



ELISA-VIDITEST anti-VCA EBV IgG and IgG avidity **Cat.No.: ODZ-175**

Instruction manual

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1. TITLE:

ELISA-VIDITEST anti-VCA EBV IgG and IgG avidity – ELISA kit for the determination of IgG antibodies to capsid antigen (VCA) of Epstein and Barr virus (EBV) in serum (plasma) and IgG avidity evaluation.

2. INTENDED USE:

ELISA-VIDITEST anti-VCA EBV IgG and IgG avidity is intended for in vitro diagnostic procedures in EBV induced and EBV associated diseases, such as infectious mononucleosis (IM) and the chronic active EBV infection. The test is also useful in the diagnosis of Burkitt's lymphoma, nasopharyngeal carcinoma, carcinoma of the Waldeyer's ring and in characterisation of opportunistic lymphomas (oligo- and polyclonal). The other use of the test is in characterisation of chronic fatigue syndrome, in neuroinfections and immunosuppression which is frequently associated with EBV reactivation.

The kit is intended for differentiation of primary and recurrent EBV infection. Primary infection induces mainly low avidity (bind with low affinity) IgG antibodies to viral antigens. Later, antibodies with high avidity prevail. The predominance of low avidity IgG antibodies indicates recent primary infection. In other words, individuals with predominance of high avidity antibodies underwent the primary infection in the past. If such individuals have the symptoms of active EBV infection, it usually means the reactivation of the infection.

3. TEST PRINCIPLE:

ELISA-VIDITEST anti-VCA EBV IgG and IgG avidity is a solid-phase immunoanalytical test. The strips are coated by a mixture of specific antigens that bear immunodominant epitopes of VCA. Each serum sample is applied into two wells in parallel (eventually, into four wells) and the anti-VCA antibodies present in serum bind to the immobilized antigens. The next step is the incubation of one well with a wash buffer, the second respective well with urea solution. Antibodies with low and high avidity are bound to the antigen in the first well, whereas in the second well the low avidity antibodies are released due to the high concentration of urea and only the high avidity antibody-antigen complexes remain. The bound antibodies are recognized by animal anti-human IgG antibodies labelled with horseradish peroxidase. The amount of the bound labelled antibodies is revealed by an enzymatic reaction that leads to a colour change. The presence of the low avidity antibodies is indicated by a drop of absorbance in wells where urea solution was added. The ratio between the optical density of the well without urea (the one with the wash buffer) and the corresponding well with urea represents relative avidity index (RAI).

4. KIT COMPONENTS:

ELISA 8-well break-away strips coated with the antigen	STRIPS Ag	1 microplate
1.3 mL High avidity control serum, r.t.u. *	CONTROL HIGH AVID	1 vial
1.3 mL Low avidity control serum, r.t.u.	CONTROL LOW AVID	1 vial
1.3 mL Standard 1, r.t.u.	STANDARD 1	1 vial
1.3 mL Standard 2, r.t.u.	STANDARD 2	1 vial
1.3 mL Negative control serum, r.t.u.	CONTROL -	1 vial
13 mL Anti-human IgG antibodies labelled with horseradish peroxidase, r.t.u. (Px-conjugate)	CONJ	1 vial
125 mL Wash buffer, 10x concentrated	WASH 10x	1 vial
15 mL Urea solution, r.t.u.	UREA	1 vial
100 mL Dilution buffer, r.t.u.	DIL	1 vial
13 mL Chromogenic substrate (TMB substrate), r.t.u.	TMB	1 vial
13 mL Stop solution, r.t.u.	STOP	1 vial
Sealable pouch for unused strips		
Instruction manual		
Quality Control Certificate		

* ready to use

5. MATERIAL REQUIRED BUT NOT PROVIDED WITH THE KIT:

1. Distilled or deionised water for dilution of the Wash buffer concentrate.
2. Appropriate equipment for pipetting, liquid dispensing and washing.
3. Spectrophotometer/colorimeter (microplate reader – wavelength 450 nm).

