

# HAV IgM

**“Capture” Enzyme Immuno Assay (ELISA)  
for the determination of IgM class  
antibodies to Hepatitis A Virus  
in human plasma and sera**

- for “in vitro” diagnostic use only -



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## HAV IgM

### A. INTENDED USE

Enzyme ImmunoAssay (ELISA) for the determination of IgM class antibodies to Hepatitis A Virus in human plasma and sera with the "capture" system. The kit may be used for the identification of the viral agent causing hepatitis in the patient and the follow up of the acute phase of the infection. For "in vitro" diagnostic use only.

### B. INTRODUCTION

The Center for Disease Control or CDC, Atlanta, USA, defines Hepatitis A Virus as follows:

Hepatitis A continues to be one of the most frequently reported vaccine-preventable diseases in the world, despite the licensure of hepatitis A vaccine in 1995. Widespread vaccination of appropriate susceptible populations would substantially lower disease incidence and potentially eliminate indigenous transmission of hepatitis A virus (HAV) infection.

HAV, a 27-nm RNA agent classified as a picornavirus, can produce either asymptomatic or symptomatic infection in humans after an average incubation period of 28 days (range, 15-50 days). The illness caused by HAV infection typically has an abrupt onset of symptoms that can include fever, malaise, anorexia, nausea, abdominal discomfort, dark urine, and jaundice. The likelihood of having symptoms with HAV infection is related to the person's age. In children less than 6 years of age, most (70%) infections are asymptomatic; if illness does occur, it is not usually accompanied by jaundice. Among older children and adults, infection is usually symptomatic, with jaundice occurring in greater than 70% of patients. Signs and symptoms usually last less than 2 months, although 10%-15% of symptomatic persons have prolonged or relapsing disease lasting up to 6 months. In infected persons, HAV replicates in the liver, is excreted in bile, and is shed in the stool. Peak infectivity of infected persons occurs during the 2-week period before onset of jaundice or elevation of liver enzymes, when the concentration of virus in stool is highest. The concentration of virus in stool declines after jaundice appears. Children and infants can shed HAV for longer periods than adults, up to several months after the onset of clinical illness. Chronic shedding of HAV in feces does not occur; however, shedding can occur in persons who have relapsing illness. Viremia occurs soon after infection and persists through the period of liver enzyme elevation.

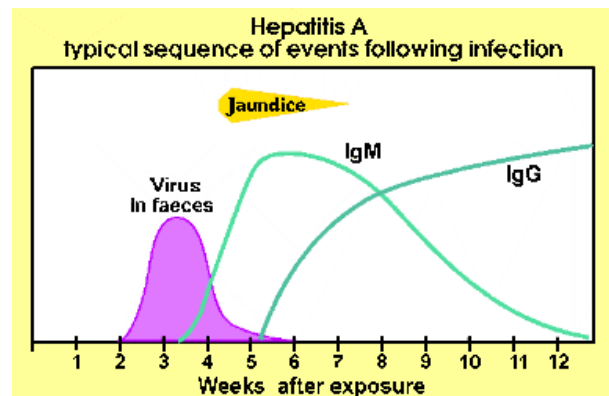
Hepatitis A cannot be differentiated from other types of viral hepatitis on the basis of clinical or epidemiologic features alone. Serologic testing to detect immunoglobulin M (IgM) antibody to the capsid proteins of HAV (IgM anti-HAV) is required to confirm a diagnosis of acute HAV infection. In most persons, IgM anti-HAV becomes detectable 5-10 days before the onset of symptoms and can persist for up to 6 months after infection. Immunoglobulin G (IgG) anti-HAV, which appears early in the course of infection, remains detectable for the person's lifetime and confers lifelong protection against the disease. Commercial diagnostic tests are available for the detection of IgM and total (IgM and IgG) anti-HAV in serum.

HAV RNA can be detected in the blood and stool of most persons during the acute phase of infection by using nucleic acid amplification methods, and nucleic acid sequencing has been used to determine the relatedness of HAV isolates.

HAV infection is acquired primarily by the fecal-oral route by either person-to-person contact or ingestion of contaminated food or water. On rare occasions, HAV infection has been transmitted by transfusion of blood or blood products collected from donors during the viremic phase of their infection. In experimentally infected nonhuman primates, HAV has been detected in saliva during the incubation period; however, transmission by saliva has not been demonstrated.

