T. gondii IgG Test System

IVD

REF 8Z8651G/SM8Z8651G Σ96

8Z8651GB Σ480

Rx Only

INTENDED USE

The ZEUS ELISA *Toxoplasma gondii* IgG Test System is designed for the qualitative and/or quantitative determination of IgG antibodies to *Toxoplasma gondii* in human serum. The assay is intended to be used to evaluate serologic evidence of previous infection with *T. gondii*, and is for *In Vitro* diagnostic use. This product is not FDA cleared (approved) for use in screening blood or plasma donors.

SIGNIFICANCE AND BACKGROUND

Toxoplamsa gondii is an obligate intracellular protozoan parasite with a worldwide distribution (1, 2). Although cats are the definitive host, the organism can infect almost all mammals and birds. Serological data indicates that chronic infection with the organism affects approximately 30% of the population of most industrialized nations, although the prevalence varies among different populations (3).

Toxoplasma exists in three forms: trophozoite, cysts, and oocysts (1, 2). The trophozoite is the invasive form present during the acute phase of infection. Formation of tissue cysts occur after multiplication of the organism within the host cell cytoplasm and may contain up to several thousand organisms. Oocysts develop in the intestinal epithelial cells of cats and are not found in other hosts. Oocysts develop only in the intestinal epithelial cells of cats, and once excreted in the feces, mature within a few days.

Infection occurs in man, and other animals, after ingestion of cysts in raw or undercooked meat or mature oocysts in material contaminated with cat feces. Ingestion liberates the parasites from the cysts or oocysts because of digestive enzymes. Once liberated the parasites invade the intestinal mucosa, multiply locally, and are then transported to other organs to form tissue cysts that persist for the life of the host. Research shows that cysts are predominant in the brain, heart, and skeletal muscle.

Infection with *T. gondii* is asymptomatic in the majority (80 - 90%) of cases (4). The most common clinical manifestation of acute toxoplasmosis in the adult is asymptomatic lymphadenopathy involving single or multiple nodes. Symptoms of lymphadenopathy include fever, malaise, and atypical lymphocytosis (symptoms that mimic infectious mononucleosis). Very rarely will more serious complications, such as encephalitis, myocarditis or pneumonitis be seen in the normal host (1).

Although the normal host usually suffers no ill effects from infection with *T. gondii*, infection in an immunocompromised host is often fatal (5). Immunocompromised patients may develop severe disseminated toxoplasmosis or toxoplasmic encephalitis, or both. Toxoplasma is a common opportunistic infection of the central nervous system in patients with acquired immunodeficiency syndrome (AIDS) (6). Serologic evidence indicates that toxoplasmic encephalitis in AIDS patients results from reactivation of latent infections. Approximately 30% of AIDS patients who are toxoplasma antibody positive will develop toxoplasmic encephalitis (7).

Infection of seronegative women with *T. gondii* during pregnancy often results in transmission of the organism across the placenta to the fetus (1, 8). Trimester of acquisition of the organism determines the severity of infection in the fetus. Infection during the first trimester may lead to spontaneous abortion, stillbirth, or overt disease in the neonate. Infection acquired later during pregnancy is usually asymptomatic in the neonate, and may not be recognized (8).

Approximately 75% of congenitally infected newborns are symptomatic. However, nearly all children born with subclinical toxoplasmosis will develop adverse ocular or neurologic sequelae later in life. Approximately 80-85% of children develop chorioretinitis and some may experience blindness or mental retardation. Varieties of serologic tests for antibodies to T. gondii may aid in the diagnosis of acute infection and assess previous exposure to the organism. The more widely used tests include the Sabin-Feldman dye test, direct agglutination, indirect hemagglutination, latex agglutination, indirect immunofluorescence, and enzyme-linked immunosorbent assays (ELISA) (9).

