September 6, 2019

Beckman Coulter
Samy Puccio
Staff Regulatory Affair Specialist
11800 SW 147th Avenue
Miami, Florida 33196-2500

Re: K182886
Trade/Device Name: Cytomics FC 500 Series (MPL or MCL) Flow Cytometer
Regulation Number: 21 CFR 864.5220
Regulation Name: Automated differential cell counter
Regulatory Class: Class II
Product Code: GKZ
Dated: December 14, 2018
Received: December 17, 2018

Dear Samy Puccio:

We have reviewed your Section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. Although this letter refers to your product as a device, please be aware that some cleared products may instead be combination products. The 510(k) Premarket Notification Database located at https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm identifies combination product submissions. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Part

801 and Part 809); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803) for devices or postmarketing safety reporting (21 CFR 4, Subpart B) for combination products (see https://www.fda.gov/combination-products/guidance-regulatory-information/postmarketing-safety-reporting-combination-products); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820) for devices or current good manufacturing practices (21 CFR 4, Subpart A) for combination products; and, if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR 1000-1050.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR Part 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to https://www.fda.gov/medical-devices/medical-device-safety/medical-device-reporting-mdr-how-report-medical-device-problems.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance) and CDRH Learn (https://www.fda.gov/training-and-continuing-education/cdrh-learn). Additionally, you may contact the Division of Industry and Consumer Education (DICE) to ask a question about a specific regulatory topic. See the DICE website (https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/contact-us-division-industry-and-consumer-education-dice) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

Douglas Jeffery, Ph.D.
Chief
Division of Immunology
and Hematology Devices
OHT7: Office of In Vitro Diagnostics
and Radiological Health
Office of Product Evaluation and Quality
Center for Devices and Radiological Health

Enclosure

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

Indications for Use

Form Approved: OMB No. 0910-0120
Expiration Date: 06/30/2020
See PRA Statement below.

510(k) Number *(if known)*
K182886

Device Name
FC 500 MPL and MCL Flow Cytometers

Indications for Use *(Describe)*

The Cytomics FC 500 MPL is a system for the qualitative and quantitative measurement of biological and physical properties of cells and other particles. These properties are measured when the cells pass through one or two laser beams in single-file.

The tetraCXP SYSTEM for Cytomics FC 500 flow cytometry systems is an automated analysis method for simultaneous identification and enumeration of lymphocyte subpopulations (CD3+, CD4+, CD8+, CD19+ and CD56+) combining four-color fluorescent monoclonal antibody reagents, quality control reagents, optional absolute count reagent and CXP software. The systems with CYTO-STAT tetraCHROME CD45-FITC/CD4-PD/CD8-ECD/CD3-PC5 Monoclonal antibody reagent is intended "For In Vitro Diagnostic Use", allowing the identification and enumeration of Total CD3+ (T cells), Total CD4+, Total CD8+, Dual CD3+/CD4+, Dual CD3+/CD8+ lymphocyte percentages and absolute counts as well as the CD4/CD8 ratio in whole blood flow cytometry. The systems with CD45-FITC/CD56-PC/CD19-ECD/CD3-PC5, the total lymphocyte percentage can be obtained. CD45-FITC/CD56-PE/CD19-ECD/CD3-PC5 monoclonal antibody reagent is intended "For In Vitro Diagnostic Use", allowing the identification and enumeration of total CD19+ (B cells) and CD3-/CD56+ (NK cells) lymphocyte percentages and absolute counts in whole blood flow cytometry. The total lymphocyte percentage can obtained as well.

Type of Use *(Select one or both, as applicable)*

☒ Prescription Use (Part 21 CFR 801 Subpart D) ☐ Over-The-Counter Use (21 CFR 801 Subpart C)

CONTINUE ON A SEPARATE PAGE IF NEEDED.

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Section 5	510(k) Summary

Note:
Throughout this documentation the use of FC500 refers to both the FC500 MCL and FC 500 MPL unless otherwise noted.

