500	50%	25	0	100	25	0	100
750	75%	25	0	100	25	0	100
1000	Cutoff	2	23	92	4	21	84
1250	125%	0	25	100	0	25	100
1500	150%	0	25	100	0	25	100
3000	300 %	0	25	100	0	25	100

Methamphetamine		Strip			Cassette		
Conc (ng/mL)	% of Cutoff	Reading		% Correct	Reading		% Correct
		Neg	Pos		Neg	Pos	
0	0	25	0	100	25	0	100
500	50%	25	0	100	25	0	100
750	75%	25	0	100	25	0	100
1000	Cutoff	11	14	56	12	13	52
1250	125%	0	25	100	0	25	100
1500	150%	0	25	100	0	25	100
3000	300 %	0	25	100	0	25	100

Morphine		Strip			Cassette		
Conc (ng/mL)	% of Cutoff	Reading		% Correct	Reading		% Correct
		Neg	Pos		Neg	Pos	
0	0	25	0	100	25	0	100
500	50%	25	0	100	25	0	100
750	75%	25	0	100	25	0	100
1000	Cutoff	7	18	72	6	19	76
1250	125%	0	25	100	0	25	100
1500	150%	0	25	100	0	25	100
3000	300 %	0	25	100	0	25	100

Phencyclidine		Strip			Cassette		
Conc (ng/mL)	% of Cutoff	Reading		% Correct	Reading		% Correct
		Neg	Pos		Neg	Pos	
0	0	25	0	100	25	0	100
500	50%	25	0	100	25	0	100
750	75%	25	0	100	25	0	100
1000	Cutoff	4	21	84	5	20	80
1250	125%	0	25	100	0	25	100
1500	150%	0	25	100	0	25	100
3000	300 %	0	25	100	0	25	100

Nortriptyline		Strip			Cassette		
Conc (ng/mL)	% of Cutoff	Reading		% Correct	Reading		% Correct
		Neg	Pos		Neg	Pos	
0	0	25	0	100	25	0	100
500	50%	25	0	100	25	0	100
750	75%	25	0	100	25	0	100
1000	Cutoff	4	21	84	5	20	80
1250	125%	0	25	100	0	25	100
1500	150%	0	25	100	0	25	100
3000	300 %	0	25	100	0	25	100

e. *Analytical specificity:*

The drugs tested for by these devices, their known metabolites, and related compounds were spiked into drug-free urine then serially diluted and tested until the concentrations which yielded a negative result were obtained. The following tables list the lowest concentration (ng/mL) which yields a positive result for the compound being tested.

ACCUSTEP DOA Tests: Cross Reactivity of Compounds

<i>Amphetamine - related compounds</i>	<i>Conc</i>	<i>Methamphetamine - related compounds</i>	<i>Conc</i>
d-Amphetamine	1000	d-Methamphetamine	1000
l-Amphetamine	>50,000	d-Amphetamine	>40,000
d-Methamphetamine	>20,000	Chloroquine	10,000
l-Methamphetamine	>20,000	(+/-) Ephedrine	>100,000
3,4-Methylenedioxyamphetamine (MDA)	2,400	l-Methamphetamine	15,000
3,4-Methylenedioxy-methamphetamine (MDMA)	>20,000	3,4-Methylenedioxyamphetamine (MDA)	>10,000
3,4-Methylenedioxyethylamphetamine (MDEA)	>100,000	3,4-Methylenedioxy-methamphetamine (MDMA)	2,000
Paramethoxyamphetamine (PMA)	1000	3,4-Methylenedioxyethylamphetamine (MDEA)	20,000
		Procaine	100,000
<i>Barbiturate-related compounds</i>	<i>Conc</i>	<i>Morphine-related compounds</i>	<i>Conc</i>
Secobarbital	300	Morphine	2,000
Allobarbital	5000	Codeine	2,000
Alphenal	625	Diacetyl Morphin (Heroin)	2,000
Amobarbital	600	Ethylmorphine	600
Aprobarbital	600	Hydromorphone	15,000
Butobarbital	75	Hydrocodone	15,000
Butalbital	3000	Oxymorphon	>20,000
Hexobarbital	>100,000	Oxycodone	>20,000
Pentobarbital	300	Merperidine	>100,000
Phenobarbital	300	6-Monoacetylmorphine	5,000
		Morphine-3-glucuronid	10,000
		Rifampicin	>50,000
		Thebaine	20,000
<i>Benzodiazepine - related compounds</i>	<i>Conc</i>	<i>Methadone - related compounds</i>	<i>Conc</i>
Oxazepam	300	Methadone	300
Alprazolam	500	Methadol	1,000
Bromazepam	1,000	Doxylamine	>40,000
Chlordiazepoxide	≥10,000	EDDP	>40,000

