

Elecsys Anti-HBc II

REF		SYSTEM
07374160 190	100	MODULAR ANALYTICS E170 cobas e 411 cobas e 601 cobas e 602

English

Intended use

Immunoassay for the in vitro qualitative determination of IgG and IgM antibodies to the hepatitis B core antigen in human serum and plasma.

The electrochemiluminescence immunoassay "ECLIA" is intended for use on Elecsys and **cobas e** immunoassay analyzers.

Regulatory approval

This assay has been CE marked according to Directive 98/79/EC. Test performance has been established and certified by a Notified Body according to the Common Technical Specifications (CTS) for diagnostic use and for screening of blood donations.

Summary

The hepatitis B virus (HBV) consists of an external envelope (HBsAg) and an inner core (HBcAg). The hepatitis core antigen comprises 183-185 amino acids.¹

During an infection with HBV, antibodies to HBcAg are generally produced, which often persist for life. Anti-HBc appears shortly after the onset of HBV infection and can usually be detected in serum soon after the appearance of HBsAg.² Anti-HBc persists in persons who have recovered from HBV infection and inactive carriers. Therefore, they are an indicator of existing or past HBV infection.^{1,2,3}

In rare cases, HBV infection can also run its course without the appearance of immunologically detectable anti-HBc (usually in immunosuppressed patients). Anti-HBc is not produced after vaccination.⁴

Due to the persistence of anti-HBc following infection with HBV, screening for anti-HBc can be used to identify previously infected individuals.⁵

Determination of anti-HBc in association with other hepatitis B tests permits the diagnosis and monitoring of HBV infections. In the absence of other hepatitis B markers (HBsAg-negative persons), anti-HBc may be the only indication of an existing HBV infection.^{2,6,7}

Test principle

Competition principle. Total duration of assay: 27 minutes.

- 1st incubation: Pretreatment of 40 µL of sample with reducing agent.
- 2nd incubation: After addition of HBcAg, a complex is formed with anti-HBc antibodies in the sample.
- 3rd incubation: After addition of biotinylated antibodies and ruthenium complex^{a)}-labeled antibodies specific for HBcAg, together with streptavidin-coated microparticles, the still-free binding sites on the HBc-antigens become occupied. The entire complex becomes bound to the solid phase via interaction of biotin and streptavidin.
- The reaction mixture is aspirated into the measuring cell where the microparticles are magnetically captured onto the surface of the electrode. Unbound substances are then removed with ProCell/ProCell M. Application of a voltage to the electrode then induces chemiluminescent emission which is measured by a photomultiplier.
- Results are determined automatically by the software by comparing the electrochemiluminescence signal obtained from the reaction product of the sample with the signal of the cutoff value previously obtained by calibration.

a) Tris(2,2'-bipyridyl)ruthenium(II)-complex (Ru(bpy)₃²⁺)

Reagents - working solutions

The reagent rackpack (M, R0, R1, R2) is labeled as A-HBCII.

- M Streptavidin-coated microparticles (transparent cap), 1 bottle, 6.5 mL:
Streptavidin-coated microparticles 0.72 mg/mL; preservative.
- R0 DTT (white cap), 1 bottle, 5 mL:
1,4-dithiothreitol 110 mmol/L; citrate buffer 50 mmol/L.

R1 HBcAg (gray cap), 1 bottle, 8 mL:

HBcAg (E. coli, rDNA) > 25 ng/mL; phosphate buffer 100 mmol/L, pH 7.4; preservative.

R2 Anti-HBcAg-Ab-biotin; anti-HBcAg-Ab~Ru(bpy)₃²⁺ (black cap), 1 bottle, 8 mL:

Biotinylated monoclonal anti-HBc antibody (mouse) 700 ng/mL; monoclonal anti-HBc antibody (mouse) labeled with ruthenium complex 200 ng/mL; phosphate buffer 100 mmol/L, pH 7.4; preservative.

A-HBCII Cal1 Negative calibrator 1 (white cap), 2 bottles of 1.0 mL each:

Human serum; preservative.

A-HBCII Cal2 Positive calibrator 2 (black cap), 2 bottles of 1.0 mL each:

Anti-HBc (human) > 8 WHO IU/mL^{b)} in human serum; preservative.

b) WHO international units

Precautions and warnings

For in vitro diagnostic use.

Exercise the normal precautions required for handling all laboratory reagents.

