Ferritin Test Kit
Package Insert

REF VID28-07-011	English

INTEND USE

VivaDiag™ **Ferritin Test Kit** is a fluorescence immunoassay (FIA) for the quantitative determination of FER in human whole blood, serum and plasma. Ferritin is used for the early diagnosis of iron deficiency, the monitoring of the effect of iron supplementation and the auxiliary diagnosis of tumor markers[1].

INTRODUCTION

Ferritin is a protein can store the iron, a small amount of ferritin existed in serum. It is clear that low ferritin values less than reference range are usually representative of body iron deficiency. The level of ferritin increases while occurs the acute or chronic liver damage. Testing the level of ferritin can diagnose the iron deficiency or iron overload, and act as the marker to auxiliary diagnose the tumor[2].

Ferritin, a major iron storage protein, is essential to iron homeostasis and is involved in a wide range of physiologic and pathologic processes. Ferritin makes iron available for critical cellular processes while protecting lipids, DNA, and proteins from the potentially toxic effects of iron. Therefore, ferritin plays a important role in early diagnosis of iron deficiency, monitoring the therapeutic effect of iron supplementation and auxiliary diagnosis of tumor markers. In clinical, ferritin is predominantly utilized as a marker of total body iron stores. In cases of iron deficiency and overload, serum ferritin serves a critical role in both diagnosis and management[3].

PRINCIPLE

VivaDiag™ **Ferritin Test Kit** is based on fluorescence immunoassay technology. ***VivaDiag™*** **Ferritin Test Kit** uses a sandwich immunodetection principle, such that the fluorescence-labeled detector antibody binds to the target protein (FER) in blood specimen. In the sample well of the device there is a membrane coated with FER-specific monoclonal antibodies. A diluted sample is applied to the test device. The FER binded by the FER antibody which conjugated by the fluorescence. When the fluorescence complex flows through the membrane, it will be captured by the FER antibody. Signal intensity of fluorescence reflects amount of the FER captured and is detected by ***VivaDiag™*** **POCT Analyzer** to show the FER concentration in specimen.

TRACEABILITY

Each ***VivaDiag™*** **Ferritin Test Kit** has a **Code Chip** containing specific information for calibration of the particular reagent lot. The predefined calibration curve is adapted to ***VivaDiag™*** **POCT Analyzer**.

This method has been standardized against the Certified Reference Material IFCC ERM-DA474 according ISO 17511: 2020[4].

COMPONENT

VivaDiag™ **Ferritin Test Kit** contains the '**Cartridges** (packaged in pouch with desiccant)', '**Code Chip**', '**Buffer Tube** (prefilled with 1 mL buffer)', and '**Package Insert**'.

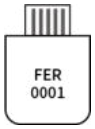
- **Cartridges**: Conjugate pad have anti-FER monoclonal antibodies and rabbit polyclonal antibodies which all conjugated by the fluorescence, the nitrocellulose membrane has anti-FER monoclonal antibodies at the test line, while goat anti-Rabbit polyclonal antibodies at the control line.
- **Code Chip**: Calibration information.
- **Buffer Tube**: Tris-HCl buffer.
- **Package Insert**: Instruction for use.

REF **VID28-07-011**

Components of ***VivaDiag™*** **Ferritin Test Kit**

- Cartridges 25

- Code Chip 1



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- Buffer 25
- Package Insert 1

MATERIAL REQUIRED BUT NOT SUPPLIED

- ***VivaDiag™*** **POCT Analyzer**

REF **VIM01-00-011**

REF **VIM1000-00-011**

- Pipettes with pipette tips for 10 μL and 75 μL.
- ***VivaDiag™*** **Ferritin Control Solution**

REF **VIC28-07-011**

STORAGE AND STABILITY

- ***VivaDiag™*** **Ferritin Test Kit** is stable for 24 months if stored at 2-30°C.
- Do not freeze or refrigerate.
- Do not open the pouch until ready to perform the assay.
- Once the pouch is opened, the test device should be used in 1 hour.
- All expiration dates are printed in Year-Month-Day format. Example: 2023-06-18 indicates June 18, 2023.

