

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

A. 510(k) Number:
k041743

B. Purpose for Submission:
New product

C. Analyte:
Amphetamine, Barbiturates, Benzodiazepines, Cocaine, Marijuana,
Methylenedioxymethamphetamine (MDMA), Opiates, Oxycodone, Phencyclidine,
Propoxyphene, and Tricyclic Antidepressants

D. Type of Test:
Qualitative lateral flow immunochromatographic test

E. Applicant:
ACON Laboratories, Inc.

F. Proprietary and Established Names:
ACON TRI-fect Drug Screen Test Device

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 §862.3610: Test System, Methamphetamine (MDMA)
21 CFR §862.3650: Enzyme Immunoassay, Opiates (Oxycodone)
Unclassified : Enzyme Immunoassay, Phencyclidine
21 CFR §862.3700: Enzyme Immunoassay, Propoxyphene
21 CFR §862.3910: Tricyclic Antidepressant Drugs Test System
2. Classification:
Class II
3. Product Code:
DKZ, DIS, JXM, DIO, LDJ, LAF, DJG, LCM, JXN, LFG
4. Panel:
Toxicology (91)

H. Intended Use:1. Intended use(s):

This device is used in the diagnosis and treatment of drug use or overdose.

2. Indication(s) for use:

“The ACON multi-CLIN Drug Screen Test Device is a rapid chromatographic immunoassay for the qualitative and simultaneous detection of Amphetamine, Barbiturates, Benzodiazepines, Cocaine, Marijuana, Methylenedioxymethamphetamine, Opiates, Oxycodone, Phencyclidine, Propoxyphene, and Tricyclic Antidepressants in urine. The designated cut-off concentrations for these drugs are as follows: Amphetamine 1000 ng/mL, Barbiturates (Secobarbital) 300 ng/mL, Benzodiazepines (Oxazepam) 300 ng/mL, Cocaine 300 ng/mL, Marijuana 50 ng/mL, Methylenedioxymethamphetamine 500 ng/mL, Opiates (Morphine) 300 ng/mL, Oxycodone 100 ng/mL, Phencyclidine 25 ng/mL, Proxyphe 300 ng/mL and Tricyclic Antidepressants (Nortriptyline) 1000 ng/mL. They are intended for healthcare professionals including professionals at point-of-care sites.

This assay provides only a preliminary analytical test result. A more specific alternate chemical method must be used in order to obtain a confirmed analytical result. Gas chromatography/mass spectrometry (GC/MS) is the preferred confirmatory method.

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

3. Special condition for use statement(s):

The ACON multi-CLIN Drug Screen Test provides only a preliminary analytical test result. A more specific alternative chemical method, such as GC/MS, must be used to obtain a confirmed analytical result. Clinical consideration and professional judgment should be applied to any drug of abuse test result, particularly when preliminary positive results are obtained.

4. Special instrument Requirements:

Not applicable, as the device is a visually-read single-use device.

I. Device Description:

The device is a single-use visually read cassette device in a bi-fold plastic housing. It contains the test strips, up to four strips containing up to eleven tests with an internal control test on each strip, and a sample well for the urine for each strip. A plastic sample dispenser is also provided. Several drops of urine are added to start the test which employs traditional immunochromatographic technology. Each cassette housing can accommodate three identical panels; the test panel and an optional snap-on positive and negative external control panel.

J. Substantial Equivalence Information:

1. Predicate device name(s):
ACON One-Step Multi-drug Multi-line Screen Test: Amphetamines, Cocaine, Methamphetamine, Opiates, Marijuana, and PCP
ACON One-Step Multi-drug Multi-line Screen Test: Barbiturates, Benzodiazepines, Methadone, MDMA, Opiates, and Tricyclic Antidepressants
ACON OXY One-Step Oxycodone Test Device
ACON One-Step Propoxyphene Test Device
2. Predicate K number(s):
k020313, k023946, k033047, k040445
3. Comparison with predicate:
The device is similar to or the same as to the previously cleared predicate(s) in the following ways: manufacturer, test principles, indication for use, cut-off concentration(s), used in a professional and point-of-care setting, sample matrix, endpoint, and test time.

The essential difference between the device and the predicate(s) is the test format; the new test contains up to 11 drug assays on up to four immunochromatographic strips in a new housing while the predicate(s) were individual tests on each strip or cartridge.

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

The sponsor did not reference any standards in the submission.