Disposal of all waste material should be in accordance with local guidelines. Safety data sheet available for professional user on request.

All human material should be considered potentially infectious. All products derived from human blood are prepared exclusively from the blood of donors tested individually and shown to be free from HBsAg (A-HBCII Cal1 only) and antibodies to HCV and HIV. The testing methods applied were FDA-approved or cleared in compliance with the European Directive 98/79/EC, Annex II, List A.

The serum containing anti-HBc (A-HBCII Cal2) was inactivated using β-propiolactone and UV-radiation.

However, as no inactivation or testing method can rule out the potential risk of infection with absolute certainty, the material should be handled with the same level of care as a patient specimen. In the event of exposure, the directives of the responsible health authorities should be followed.^{8,9}

Avoid foam formation in all reagents and sample types (specimens, calibrators and controls).

Reagent handling

The reagents in the kit are ready for use and are supplied in bottles compatible with the system.

cobas e 411 analyzer: The calibrators should only be left on the analyzers during calibration at 20-25 °C. After use, close the bottles as soon as possible and store upright at 2-8 °C.

Due to possible evaporation effects, not more than 5 calibration procedures per bottle set should be performed.

MODULAR ANALYTICS E170, **cobas e 601** and **cobas e 602** analyzers: Unless the entire volume is necessary for calibration on the analyzers, transfer aliquots of the ready-for-use calibrators into empty snap-cap bottles (CalSet Vials). Attach the supplied labels to these additional bottles. Store the aliquots at 2-8 °C for later use.

Perform **only one** calibration procedure per aliquot.

All information required for correct operation is read in from the respective reagent barcodes.

Please note: Both the vial labels, and the additional labels (if available) contain 2 different barcodes. The barcode between the yellow markers is for **cobas 8000** systems only. If using a **cobas 8000** system, please turn

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the vial cap 180° into the correct position so the barcode can be read by the system. Place the vial on the instrument as usual.

Storage and stability

Store at 2-8 °C.

Do not freeze.

Store the Elecsys reagent kit **upright** in order to ensure complete availability of the microparticles during automatic mixing prior to use.

Stability of the reagent rackpack	
unopened at 2-8 °C	up to the stated expiration date
after opening at 2-8 °C	8 weeks
on the analyzers	8 weeks

Stability of the calibrators	
unopened at 2-8 °C	up to the stated expiration date
after opening at 2-8 °C	8 weeks
on cobas e 411 at 20-25 °C	up to 6 hours
on MODULAR ANALYTICS E170, cobas e 601 and cobas e 602 at 20-25 °C	use only once

Store calibrators **upright** in order to prevent the calibrator solution from adhering to the snap-cap.

Specimen collection and preparation

Only the specimens listed below were tested and found acceptable.

Serum collected using standard sampling tubes or tubes containing separating gel.

Li-heparin, Na-heparin, K₂-EDTA, K₃-EDTA, ACD, CPD, CP2D, CPDA and Na-citrate as well as plasma collected in tubes containing separating gel.

Criterion: Correct assignment of negative and positive samples. Samples > 1.0 COI: ± 20 % recovery; samples ≤ 1.0 COI: ± 0.20 COI recovery.

Stable for 14 days at 2-8 °C, 7 days at 15-25 °C, 3 months at -20 °C. The samples may be frozen 5 times.

The sample types listed were tested with a selection of sample collection tubes or systems that were commercially available at the time of testing, i.e. not all available tubes of all manufacturers were tested. Sample collection systems from various manufacturers may contain differing materials which could affect the test results in some cases. When processing samples in primary tubes (sample collection systems), follow the instructions of the tube manufacturer.

Attention: Particularly important for the Elecsys Anti-HBc II assay: Frozen samples, samples containing precipitates, and samples for repeat measurements must be carefully centrifuged before performing the assay.

The performance of the Elecsys Anti-HBc II assay has not been established with cadaveric samples or body fluids other than serum and plasma.

Do not use samples and controls stabilized with azide.

Ensure the samples, calibrators and controls are at 20-25 °C prior to measurement.

Due to possible evaporation effects, samples and calibrators on the analyzers should be analyzed/measured within 2 hours.

Materials provided

See "Reagents – working solutions" section for reagents.