PRINCIPLE OF THE ASSAY

The ZEUS ELISA *T. gondii* IgG Test System is designed to detect IgG class antibodies to *T. gondii* in human sera. Creation of the sensitized wells of the plastic microwell strips occurred using passive adsorption with with Toxoplasma antigen. The test procedure involves three incubation steps:

1. Test sera (properly diluted) are incubated in antigen coated microwells. Any antigen specific antibody in the sample will bind to the immobilized antigen. The plate is washed to remove unbound antibody and other serum components.
2. Peroxidase Conjugated goat anti-human IgG is added to the wells and the plate is incubated. The Conjugate will react with IgG antibody immobilized on the solid phase in step 1. The wells are washed to remove unreacted Conjugate.
3. The microwells containing immobilized peroxidase Conjugate are incubated with peroxidase Substrate Solution. Hydrolysis of the Substrate by peroxidase produces a color change. After a period of time the reaction is stopped and the color intensity of the solution is measured photometrically. The color intensity of the solution depends upon the antibody concentration in the original test sample.

TEST SYSTEM COMPONENTS

Materials Provided:

Each Test System contains the following components in sufficient quantities to perform the number of tests indicated on the packaging label. **NOTE: The following components contain Sodium Azide as a preservative at a concentration of <0.1% (w/v): Controls, Calibrator, and SAVe Diluent®.**

Component	Σ96	Σ480	Description
PLATE	1	5	Plate: 96 wells configured in twelve, 1x8-well, strips coated with inactivated *T. gondii* antigen. The strips are packaged in a strip holder and sealed in an envelope with desiccant.
CONJ	1	5	Conjugate: Conjugated (horseradish peroxidase) goat anti-human IgG (Fc chain specific) in 15mL, white-capped bottle(s). Ready to use.
CONTROL +	1	2	Positive Control (Human Serum): 0.35mL, red-capped vial(s).
CAL	1	4	Calibrator (Human Serum): 0.5mL, blue-capped vial(s).
CONTROL -	1	2	Negative Control (Human Serum): 0.35mL, green-capped vial(s).
DIL SPE	1	4	SAVe Diluent®: 30mL, green-capped, bottle(s) containing Tween-20, bovine serum albumin and phosphate-buffered-saline. Ready to use. **NOTE: The SAVe Diluent® will change color when combined with serum.**
SOLN TMB	1	5	TMB: 15mL, amber-capped, amber bottle(s) containing 3, 3', 5, 5' - tetramethylbenzidine (TMB). Ready to use.
SOLN STOP	1	3	Stop Solution: 15mL, red-capped, bottle(s) containing 1M H_2SO_4, 0.7M HCl. Ready to use.
WASHBUF 10X	1	5	Wash Buffer Concentrate (10X): Dilute 1 part concentrate + 9 parts deionized or distilled water. 100mL, clear-capped, bottle(s) containing a 10X concentrated phosphate-buffered-saline and Tween-20 solution (blue solution). **NOTE: 1X solution will have a pH of 7.2 ± 0.2.**

NOTES:

1. **The following components are not Test System Lot Number dependent and may be used interchangeably with the ZEUS ELISA Test Systems: TMB, Stop Solution, and Wash Buffer. SAVe Diluent® may be used interchangeably with any ZEUS ELISA Test System utilizing Product No. 005CC.**
2. **Test System also contains a Component Label containing lot specific information inside the Test System box.**