L. Test Principle:

The device employs lateral flow immunochromatographic technology and is based on the principle of competitive binding. Drugs, 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 red 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 red line in control 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 a drug test region.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:
 - a. *Precision/Reproducibility:*

The sponsor tested the device to determine if its analytical specificity was at or around the same designated cut-off concentrations as those of the individual predicate strips. Cutoffs for amphetamines, cocaine, THC, opiates, and PCP are based on the recommendation of the Substance Abuse and Mental Health Services Administration (SAMHSA). Drug free urine and drug urine samples at -65% cut-off, -50% cutoff, -25% cut-off, +25% cut-off, and +50% cutoff were tested with three lots of ACON TRI-fect Drug Screen Test Device as well as three lots of ACON Single Drug Test Strips according to package inserts. Each lot was tested thirty times. The average percent correct read is described in the table below:

Cut-Off Concentration Testing: Average Correct Result

Drug Tested	Drug-free Urine	-65% Cut-Off	-50% Cut-Off	-25% Cut-Off	+25% Cut-Off	+50% Cut-Off
Amphetamines	100%	100%	100%	90.0	100	100%
Barbiturates	100%	100%	100%	81.1	100	100%
Benzodiazepines	100%	100%	100%	100	74.4	100%
Cocaine/Metabolites	100%	100%	100%	100	100	100%
Marijuana (THC)	100%	100%	100%	100	100	100%
MDMA	100%	100%	100%	81.1	100	100%
Opiates	100%	100%	100%	80.0	100	100%
Oxycodone	100%	100%	100%	84.4	100	100%
Phencyclidine	100%	100%	100%	100	85.6	100%
Propoxyphene	100%	100%	100%	78.9	100	100%
Tricyclic Antidepressants	100%	100%	100%	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 method):

This device has internal process controls. A red line appearing in the negative control region confirms sufficient sample volume, adequate membrane wicking, and that the correct technique has been used. Users are informed not to interpret the test if a line forms in the positive control region or if no line forms in the negative control region.

Control standards are not supplied with this device but the manufacturer recommends the use of commercially available controls. 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:

See the Precision/Reproducibility section above for performance around the stated cutoff concentration.

e. Analytical specificity:

The drugs tested for by this device, their known metabolites, and related compounds were spiked into drug-free urine at a concentration of 1000 ug/mL, then serially diluted and tested with the ACON multi-CLIN Drug Screen Test Device until the concentrations which yielded a negative result were obtained. The following table lists the lowest concentration which yields a positive result for the compound being tested when read at five minutes. Cross-reactivity was calculated by dividing the concentration at which the compound yielded a positive result by the designated cut-off concentration.

ACON multi-CLIN Drug Test: Cross-reactivity of Compounds

Compound	Conc (ng/mL)	% Cross Reactivity	Compound	Conc (ng/mL)	% Cross Reactivity
AMPHETAMINES			METHYLENEDIOXYMETHAMPHETAMINE (MDMA)		
d-Amphetamine	1,000	100	3,4-MDMA	500	100
d,l-Amphetamine	3000	33	l-Methamphetamine	100,000	0.5
l-Amphetamine	50,000	2	3,4-MDA	3000	17
p-OH-Amphetamine	3125	32	3,4-MDMA	300	167
3,4-MDA	2000	50	OPIATES		
Phentermine	3000	33	Morphine	300	100
BARBITURATES			Codeine	300	100
Secobarbital	300	100	Ethylmorphine	6250	5
Amobarbital	300	100	Hydrocodone	50,000	0.6
Alphenal	150	200	Hydromorphone	3125	10
Aprobarbital	200	150	Levorphanol	1500	20
Butobarbital	75	400	6-Monoacetylmorphine	400	75
Butalbital	2500	12	Morphine-3-β-d-glucuronide	1000	30
Butethanol	100	300	Norcodeine	6250	5
Cyclobarbital	400	75	Normorphine	100,000	0.3
Cyclopentobarbital	600	50	Oxycodone	30,000	1
Pentobarbital	300	100	Oxymorphone	100,000	0.3
Phenobarbital	100	300	Thebaine	6250	5
BENZODIAZEPINES			OXYCODONE		
Oxazepam	300	100	Oxycodone	100	100
Alprazolam	196	153	6-Acetylcodeine	100,000	0.1
Alprazolam, -OH	1262	24	Codeine	25,000	0.4
Bromazepam	1562	19	Dihydrocodeine	12,500	0.8
Chlordiazepoxide	1562	19	Ethylmorphine	25,000	0.4
Clobazam	98	306	Hydrocodone	6250	2
Clonazepam	781	38	Hydromorphone	12,500	0.8