Depending on conditions, HAV can be stable in the environment for months. Heating foods at temperatures greater than 185 F (85 C) for 1 minute or disinfecting surfaces with a 1:100 dilution of sodium hypochlorite (i.e., household bleach) in tap water is necessary to inactivate HAV.

Because most children have asymptomatic or unrecognized infections, they play an important role in HAV transmission and serve as a source of infection for others. In one study of adults without an identified source of infection, 52% of their households included a child less than 6 years old, and the presence of a young child was associated with HAV transmission within the household. In studies where serologic testing of the household contacts of adults without an identified source of infection was performed, 25%-40% of the contacts less than 6 years old had serologic evidence of acute HAV infection (IgM anti-HAV).



### C. PRINCIPLE OF THE TEST

The assay is based on the principle of "IgM capture" where IgM class antibodies in the sample are first captured by the solid phase coated with anti hIgM antibody.

After washing out all the other components of the sample and in particular IgG antibodies, the specific IgM captured on the solid phase are detected by the addition of a purified preparation of inactivated HAV, labelled with an antibody conjugated with peroxidase (HRP).

After incubation, microwells are washed to remove unbound conjugate and then the chromogen/substrate is added.

In the presence of peroxidase the colorless substrate is hydrolysed to a colored end-product, whose optical density may be detected and is proportional to the amount of antibodies to HAV present in the sample.

## D. COMPONENTS

The kit contains reagents for 96 tests.

### 1. Microplate: MICROPLATE

12 strips of 8 breakable wells coated with anti human IgM antibody, affinity purified, and sealed into a bag with desiccant. Bring the microplate to room temperature before opening the bag. Unused strips have to be returned into the bag and the bag has to be sealed and stored back to 2..8°C, in presence of the desiccant.

### 2. Negative Control: CONTROL -

1x4.0 ml/vial. Ready to use control. It contains goat serum proteins, 10 mM tris buffer pH 6.0+/-0.1, 0.1% Tween 20, 0.09% sodium azide and 0.1% Kathon GC as preservatives. The negative control is colourless.

### 3. Positive Control: CONTROL +

1x4.0 ml/vial. Ready to use control. It contains anti HAV IgM, goat serum proteins, 10 mM tris buffer pH 6.0+/-0.1, 0.1% Tween 20, 0.09% sodium azide and 0.1% Kathon GC as preservatives. The positive control is green colour coded.

### 4. Calibrator: CAL ....

N°1 lyophilized vial. To be dissolved with EIA grade water as reported in the label. It contains anti HAV IgM, 2% BSA, 10 mM tris buffer pH 6.0+/-0.1, 0.09% sodium azide and 0.1% Kathon GC as preservatives.

**Note: The volume necessary to dissolve the content of the vial may vary from lot to lot. Please use the right volume reported on the label .**

### 5. Wash buffer concentrate: WASHBUF 20X

1x60ml/bottle. 20x concentrated solution. Once diluted, the wash solution contains 10 mM phosphate buffer pH 7.0+/-0.2, 0.05% Tween 20 and 0.05% Kathon GC.

### 6. Enzyme conjugate 20X: CONJ

1x0.8 ml/vial. 20X concentrated solution. It contains Horseradish peroxidase conjugated antibody specific to HAV in presence of 10 mM Tris buffer pH 6.8+/-0.1, 2% BSA, 0.1% Kathon GC and 0.02% gentamicine sulphate as preservatives.

### 7. HAV Antigen: Ag HAV

1x16 ml/vial. Ready-to-use solution. It contains inactivated and stabilised HAV in presence of 10 mM Tris buffer pH 6.8+/-0.1, 2% BSA, 0.1% Kathon GC and 0.02% gentamicine sulphate as preservatives. The reagent is red colour coded.

### 8. Specimen Diluent: DILSPE

2x60.0 ml/vial. Proteic buffered solution for the dilution of samples. It contains goat serum proteins, 10 mM tris buffer pH 6.0+/-0.1, 0.1% Tween 20, 0.09% sodium azide and 0.1% Kathon GC as preservatives. The reagent is blue colour coded.

