Access
Immunoassay Systems

HBc Ab

REF 34240

Intended Use

The Access HBc Ab assay is a qualitative immunoassay integrated to the Access Immunoassay Systems, for the detection of antibodies directed against hepatitis B core antigen in human serum or plasma.

Summary and Explanation

During the course of a primary infection by hepatitis B virus, anti-HBc antibodies are the first to appear after HBs and HBe antigens. IgM antibodies are synthesized first, they persist for a few weeks to a few months then disappear during convalescence while IgG remain for several years after recovery and in chronic carriers (high titers of anti-HBc antibody).[1,2,3,4]

Therefore, the presence of anti-HBc antibody may signify a past or recent infection by HBV. The antibodies can be found in association with HBs Ag or anti-HBs Ab, or infrequently alone, in which case they may be then considered as the only serologic marker of a recent hepatitis B and a potentially infectious blood.[5,6,7,8,9]

Thus, detection of anti-HBc antibodies allows to establish the diagnosis of a recent or past hepatitis B infection and to follow the infection course in association with the determination of other B markers.

Principles of the Procedure

The Access HBc Ab is a qualitative immunoassay based on the immunocapture of serum immunoglobulins on the solid phase. During the reaction, paramagnetic particles coated with protein A are added to a reaction vessel. In a second sequence of pipetting, the sample (serum, plasma or control) is added to the reaction vessel with the pretreatment solution and conjugate. The specific and non-specific immunoglobulins contained in the sample are captured by the solid phase. Only the antibodies specific to hepatitis B virus core are identified by the HBc antigen of the alkaline phosphatase conjugate. The specimen pretreatment solution ensures the elimination of all the non-specific reactions.

Then, the chemiluminescent substrate Lumi-Phos* 530 is added to the vessel and light generated by the reaction is measured with a luminometer. The light production is proportional to the amount of enzyme conjugate present at the end of the reaction, and therefore to the anti-HBc present in the tested sample. By comparison of this signal intensity with the cut-off value determined during the assay calibration on the instrument, it is then possible to conclude if there is presence or absence of anti-HBc antibody in the sample.

Product Information

Access HBc Ab Reagent Packs

Cat. No. 34240: 100 determinations, 2 packs, 50 tests/pack

- Provided ready to use.
- Store upright and refrigerate at 2 to 10°C.
- Refrigerate at 2 to 10°C for a minimum of two hours before use on the instrument.
- Stable until the expiration date stated on the label when stored at 2 to 10°C.
- After initial use, keep the pack loaded or store it upright at 2 to 10°C and use it within one month.
- Signs of possible deterioration are a broken elastomeric layer on the pack or quality control values out of range.
- If the reagent pack is damaged (i.e., broken elastomer), discard the pack.

© 2011 Beckman Coulter, Inc.

R1a:	Paramagnetic particles coated with protein A, suspended in TRIS with surfactant, < 0.1% sodium azide, 0.1% ProClin** 300.
R1b:	Special Wash Buffer containing surfactant, potassium thiocyanate, < 0.1% sodium azide, 0.1% ProClin 300.
R1c:	Specimen Treatment Solution containing surfactant, potassium thiocyanate, < 0.1% sodium azide, 0.1% ProClin 300.
R1d:	Recombinant HBc antigen (E. coli) conjugate/alkaline phosphatase in PBS with surfactant, < 0.1% sodium azide, 0.1% ProClin 300.

Warnings and Precautions

- For *in vitro* diagnostic use.
- Patient samples and blood-derived products may be routinely processed with minimum risk using the procedure described. However, handle these products as potentially infectious according to universal precautions and good clinical laboratory practices, regardless of their origin, treatment, or prior certification. Use an appropriate disinfectant for decontamination. Store and dispose of these materials and their containers in accordance with local regulations and guidelines.[10]
- A negative result does not preclude the possibility of exposure to a hepatitis B virus infection.
- Sodium azide may react with lead and copper plumbing to form highly explosive metal azides. On disposal of liquids, flush with a large volume of water to prevent azide build-up.[11]
- Xi. Irritant: 0.1% ProClin 300.