PRECAUTIONS

1. For *In Vitro* diagnostic use.
2. Follow normal precautions exercised in handling laboratory reagents. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing, gloves, and eye/face protection. Do not breathe vapor. Dispose of waste observing all local, state, and federal laws.
3. The wells of the ELISA plate do not contain viable organisms. However, consider the strips **potentially biohazardous materials** and handle accordingly.
4. The Controls are **potentially biohazardous materials**. Source materials from which these products were derived were found negative for HIV-1 antigen, HBsAg and for antibodies against HCV and HIV by approved test methods. However, since no test method can offer complete assurance that infectious agents are absent, handle these products at the Biosafety Level 2 as recommended for any potentially infectious human serum or blood specimen in the Centers for Disease Control/National Institutes of Health manual "Biosafety in Microbiological and Biomedical Laboratories": Current Edition; and OSHA's Standard for Bloodborne Pathogens (13).
5. Adherence to the specified time and temperature of incubations is essential for accurate results. **All reagents must be allowed to reach room temperature (20 - 25°C) before starting the assay**. Return unused reagents to refrigerated temperature immediately after use.
6. Improper washing could cause false positive or false negative results. Be sure to minimize the amount of any residual wash solution; (e.g., by blotting or aspiration) before adding Conjugate or Substrate. Do not allow the wells to dry out between incubations.
7. The SAVe Diluent®, Controls, and Calibrator contain Sodium Azide at a concentration of <0.1% (w/v). Sodium Azide has been reported to form lead or copper azides in laboratory plumbing which may cause explosions upon hammering. To prevent, rinse sink thoroughly with water after disposing of solution containing Sodium Azide.
8. The Stop Solution is TOXIC if inhaled, has contact with skin or if swallowed. It can cause burns. In case of accident or ill feelings, seek medical advice immediately.
9. The TMB Solution is HARMFUL. It is irritating to eyes, respiratory system and skin.
10. The Wash Buffer concentrate is an IRRITANT. It is irritating to eyes, respiratory system and skin.
11. Wipe the bottom of the plate free of residual liquid and/or fingerprints that can alter optical density (OD) readings.
12. Dilution or adulteration of these reagents may generate erroneous results.
13. Do not use reagents from other sources or manufacturers.
14. TMB Solution should be colorless, very pale yellow, very pale green, or very pale blue when used. Contamination of the TMB with Conjugate or other oxidants will cause the solution to change color prematurely. Do not use the TMB if it is noticeably blue in color.
15. Never pipette by mouth. Avoid contact of reagents and patient specimens with skin and mucous membranes.
16. Avoid microbial contamination of reagents. Incorrect results may occur.
17. Cross contamination of reagents and/or samples could cause erroneous results.
18. Reusable glassware must be washed and thoroughly rinsed free of all detergents.
19. Avoid splashing or generation of aerosols.
20. Do not expose reagents to strong light during storage or incubation.
21. Allowing the microwell strips and holder to equilibrate to room temperature prior to opening the protective envelope will protect the wells from condensation.
22. Collect the wash solution in a disposal basin. Treat the waste solution with disinfectant (i.e.: 10% household bleach - 0.5% Sodium Hypochlorite). Avoid exposure of reagents to bleach fumes.
23. Caution: Neutralize any liquid waste at an acidic pH before adding to a bleach solution.
24. Do not use ELISA plate if the indicator strip on the desiccant pouch has turned from blue to pink.
25. Do not allow the Conjugate to come in contact with containers or instruments that may have previously contained a solution utilizing Sodium Azide as a preservative. Residual amounts of Sodium Azide may destroy the Conjugate's enzymatic activity.
26. Do not expose any of the reactive reagents to bleach-containing solutions or to any strong odors from bleach-containing solutions. Trace amounts of bleach (sodium hypochlorite) may destroy the biological activity of many of the reactive reagents within this Test System.

MATERIALS REQUIRED BUT NOT PROVIDED

1. ELISA microwell reader capable of reading at a wavelength of 450nm. **NOTE: Use of a single (450nm), or dual (450/620 - 650nm), wavelength reader is acceptable. Dual wavelength is preferred, as the additional reference filter has been determined to reduce potential interference from anomalies that may absorb light.**
2. Pipettes capable of accurately delivering 10 - 200µL.
3. Multichannel pipette capable of accurately delivering 50 - 200µL.
4. Reagent reservoirs for multichannel pipettes.
5. Wash bottle or microwell washing system.
6. Distilled or deionized water.
7. One liter graduated cylinder.
8. Serological pipettes.
9. Disposable pipette tips.
10. Paper towels.
11. Laboratory timer to monitor incubation steps.
12. Disposal basin and disinfectant (i.e.: 10% household bleach - 0.5% Sodium Hypochlorite).

STORAGE CONDITIONS

2°C – 8°C	Coated Microwell Strips: Immediately reseal extra strips with desiccant and return to proper storage. After opening - strips are stable for 60 days, as long as the indicator strips on the desiccant pouch remains blue.
	Conjugate – DO NOT FREEZE.
	Unopened Test System, Calibrator, Positive Control, Negative Control, TMB, SAVe Diluent®
2°C – 25°C	Stop Solution: 2 - 25°C Wash Buffer (1X): 20 - 25°C for up to 7 days, 2 - 8°C for 30 days. Wash Buffer (10X): 2 - 25°C

SPECIMEN COLLECTION

1. ZEUS Scientific recommends that the user carry out specimen collection in accordance with CLSI document M29: Protection of Laboratory Workers from Infectious Disease (Current Edition).
2. No known test method can offer complete assurance that human blood samples will not transmit infection. Therefore, consider all blood derivatives potentially infectious.