510(k) Summary for
The FC 500 Flow Cytometers
Software Design Change

510(k) Owner / Submitter Information

Company Name: Beckman Coulter Inc.
Address: 11800 SW 147th Ave., Miami, FL 33196
Phone #: (305) 380-4509
Fax #: (786) 639-4156
Contact Person: Samy Puccio
Email Address: spuccio@beckman.com

Date Submitted:

December 14, 2018

Device Information

Trade Name: FC 500 MPL Flow Cytometer, FC 500 MCL Flow Cytometer
Common Name: FC 500
Classification Name: Automated differential cell counter (21 CFR 864.5220)
Classification: Class II
Product Code: GKZ
Panel: Hematology and Pathology Devices Panel

Predicate Device Information

Predicate Product	510(k) Number	Date Cleared	Classification	21 CFR	Product Code
FC 500 MPL	K071681	Oct 4, 2007	Class II	864.5220	GKZ
FC 500 MCL	K030828	May 21, 2003	Class II	864.5220	GKZ

FC 500 Flow Cytometer

The FC 500 Flow Cytometer has two cleared configurations:

1. MPL (Multi Plate Loader)
    - This configuration manages sample preparations using 24 and 96 well plates as well as 12 x 72mm tubes.
    - The workstation contains MXP software for data acquisition, data managements, instrument management, sample management and sample processing.
2. MCL (Multi Carousel Loader)

- This configuration manages sample preparations using 12 x 72mm tubes in a 32 tube carousel.
- The workstation contains the CXP software and receives data from the Cytometer to display numeric results and dataplots. The CXP software also includes patient management, control management and LIS components.

Both devices use flow cytometric principles to determine qualitative and quantitative measurements of biological and physical properties of cells and other particles. These properties are measured when the cells pass through one or two laser beams in single file. The instrument can simultaneously measure forward scatter, side scatter, and five fluorescent dyes using one or two lasers at 488 nm and either 635 nm (solid-state laser) or 633 nm (HeNe laser). Therefore, the instrument can perform correlated multi-parameter analyses of individual cells.

To ensure that the cells move through the laser beam one at a time, the instrument uses hydrodynamic focusing in the flow cell. As the stream of sheath fluid is flowing through the flow cell, a stream of sample is injected into the middle of the sheath stream, The sheath stream surrounds, but does not mix with the sample stream, and its pressure focuses the sample stream so that the cells flow through the laser beam single file.

Before the laser beam reaches the sample stream, cross-cylindrical lenses focus the beam keeping it perpendicular to the sample stream flow while making the beam small enough to illuminate only one cell at a time.

As the cells in the sample stream go through the sensing area of the flow cell, the laser beam illuminates them. The cells scatter the laser light and emit fluorescent light from fluorescent dyes attached to them.

- The amount of laser light scattered at narrow angles to the axis of the laser beam is called forward scatter (FS) which is proportional to the size of the cell that scattered the light.
- The amount of laser light scattered at about a 90^{o} angle to the axis of the laser beam is called side scatter (SS) which is proportional to the granularity of the cell that scattered the laser light (e.g., SS can be used to differentiate between lymphocytes, monocytes, and granulocytes).
- The cells also emit fluorescent light (FL) at all angles to the axis of the laser beam. The amount of FL enables the instrument to measure characteristics of the cells emitting the light, depending on the reagents used (e.g., FL can be used to identify molecules such as cell surface antigens).

The scattered laser light and fluorescent light are collected, separated and measured.

- The FS sensor collects the forward scatter. When the light reaches the FS sensor, the sensor generates voltage pulse signals which are proportional to the amount of light the sensor receives. The signals are processed to measure the characteristics of the cells that scattered the light.
- The pickup lens/spatial filter assembly collects SS and FL from the sensing area of the flow cell. Using a series of filters which reflect specific wavelengths of light towards

their respective sensors and allow transmission of longer wavelengths of light, the SS and varying FL wavelengths (produced by fluorochromes such as FITC, PE, ECD, PC5, and ACD) are separated, collected, and measured.

The cytometer has seven sensors, each generating a voltage pulse signal as each cell passes through the laser beam. The voltage pulse signal is proportional to the intensity of the light the sensor received. The cytometer electronics amplify, condition, integrate and analyze these pulses.

The results of sample analysis appear on the workstation screen as graphs in which the user defines the parameters on the plot axes. To analyze the data, regions and gates are defined by the user to select the cells of interest, and then statistics are generated.

Design Change Description:

This modification to the FC 500 Flow Cytometers is being implemented as part of corrective actions for a field action initiated by Beckman Coulter (BEC) in January 2018. The field action was issued on the FC 500 to notify customers that BEC received and confirmed reports of failures causing signal loss and/or signal drifting resulting in the absence of data or a shift in the population in the data plots.

As part of the corrective actions, BEC developed a software update that contains additional risk control measures for the device to mitigate the potential failure modes associated with the reported signal loss and/or signal drift.