6. PREPARATION OF REAGENTS AND SAMPLES:

- a. **Allow all kit components to reach room temperature.**
- b. **Vortex samples, the Standards and the Controls in order to ensure homogeneity** and mix all solution well prior use.
- c. **Dilute serum (plasma) samples 101x in Dilution buffer** and mix (e.g. 5 µL of serum sample + 500 µL of Dilution buffer). Do not dilute the Controls and Standards, they are ready to use.
- d. Prepare Wash buffer by diluting the Wash buffer concentrate 10 times with an appropriate volume of distilled or deionised water (e.g. 100 mL of the concentrated Wash buffer + 900 mL of distilled water). If there are crystals of salt present in the concentrated Wash buffer, warm up the vial to +32 to +37° C in a water bath. Diluted Wash buffer is stable for one week if stored at +2 to +10° C.
- e. Do not dilute Px-conjugate, TMB substrate, Urea solution and Stop solution, they are ready to use.

7. ASSAY PROCEDURE FOR THE QUALITATIVE/ SEMIQUANTITATIVE DETECTION OF IgG ANTIBODIES IN SERUM (PLASMA) SAMPLES:

- a. Allow the vacuum-closed aluminium bag with strips to reach a room temperature. Withdraw the adequate number of strips and put unused strips into the provided pouch and seal it carefully with the desiccant kept inside.
- b. Pipette 100 µL of Dilution buffer, Standards, Control sera and serum samples to the wells according to the pipetting scheme in Figure 1 (page 3): fill first well with Dilution buffer (DIL) to determine reaction background. Fill the next two wells with STANDARD 1 (it serves as a calibrator). Fill the next well with Negative control serum (CONTROL -).

The remaining wells fill with diluted tested samples (S1...). It is also suitable to apply positive control serum (STANDARD 2) for the test control. It is satisfactory to apply one serum into one well (S1, S2, S3...). However, if you want to minimize a laboratory error, apply control sera and tested sera as doublets, STANDARD 1 as triplet. We also recommend applying internal reference positive control sample for verification of the calibration, continuity and variability of the test.

c. Incubate 30 minutes (±5 min) at room temperature.

d. Aspirate the liquid from the wells into a collecting bottle containing appropriate disinfectant (see Safety Precautions). Wash and aspirate the wells 4x with 250 µl/well of Wash buffer. Avoid cross-contamination between wells!

If some liquid remains in the wells, invert the plate and tap it on an adsorbent paper to remove the last remaining drops.

e. Mix Px-conjugate r.t.u. (CONJ) well and then add 100 µL of Px-conjugate into each well.

f. Incubate 60 minutes (±5 min) at room temperature.

g. Aspirate and wash four times with 250 µl/well of Wash buffer. Tap the plate on an adsorbent paper.

h. Dispense 100 µl of TMB substrate into each well.

i. **Incubate for 10 minutes (+/-5 seconds) in dark at room temperature.** The time measurement must be started at the beginning of TMB dispensing. Cover the strips with an aluminium foil or keep them in the dark during the incubation with TMB substrate.

j. **Stop the reaction** by adding 100 µL of Stop solution (STOP). Use the same pipetting rhythm as with the TMB substrate to ensure the same reaction time in all wells. Tap gently the microplate for a few times to ensure complete mixing of the reagents.

k. Read the absorbance at **450 nm with a microplate reader within 10 minutes**. It is recommended to use reference reading at 620-690 nm.

Figure 1. Pipetting scheme for the detection of IgG antibodies:

	1	2	3	4	5	6	7	8	9	10	11	12
a	DIL											
b	STANDARD 1											
c	STANDARD 1											
d	CONTROL -											
e	S1											
f	S2											
g	S3											
h	S...											

8. PROCESSING OF RESULTS FOR THE DETECTION OF IgG ANTIBODIES:

Begin the processing of results with subtraction of the background absorbance (absorbance of the DIL well) from the absorbances of all other wells.

8.1 Processing of results for Qualitative interpretation

1. Compute the mean absorbance of STANDARD 1. If you applied STANDARD 1 into 3 wells and if any of the three STANDARD 1 absorbances falls out of the range +/-20% of the mean absorbance then exclude the deviating well from the calculation and compute a new STANDARD 1 mean using the values from the other two wells.

2. **Compute the Cut-off value** of the test by multiplication the STANDARD 1 mean by the Correction factor. **The correction factor value determined for this lot of the kit is stated in the Quality control certificate.**
3. Sera that have absorbance value < 90% cut-off are negative and sera with absorbance value > 110% cut-off are considered to be positive.