WARNINGS AND PRECAUTIONS

- For *in vitro* diagnostic use only.
- Do not reuse the **Cartridges** and do not use your test kits beyond the expiration date.
- Use the test kits at temperatures between 18-25°C.
- Use the test kits between 10-90% humidity.
- Do not use the **Cartridges** in extremely temperature. If the **Cartridges** has been stored refrigerated, bring to the ambient temperature (18-25°C) prior to testing and avoid moisture absorption.
- Keep the test kit away from direct sunlight.
- Please follow the **Package Insert** when testing.
- Please contact your local distributor if you have any questions you cannot solve.
- All parts of kit are considered biohazardous and can potentially transmit infectious diseases from blood borne pathogens, even after you have performed cleaning and disinfection. Follow proper precautions and all local regulations when disposing of the used test kits and other accessories.
- Do not interchange the test components between different lots or use the test components after the expiration date, either of which might yield incorrect test result(s).
- ***VivaDiag™*** **Ferritin Test Kit** will provide accurate and reliable results subject to the below conditions.

a) ***VivaDiag™*** **Ferritin Test Kit** should be used combined with ***VivaDiag™*** **POCT Analyzer**.

b) Recommended plasma or whole blood samples should be used EDTA, heparin or citrate anticoagulants.

SAMPLE COLLECTION AND PROCESSING

The sample type for ***VivaDiag™*** **Ferritin Test Kit** is human whole blood/serum/plasma.

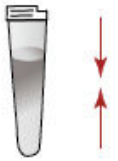
For the ***VivaDiag™*** **Ferritin Test Kit**:

- For serum sample, collect the blood in a tube without anticoagulant and allow to be clotted. Remove the serum from the clot as soon as possible to avoid hemolysis.
- For plasma/whole blood sample, collect the blood in a tube treated with EDTA, heparin or citrate. Anticoagulants other than EDTA, heparin, citrate for plasma sample have not been evaluated.
- If testing cannot be conducted within an hour after preparation of specimen, the serum/plasma should be stored at 2-8°C for 7 days, or at -20 ± 10°C for 6 months; the whole blood should be stored at 2-8°C for 2 days, and cannot be kept below 0°C.
- Once the serum/plasma sample was frozen, it should be thawed only once and only for test, because repeated freezing and thawing can result in the change of test values.

PREPARE FOR TEST

1. The ambient temperature was maintained at 18-25°C.
2. Check the contents of ***VivaDiag™*** **Ferritin Test Kit**: '**Cartridges** (packaged in pouch with desiccant)', '**Code Chip**', '**Buffer Tube** (prefilled with 1 mL buffer)', and '**Package Insert**'.
3. Take out the test kit and leave it at ambient temperature 18-25°C. If the kit was stored at 2°C, rewarm the kit for at least 30 minutes. If the storage temperature is higher than 2°C, the rewarming time should be shortened appropriately.
4. Place the **Cartridges** on a clean, dust-free and flat surface.
5. Turn on the Analyzer for at least 5 minutes before testing.
6. Check the label information of the **Code Chip** to make sure that the **Code Chip** matches **Cartridges**.
7. Pipette 10 µL serum/plasma or 10 µL whole blood to the **Buffer Tube**.

8. Invert and mix the solution 10 times or use a vortex to homogenize.



9. Use the mixed solution within one hour.

TEST PROCEDURE

Take *VivaDiag™* POCT Analyzer (VIM1000) as an example.

Step 1- Input information

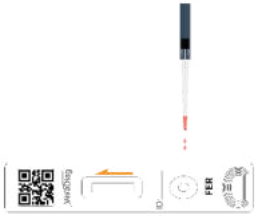
- From the main screen, select "**Single Test**".
- Insert the **Code Chip** module into the lower left front corner of the Analyzer.

- The Analyzer will read the information automatically.
- The Analyzer makes a beep when the information is read successfully and the "**Project name**" changes from "**test**" to "**FER**".
- Select "**Sample ID**", and input the sample ID in the pop-up window.
- Press Enter "↵" in the pop-up window.
- From the main screen, select "**Project Management**" to check the project information and batch information.

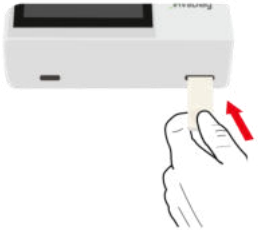
Step 2- Run test

Standard Test Model

- Pipette 75 µL mixed solution from **Buffer Tube** to the sample well of **Cartridge**. Avoid air bubbles.