Intended Use/Indications for Use:

FC 500 MPL (K071681)

The Cytomics FC 500 MPL is a system for the qualitative and quantitative measurement of biological and physical properties of cells and other particles. These properties are measured when the cells pass through one or two laser beams in single-file.

FC 500 MLC (K030828)

The tetraCXP SYSTEM for Cytomics FC 500 flow cytometry systems is an automated analysis method for simultaneous identification and enumeration of lymphocyte subpopulations (CD3+, CD4+, CD8+, CD19+ and CD56+) combining four-color fluorescent monoclonal antibody reagents, quality control reagents, optional absolute count reagent and CXP software. The systems with CYTO-STAT tetraCHROME CD45-FITC/CD4-PE/CD8-ECD/CD3-PC5 Monoclonal antibody reagent is intended "For In Vitro Diagnostic Use", allowing the identification and enumeration of Total CD3+ (T cells), Total CD4+, Total CD8+, Dual CD3+/CD4+, Dual CD3+/CD8+ lymphocyte percentages and absolute counts as well as the CD4/CD8 ratio in whole blood flow cytometry. The systems with CD45-FITC/CD56-PE/CD19-ECD/CD3-PC5, the total lymphocyte percentage can be obtained. CD45-FITC/CD56-PE/CD19-ECD/CD3-PC5 monoclonal antibody reagent is intended "For In Vitro Diagnostic Use", allowing the identification and enumeration of total CD19+ (B cells) and CD3-/CD56+ (NK cells) lymphocyte percentages and absolute counts in whole blood flow cytometry. The total lymphocyte percentage can obtained as well.

Comparison to Predicate:

The design changes applied to the FC 500 MPL and MCL Flow Cytometers serve as additional risk control measures to mitigate each of the potential failure modes identified in the root cause analysis of the field action that initiated these changes.

These design changes do not impact the intended use or performance claims of the FC 500 Flow Cytometers.

Device Comparison Table:

Characteristic	FC500 MPL and MCL (K071681 {MPL} & K030828 {MCL}, Predicate)	Proposed Device
Indications for use	**K071681 (MPL)** The Cytomics FC 500 MPL is a system for the qualitative and quantitative measurement of biological and **K030828 (MCL)** The tetraCXP SYSTEM for Cytomics FC 500 flow cytometry systems is an automated analysis method for simultaneous identification and enumeration of lymphocyte subpopulations (CD3+, CD4+, CD8+, CD19+ and CD56+) combining four-color fluorescent monoclonal antibody reagents, quality control reagents, optional absolute count reagent and CXP software. The systems with CYTO-STAT tetraCHROME CD45-FITC/CD4-PE/CD8-ECD/CD3-PC5 Monoclonal antibody reagent is intended "For In Vitro Diagnostic Use", allowing the identification and enumeration of Total CD3+ (T cells), Total CD4+, Total CD8+, Dual CD3+/CD4+, Dual CD3+/CD8+ lymphocyte percentages and absolute counts as well as the CD4/CD8 ratio in whole blood flow cytometry. The systems with CD45-FITC/CD56-PE/CD19-ECD/CD3-PC5, the total lymphocyte percentage can be obtained. CD45-FITC/CD56-PE/CD19-ECD/CD3-PC5 monoclonal	Same Same

	antibody reagent is intended "For In Vitro Diagnostic Use", allowing the identification and enumeration of total CD19+ (B cells) and CD3-/CD56+ (NK cells) lymphocyte percentages and absolute counts in whole blood flow cytometry. The total lymphocyte percentage can obtained as well.	
Device Classification & Product Code	21 CFR 864.5220 Automated Cell Counter, GKZ	Same for both
Manufacturer	Beckman Coulter	Same for both
Safety Features	Interlocks and mitigation of hazards via software and hardware controls	Same, with addition of changes as detailed in this submission
Sample Analysis	• Principle of analysis – Flow cytometric • Detection hardware – Lasers, fluidics, optics, electronics • Sample analysis pathway	Same for both
Quality Control Techniques	• Daily Instrument Checks • Commercial Controls • Inter-laboratory Quality Assurance Program (IQAP)	Same for both
Controlling software	System Software	Same for both
Syringe Type	**K071681 (MPL)** 500 µL Hamilton Syringe **K030828 (MCL)** no syringe	Same Same
Sample Preparation	External to instrument	Same for both
Sample presentation	**K071681 (MPL)** 12 x 75mm tubes, 24 or 96 well plate **K030828 (MCL)** 12x77mm tubes in a 32 tube carousel	Same Same