8.2. Semiquantitative evaluation

Determine the Positivity Index for each serum sample as follows:

1. Compute the cut-off value (see previous paragraph 8.1).
2. Compute the Positivity Index according to the following formula:

$$\text{Sample Positivity Index} = \frac{\text{Sample absorbance}}{\text{Cut-off value}}$$

3. Express the serum reactivity according to Table 1 (Semiquantitative interpretation of results).

Table 1: Semiquantitative interpretation of results

<u>Index value</u>	<u>Evaluation</u>
< 0.90	Negative
0.90 - 1.10	+/-
1.11 - 3.00	+
3.01 - 5.00	++
5.01 - 8.00	+++
> 8.00	++++

Note! An indifferent sample reactivity, i.e. interpreted as +/-, requires repetition of the sample testing. If the result is again indifferent then it is recommended to use an alternative testing method or to obtain another sample from the patient, usually withdrawn 1-2 weeks later.

Example of calculation:

STANDARD 1 absorbancies	= 1.111; 1.143
Mean STANDARD 1 absorbance	= 1.127
Sample absorbance	= 0.800
Correction factor	= 0.18
Cut-off value	= 1.127 x 0.18 = 0.203
Sample Positivity Index	= 0.800 / 0.203 = 3.94

9. ASSAY PROCEDURE FOR MEASURING AVIDITY OF IgG ANTIBODIES:

- a. Allow the vacuum-closed aluminium bag with strips to reach a room temperature. Withdraw the adequate number of strips and put unused strips into the provided pouch and seal it carefully with the desiccant kept inside.
- b. Pipette 100 µL of Dilution buffer, Controls and serum samples to the wells according to the pipetting scheme in Figure 2 (page 5). First, fill wells in the first row of the first two strips with Dilution buffer (DIL) to determine the reaction background. Then fill two wells with High avidity control serum (CONTROL HIGH AVID) and two wells with Low avidity control serum (CONTROL LOW AVID). If you want to use qualitative interpretation for serum samples, fill next two wells with STANDARD 1. Then pipette the diluted serum samples (S1, S2, S3...) in doublets into the remaining wells. It is satisfactory to use the

“simple doublettes”, however, if you want to minimize a pipetting error, apply serum samples as quadruplettes, i.e. two wells for each of the respective strip.

- c. **Incubate 30 minutes (± 5 min) at room temperature.**
- d. Aspirate the liquid from the wells into a collecting bottle containing appropriate disinfectant (see Safety Precautions). Wash and aspirate the wells 4x with 250 μ l/well of Wash buffer. Avoid cross-contamination between wells! If some liquid remains in the wells, invert the plate and tap it on an adsorbent paper to remove the last remaining drops.
- e. Add **100 μ L of Wash buffer (WASH)** into wells of even-numbered strips (i.e. column 2, 4, 6, 8, 10 and 12) and **100 μ L of Urea solution (UREA)** into each well of odd-numbered strips (i.e. column 1, 3, 5, 7, 9 and 11).
- f. **Incubate 10 minutes (± 5 sec) at room temperature.**
- g. Aspirate and wash 4x with 250 μ l/well of Wash buffer. Tap the plate on an adsorbent paper.
- h. Mix Px-conjugate r.t.u. (CONJ) well and then add 100 μ L of Px-conjugate into each well.
- i. **Incubate 60 minutes (± 5 min) at room temperature.**
- j. Aspirate and wash four times with 250 μ l/well of Wash buffer. Tap the plate on an adsorbent paper.
- k. Dispense 100 μ l of TMB substrate into each well.
- l. **Incubate for 10 minutes (+/-5 seconds) in dark at room temperature.**
The time measurement must be started at the beginning of TMB dispensing. Cover the strips with an aluminium foil or keep them in the dark during the incubation with TMB substrate.
- m. **Stop the reaction** by adding 100 μ L of Stop solution (STOP). Use the same pipetting rhythm as with the TMB substrate to ensure the same reaction time in all wells. Tap gently the microplate for a few times to ensure complete mixing of the reagents.
- n. Read the absorbance at **450 nm with a microplate reader within 10 minutes**. It is recommended to use reference reading at 620-690 nm.