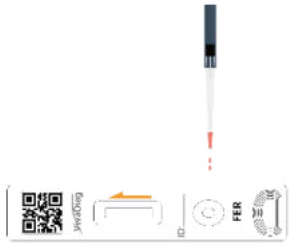
- Insert the **Cartridge** into the holder of ***VivaDiag™*** **POCT Analyzer**. Ensure proper orientation of the **Cartridges** before pushing it into the holder. An arrow has been marked on the **Cartridges** especially for this purpose.



- Select "**Standard Test**", the **Cartridge** will automatically go inside ***VivaDiag™*** **POCT Analyzer** and the analyzer will scan the sample-loaded **Cartridge** after 10 minutes.
- Read the test result on the display screen of ***VivaDiag™*** **POCT Analyzer**, or print it by selecting the "**Print**" button on the display screen.

Quick Test Model

- Pipette 75 µL mixed solution from the **Buffer Tube** to the sample well of the **Cartridge**. Avoid air bubbles.



- Place the **Cartridge** on a clean, dust-free and flat surface and reaction for 10 minutes.
- Insert the **Cartridge** into the holder of ***VivaDiag™*** **POCT Analyzer**. Ensure proper orientation of the **Cartridge** before pushing it into the holder. An arrow has been marked on the **Cartridge** especially for this purpose.

- Select "**Quick Test**", the **Cartridge** will automatically go inside ***VivaDiag™*** **POCT Analyzer**. The Analyzer will scan the sample-loaded **Cartridge** in seconds.
- Read the test result on the display screen of ***VivaDiag™*** **POCT Analyzer**, or print it by selecting the "**Print**" button on the display screen.

CALCULATION OF RESULT

The **Code Chip** contains specific information for calibration curve of the particular reagent lot.

VivaDiag™ **POCT Analyzer** will automatically calculate the result with the fluorescence signal according to the calibration curve in the **Code Chip**. "FER" concentration of the test sample will be displayed on the screen in term of ng/mL.

INTERPRETATION OF TEST RESULT

Reference range:

FER: 30-350 ng/mL for male

FER: 20-250 ng/mL for female.

Measuring range:

FER: 5-1500 ng/mL;

Risk of iron deficiency anemia:

Risk of iron deficiency anemia: Male	
FER≤30.00 ng/mL	High risk
FER>30.00 ng/mL	Low risk
Risk of iron deficiency anemia: Female	
FER≤20.00 ng/mL	High risk
FER>20.00 ng/mL	Low risk

Risk of cancer:

Risk of cancer: Male	
FER≤350.00 ng/mL	Low risk
FER>350.00 ng/mL	High risk
Risk of cancer: Female	
FER≤250.00 ng/mL	Low risk
FER>250.00 ng/mL	High risk

QUALITY CONTROL

Good Laboratory Practice suggests that controls should be tested with each new lot or shipment of test materials, or every 30 days, and as otherwise required by your laboratory's standard quality control procedures. Controls should be tested in the same manner as if testing patient specimens. When running patient specimens or external controls, failure of the internal/ external controls will generate an invalid test result. (Built-in control failure or an external control out of range) no patient results will be reported.

Users should follow government guidelines (for example, Federal, State or Local) and/or accreditation requirements for quality control.

Control materials are not provided with ***VivaDiag™*** **Ferritin Test Kit**. For more information regarding obtaining the control materials, contact with your local distributor for assistance.

(Please refer to the instruction for use of control material).

LIMITATIONS OF THE PROCEDURE

- Test results must always be evaluated with other data available to the physician.
- The performance of this product has been established for human whole blood/serum/plasma only. Other specimen types have not been evaluated.
- These assays are fluorescence immunoassays and may be affected by environmental conditions.
- There is a possibility that substances and/or factors may interfere with the test and cause false results. Technical or procedural errors can also contribute to erroneous results.
- The false results may be caused by the cross-reactions or other non-specific antibody in the sample.
- Any clinical diagnosis based on the test result must be supported by a comprehensive judgment of the concerned physician including clinical symptoms and other relevant test results.