- 2 x 4 bottle labels

Materials required (but not provided)

- [REF](#) 04927931190, PreciControl Anti-HBc II, for 8 x 1.3 mL
- [REF](#) 11732277122, Diluent Universal, 2 x 16 mL sample diluent or [REF](#) 03183971122, Diluent Universal, 2 x 36 mL sample diluent
- [REF](#) 11776576322, CalSet Vials, 2 x 56 empty snap-cap bottles
- General laboratory equipment
- MODULAR ANALYTICS E170 or **cobas e** analyzer

Accessories for **cobas e 411** analyzer:

- [REF](#) 11662988122, ProCell, 6 x 380 mL system buffer

- [REF](#) 11662970122, CleanCell, 6 x 380 mL measuring cell cleaning solution
 - [REF](#) 11930346122, Elecsys SysWash, 1 x 500 mL washwater additive
 - [REF](#) 11933159001, Adapter for SysClean
 - [REF](#) 11706802001, Elecsys 2010 AssayCup, 60 x 60 reaction vessels
 - [REF](#) 11706799001, Elecsys 2010 AssayTip, 30 x 120 pipette tips
- Accessories for MODULAR ANALYTICS E170, **cobas e 601** and **cobas e 602** analyzers:

- [REF](#) 04880340190, ProCell M, 2 x 2 L system buffer
- [REF](#) 04880293190, CleanCell M, 2 x 2 L measuring cell cleaning solution
- [REF](#) 03023141001, PC/CC-Cups, 12 cups to prewarm ProCell M and CleanCell M before use
- [REF](#) 03005712190, ProbeWash M, 12 x 70 mL cleaning solution for run finalization and rinsing during reagent change
- [REF](#) 03004899190, PreClean M, 5 x 600 mL detection cleaning solution
- [REF](#) 12102137001, AssayTip/AssayCup Combimagazine M, 48 magazines x 84 reaction vessels or pipette tips, waste bags
- [REF](#) 03023150001, WasteLiner, waste bags
- [REF](#) 03027651001, SysClean Adapter M

Accessories for all analyzers:

- [REF](#) 11298500316, ISE Cleaning Solution/Elecsys SysClean, 5 x 100 mL system cleaning solution

Assay

For optimum performance of the assay follow the directions given in this document for the analyzer concerned. Refer to the appropriate operator's manual for analyzer-specific assay instructions.

Resuspension of the microparticles takes place automatically prior to use. Read in the test-specific parameters via the reagent barcode. If in exceptional cases the barcode cannot be read, enter the 15-digit sequence of numbers.

MODULAR ANALYTICS E170, **cobas e 601** and **cobas e 602** analyzers: PreClean M solution is necessary.

Bring the cooled reagents to approximately 20 °C and place on the reagent disk (20 °C) of the analyzer. Avoid foam formation. The system automatically regulates the temperature of the reagents and the opening/closing of the bottles.

Place the calibrators in the sample zone.

All the information necessary for calibrating the assay is automatically read into the analyzer.

After calibration has been performed, store the calibrators at 2-8 °C or discard (MODULAR ANALYTICS E170, **cobas e 601** and **cobas e 602** analyzers).

Calibration

Traceability: This method has been standardized against the anti-HBc reference material WHO Standard (NIBSC code 95/522).

Calibration frequency: Calibration must be performed once per reagent lot using A-HBCII Cal1, A-HBCII Cal2 and fresh reagent (i.e. not more than 24 hours since the reagent kit was registered on the analyzer).

Renewed calibration is recommended as follows:

- after 1 month (28 days) when using the same reagent lot
- after 7 days (when using the same reagent kit on the analyzer)
- as required: e.g. quality control findings with PreciControl Anti-HBc II outside the defined limits

Range for the electrochemiluminescence signals (counts) for the calibrators:

Negative calibrator (A-HBCII Cal1):

42000-300000 (**cobas e 411** analyzer) or

100000-700000 (MODULAR ANALYTICS E170, **cobas e 601** and **cobas e 602** analyzers).

Positive calibrator (A-HBCII Cal2):

100-3000 (MODULAR ANALYTICS E170 and **cobas e** analyzers).

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Quality control

For quality control, use PreciControl Anti-HBc II.

Controls for the various concentration ranges should be run individually at least once every 24 hours when the test is in use, once per reagent kit, and following each calibration.

The control intervals and limits should be adapted to each laboratory's individual requirements. Values obtained should fall within the defined limits. Each laboratory should establish corrective measures to be taken if values fall outside the defined limits.