R 43: May cause sensitization by skin contact.
S 28-37: After contact with skin, wash immediately with plenty of soap and water. Wear suitable gloves.

- Xi. Irritant: 19.4% KSCN.

R 32-43: Contact with acids liberates very toxic gas. May cause sensitization by skin contact.
S 28-36/37: After contact with skin, wash immediately with plenty of soap and water. Wear suitable protective clothing and gloves.

- The Material Safety Data Sheet (MSDS) is available upon request.

Specimen Collection and Preparation

1. Serum or plasma (heparin, EDTA or citrate) are the recommended samples. The blood preservatives ACD, CPD and CPDA are compatible with the assay.
2. Observe the following recommendations for handling, processing, and storing blood samples:[12]
   - Collect all blood samples observing routine precautions for venipuncture.
   - Allow serum samples to clot completely before centrifugation.
   - Keep tubes stoppered at all times.
   - Within two hours after centrifugation, transfer at least 500 µL of cell-free sample to a storage tube. Tightly stopper the tube immediately.
   - Store samples tightly stoppered at room temperature (15 to 30°C) for no longer than eight hours.
   - If the assay will not be completed within eight hours, refrigerate the samples at 2 to 8°C.
   - If the assay will not be completed within 48 hours, or for shipment of samples, freeze at -20°C or colder.
   - Thaw samples only once.

© 2011 Beckman Coulter, Inc.

3. Use the following guidelines when preparing specimens:
   - Ensure residual fibrin and cellular matter have been removed prior to analysis.
   - Follow blood collection tube manufacturer's recommendations for centrifugation.
4. Each laboratory should determine the acceptability of its own blood collection tubes and serum separation products. Variations in these products may exist between manufacturers and, at times, from lot-to-lot.
5. Samples containing up to 80 mg/L bilirubin or up to 200 g/L albumin, lipemic samples containing the equivalent of 36 g/L triolein and hemolyzed samples containing up to 10 g/L hemoglobin do not affect the result. However, it is recommended to use clear and non-hemolyzed samples.
6. Do not use heat-inactivated samples.

Materials Provided

R1 Access HBc Ab Reagent Packs

Materials Required But Not Provided

1. Access HBc Ab Calibrators
   Negative and positive for anti-HBc antibody.
   Cat. No. 34245
2. Quality control materials: Access HBc Ab QC or other commercial quality control sera.
   Cat. No. 34249
3. Access Substrate
   Cat. No. 81906
4. **Access, Access 2:**
   Access Wash Buffer II, Cat. No. A16792
   UniCel DxI:
   UniCel DxI Wash Buffer II, Cat. No. A16793

Procedural Comments

1. Refer to the appropriate system manuals and/or Help system for a specific description of installation, start-up, principles of operation, system performance characteristics, operating instructions, calibration procedures, operational limitations and precautions, hazards, maintenance, and troubleshooting.
2. Mix contents of new (unpunctured) reagent packs by gently inverting pack several times before loading on the instrument. Do not invert open (punctured) packs.
3. Use five (5) µL of sample for each determination in addition to the sample container and system dead volumes. Refer to the appropriate system manuals and/or Help system for the minimum sample volume required.
4. The first result is obtained within 30 minutes.

Procedure

Refer to the appropriate system manuals and/or Help system for information on managing samples, configuring tests, requesting tests, and reviewing test results.

Calibration Details

Calibration data determining the assay cut-off value is valid for 28 days. Refer to the appropriate system manuals and/or Help system for complete instructions on calibration procedures.