### 9. Chromogen/Substrate: SUBS TMB

1x16ml/vial. It contains a 50 mM citrate-phosphate buffered solution at pH 3.5-3.8, 0.03% tetra-methyl-benzidine or TMB and 0.02% hydrogen peroxide of H<sub>2</sub>O<sub>2</sub>.

**Note: To be stored protected from light as sensitive to strong illumination.**

### 10. Sulphuric Acid: H<sub>2</sub>SO<sub>4</sub> 0.3 M

1x15ml/vial. It contains 0.3 M H<sub>2</sub>SO<sub>4</sub> solution. Attention: Irritant (Xi R36/38; S2/26/30)

### 11. Plate sealing foils

### 12. Package insert

## E. MATERIALS REQUIRED BUT NOT PROVIDED

1. Calibrated Micropipettes of 10ul, 100ul and 1000ul and disposable plastic tips.
2. EIA grade water (double distilled or deionised, charcoal treated to remove oxidizing chemicals used as disinfectants).
3. Timer with 60 minute range or higher.
4. Absorbent paper tissues.
5. Calibrated ELISA microplate thermostatic incubator (dry or wet) set at +37°C (+/-0.1°C tolerance).
6. Calibrated ELISA microwell reader with 450nm (reading) and with 620-630nm (blanking) filters.
7. Calibrated ELISA microplate washer.
8. Vortex or similar mixing tools.

## F. WARNINGS AND PRECAUTIONS

1. The kit has to be used by skilled and properly trained technical personnel only, under the supervision of a medical doctor responsible of the laboratory.
2. All the personnel involved in performing the assay have to wear protective laboratory clothes, talc-free gloves and glasses. The use of any sharp (needles) or cutting (blades) devices should be avoided. All the personnel involved should be trained in biosafety procedures, as recommended by the Center for Disease Control, Atlanta, U.S. and reported in the National Institute of Health's publication: "Biosafety in Microbiological and Biomedical Laboratories", ed. 1984.
3. All the personnel involved in sample handling should be vaccinated for HBV and HAV, for which vaccines are available, safe and effective.
4. The laboratory environment should be controlled so as to avoid contaminants such as dust or air-born microbial agents, when opening kit vials and microplates and when performing the test. Protect the Chromogen/Substrate (TMB & H<sub>2</sub>O<sub>2</sub>) from strong light and avoid vibration of the bench surface where the test is undertaken.
5. Upon receipt, store the kit at 2-8°C into a temperature controlled refrigerator or cold room.
6. Do not interchange components between different lots of the kits. It is recommended that components between two kits of the same lot should not be interchanged.
7. Check that the reagents are clear and do not contain visible heavy particles or aggregates. If not, advise the laboratory supervisor to initiate the necessary procedures.
8. Avoid cross-contamination between serum/plasma samples by using disposable tips and changing them after each sample.
9. Avoid cross-contamination between kit reagents by using disposable tips and changing them between the use of each one.
10. Do not use the kit after the expiration date stated on external (primary container) and internal (vials) labels. Treat all specimens as potentially infective. All human serum specimens should be handled at Biosafety Level 2, as recommended by the Center for Disease Control, Atlanta, U.S. in compliance with what reported in the Institutes of Health's publication: "Biosafety in Microbiological and Biomedical Laboratories", ed. 1984.
11. The use of disposable plastic-ware is recommended in the preparation of the washing solution or in transferring components into other containers of automated workstations, in order to avoid contamination.
12. Waste produced during the use of the kit has to be discarded in compliance with national directives and laws concerning laboratory waste of chemical and biological substances. In particular, liquid waste generated from the washing procedure, from residuals of controls and from samples has to be treated as potentially infective material and inactivated. Suggested procedures of inactivation are treatment with a 10% final concentration of household bleach for 16-18 hrs or heat inactivation by autoclave at 121°C for 20 min..

13. Accidental spills have to be adsorbed with paper tissues soaked with household bleach and then with water. Tissues should then be discarded in proper containers designated for laboratory/hospital waste.

14. The Stop Solution is an irritant. In case of spills, wash the surface with plenty of water

15. Other waste materials generated from the use of the kit (example: tips used for samples and controls, used microplates) should be handled as potentially infective and disposed according to national directives and laws concerning laboratory wastes.

#### G. SPECIMEN: PREPARATION AND RECOMMENDATIONS

1. Blood is drawn aseptically by venepuncture and plasma or serum is prepared using standard techniques of preparation of samples for clinical laboratory analysis. No influence has been observed in the preparation of the sample with citrate, EDTA and heparin.

