

**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY**

A. 510(k) Number:

k091539

B. Purpose for Submission:

Addition of synovial fluid

C. Manufacturer and Instrument Name:

Iris Diagnostics Division of Iris International, Inc., iQ 200® Urine Analyzer Body Fluids Module

D. Type of Test or Tests Performed:

Quantitative cell count, red blood cells (RBC) and nucleated cells (NUCL)

E. System Descriptions:

1. Device Description:

iQ 200® Urine Analyzer Body Fluids Module is an additional use for the iQ 200® Urine Analyzer. It is used by an appropriately trained laboratory user to examine and count red blood cells and nucleated cells in synovial fluid and is an added body fluid type to the previously cleared iQ 200 Urine analyzer Body Fluids module cerebrospinal and serous fluids.

iQ 200® Urine Analyzer Body Fluids Module automates body fluid handling, capturing particle images in a manner very similar to that of the Urinalysis Application.

2. Principles of Operation:

Hyaluronidase is added to the specimen, mixed and incubated. Two aliquots from each body fluid specimen are prepared. One aliquot is diluted in normal saline to provide a concentration in the linear range of the instrument. The second aliquot is treated with a lysing reagent to allow unambiguous identification of WBC and other nucleated cells by eliminating RBC confusion. Particle images are captured and saved electronically as the sample flows past a microscope objective at a high speed, electronically concentrating particles. Particle images are then ordered by size into assigned categories on a video display. An appropriately trained laboratory user may change machine assignments, after which particle concentrations are computed and reported.

3. Modes of Operation:

Samples are automatically processed and imaged but an appropriately trained laboratory user must classify cell images.

4. Specimen Identification:

Barcode labeled specimen tubes

5. Specimen Sampling and Handling:

Synovial specimens should be collected using K₂EDTA as an anti-coagulant. The only tubes recommended for use with the iQ Body Fluids Module are 10 mL plastic conical bottom tubes supplied by Iris Diagnostics. Two aliquots of each specimen are created. One aliquot is lysed and compared to the aliquot that was not lysed.

6. Calibration:

IRIS iQ Calibrator is used to calibrate the system monthly.

7. Quality Control:
IRIS iQ Positive Control, iQ Negative Control, and iQ Focus are used as quality control material. The Body Fluids Module allows for two additional controls every 24 hours (when body fluids analyses are performed): a reagent background check (performed weekly) ensuring that the process reagents have not been contaminated and two levels of positive control with defined values to confirm system accuracy. These controls are run with two tubes, just as you would run a patient specimen.
8. Software:
The software used is for operating the system. The software documentation for this module consists of a Hazard Analysis, summary of software development design, compliance and validation process, and system validation. Documentation conforms to the FDA software documentation guideline.

FDA has reviewed applicant's Hazard Analysis and Software Development processes for this line of product types:
Yes X or No _____

F. Regulatory Information:

1. Regulation section:
21 CFR 864.5200, Automated cell counter
2. Classification:
Class II
3. Product code:
GKL, Counter, Cell, Automated (Particle Counter)
4. Panel:
Hematology (81)

G. Intended Use:

1. Intended Use and Indication(s) for Use:
The iQ®200 Urine Analyzer Body Fluids Module is an in-vitro diagnostic device used by an appropriately trained laboratory user to examine and count red blood cells and nucleated cells in cerebrospinal fluid, serous fluids and synovial fluid. This module is a capability added to the iQ®200 Urine Analyzer.
2. Special Conditions for Use Statement(s):
For Prescription Use Only

H. Substantial Equivalence Information:

1. Predicate Device Name(s) and 510(k) numbers:
Sysmex® XT-4000i, k091313
2. Comparison with Predicate Device:

Similarities		
<i>Item</i>	<i>iQ® 200 Urine Analyzer Body Fluids Module (with Synovial Fluid)</i>	<i>Sysmex® XT-4000i K091313</i>
Intended Use	The iQ®200 Urine Analyzer Body Fluids Module is an in-vitro diagnostic device used by an appropriately trained laboratory	The Sysmex XT-4000i is a quantitative multi-parameter automated hematology analyzer intended for <i>in vitro</i> diagnostic use in screening patient populations found

Similarities		
Item	<i>iQ® 200 Urine Analyzer Body Fluids Module (with Synovial Fluid)</i>	<i>Sysmex® XT-4000i K091313</i>
	user to examine and count red and white blood cells and other nucleated cells in cerebrospinal fluid, serous fluids and synovial fluid. This module is a capability added to the iQ®200 Urine Analyzer, a cleared urinalysis instrument	in clinical laboratories. The XT-4000i classifies and enumerates various parameters for whole blood and has a Body Fluid- mode for body fluids. The Body Fluid mode enumerates the WBC-BF, RBC-BF, MN%/#, PMN%/# and TC-BF# parameters in cerebrospinal fluids (CSF), serous fluids (peritoneal, pleural) and synovial fluids.
Specimen Types	Cerebrospinal fluid, serous fluids and synovial fluid	Whole blood, cerebrospinal fluid, serous fluids and synovial fluid
Specimen Collection	Synovial specimens should be collected using K ₂ EDTA as an anti-coagulant.	Same.
Parameters Tested	Enumerates red blood cells, white blood cells and nucleated cells in synovial fluid.	Enumerates the WBC-BF, RBC-BF, MN%/#, PMN%/# and TC-BF# parameters in CSF, serous fluids and synovial fluids.