Compound	Conc (ng/mL)	% Cross Reactivity	Compound	Conc (ng/mL)	% Cross Reactivity
Chlorazepate	195	154	Levorphanol	100,000	0.1
Delorazepam	1562	19	6-Monoacetylmorphine	100,000	0.1
Desalkylflurazepam	390	77	Morphine	100,000	0.1
Diazepam	195	154	Morphine-3-β-d-glucuronide	100,000	0.1
Estazolam	2500	12	Norcodeine	100,000	0.1
Flunitrazepam	390	77	Normorphone	100,000	0.1
(±) Lorazepam	1562	19	Oxymorphone	780	13
RS-Lorazepam glucuronide	156	192	Procaine	100,000	0.1
Midazolam	12,500	2	Thebaine	25,000	0.4
Nitrazepam	98	306	PHENCYCLIDINE		
Norchlordiazepoxide	195	154	Phencyclidine	25	100
Nordiazepam	390	77	4-Hydroxyphencyclidine	12,500	0.2
Temazepam	98	306	PROPOXYPHENE		
Triazolam	2500	12	d-Propoxyphene	300	100
COCAINE			Norpropoxyphene	300	100
Benzoyllecgonine	300	100	TRICYCLIC ANTIDEPRESSANTS		
Cocaine	780	38	Nortriptyline	1000	100
Cocaethylene	12,500	2	Amitriptyline	1500	67
Ecgonine	32,000	0.9	Clomipramine	12,500	8
MARIJUANA			Cyclobenzaprine	6250	16
11-nor-Δ ⁹ -THC-9-COOH	50	100	Desipramine	200	500
Cannabinol	20,000	0.25	Imipramine	400	250
Δ ⁸ -THC	15,000	0.33	Maprotiline	2000	50
-Δ ⁹ -THC	15,000	0.33	Nordoxepine	1000	100
			Perphenazine	50,000	2
			Promazine	1500	67
			Promethazine	25,000	4
			Trimipramine maleate	3000	33

Almost 200 compounds were tested for possible interference with the ACON TRI-fect Drug Screen Test in drug-free urine, in a urine pool spiked with -65% of the cutoff levels of the drugs of abuse, and in a urine pool spiked with +50% of the cutoff levels of the drugs of abuse. The compounds tested for possible interference are listed in the package insert; no compound caused an incorrect test result in any of the three urine pools when tested at 1000 ng/mL.

The pH of an aliquoted negative urine pool was adjusted to a range of 5 to 9 in 1 pH unit increments; four of the five aliquots were spiked with a drug to -65%, -50%, +25%, and +50% 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.

Fifteen (15) urine samples of specific gravity ranging from 1.004 to 1.034 were aliquoted into five samples each; one sample remained neat while the other four aliquots were spiked with each drug to the concentration of -65%, -50%, +25%, and +50% 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:

The identified cutoff concentrations for amphetamines, cocaine, THC, opiates, and PCP are those recommended by the Substance Abuse and Mental Health Services Administration (SAMHSA); these cutoffs are listed above. The test will yield a positive result when a given drug exceeds this concentration in the urine sample. Analytical performance of the device around the cutoff is described in SectionbM.1.a. above.

2. Comparison studies:

a. Method comparison with predicate device:

Urine samples were collected from presumed non-user volunteers and known positive specimens were obtained from several clinical laboratories. Drug positive samples were confirmed by GC/MS or HPLC. Specimens were coded, randomized, and blinded for side-by-side comparisons between ACON TRI-fect Drug Screen Test and ACON Single Drug Test Strips. The results are shown in the tables below:

Comparison of ACON TRI-fect to ACON One Step Tests

		ACON Single Test							
		AMP		BAR		BZO		COC	
		pos	neg	pos	neg	pos	neg	pos	neg
ACON TRI-fect	Positive	140	0	103	0	122	1	132	4
	Negative	3	307	0	307	0	302	0	308
	Total	143	307	103	307	122	303	132	312
% Agreement with ACON Single Test		98	100	100	100	100	99.7	100	98.7
% Overall Agreement		99		100		99		99	

		ACON Single Test							
		THC		MDMA		OPI		OXY	
		pos	neg	pos	neg	pos	neg	pos	neg
ACON TRI-fect	Positive	132	0	91	1	149	0	141	2
	Negative	9	307	0	301	0	300	0	307
	Total	141	307	91	302	149	300	141	309
% Agreement with ACON Single Test		94	100	100	99.7	100	100	100	99.4
% Overall Agreement		98		99		100		99	