Follow the applicable government regulations and local guidelines for quality control.

Note:

For technical reasons re-assigned target values valid only for a specific reagent and control lot combination, must be entered manually on all analyzers (except for the **cobas e 602** analyzer). Therefore always refer to the value sheet included in the reagent kit or PreciControl kit to make sure that the correct target values are used.

When a new reagent or control lot is used, the analyzer will use the original values encoded in the control barcodes.

Calculation

The analyzer automatically calculates the cutoff based on the measurement of A-HBcII Cal1 and A-HBcII Cal2.

The result of a sample is given either as reactive or non-reactive as well as in the form of a cutoff index (signal sample/cutoff).

Limitations - interference

The assay is unaffected by icterus (bilirubin $\leq 1129 \mu\text{mol/L}$ or $\leq 66 \text{ mg/dL}$), hemolysis (Hb $\leq 0.621 \text{ mmol/L}$ or $\leq 1000 \text{ mg/dL}$), lipemia (Intralipid $\leq 2000 \text{ mg/dL}$) and biotin ($\leq 102 \text{ nmol/L}$ or $\leq 25 \text{ ng/mL}$).

Criterion:

Samples > 1.0 COI: $\pm 20\%$ recovery

Samples ≤ 1.0 COI: ± 0.20 COI recovery

Samples should not be taken from patients receiving therapy with high biotin doses (i.e. $> 5 \text{ mg/day}$) until at least 8 hours following the last biotin administration.

No interference was observed from rheumatoid factors up to a concentration of 1200 IU/mL .

No significant interfering effects of 24 commonly used and special therapeutic drugs could be detected. Special drugs tested: pegylated interferon alpha-2 a, pegylated interferon alpha-2 b, lamivudine, adefovir, entecavir, telbivudin, tenofovir.

In rare cases, interference due to extremely high titers of antibodies to analyte-specific antibodies, streptavidin or ruthenium can occur. These effects are minimized by suitable test design.

For diagnostic purposes, the results should always be assessed in conjunction with the patient's medical history, clinical examination and other findings.

Limits and ranges

Detection limit: ≤ 0.8 WHO IU/mL

The stated sensitivity was determined by reading off the anti-HBc concentration corresponding to the signal of the cutoff value from standard curves obtained by serial dilution of the WHO anti-HBc reference material in human serum free from hepatitis B.

Expected values

Interpretation of the results

Samples with a cutoff index > 1.0 are non-reactive in the Elecsys Anti-HBc II assay. These samples are considered negative for anti-HBc and do not need further testing.

Samples with a cutoff index ≤ 1.0 are reactive in the Elecsys Anti-HBc II assay. All samples found to be reactive in the initial test must be retested in duplicate with the Elecsys Anti-HBc II assay. If the results in the follow-up test are "non-reactive" in both cases, then the sample is deemed negative for anti-HBc.

If at least one of the repeat measurements is reactive, then the sample is deemed repeatedly reactive.

Specific performance data

Representative performance data on the analyzers are given below. Results obtained in individual laboratories may differ.

Precision

Precision was determined using Elecsys reagents, human sera and controls.

cobas e 411 analyzer						
Sample	Mean COI	Repeatability ^{c)}		Intermediate precision ^{d)}		
		SD COI	CV %	Mean COI	SD COI	CV %
HS ^{e)} , negative	2.23	0.029	1.3	2.23	0.070	3.2
HS, weakly positive	0.855	0.016	1.9	0.855	0.034	3.9
HS, positive	0.029	0.001	4.0	0.029	0.002	6.6
PC ^{f)} A-HBcII 1	1.92	0.039	2.0	1.92	0.094	4.9
PC A-HBcII 2	0.490	0.012	2.5	0.490	0.039	8.0

c) Precision according to CLSI EP05-A3 (21 days) (Clinical and Laboratory Standards Institute)

d) Intermediate precision according to CLSI EP05-A3 (21 days) (Clinical and Laboratory Standards Institute)

e) HS = human serum

f) PC = PreciControl

MODULAR ANALYTICS E170, cobas e 601 and cobas e 602 analyzers						
Sample	Mean COI	Repeatability		Intermediate precision		
		SD COI	CV %	Mean COI	SD COI	CV %
HS, negative	2.30	0.042	1.8	2.30	0.062	2.7
HS, weakly positive	0.882	0.019	2.2	0.882	0.043	4.9
HS, positive	0.028	0.0008	2.8	0.028	0.002	7.3
PC A-HBcII 1	2.22	0.034	1.5	2.22	0.065	2.9
PC A-HBcII 2	0.603	0.019	3.2	0.603	0.032	5.4