<i>Benzodiazepine - related compounds</i>	<i>Conc</i>	<i>PCP - related compounds</i>	<i>Conc</i>
Clobazam	300	Phencyclidine	25
Clonazepam	8,000	TCP	3000
Clorazepate	2000		
Delorazepam	2400		
Desalkflurazepam	2500		
Diazepam	300	<i>NOR - related compounds</i>	<i>Conc</i>
Estazolam	2,000	Nortriptyline	1000
Fentanyl	>100,000	Amitriptyline	1000
Flunitrazepam	1,200	Chlorpromazine	3500
Flurazepam	>10,000	Clomipramine	10,000
α -Hydroxyalprazolam	100,000	Cyclobenzaprine	1500
Lorazepam	2,000	Desipramine	500
Lormetazepam	1,000	Diphenhydramine	20,000
Medazepam	>100,000	Doxepin	1,000
Midazolam	>50,000	Imipramine	800
Nitrazepam	>50,000	Nordoxepine	1000
Nordiazepam	300	Perphenazine	2,500
Prazepam	>100,000	Promazine	200
Temazepam	500	Promethazine	40,000
Triazolam	2,000	Protryptiline	3000
		Trimipramine	2500
<i>Cocaine - Related Compounds</i>	<i>Conc</i>	<i>THC - related compounds</i>	<i>Conc</i>
Benzoyllecgonine	300	11-nor- Δ^9 -THC-9-COOH	50
Cocaine	1000	11-nor- Δ^8 -THC-9-COOH	50
Ecgonine	40,000	11-hydroxy-- Δ^9 -THC	100,000
Ecgonine methyl ester	100,000	Δ^8 -THC	15,000
		Δ^9 -THC	15,000
		Cannabinol	20,000
		Cannabidiol	100,000

The following unrelated compounds were found not to cross-react when tested spiked into drug-free urine at concentrations at 100 μ g/ml:

Acetaminophen	Furosemide
Acetone	Guaiacol Glyceryl Ether
Albumin	Hemoglobin
Amitriptyline	Ibuprofen
Ampicillin	Imipramine
Aspartame	(+/-)-Isoproterenol
Aspirin	Lidocaine
Atropine	N-Methyl-Ephedrine
Benzocaine	(+)-Naproxen
Bilirubin	Oxalic Acid
Caffeine	Penicillin-G
Chloroquine	Pheniramine
Chlorpheniramine	Phenothiazine

Creatine	L-Phenylephrine
Dextrorphan tartrate	β-Phenylethylamine
4-Dimethylaminoantipyrine	Procaine
Dopamine	Quinidine
(+/-)-Ephedrine	Ranitidine
(-)-Ephedrine	Sulindac
Erythromycin	Tyramine
Ethanol	Vitamin C

The pH of an aliquoted negative urine pool was adjusted to pH 3, pH 5, pH6.5, pH 7.5, or pH 8.5; three of the four aliquots at each pH were spiked with a drug to 75%, 125%, and 300% of the cutoff concentration. The spiked, pH-adjusted urine was tested in duplicate. Altering the pH of the urine sample did not affect the accuracy of any of the test results.

Four (4) urine samples with specific gravities of 1.00, 1.01, 1.02, and 1.03 were aliquoted into four samples each; one sample remained neat while the other three aliquots were spiked with each drug to the concentration of 75%, 125%, and 300% of the cutoff respectively. Each sample was tested in duplicate. Variations in specific gravity did not affect the accuracy of any of the test results.

f. Assay cut-off:

Analytical performance of the device around the cutoff is described in Section 1.M.d above.

2. Comparison studies:

a. Method comparison with predicate device:

The ACCUSTEP Multi-Strip Drugs of Abuse Cassette and Dipstick Card were evaluated in comparison to GC/MS and the predicate. Specimens, including at least 48 negative and 38 positive samples, were obtained from commercial reference laboratories. All samples were confirmed by GC/MS but no clinical information was available:

Agreement between Individual ACCUSTEP Tests and GC/MS

ACCU STEP Drug	Result	Drug Concentration by GC/MS					Agrmnt w/ GC
		Neg	<25% C/O	25 % to C/O	C/O to +125%	>125% C/O	
AMP	Pos	0	0	0	5	41	98%
	Neg	36	12	7	2	0	
BAR	Pos	0	0	1	3	42	98%
	Neg	35	10	6	1	0	

		Drug Concentration by GC/MS					
ACCU STEP Drug	Result	Neg	<25% C/O	25 % to C/O	C/O to +125%	>125% C/O	Agrmnt w/ GC
BZO	Pos	0	3	1	5	36	94%
	Neg	35	12	5	2	0	
COC	Pos	0	0	1	4	51	98%
	Neg	35	12	6	1	0	
MTD	Pos	0	0	0	4	45	98%
	Neg	35	11	8	2	0	
MET	Pos	0	0	0	4	57	98%
	Neg	35	9	8	2	0	
MOR	Pos	0	0	1	7	33	98%
	Neg	35	21	7	1	0	
PCP	Pos	0	0	0	5	40	99%
	Neg	35	11	2	1	0	
NOR	Pos	0	0	0	6	29	97%
	Neg	35	15	7	3	0	
THC	Pos	0	0	1	7	53	98%
	Neg	35	10	14	2	0	

b. *Matrix comparison:*

Not applicable; these devices are for use with urine only.

3. Clinical studies:

a. *Clinical Sensitivity:*

Not applicable.

b. *Clinical specificity:*

Not applicable.

c. Other clinical supportive data (when a. and b. are not applicable):

4. Clinical cut-off:

Not applicable.

5. Expected values/Reference range:

Not applicable.

N. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

O. Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.