2. Samples have to be clearly identified with codes or names in order to avoid misinterpretation of results. When the kit is used for the screening of blood units, bar code labeling and reading is strongly recommended.

3. Samples containing residues of fibrin or heavy particles or microbial filaments and bodies should be discarded as they could give rise to false results.

4. Sera and plasma can be stored at +2°...8°C for up to five days after collection. For longer storage periods, samples can be stored frozen at -20°C for several months. Any frozen samples should not be freeze/thawed more than once as IgM antibodies may get damaged and as this procedure may generate particles that could affect the test result.

5. If particles are present, centrifuge at 2.000 rpm for 20 min or filter using 0.2-0.8u filters to clean up the sample for testing.

#### H. PREPARATION OF COMPONENTS AND WARNINGS

A study conducted on an opened kit has not pointed out any relevant loss of activity up to 3 months.

##### 1. Antibody coated microwells:

Allow the microplate to reach room temperature (about 1 hr) before opening the container. Check that the desiccant has not turned dark green, indicating a defect in conservation.

In this case, call Dia.Pro's customer service.

Unused strips have to be placed back into the aluminium pouch, with the desiccant supplied, firmly zipped and stored at +2°...8°C. When opened the first time, unused strips are stable until the humidity indicator inside the desiccant bag turns from yellow to green.

##### 2. Negative Control:

Ready to use. Mix well on vortex before use.

##### 3. Positive Control:

Ready to use. Mix well on vortex before use. Handle this component as potentially infectious, even if HAV, eventually present in the control, has been chemically inactivated.

##### 4. Calibrator:

Add the volume of ELISA grade water, reported on the label, to the lyophilised powder; let fully dissolve and then gently mix on vortex. The solution is not stable. Store the Calibrator frozen in aliquots at -20°C.

**Note:** When dissolved the Calibrator is not stable. Store in aliquots at -20°C.

##### 5. Wash buffer concentrate:

The whole content of the concentrated solution has to be diluted 20x with bidistilled water and mixed gently end-over-end before use.

Once diluted, the wash solution is stable for 1 week at 2-8°C.

During preparation avoid foaming as the presence of bubbles could impact on the efficiency of the washing cycles.

**Note:** Once diluted, the wash solution is stable for 1 week at +2...8°C.

##### 6. Enzyme conjugate:

20X preparation. Mix well on vortex.

Avoid contamination of the liquid with oxidizing chemicals, dust or microbes when the reagent is aspirated to be used.

##### 7. HAV Antigen:

Ready to use. Mix well on vortex before use.

Handle this component as potentially infectious, even if HAV has been chemically inactivated.

##### 6+7. HAV Antigen/Antibody complex:

About 5-10 min before its use, dilute the 20X concentrated Enzyme Conjugate in the proper volume of HAV Antigen, necessary for the assay. Then mix on vortex carefully.

Example: To run 2 strips, dilute 100 ul Enzyme Conjugate 20X into 2 ml of HAV Antigen.

**Note:** This immunocomplex is not stable; discard the exceeding volume.

##### 8. Sample Diluent:

Ready to use. Mix well on vortex before use.

##### 9. Chromogen/Substrate:

Ready to use. Mix well on vortex before use.

Avoid contamination of the liquid with oxidizing chemicals, air-driven dust or microbes.

Do not expose to strong light, oxidizing agents and metallic surfaces. If this component has to be transferred use only plastic, and if possible, sterile disposable container.

##### 10. Sulphuric Acid:

Ready to use. Mix well on vortex before use.

Attention: Irritant (Xi R36/38; S2/26/30)

Legenda: R 36/38 = Irritating to eyes and skin.

S 2/26/30 = In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

#### I. INSTRUMENTS AND TOOLS USED IN COMBINATION WITH THE KIT

1. Micropipettes have to be calibrated to deliver the correct volume (tolerance +/-5%) required by the assay and must be submitted to regular decontamination (household alcohol, 10% solution of bleach, hospital grade disinfectants) of those parts that could accidentally come in contact with the sample. They should also be regularly maintained. Decontamination of spills or residues of kit components should also be carried out regularly. They should also be regularly maintained in order to show a precision of 1% and a trueness of  $\pm 2\%$ .