Differences		
Item	<i>iQ® 200 Urine Analyzer Body Fluids Module (with Synovial Fluid)</i>	<i>Sysmex® XT-4000i K091313</i>
Methodology	Hyaluronidase treated specimen divided into two aliquots: one diluted in normal saline to provide a concentration in the linear range of the instrument and the second aliquot treated with a lysing agent to allow unambiguous identification of WBC and other nucleated cells by eliminating RBC. Particle images are captured and saved electronically as the sample flows past a microscope objective at a high speed, electronically concentrating particles. Particle images are then ordered by size into assigned categories on a video display. A trained user could change machine assignments, after which particle concentrations are recomputed and reported	Performs hematology according to the Hydro Dynamic Focusing (DC Detection), flow cytometry method (using a semiconductor laser), and SLS-hemoglobin laser).
Reagents / Consumables	Body Fluids specific consumables: - Hyaluronidase (not supplied by Iris Diagnostics) - iQ® Body Fluids Control –Two levels - iQ® Body Fluids Lysing Reagent	CELLPACK™ (Diluent) STROMATOLYSER™- FB and, STROMATOLYSER-4DL™ (Lyse) STROMATOLYSER- 4DS™ (Stain) SULFOLYSER (Lyse) RET-SEARCH II (Diluent) RET-SEARCH (Stain)
Calibrator / Quality Control	- iQ® Calibrator Pack - iQ® Control/Focus Set - iQ® Body Fluids Control – Two levels	c-Check (XE) - 3 Levels Calibrator (X Cal)

I. Special Control/Guidance Document Referenced (if applicable):

CLSI H56-A *Body Fluid Analysis for cellular composition; Approved guideline*

CLSI EP9-A2 *Method Comparison and Bias Estimation Using Patient Samples, Approved Standard-Second Edition*

CLSI EP6-A *Evaluation of the Linearity of Quantitative Measurement Procedures, Approved Guideline*

J. Performance Characteristics:

1. Analytical Performance:

a. *Accuracy:*

Comparison studies were performed at two US sites. The patient samples represent females and males ages 21 through 93 from doctors' offices, reference laboratories, hospitals, rheumatoid disease clinics and urgent care facilities. Fifty-five (55) synovial fluid specimens out of 76 samples collected had valid duplicates and were used to calculate the Deming regression for RBC and NUCL.

The regression was calculated on the average of the duplicates where the hemacytometer count is the reference compared to the iQ 200 BF module. The iQ200 determination of RBC and WBC in synovial fluid is equivalent to that determined by the hemacytometer manual method. Equivalence is defined as statistically equivalent or better accuracy and precision as shown by Deming first order regression coefficients $R^2 \geq 0.95$ and $P\text{-value} < 0.05$. Regression analyses are as follows:

Summary of the Deming regression comparison between iQ 200 Body Fluids Module for synovial fluid and the hemacytometer manual counts:

Cell	Number of samples	R ²	Intercept	p-Value	Slope
RBC	55	0.9909	9.15	0.9916	0.9972
NUCL	55	0.9794	-79.08	0.8299	0.9435

b. *Precision/Reproducibility:*

A precision study was performed on the hemacytometer count and the iQ 200 BF count as a plot of the difference of the two counts versus the average of the two counts for both RBC and NUCL for 61 specimens. The results indicated that the differences of the duplicates between the two devices are not significantly different as it relates to the two methods.

c. *Linearity:*

A linearity study was performed by preparing an evenly distributed sequence of seven pooled dilutions ranging from 0/ μ L to 83,500/ μ L for RBC to 61,125/ μ L for Nucleated Cells. Two replicates for each pool dilutions were processed independently. The test was conducted following the CLSI EP6A protocol. The linearity results are as follows:

RBC RANGE reported: 0 - 83,500/uL, NUCL RANGE reported: 0 - 61,125/uL.

d. *Carryover:*

Carryover was evaluated by assaying a synovial fluid sample with high cell

count three consecutive times followed immediately by testing a synovial fluid in which cells had been removed (low count) three consecutive times. The results of the carryover study were within manufacturer's specification for carryover of $\leq 0.5\%$.

- e. *Interfering Substances:*
Not applicable.

2. Other Supportive Instrument Performance Data Not Covered Above:

Sample Stability:

Twelve specimens had adequate volume to use for a stability study. Time zero (T_0) arrival of the specimen in the laboratory and Time 24 Hours later (T_{24}) were used to conduct the study. Sufficient sample volume was not available to analyze specimens at any other time point between T_0 and T_{24} . Seven of the 12 specimens had enough volume to analyze the samples in duplicate for both the T_0 and T_{24} analyses. Samples were stored at $2 - 8^\circ\text{C}$. Results were compared for the RBC count and for the NUCL count by evaluating the statistical interval around the measurement at 95% CI. Results of this study demonstrate that synovial fluid specimens are stable for at least 24 hours when stored at $2 - 8^\circ\text{C}$.

K. Proposed Labeling:

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

L. Conclusion:

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