Analytical specificity

309 samples containing potentially interfering substances were tested with the Elecsys Anti-HBc II assay comprising specimens:

- containing antibodies against HAV, HCV, HIV, HSV, Rubella, CMV, EBV, Toxoplasma gondii, Treponema pallidum
- positive for E. coli
- after vaccination against HAV and HBV
- non-viral induced liver diseases
- autoimmune diseases (ANA and SLE)

No false reactive results were found with the Elecsys Anti-HBc II assay (after repetition) resulting in a specificity of 100 %. 81 samples were identified as congruently positive with the Elecsys Anti-HBc II and another commercially available Anti-HBc assay. 1 sample was found to be indeterminate and was excluded from calculation.

Clinical sensitivity

Of 793 samples from HBV infected patients in different stages of the disease, 793 were found repeatedly reactive with the Elecsys Anti-HBc II assay. The sensitivity of the Elecsys Anti-HBc II assay in this study was found to be 100 %.

Stage of disease	N	Reactive
Chronic or acute HBV infection (anti-HBc positive, HBsAg positive)	568	568
Passed HBV infection (anti-HBc positive, HBsAg negative, anti-HBs positive, anti-HBe negative)	56	56

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Stage of disease	N	Reactive
Passed or recovered HBV infection (anti-HBc positive, HBsAg negative, anti-HBs negative, anti-HBe positive)	9	9
Passed or recovered HBV infection (anti-HBc positive, HBsAg negative, anti-HBs positive, anti-HBe positive)	160	160

Seroconversion sensitivity

Seroconversion sensitivity of the Elecsys Anti-HBc II assay has been investigated by testing 10 commercially available seroconversion panels. Elecsys Anti-HBc II assay was shown to be sensitive in early detection of infection in line with other anti-HBc assays and additional HBV serological markers.

Clinical specificity

A total of 20101 samples from blood donors, diagnostic routine, pregnant women and dialysis patients from 5 centers in Europe was tested with the Elecsys Anti-HBc II assay.

The resulting specificity in the study based on a repeatedly reactive basis (RR) was 99.93 % in blood donors (serum), the 95 % lower confidence limit was 99.84-99.97 %.

Specificity in blood donors (plasma) was found to be 99.88 %, the 95 % lower confidence limit was 99.78-99.94 %.

Specificity in diagnostic routine/hospitalized patients was found to be 100 % (95 % lower confidence limit: 99.60-100 %), in dialysis patients 99.31 % (95 % lower confidence limit: 98.23-99.81 %) and in pregnant women 100 % (95 % lower confidence limit: 99.62-100 %).

Cohort	N	Specificity (%) IR ^{g)}	95 % confidence limit (%) IR	Specificity (%) RR ^{h)}	95 % confidence limit (%) RR
Blood donors (serum)	8163	99.93	99.84-99.97	99.93	99.84-99.97
Blood donors (EDTA plasma)	9162	99.88	99.78-99.94	99.88	99.78-99.94
Diagnostic routine / hospitalized patients	997	100	99.60-100	100	99.60-100
Dialysis patients	779	99.13	97.99-99.72	99.31	98.23-99.81
Pregnant women	1000	100	99.62-100	100	99.62-100

g) initial reactive

h) repeatedly reactive

References

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- Occupational Safety and Health Standards: Bloodborne pathogens. (29 CFR Part 1910.1030). Fed. Register.
- Directive 2000/54/EC of the European Parliament and Council of 18 September 2000 on the protection of workers from risks related to exposure to biological agents at work.

For further information, please refer to the appropriate operator's manual for the analyzer concerned, the respective application sheets, the product information and the Method Sheets of all necessary components (if available in your country).

A point (period/stop) is always used in this Method Sheet as the decimal separator to mark the border between the integral and the fractional parts of a decimal numeral. Separators for thousands are not used.

Symbols

Roche Diagnostics uses the following symbols and signs in addition to those listed in the ISO 15223-1 standard:

	Contents of kit
	Analyzers/Instruments on which reagents can be used
	Reagent
	Calibrator
	Volume after reconstitution or mixing
	Global Trade Item Number

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