2. The ELISA incubator has to be set at +37°C (tolerance of +/-0.5°C) and regularly checked to ensure the correct temperature is maintained. Both dry incubators and water baths are suitable for the incubations, provided that the instrument is validated for the incubation of ELISA tests.

3. The ELISA washer is extremely important to the overall performances of the assay. The washer must be carefully validated and correctly optimized using the kit controls and reference panels, before using the kit for routine laboratory tests. 4-5 washing cycles (aspiration + dispensation of 350ul/well of washing solution = 1 cycle) are sufficient to ensure that the assay performs as expected. A soaking time of 20-30 seconds between cycles is suggested. In order to set correctly their number, it is recommended to run an assay with the kit controls and well characterized negative and positive reference samples, and check to match the values reported below in the section O'. Regular

calibration of the volumes delivered by, and maintenance (decontamination and cleaning of needles) of the washer has to be carried out according to the instructions of the manufacturer.

- Incubation times have a tolerance of  $\pm 5\%$ .
- The ELISA reader has to be equipped with a reading filter of 450nm and with a second filter (620-630nm, strongly recommended) for blanking purposes. Blanking is carried out on the well identified in the section "Assay Procedure". The optical system of the reader has to be calibrated regularly to ensure the correct optical density is measured. It should be regularly maintained according to the manufacturer's instructions.
- When using an ELISA automated work station, all critical steps (dispensation, incubation, washing, reading, data handling) have to be carefully set, calibrated, controlled and regularly serviced in order to match the values reported in the section O "Internal Quality Control". The assay protocol has to be installed in the operating system of the unit and validated as for the washer and the reader. In addition, the liquid handling part of the station (dispensation and washing) has to be validated and correctly set. Particular attention must be paid to avoid carry over by the needles used for dispensing and for washing. This must be studied and controlled to minimize the possibility of contamination of adjacent wells. The use of ELISA automated work stations is recommended when the number of samples to be tested exceed 20-30 units per run.
- Dia.Pro's customer service offers support to the user in the setting and checking of instruments used in combination with the kit, in order to assure compliance with the requirements described. Support is also provided for the installation of new instruments to be used with the kit.

#### L. PRE ASSAY CONTROLS AND OPERATIONS

- Check the expiration date of the kit printed on the external label (primary container). Do not use the device if expired.
- Check that the liquid components are not contaminated by visible particles or aggregates. Check that the Chromogen/Substrate is colourless or pale blue by aspirating a small volume of it with a sterile plastic pipette. Check that no breakage occurred in transportation and no spillage of liquid is present inside the box (primary container). Check that the aluminium pouch, containing the microplate, is not punctured or damaged.
- Dilute all the content of the 20x concentrated Wash Solution as described above.
- Dissolve the Calibrator as described above and gently mix.
- Allow all the other components to reach room temperature (about 1 hr) and then mix gently on vortex all liquid reagents.
- Set the ELISA incubator at  $+37^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$  and prepare the ELISA washer by priming with the diluted washing solution, according to the manufacturers instructions. Set the right number of washing cycles as found in the validation of the instrument for its use with the kit.
- Check that the ELISA reader is turned on or ensure it will be turned on at least 20 minutes before reading.
- If using an automated work station, turn on, check settings and be sure to use the right assay protocol.
- Check that the micropipettes are set to the required volume.
- Check that all the other equipment is available and ready to use.
- In case of problems, do not proceed further with the test and advise the supervisor.

#### M. ASSAY PROCEDURE

The assay has to be carried out according to what reported below, taking care to maintain the same incubation time for all the samples in testing.

- Dilute samples 1:101 by dispensing first 10  $\mu\text{l}$  sample and then 1 ml Sample Diluent into a dilution tube; mix gently on vortex.
- Place the required number of Microwells in the microwell holder. Leave the 1<sup>st</sup> well empty for the operation of blanking.
- Dispense 100  $\mu\text{l}$  Negative Control in triplicate, 100  $\mu\text{l}$  Positive Control in single and 100  $\mu\text{l}$  Calibrator in duplicate in proper wells. Do not dilute controls and the calibrator as they are ready to use!
- Dispense 100  $\mu\text{l}$  diluted samples in the proper sample wells and then check that all the samples wells are blue coloured and that controls and calibrator have been dispensed.
- Incubate the microplate for **60 min at  $+37^{\circ}\text{C}$** .