		ACON Single Test					
		PCP		PPX		TCA	
		pos	neg	pos	neg	pos	neg
ACON TRI-fect	Positive	89	0	135	0	54	0
	Negative	0	301	0	305	0	316
	Total	89	301	135	305	54	316
% Agreement with ACON Single Test		100	100	100	100	100	100
% Overall Agreement		100		100		100	

Samples were analyzed by GC/MS and compared to the ACON TRI-fect test. Samples were considered positive if they were above the cutoff level listed in Section H.2. The percentage of samples $\pm 25\%$ of the cutoff (as determined by GC/MS) varied by drug: AMP 7.6%, BAR 2.9%, BZO 2.6%, COC 7.7%, THC 5.1%, MDMA 2.8%, OPI 3.8%, OXY 2%, PCP 3.1%, PPX 1.6%, TCA 6.2%. Results are described in the tables below:

Comparison of ACON TRI-fect to GC/MS

		GC/MS							
		AMP		BAR		BZO		COC	
		pos	neg	pos	neg	pos	neg	pos	neg
ACON TRI-fect	Positive	134	6	99	4	135	2	119	17
	Negative	2	308	2	305	5	308	0	308
	Total	136	314	101	309	140	310	119	325
% Agreement with GC/MS		98.5	98.1	98	99	96	99.4	100	95
% Overall Agreement		98		99		99		96	

		GC/MS							
		THC		MDMA		OPI		OXY	
		pos	neg	pos	neg	pos	neg	pos	neg
ACON TRI-fect	Positive	116	16	88	4	140	9	140	3
	Negative	5	311	0	301	0	300	1	306
	Total	121	327	88	305	140	309	141	309
% Agreement with GC/MS		95.9	95.1	100	98.7	100	97.1	99.3	99
% Overall Agreement		95		99		98		99	

		GC/MS					
		PCP		PPX		TCA	
		pos	neg	pos	neg	pos	neg
ACON TRI-fect	Positive	85	4	145	0	32	22
	Negative	1	300	1	304	0	316
	Total	86	304	146	304	32	338
% Agreement with GC/MS		98.8	98.7	99.3	100	100	93.5
% Overall Agreement		99		99		94	

b. Matrix comparison:

Not applicable; this test is for urine samples only.

3. Clinical studies:

a. Clinical sensitivity:

The device's reproducibility in the hands of professional users was demonstrated in studies conducted at three doctor's office sites. A registered medical assistant at each site tested urine that was spiked with multiple drugs at the following concentrations: 0, -50% of the stated cutoff concentration, -25% cutoff, +25% cutoff, and +50% cutoff. Ninety blinded and randomized specimens were tested at each site, which included 15 samples for each of the five drug levels and 15 samples that generated invalid results. Thus, a total of 60 samples were tested for each level of drug. All invalid tests were correctly interpreted; the results of the drug testing are presented in the table below:

Reproducibility of ACON TRI-fect Test at Different Drug Levels

Test	% Cut-Off	% Correct Read	Test	% Cut-Off	% Correct Read
Amphetamines	0	100	Opiates	0	100
	-50%	100		-50%	100
	-25%	84		-25%	84
	+25%	100		+25%	100
	+50%	100		+50%	100
Barbiturates	0	100	Oxycodone	0	100
	-50%	100		-50%	100

Test	% Cut-Off	% Correct Read	Test	% Cut-Off	% Correct Read
	-25%	84		-25%	84
	+25%	100		+25%	100
	+50%	100		+50%	100
Benzodiazepines	0	100	PCP	0	100
	-50%	100		-50%	100
	-25%	84		-25%	84
	+25%	100		+25%	100
	+50%	100		+50%	100
Cocaine Metabolites	0	100	Propoxyphene	0	100
	-50%	100		-50%	100
	-25%	84		-25%	84
	+25%	100		+25%	100
	+50%	100		+50%	100
THC/Marijuana	0	100	Tricyclic Antidepressants	0	100
	-50%	100		-50%	100
	-25%	84		-25%	84
	+25%	100		+25%	100
	+50%	100		+50%	100
MDMA	0	100	Invalid Result Samples	0	100
	-50%	100		-50%	100
	-25%	84		-25%	84
	+25%	100		+25%	100
	+50%	100		+50%	100

Overall agreement of TRI-fect with expected results in the hands of professional users at point-of-care sites: 2398/2475 = 97%

b. Clinical specificity:

Not applicable. Clinical studies are not typically submitted for this device type.

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. Conclusion:

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