Figure 2. Pipetting scheme for measuring avidity of IgG antibodies:

	UREA	WASH	UREA	WASH	...							
	1	2	3	4	5	6	7	8	9	10	11	12
A	DIL	DIL	S5	S5								
B	CONTROL HIGH AVID	CONTROL HIGH AVID	...									
C	CONTROL LOW AVID	CONTROL LOW AVID										
D	STANDARD 1	STANDARD 1										
E	S1	S1										
F	S2	S2										
G	S3	S3										
H	S4	S4										

10. PROCESSING OF RESULTS FOR MEASURING AVIDITY OF IgG ANTIBODIES:

- a. First, subtract the absorbance of the background (absorbance of the DIL well) from the absorbancies of all other wells. Use the respective background value for wells incubated with the Urea solution and for wells incubated without the Urea solution.

Important note: Avidity evaluation is possible in anti-VCA IgG-positive serum samples only. If the tested serum sample is negative or indifferent, the relative avidity index (RAI) cannot be assessed. IgG-positivity can be checked using following calculation:

Calculate cut-off value of the test: Multiply the absorbance value of STANDARD 1 in the wells with Wash buffer (WASH) with correction factor. **The correction factor value determined for this lot of the kit is written in the Quality control certificate.**

Samples incubated with Wash buffer with absorbance (OD) lower than the 90% cut-off value are considered negative and samples (incubated with WASH) with absorbance higher than the 110% cut-off value are considered positive.

- b. If you applied two duplicates, compute the mean absorbance of serum from wells on the same strip.
- c. Calculate the relative avidity index value (**RAI**): divide the absorbance of a sample well incubated with the Urea solution by the absorbance of the sample well incubated with the Wash buffer, express in percent (i.e. multiply by 100).
Both Controls (CONTROL HIGH AVID and CONTROL LOW AVID) are used for the internal validity test and must be involved in each run of the assay.

Formula:

$$\frac{\text{absorbance with urea solution}}{\text{absorbance with wash buffer}} \times 100 = \text{RAI (\%)}$$

INTERPRETATION OF RESULTS:

<u>RAI value in %</u>	<u>Interpretation</u>
< 40 %	Presence of low avidity antibodies
40 % - 60 %	Indifferent result
> 60 %	Presence of high avidity antibodies

Example:

Absorbances of High avidity control in wells with Urea solution	= 1.770; 1.718
Mean absorbance of High avidity control in wells with Urea solution	= 1.744
Absorbances of High avidity control in wells with Wash buffer	= 1.845; 1.904
Mean absorbance of High avidity control in wells with Wash buffer	= 1.875
RAI (%)	= (1.744 x 100) / 1.875 = 93 %

11. DIAGNOSTIC INTERPRETATION OF THE RESULTS

VCA IgG	VCA IgM	VCA IgA	EA (D) IgG	EBNA-1 IgG	EBNA-1 IgM	Stadium EBV infekce
-	-	-	-	-	-	EBV negativne
- + low avidity	+ +	+ +	- +	- -	+ +	EBV primoinfection (acute phase)
+ low avidity	+ +	+ +	+ -	+/- -	+ -	EBV primoinfection (transient phase)
+ low → high avidity	+ -	+ -	+ -	- +	- -	EBV primoinfection (convalescent phase)
+ high avidity	-	- +	-	+	-	Seropositivity without signs of the active EBV infection
+ high avidity	- +	- +	+ +	+ +	- -	EBV reactivation

VIDIA offers also the other diagnostic assays to detect the antibodies against the other EBV antigens:

ELISA-VIDITEST anti-EBNA-1 EBV IgM and IgG

ELISA-VIDITEST anti-VCA EBV IgM and IgA

ELISA-VIDITEST anti-EA (D) EBV IgM and IgG

For the confirmation of the results you can use:

IF-VIDITEST anti-VCA EBV IgM and IgG

IF-VIDITEST anti-EA EBV (D+R or D) IgG

12. CHARACTERISTICS OF THE TEST:

12.1 Validity of the test

The test is valid if:

- The background of the reaction (the absorbance of the Dilution buffer) is less than 0.100.
- RAI of High avidity control serum (CONTROL HIGH AVID) is > 60 %.
- RAI of Low avidity control serum (CONTROL LOW AVID) is < 40 %.
- The mean STANDARD 1 absorbance should be in range that **is written in enclosed Quality control certificate**.
- OD values of control sera should be:
STANDARD1 > STANDARD2 > CONTROL -.

12.2. Precision of the test

Tests were done with samples of various OD value when performing the interassay and intraassay variability evaluation.