**Important note:** Strips have to be sealed with the adhesive sealing foil, supplied, only when the test is carried out manually. Do not cover strips when using ELISA automatic instruments.

- About 5-10 minutes before use, prepare the HAV Antigen/Antibody immunocomplex as described previously.
- Wash the microplate with an automatic washer as reported previously (section I.3).
- Pipette 100  $\mu\text{l}$  HAV Antigen/Antibody complex into each well, except the 1<sup>st</sup> blanking well, and cover with the sealer. Check that all wells are red coloured, except A1.

**Important note:** Be careful not to touch the plastic inner surface of the well with the tip filled with the Enzyme Conjugate. Contamination might occur.

- Incubate the microplate for **60 min at  $+37^{\circ}\text{C}$** .
- Wash microwells as in step 7.
- Pipette 100  $\mu\text{l}$  Chromogen/Substrate mixture into each well, the blank well included. Then incubate the microplate at **room temperature ( $18-24^{\circ}\text{C}$ ) for 20 minutes**.

**Important note:** Do not expose to strong direct illumination. High background might be generated.

- Pipette 100  $\mu\text{l}$  Sulphuric Acid into all the wells to stop the enzymatic reaction using the same pipetting sequence as in step 10. Addition of acid will turn the positive control and positive samples from blue to yellow.
- Measure the colour intensity of the solution in each well, as described in section I.5, at 450nm filter (reading) and at 620-630nm (background subtraction, strongly recommended), blanking the instrument on A1.

#### Important notes:

- If the second filter is not available ensure that no finger prints are present on the bottom of the microwell before reading at 450nm. Finger prints could generate false positive results on reading.
- Reading has to be carried out just after the addition of the Stop Solution and anyway not any longer than 20 minutes

after its addition. Some self oxidation of the chromogen can occur leading to high background.

## N. ASSAY SCHEME

Controls&Calibrator (*) samples diluted 1:101	100 ul
<b>1<sup>st</sup> incubation</b>	<b>60 min</b>
Temperature	+37°C
Washing	4-5 cycles
HAV & Tracer	100 ul
<b>2<sup>nd</sup> incubation</b>	<b>60 min</b>
Temperature	+37°C
Washing	4-5 cycles
TMB/H <sub>2</sub> O <sub>2</sub> mix	100 ul
<b>3<sup>rd</sup> incubation</b>	<b>20 min</b>
Temperature	r.t.
Sulphuric Acid	100 ul
Reading OD	450nm

### (\*) Important Notes:

- The Calibrator (CAL) does not affect the Cut Off calculation, therefore it does not affect the test's results calculation.
- The Calibrator (CAL) used only if a laboratory internal quality control is required by the Management.

An example of dispensation scheme is reported in the table below:

Microplate												
	1	2	3	4	5	6	7	8	9	10	11	12
A	BLK	S2										
B	NC	S3										
C	NC	S4										
D	NC	S5										
E	CAL(*)	S6										
F	CAL(*)	S7										
G	PC	S8										
H	S1	S9										

Legenda: BLK = Blank NC = Negative Control  
CAL(\*) = Calibrator - Not mandatory PC = Positive Control S = Sample

## O. INTERNAL QUALITY CONTROL

A check is performed on the controls any time the kit is used in order to verify whether the expected OD450nm or S/Co values have been matched in the analysis.

Ensure that the following parameters are met:

Parameter	Requirements
Blank well	< 0.100 OD450nm value
Negative Control mean value (NC)	< 0.150 OD450nm value after blanking coefficient of variation < 30%
Positive Control	> 0.500 OD450nm

If the results of the test match the requirements stated above, proceed to the next section.