3. Use only freshly drawn and properly refrigerated sera obtained by approved aseptic venipuncture procedures in this assay (10). Do not use if there are any added anticoagulants or preservatives. Avoid using hemolyzed, lipemic, or bacterially contaminated sera.
4. Store sample at room temperature for no longer than 8 hours. If testing is not performed within 8 hours, sera may be stored between 2 - 8°C, for no longer than 48 hours. If a delay in testing is anticipated, store test sera at –20°C or lower. Avoid multiple freeze/thaw cycles which may cause loss of antibody activity and give erroneous results. It is the responsibility of the individual laboratory to use all available references and/or its own studies to determine stability criteria for its laboratory (14).

ASSAY PROCEDURE

1. Remove the individual components from storage and allow them to warm to room temperature (20 - 25°C).
2. Determine the number of microwells needed. Allow for six Control/Calibrator determinations (one Reagent Blank, one Negative Control, three Calibrators and one Positive Control) per run. Run a Reagent Blank on each assay. Check software and reader requirements for the correct Controls/Calibrator configurations. Return unused strips to the resealable pouch with desiccant, seal, and return to storage between 2 - 8°C.

EXAMPLE PLATE SET-UP		
	1	2
A	Blank	Patient 3
B	Negative Control	Patient 4
C	Calibrator	Etc.
D	Calibrator	
E	Calibrator	
F	Positive Control	
G	Patient 1	
H	Patient 2	

3. Prepare a 1:21 dilution (e.g.: 10µL of serum + 200µL of SAVe Diluent®) of the Negative Control, Calibrator, Positive Control, and each patient serum. **NOTE: The SAVe Diluent® will undergo a color change confirming that the specimen has been combined with the diluent.**
4. To individual wells, add 100µL of each diluted Control, Calibrator and patient specimen. Ensure that the samples are properly mixed. Use a different pipette tip for each sample.
5. Add 100µL of SAVe Diluent® to well A1 as a Reagent Blank. Check software and reader requirements for the correct Reagent Blank well configuration.
6. Incubate the plate at room temperature (20 - 25°C) for 25 ± 5 minutes.
7. Wash the microwell strips 5 times.
   a. **Manual Wash Procedure**:
      1. Vigorously shake out the liquid from the wells.
      2. Fill each microwell with Wash Buffer. Make sure no air bubbles are trapped in the wells.
      3. Repeat steps 1. and 2. for a total of 5 washes.
      4. Shake out the wash solution from all the wells. Invert the plate over a paper towel and tap firmly to remove any residual wash solution from the wells. Visually inspect the plate to ensure that no residual wash solution remains. Collect wash solution in a disposable basin and treat with disinfectant at the end of the day's run.
   b. **Automated Wash Procedure**:
      If using an automated microwell wash system, set the dispensing volume to 300 - 350µL/well. Set the wash cycle for 5 washes with no delay between washes. If necessary, the microwell plate may be removed from the washer, inverted over a paper towel and tapped firmly to remove any residual wash solution from the microwells.
8. Add 100µL of the Conjugate to each well, including the Reagent Blank well, at the same rate and in the same order as the specimens.
9. Incubate the plate at room temperature (20 - 25°C) for 25 ± 5 minutes.
10. Wash the microwells by following the procedure as described in step 7.
11. Add 100µL of TMB to each well, including the Reagent Blank well, at the same rate and in the same order as the specimens.
12. Incubate the plate at room temperature (20 - 25°C) for 10 - 15 minutes.
13. Stop the reaction by adding 50µL of Stop Solution to each well, including the Reagent Blank well, at the same rate and in the same order as the TMB. Positive samples will turn from blue to yellow. After adding the Stop Solution, tap the plate several times to ensure that the samples are thoroughly mixed.
14. Set the microwell reader to read at a wavelength of 450nm and measure the optical density (OD) of each well against the Reagent Blank. Read the plate within 30 minutes of the addition of the Stop Solution.