12.2.1 Intraassay variability

The coefficient of intraassay variability is max. 5% (n = the number of parallels):

Example:

n	A	$\pm\delta$	CV
14	2.268	0.094	4.1 %

12.2.2 Interassay variability

The coefficient of interassay variability is max. 15%. It is measured for each particular Lot as comparison of the OD values of the same serum sample in several consecutive tests.

Example:

n	A	$\pm\delta$	min – max	CV
10	0.674	0.090	0.567-0.779	13.4%
9	0.832	0.061	0.729-0.927	7.3%
7	1.116	0.069	1.048-1.221	6.2%

12.2.3 Recovery test

Measured values of recovery test for every Lot are between 80-120% of expected values.

12.3. Diagnostic sensitivity and specificity of the test

The diagnostic sensitivity was measured by testing the population sample that is expected to have anti-VCA IgG antibodies (blood donors, patients with active EBV infection). The results were confirmed by other commercial test. The diagnostic sensitivity was 98.1 %.

The specificity of the test was measured by testing EBV negative healthy blood donors. The specificity of the test was 97.1%.

Diagnostic concordance for avidity determination was tested on clinically defined serum samples:

Samples	Number	Determined avidity			Diagnostic concordance
		high	equivocal	low	
Healthy seropositive individuals	46	40	6	0	100%
Patients with infectious mononucleosis	41	1	2	38	97.6%
Patients with serological report of EBV reactivation	19	15	3	1	94.7%

12.4. Interference

Haemolytic and lipemic samples have no influence on test results to minimal concentration 50 mg/mL of haemoglobin, 5 mg/mL of bilirubin and 50 mg/mL triglycerides.

13. SAFETY PRECAUTIONS:

All ingredients of the kit are intended for laboratory use only.

The Calibrator and the Controls contain human sera that has been tested negative for HBsAg, anti-HIV-1,2 and anti-HCV. However they should be regarded as contagious and handled and disposed of according to the appropriate regulations.

Autoclave all reusable materials that were in contact with human samples for 1 hour at 121°C, burn disposable ignitable materials, decontaminate liquid wastes and nonignitable materials with 3% chloramines at least 30 minutes.

Liquid wastes containing acid (Stop solution) should be neutralized in 4% sodium bicarbonate solution.

The waste from strip washing, disinfect in waste container using appropriate disinfection solution (e.g. Incidur, Incidin, chloramin,...) in concentrations recommended by the producer.

Handle Stop solution with care. Avoid contact with skin or mucous membranes. In case of contact with skin, rinse immediately with plenty of water and seek medical advice.

Do not smoke, eat or drink during work. Do not pipette by mouth. Wear disposable gloves while handling reagents or samples and wash your hands thoroughly afterwards. Avoid spilling or producing aerosol.

14. HANDLING PRECAUTIONS:

Manufacturer guarantees performance of the entire ELISA kit.

Follow the assay procedure indicated in the Instruction manual.

Wash buffer, chromogenic substrate TMB, Stop solution and Dilution buffer are interchangeable between ELISA-VIDITEST kits unless otherwise stated in the instruction manual.

Controls, TMB substrate, Dilution buffer, Urea solution and Px-conjugate contain preservative ProClin 300[®].

Avoid microbial contamination of serum samples and kit reagents.

Avoid cross-contamination of reagents.

Avoid contact of the TMB substrate with oxidizing agents or metal surfaces.

Variations in the test results are usually due to:

- * Insufficient mixing of reagents and samples
- * Inaccurate pipetting and inadequate incubation times
- * Poor washing technique or spilling the rim of well with sample or Px-conjugate
- * Use of identical pipette tip for different solutions

15. STORAGE AND EXPIRATION:

Store the kit and the kit reagents at +2 to +10°C, in a dry place and protected from the light. Store the unused strips in the sealable pouch and keep the desiccant inside.

Store serum samples at +2 to +10°C up to one week. For longer period make aliquots and keep them at -20°C. Avoid repeated thawing and freezing.

Do not store diluted serum samples. Always prepare fresh.

Kits are shipped in cooling bags, the transport time of 72 hours have no influence on expiration.

If you find damage at any part of the kit, please inform the manufacturer immediately.

Expiration date is indicated at the ELISA kit label and at all reagent labels.