If they do not, do not proceed any further and perform the following checks:

Problem	Check
<b>Blank well</b> > 0.100 OD450nm	1. that the Chromogen/Substrate solution has not become contaminated during the assay
<b>Negative Control (NC)</b> > 0.150 OD450nm after blanking coefficient of variation > 30%	1. that the washing procedure and the washer settings are as validated in the pre qualification study; 2. that the proper washing solution has been used and the washer has been primed with it before use; 3. that no mistake has been done in the assay procedure (dispensation of positive control)

	instead of negative control; 4. that no contamination of the negative control or of the wells where the control was dispensed has occurred due to positive samples, to spills or to the enzyme conjugate; 5. that micropipettes have not become contaminated with positive samples or with the enzyme conjugate 6. that the washer needles are not blocked or partially obstructed.
<b>Positive Control</b> < 0.500 OD450nm	1. that the procedure has been correctly performed; 2. that no mistake has occurred during the distribution of the control (dispensation of negative control instead of positive control). 3. that the washing procedure and the washer settings are as validated in the pre qualification study; 4. that no external contamination of the positive control has occurred.

If any of the above problems have occurred, report the problem to the supervisor for further actions.

If Calibrator has used, verify the following data:

Parameter	Requirements
Calibrator	S/Co > 1

If the results of the test doesn't match the requirements stated above, operate as follows:

Problem	Check
<b>Calibrator</b> S/Co < 1	1. that the procedure has been correctly performed; 2. that no mistake has occurred during its distribution (e.g.: dispensation of negative control instead) 3. that the washing procedure and the washer settings are as validated in the pre qualification study; 4. that no external contamination of the calibrator has occurred.

Anyway, if all other parameters (Blank, Negative Control, Positive Control), match the established requirements, the test may be considered valid.

## P. CALCULATION OF THE CUT-OFF

The test results are calculated by means of the mean OD450nm value of the Negative Control (NC) and a mathematical calculation, in order to define the following cut-off formulation:

$$\text{Cut-Off} = \text{NC} + 0.250$$

The value found for the test is used for the interpretation of results as described in the next paragraph.

**Important note:** When the calculation of results is performed by the operating system of an ELISA automated work station, ensure that the proper formulation is used to calculate the cut-off value and generate the correct interpretation of results.

## Q. INTERPRETATION OF RESULTS

Test results are interpreted as a ratio of the sample OD450nm and the Cut-Off value (or S/Co) according to the following table:

S/Co	Interpretation
< 0.8	Negative
0.8 – 1.2	Equivocal
> 1.2	Positive

A negative result indicates that the patient is not undergoing an acute infection by HAV.

Any patient showing an equivocal result, should be re-tested by examining a second sample after 1-2 weeks from first testing. A positive result is indicative of an HAV infection event and therefore the patient should be treated accordingly.

An example of calculation is reported below:

*The following data must not be used instead of real figures obtained by the user.*

Negative Control: 0.050 – 0.060 – 0.070 OD450nm  
Mean Value: 0.060 OD450nm  
Lower than 0.150 – Accepted  
Positive Control: 2.189 OD450nm  
Higher than 0.500 – Accepted

Cut-Off = 0.060+0.250 = 0.310

Calibrator: 0.550 - 0.530 OD450nm  
Mean value: 0.540 OD450nm S/Co = 1.7  
S/Co higher than 1.0 – Accepted

Sample 1: 0.070 OD450nm  
Sample 2: 1.690 OD450nm  
Sample 1 S/Co < 0.8 = negative  
Sample 2 S/Co > 1.2 = positive

#### Important notes:

1. Interpretation of results should be done under the supervision of the laboratory supervisor to reduce the risk of judgment errors and misinterpretations.
2. Any positive result should be confirmed by an alternative method (confirmation test) before a diagnosis of viral hepatitis is confirmed.
3. When test results are transmitted from the laboratory to another facility, attention must be paid to avoid erroneous data transfer.
4. Diagnosis of viral hepatitis infection has to be taken by and released to the patient by a suitably qualified medical doctor.

## R. PERFORMANCE CHARACTERISTICS

### 1. Limit of detection

In absence of a defined international standard for HAV IgM, the limit of detection of the assay has been calculated by means of the following preparations:

1. Accurun # 121 supplied by Boston Biomedica Inc. – USA
2. Accurun # 51 supplied by Boston Biomedica Inc., USA

These preparation were prepared according to the manufacturer's instructions, diluted in Sample Diluent (1:100) and then further diluted in Sample Diluent to generate a limiting curve (accurun # 121).

Results of Quality Control are given in the following table:

Preparation	Dilutions	S/Co
Accurun # 121	1:100	5.4
	1:200	4.1
	1:400	2.8
	1:800	1.9
	1:1600	1.0
Accurun # 51	1:100	4.2

### 2. Diagnostic Sensitivity:

The diagnostic sensitivity has been tested on panels of samples classified positive by a US FDA approved kit. Positive samples were collected from patients carrying HAV acute infection, confirmed by clinical symptoms and analysis.