PERFORMANCE CHARACTERISTICS

Analytical performance

- **Precision**

Precision was determined using ***VivaDiag™*** **Ferritin Test Kit**, samples and controls in a Multisite Precision Evaluation Study protocol (EP05-A3)[5] of the CLSI (Clinical and Laboratory Standards Institute): 3 sites (Analyzers) use the same samples. At each site, the samples are assayed on each of 5 days, one run per day, five replicates per run. Overall, this constitutes a 3 × 5 × 5 design. The following results were obtained:

Sample	Mean (ng/mL)	Repeatability		Reproducibility	
		SD (ng/mL)	CV (%)	SD (ng/mL)	CV (%)
Sample 1	18.62	6.0715	10.3%	7.3283	11.2%
Sample 2	300.41	17.6053	11.5%	18.8621	12.4%
Sample 3	638.84	25.9418	2.6%	27.1986	3.5%
Control 1	100.67	19.0847	5.8%	20.3415	6.6%
Control 2	200.94	21.9177	6.3%	23.1745	7.2%

- **Detection Capability**

Limit of Blank (LoB) = 2.10 ng/mL

Limit of Detection (LoD) = 4.10 ng/mL

The LoD for ***VivaDiag™*** **Ferritin Test Kit** is 4.10 ng/mL, determined consistent with the guidelines in CLSI document EP17-A2[6] and with proportions of false positives (α) less than 5% and false negatives (β) less than 5%; based on 100 determinations, with 60 blank and 40 low level replicates; and a LoB of 2.10 ng/mL.

- **Linearity**

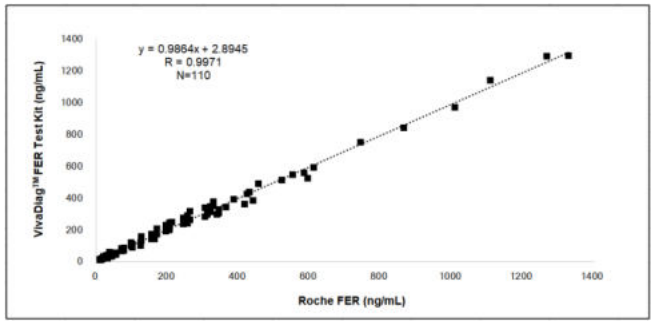
Eleven standards were prepared using purified FER at concentrations ranging from 5 ng/mL to 1500 ng/ mL, and linear regression analysis of the data indicates that the assay is linear throughout the measuring range of the test.

For *VivaDiag™* Ferritin Test Kit, the measurement procedure shows linearity for the interval from 5 ng/mL to 1500 ng/ mL, with deviations from linearity within ±15%.

- **Measurement Procedure Comparison**

A study was performed where human serum samples were tested using ***VivaDiag™*** **Ferritin Test Kit** and **Roche E411 FER test**. Data from this study were analyzed using Ordinary Linear Regression methods and are summarized in the following table and figure.

Method	Number of Specimens	Intercept	Slope	Correlation Coefficient
Ordinary Linear Regression	110	2.8945	0.9864	0.9971



· **Specificity**

Study of interference from Bilirubin, Triglycerides, Hemoglobin and Rheumatoid factors with ***VivaDiag™*** **Ferritin Test Kit** showed following results.

Interfering Substance	Concentration Added	Interference (%)
Bilirubin	0.2 g/L	<5.4
Triglyceride	10 g/L	<6.3
Hemoglobin	10 g/L	<4.9
Rheumatoid Factors	200 IU/mL	<6.7

LITERATURE REFERENCES

[1] Bates HM. How to Detect Iron Deficiency Before Anemia Develops. Laboratory Pathfinder Jan 1980:17-22.

[2] Mary Ann Knovich, Jonathan A. Storey, Lan G. Coffman, and Suzy V. Torti, Frank M. Torti. Ferritin for the clinician. Blood Rev. 2009 May ; 23(3): 95–104.

[3] Piperno A. Classification and diagnosis of iron overload. Haematologica. 1998;83:447–55.

[4] ISO. In vitro diagnostic medical devices-Requirements for establishing metrological traceability of values assigned to calibrators, trueness control materials and human samples. ISO17511.International Organization for Standardization;2020.

[5] CLSI. Evaluation of Precision of Quantitative Measurement Procedures; Approved Guideline—Third Edition. CLSI document EP05-A3. Wayne, PA: Clinical and Laboratory Standards Institute; 2014.

[6] CLSI. Evaluation of Detection Capability for Clinical Laboratory Measurement Procedures; Approved Guideline—Second Edition. CLSI document EP17-A2. Wayne, PA: Clinical and Laboratory Standards Institute; 2012.

INDEX OF SYMBOLS

	Consult instructions for use		Use by		Contains sufficient for <n> tests
IVD	For *in vitro* diagnostic use only	LOT	Lot number	REF	Catalog number
2°C 30°C	Storage temperature limitations		Manufacturer		Do not reuse
EC REP	Authorized Representative				

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CE
IVD

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