Specimen Introduction	Specimens are loaded in the Autoloader using cassettes / or the single loader as single specimen tubes	Same for both
Prepared Sample Introduction	**K071681 (MPL)** 12 x 75mm tubes, 24 or 96 well plate **K030828 (MCL)** 12x77mm tubes in a 32 tube carousel	Same Same
Specimen Identification	Barcode – positive sample identification or manual entry	Same for both
Prepared Sample Identification	**K071681 (MPL)** Tracked by well position. **K030828 (MCL)** Tracked by tube location and barcode	Same Same
Resuspension of prepared sample prior to introduction to system	**K071681 (MPL)** Prepared sample is mixed by the syringe using aspiration and dispense re-suspension **K030828 (MCL)** Stir motor	Same Same
Off-line analysis software	CXP analysis	Same for both
Instrument Quality Control Techniques	**K071681 (MPL)** Flow Check **K030828 (MCL)** ClearLLab Flow Check Pro	Same Same
Standardization	A standardization check is performed on each QC per lab process or IFU	Same for both
Analytical Features		
Off-line analysis software	Workstation also offered as off-line analysis software package	Same for both
Data Handling	Electronics and software required to support data handling	Same for both
Optics	Laser light delivered by mirrors, prisms, and lenses	Same for both

Data Processing	• Region/gates evaluation • Statistics generation • Export of results to MS Excel	Same for both
Analysis Algorithm (Interface and Reports)	• Interface to algorithms • Algorithm results reporting	Same for both
User interface	Plots and reports	Same for both
Report generator	• Panel reports • QC	Same for both
Post-Analytical Features		
Workstation	Software functionality to allow – **K071681 (MPL)** • System configuration management • System service test and adjustment procedures **K030828 (MCL)** • Patient data management – storage, review, reporting to LIS • Control data management – storage, review, reporting • System configuration management • System service test and adjustment procedures	Same Same

Summary of Performance Testing:

The testing approaches were complementary to demonstrate safety and effectiveness. No guidance documents or standards were used to establish the test methods.

Study Title	Study Description and Outcomes
Pre-acquisition	The test method for the pre-acquisition study induced signal loss prior to the analysis of a sample run, and verified that the software detection tool (SDT) detected the failure, aborted the run and alerted the operator of the signal error.
Post-acquisition	The test method for the post-acquisition study consisted of 2 test cases utilizing the SDT during data acquisition to detect signal loss: 1) a combination of retrospective data imprinted with failure patterns characterized from field data and prospective sample runs processed through a modified instrument which allowed the user to induce random signal loss and 2) use of the SDT on an additional set of files that were deemed difficult to detect with the pre-mitigation data review instructions. These tests verified that the SDT identified data files with signal loss and alerted the user to review the data plots for the run.
Real World Data	The testing method for the real word data study applied the SDT to customer files sourced from the field and prospective testing performed with field returned boards with verifiable signal failure. Failures were then confirmed by visual review of the time plots. These tests verified that the SDT identified the failures as corroborated by the visual reviews.
Reader Study	The testing method for the reader study aligned the user instructions in the IFU for visual review of time plots. In this testing method, the multiple readers were blinded to review 10 files where 7 of these files contained signal loss undetectable by the SDT. Readers followed instructions on the assay IFU and addendum to visually assess the test files. This study confirmed that visual review of time plots identifies signal loss.

The complementary performance studies confirm the process by which samples with signal loss are detected either prior to acquisition or appropriately quarantined by the SDT, post-acquisition, for further review by the user. The use of the SDT, in addition to visual review of time plots provides a comprehensive solution. The studies demonstrated the safe and effective use of the SDT.

Substantial Equivalence Conclusion to Demonstrate Safety, Effectiveness & Equivalent Performance to Predicate:

The updates to the FC 500 that are the subject of this submission, do not change the intended use, nor add or delete a contraindication for the device. The changes do not alter the device control mechanism, operating principle, energy type, environmental specification, ergonomics of the user interface, dimensional specifications, nor packaging. The device does not have expiration dating nor is it subject to sterilization.

In summary, the updated FC 500 MPL and MCL Flow Cytometers, as described in this submission are substantially equivalent in terms of safety and effectiveness to the predicate devices.

This summary of safety and effectiveness is being submitted in accordance with the requirements of the Safe Medical Device Act of 1990 and the implementing regulation 21 CFR 807.92.