An overall value of 100% has been found in the study conducted on a total number of more than 100 samples. A seroconversion panel has also been studied.

Results obtained by examining a preparation supplied by Boston Biomedica Inc., USA, are reported below.

### Seroconversion Panel : PHT 902

Sample	OD450nm	S/Co	DiaSorin Refer.	
			S/Co	Score
CTRL (-)	0,048	0,2		
CTRL (+)	1,736	5,8		
PHT902				
1	0,037	0,1	0,3	neg
2	0,042	0,1	0,3	neg
3	1,956	6,6	6,8	pos
4	1,988	6,7	6,7	pos
5	0,669	2,2	1,5	pos

### 3. Diagnostic Specificity:

The diagnostic specificity has been determined on panels of specimens, negative with the reference kit, derived from normal individuals and blood donors of European origin.

Both plasma, derived with different standard techniques of preparation (citrate, EDTA and heparin), and sera have been used to determine the specificity. No false reactivity due to the method of specimen preparation has been observed.

Frozen specimens have also been tested to check whether this interferes with the performance of the test. No interference was observed on clean and particle free samples.

Samples derived from patients with different viral (HCV, HDV, HBV, HEV) and non viral pathologies of the liver that may interfere with the test were examined.

No cross reaction were observed.

The Performance Evaluation study conducted in a qualified external reference centre on more than 500 samples has provided a value > 98%.

### 3. Precision:

It has been calculated on two samples, one negative and one low positive, examined in 16 replicates in three separate runs. Results are reported as follows:

#### Test # 1

Sample	Negative	Low Pos.
OD450nm	0.058	0.719
Std. Deviation	0.008	0.052
CV %	14.3	7.2

#### Test # 2

Sample	Negative	Low Pos.
OD450nm	0.048	0.709
Std. Deviation	0.007	0.063
CV %	13.9	8.9

#### Test # 3

Sample	Negative	Low Pos.
OD450nm	0.050	0.713
Std. Deviation	0.007	0.055
CV %	13.4	7.7

All the IVD Products manufactured by the company are under the control of a certified Quality Management System in compliance with ISO 13485 rule. Each lot is submitted to a quality control and released into the market only if conforming with the EC technical specifications and acceptance criteria.

Produced by  
Dia.Pro Diagnostic Bioprobes Srl  
Via G. Carducci n°27 – Sesto San Giovanni (MI) – Italy



#### S. LIMITATIONS

False positivity has been assessed as less than 2% of the normal population, mostly due to high titers of RF.

Frozen samples containing fibrin particles or aggregates may generate false positive results.

Bacterial contamination or heat inactivation of the specimen may affect the absorbance values of the samples with consequent alteration of the level of the analyte.

This test is suitable only for testing single samples and not pooled ones.

Diagnosis of an infectious disease should not be established on the basis of a single test result. The patient's clinical history, symptomatology, as well as other diagnostic data should be considered.

#### REFERENCES

1. Dienstag J.L.. "Hepatitis A Virus : identification, characterization and epidemiologic investigations". Progress in liver disease VI, Popper E., Schaffner F. (eds), pp 343-370, New York, Gruner and Stratton, 1979.
2. Duermeier W., Van der Veen J., Koster B. "ELISA in Hepatitis A". Lancet. I.: 823-824, 1978
3. Parry J.V., (1981) "Hepatitis A infection: guidelines for the development of satisfactory assays for laboratory diagnosis". The Institute of Medical Laboratory Sciences, 38, 303-311.
4. Lindberg J., Frosner G., Hansson B.G. et al. "Serologic markers of hepatitis A and B in chronic active hepatitis". Scandinavian Journal of Gastroenterology, 13:525-527, 1978.
5. Barbara J.A., Howell D.R., Briggs M., Parry J.V.. "Post transfusion hepatitis A". Lancet (1982), 1-738.
6. Zchoval R., Dienstag J.L., Purcell R.H. "Tests for hepatitis A virus antigen and antibody" in "Hepatitis A". Gerety R.J. (Ed), pp 33-46, Orlando, Academic Press, Inc. 1984