Quality Control

Quality controls are recommended at least every 24 hours and upon system start-up prior to running patient samples.[13] More frequent use of controls or the use of additional controls is left to the discretion of the user based on good laboratory practices or laboratory accreditation requirements and applicable laws. Use the suggested product Access HBc Ab QC, or include quality control sera from other sources. Follow manufacturer's instructions for reconstitution and storage. Each laboratory should establish mean values and acceptable ranges to assure proper performance. Quality control results that do not fall within acceptable ranges may

indicate invalid test results. Examine all test results generated since obtaining the last acceptable quality control test point for this analyte. Refer to the appropriate system manuals and/or Help system for information about reviewing quality control results.

Results

Results of the Access HBc Ab assay performed on the patient samples are automatically calculated by the system software using the cut-off value determined by the active calibration. Results are reported as reactive or non-reactive in function of their ratio with the cut-off value (signal greater than and equal to or lower than the cut-off value). However, results located 10% below the cut-off should be carefully interpreted and retested in duplicate. This gray zone (0.9–1.0) must be saved in memory by the user (refer to the appropriate system manuals and/or Help system for complete instructions on gray zone for a qualitative assay). A flag which is automatically reported allows to quickly spot a result located within the gray zone. Patient test results can be reviewed using the appropriate screen. Refer to the appropriate system manuals and/or Help system for complete instructions on reviewing results.

Any sample found reactive in the first test should be retested in duplicate. If the initial result is repeated, the sample is considered as positive for the Access HBc Ab assay.

If a sample result is found within the gray zone, it is recommended the patient anti-HBc antibody titer be controlled by collecting samples on a regular basis (about once a week). An antibody titer increase may directly indicate a recent infection by HBV while a stable titer would tend to indicate a past infection or a chronic carrier. Regardless, the interpretation will be definitive only if associated with the determination of the other B markers.

Limitations of the Procedure

1. The Access HBc Ab assay is strictly limited to the detection of anti-HBc antibody in human serum or plasma.
2. A positive result obtained with the Access HBc Ab assay should be compared with clinical data and confirmed by other diagnostic assays for the presence of other associated B markers in order to be able to confirm the infection.
3. The differentiation between an acute or a chronic hepatitis B can only be done by detection of anti-HBc IgM.
4. For assays employing antibodies, the possibility exists for interference by heterophile antibodies in the patient sample. Patients who have been regularly exposed to animals or have received immunotherapy or diagnostic procedures utilizing immunoglobulins or immunoglobulin fragments may produce antibodies, e.g. HAMA, that interfere with immunoassays. Additionally, other heterophile antibodies such as human anti-goat antibodies may be present in patient samples.[14,15]
   Such interfering antibodies may cause erroneous results. Carefully evaluate the results of patients suspected of having these antibodies.
5. The Access HBc Ab results should be interpreted in light of the total clinical presentation of the patient, including: symptoms, clinical history, data from additional tests, and other appropriate information.

Specific Performance Characteristics

Intra-assay Precision

Intra-assay precision was determined internally on a panel of 4 sera defined as follows:

S1	ratio of 0.18 ± 20%
S2	ratio of 1.83 ± 20%
S3	ratio of 4.17 ± 20%
S4	ratio of 27 ± 20%

© 2011 Beckman Coulter, Inc.

Each sample was tested 30 times in the same run. On average, the intra-assay variation coefficients are lower than 7% (Table 1).

Table 1: Intra-assay Precision of the Access HBc Ab assay

Panel	Mean (n=30) S/CO ratio	%CV
Serum 1	0.18	2.29
Serum 2	1.87	4.19
Serum 3	4.02	6.93
Serum 4	26.65	4.62

Inter-assay Precision

The inter-assay precision (samples tested in triplicate, twice a day, 5 separate days) performed on the same samples provided coefficient of variation values ranging from 4.7% to 8.5% (the largest variation being observed for the negative serum) or, on average, lower than 7% (Table 2).

Table 2: Inter-assay Precision of the Access HBc Ab assay

Panel	Mean (n=30) S/CO ratio	%CV
Serum 1	0.19	8.50
Serum 2	1.80	4.79
Serum 3	3.95	5.76
Serum 4	26.25	7.06

Sensitivity

The sensitivity of the Access HBc Ab assay was evaluated at one internal and two external sites.