16. REFERENCES:

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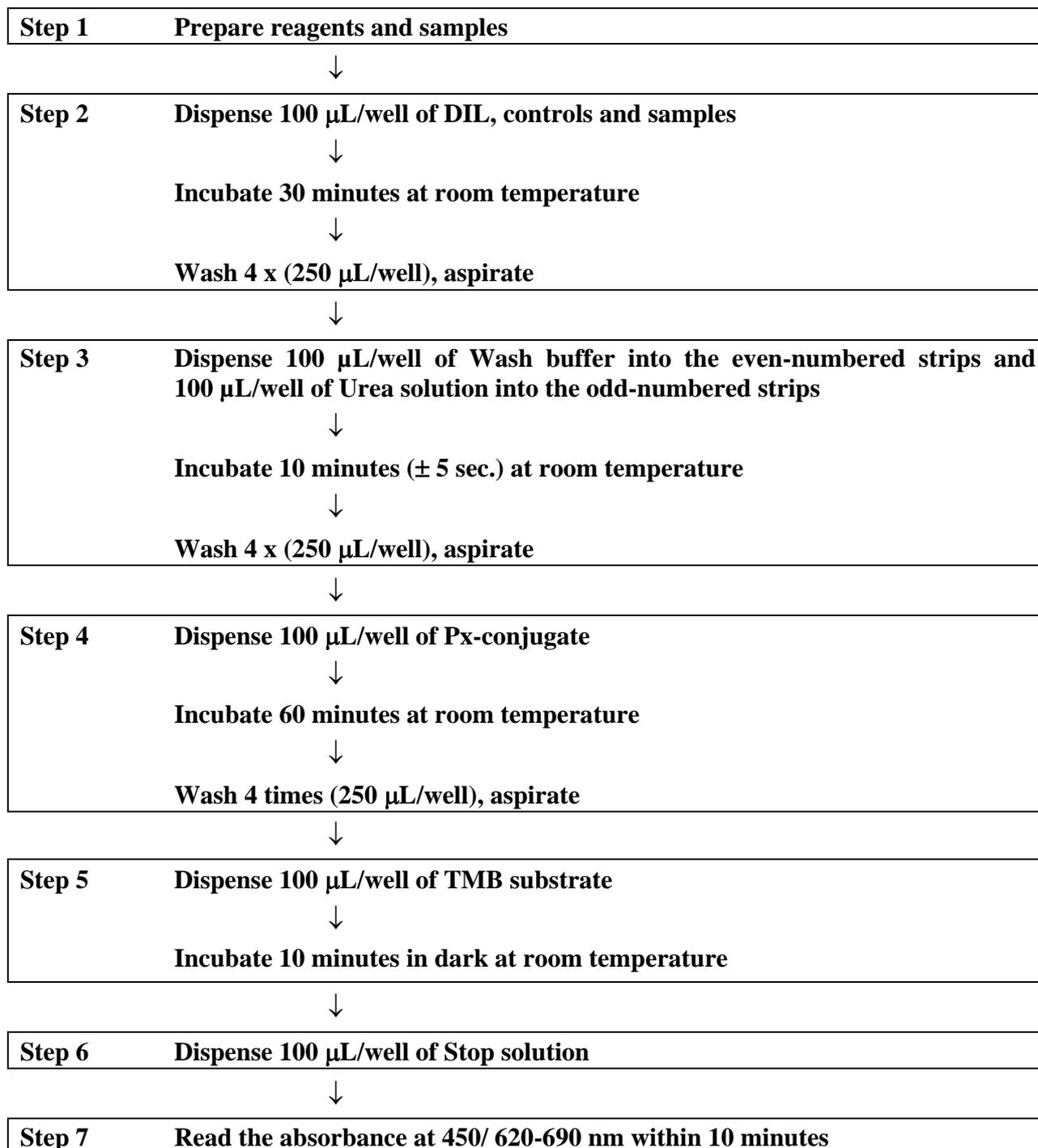
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Weissbrich, B.: The use of semi-automated EBV IgG avidity determination for diagnosis of infectious mononucleosis; *J. Med.Virol.*, 1998, 54, s.145-153

17. FLOW CHART:

Note: If you carry out the test only due to determination of IgG antibodies (and not due to determination of their avidity), please omit the Step 3.



Date of the last revision of this manual: 05/2013