ABBREVIATED TEST PROCEDURE

1. Dilute Serum 1:21.
2. Add diluted sample to microwell - 100µL/well.
3. → *Incubate 25 ± 5 minutes.*
4. Wash.
5. Add Conjugate - 100µL/well.
6. → *Incubate 25 ± 5 minutes.*
7. Wash.
8. Add TMB - 100µL/well.
9. → *Incubate 10 - 15 minutes.*
10. Add Stop Solution - 50µL/well - Mix.
11. READ within 30 minutes.

QUALITY CONTROL

1. Each time the assay is performed, the Calibrator must be run in triplicate. A Reagent Blank, Negative Control, and Positive Control must also be included.
2. Calculate the mean of the three Calibrator wells. If any of the three values differ by more than 15% from the mean, discard that value and calculate the mean using the remaining two wells.
3. The mean OD value for the Calibrator, Positive Control, and Negative Control should fall within the following ranges:

	OD Range
Negative Control	≤0.250
Calibrator	≥0.300
Positive Control	≥0.500

   a. The OD of the Negative Control divided by the mean OD of the Calibrator should be ≤0.9.
   b. The OD of the Positive Control divided by the mean OD of the Calibrator should be ≥1.25.
   c. If the above conditions are not met the test should be considered invalid and should be repeated.
4. The Positive Control and Negative Control are intended to monitor for substantial reagent failure, but will not ensure precision at the assay Cutoff.
5. Additional Controls may be tested according to guidelines or requirements of local, state, and/or federal regulations or accrediting organizations.
6. Refer to CLSI document C24: Statistical Quality Control for Quantitative Measurement Procedures for guidance on appropriate QC practices.

INTERPRETATION OF RESULTS

1. **Calculations:**
   a. *Correction Factor:* The manufacturer determined a Cutoff OD Value for positive samples and correlated it to the Calibrator. The Correction Factor (CF) allows for the determination of the Cutoff Value for positive samples. It will also correct for slight day-to-day variations in test results. The Correction Factor is determined for each lot of components and is printed on the Component Label located in the Test System box.
   b. *Cutoff OD Value:* To obtain the Cutoff OD Value, multiply the CF by the mean OD of the Calibrator determined above.
   (CF x Mean OD of Calibrator = Cutoff OD Value)
   c. *Index Values/OD Ratios:* Calculate the Index Value/OD Ratio for each specimen by dividing its OD Value by the Cutoff OD from step b.

Example:	Mean OD of Calibrator	=	0.793
	Correction Factor (CF)	=	0.25
	Cutoff OD	=	0.793 x 0.25 = 0.198
	Unknown Specimen OD	=	0.432
	Specimen Index Value/OD Ratio	=	0.432/0.198 = 2.18

2. **Interpretations:** Index Values/OD Ratios are interpreted as follows.

	Index Value/OD Ratio
Negative Specimens	≤0.90
Equivocal Specimens	0.91 to 1.09
Positive Specimens	≥1.10

   a. An OD ratio ≤0.90 indicates no significant amount of IgG antibodies to *T. gondii* detected. A negative result indicates no current or previous infection with *T. gondii*. Presume that such individuals are susceptible to primary infection. However, specimens taken too early during a primary infection may not have detectable levels of IgG antibody. When health care professionals suspect a primary infection, take another specimen in eight to 14 days, and test concurrently in the same assay, with the original specimen, to look for seroconversion.
   b. An OD ratio ≥1.10 indicates that IgG antibodies specific to *T. gondii* were detected. A positive value indicates a current or previous infection with *T. gondii*. Presume that such individuals are at risk of transmitting *T. gondii* infection but are not necessarily currently contagious.
   c. Specimens with OD ratio values in the equivocal range (0.91 - 1.09) should be retested in duplicate. Report any two of the three results which agree. Evaluate repeatedly equivocal using an alternate serological method and/or re-evaluate by drawing another sample one to three weeks later.
   d. When testing to evaluate paired (acute and convalescent) sera, place both samples in the same assay. If the acute specimen is negative and the convalescent specimen is positive, seroconversion has taken place and that indicates a primary *T. gondii* infection.
3. **Conversion of OD Ratio to IU/mL:**As an option, OD ratios may be converted to IU/mL by multiplying the OD ratio by 20. IU/mL values may then be interpreted as follows:

	IU/mL
Negative Specimens	≤ 18
Equivocal Specimens	18.1 to 21.9
Positive Specimens	≥ 22

   a. Interpretation criteria for positive, negative, and equivocal specimens are as stated in sections A, B, C, and D above.
   b. The assay is linear and correlates well with the WHO Standard between 0 and 35 IU/mL. Specimens producing a result greater than 35 IU/mL should be reported as "positive", or ">35 IU/mL". If greater accuracy is required, the specimen must be diluted and retested. The final result may be found by multiplying the resulting IU/mL value by the dilution factor.

Example: Initial Result: Ratio = 2.86 = 57.3 IU/mL
Dilute 1:4 in SAVe® Diluent then, 1:21 as the procedure indicates.
Retest Result:Ratio = 1.46 = 29.3 IU/mL x 4 = 117.3 IU/mL.

LIMITATIONS OF THE ASSAY

1. Do not use the antibody titer of a single serum specimen to determine recent infection. Collect and test paired samples (acute and convalescent) concurrently to demonstrate seroconversion.
2. Interpret test results in conjunction with the clinical evaluation and the results of other diagnostic procedures.
3. Samples collected too early in the course of an infection may not have detectable levels of IgG. In such cases, collect a second sample after two to seven weeks and test concurrently with the original specimen to look for seroconversion, or perform an IgM specific assay, such as the ZEUS ELISA *T. gondii* IgM Test System.
4. Interpret a positive test for *T. gondii* IgG in neonates with caution since passively acquired maternal antibody can persist for up to six months. However, a negative test for IgG antibody in the neonate may help exclude congenital infection (12).
5. Consider results as either positive or negative for the presence of Toxoplasma IgG antibodies, as the results of this test are qualitative.

EXPECTED RESULTS

Depending on age and geographic location, 20 - 70% of the adult population in the United States have detectable antibodies to *T. gondii* (2).

PERFORMANCE CHARACTERISTICS

1. **Comparative Studies:**
   A study was conducted to compare the ZEUS ELISA *T. gondii* IgG Test System to another ELISA product for detection of IgG antibodies to *T. gondii*. Tests evaluated a total of 201 serum specimens on the two procedures. These results are summarized below:

		Reference ELISA Toxoplasma IgG	
		Positive	**Negative**
ZEUS ELISA *T. gondii* IgG Test System	**Positive**	45	6
	Negative	3	147
Sensitivity = 93.8% (45/48)		Specificity = 96.1% (147/153)	

   A **WHO Standard** study was conducted in-house to evaluate the recovery of the WHO Standard using the ZEUS ELISA *T. gondii* IgG Test System. The results of this investigation are shown below:

Standard	Ratio	IU/mL	INTERPRETATION
500 IU/mL	3.34	416*	Positive
250 IU/mL	2.85	208*	Positive
125 IU/mL	2.44	112*	Positive
62 IU/Ml	1.78	52*	Positive
31 IU/mL	1.30	26	Positive
16 IU/mL	0.92	18.4	Equivocal
8 IU/mL	0.58	11.6	Negative
4 IU/mL	0.33	6.6	Negative
2 IU/mL	0.13	2.6	Negative

* Specimens were initially >35 IU/mL. Required additional dilutions to accurately determine the unit value.

2. **Precision and Reproducibility:**

Four specimens, with OD ratio values in the positive, calibrator, and negative ranges, were tested to determine intra-assay and inter-assay variation. On each of three days, a technician tested each specimen once a day, eight times each, resulting in 24 test points. A responsible party then calculated the mean OD ratio and coefficient of variation from the resulting data. Depiction of the results of the experiment is below.

	Inter-Assay (n=8)						Intra-Assay (n=3)	
	Run 1		Run 2		Run 3			
	Mean Ratio	% CV	Mean Ratio	% CV	Mean Ratio	% CV	Mean Ratio	% CV
Serum 1	3.23	4.0	3.38	4.8	3.32	4.1	3.31	1.8
Serum 2	1.90	5.7	1.72	13.3	1.81	7.1	1.81	4.0
Serum 3	1.87	6.5	1.76	13.2	1.53	7.5	1.72	8.2
Serum 4	0.46	12.0	0.43	10.2	0.41	8.3	0.43	5.1

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