Two official panels from SFTS (Société Française de Transfusion Sanguine), including 40 and 17 samples, respectively, were studied in two external sites as well as an additional panel of 52 samples assayed in one of the two sites (serum collection at the evaluating site). Three other panels, clinically well documented, including a total of 323 samples, were studied in an internal study.

On a total of 432 samples, 3 discrepancies were observed:

- a sample from the additional SFTS panel (17 samples), classified as low reactive, was not detected by the Access HBc Ab assay.
- a sample, considered as non-reactive from the clinical file, was found reactive.
- a sample located within the grey zone by the Access assay was found discrepant by the technique used for the comparison (clinical picture: resolvent stage of a viral infection).

Good concordance was observed between the Access HBc Ab and the different kits being used for the clinically well documented and assayed samples (acute hepatitis, chronic hepatitis and immunized subjects). It is equivalent to 99.3% (429/432).

Specificity - Normal Blood Donor Population

A population of 5116 non selected blood donors was analyzed at one internal and two external sites. For all the samples, 5104 were found non-reactive and 44 repeat reactive by the Access HBc Ab assay. Among these 44 samples, 23 were confirmed as reactive by at least two other commercialized immunoassays, 9 show discrepant results between the four different assays being used and 12 results are false reactive by the Access kit.

The specificity of the Access HBc Ab assay on this non-reactive population is equivalent to 99.77% (5104/5116).

The study of the anticoagulant influence was also performed. 19 sample series including the corresponding sera or plasmas collected on heparin, citrate, ACD, CPDA and CPD and 106 sera/plasmas collected on EDTA for a total of 213 samples were studied. No significant

difference was demonstrated between the raw signals obtained on plasma and the raw signals obtained on the corresponding serum.

Specificity - Crossed Reactivity/Groups at Risk

A population including 270 samples from patients with different infectious autoimmune diseases likely to provoke a crossed reactivity with the hepatitis B virus was studied in our research center (Table 3). Sera from groups at risk were also included in this study. The samples found positive were confirmed by a second commercialized immunoassay.

Table 3: Specificity of the Access HBc Ab assay

Pathology	Number of samples tested[†]	Number of positive samples	Number of confirmed samples	Specificity %
Autoimmune diseases	**20**	**2**	**2**	**100% (18/18)**
Antinuclear factors	10	0		
Rheumatoid factor	10	2	2	
Viral and parasitic infections including:	**197**	**9+1ZG**	**9**	**99.5% (187/188)**
HAV (IgM, IgG)	20	0		
HCV	10	2	2	
CMV (IgM, IgG)	20	0		
EBV (IgM, IgG)	20	0		
HSV (IgM, IgG))	20	0		
VZW (IgM, IgG)	20	0		
Yellow Fever	12	4	4	
Mumps (IgM,IgG)	20	1	1	
Measles (IgM, IgG)	20	1+1ZG	1	
Poliomyelitis	35	1	1	
Groups at risk	**43**	**11**	**11**	**100%** (32/32)
Hemodialysed	33	7	7	
HIV positives	10	4	4	
Other origins	**10**	**1**	**1**	**100%** (9/9)
Myeloma	10	1	1	
TOTAL	**270**	**23+1ZG**	**23**	**99.6% (246[††]/247)**

[†] Retrospective samples frozen and thawed several times.

[††] A sample positive for anti-Measles IgG gives a result within the gray zone with the Access HBc Ab assay (r = 0.94) not confirmed by a second technique.

© 2011 Beckman Coulter, Inc.

Access
Immunoassay Systems

HBc Ab CALIBRATORS

REF 34245

Intended Use

The Access HBc Ab Calibrators are intended for use with the Access HBc Ab assay for the detection of total anti-HBc antibody in human serum or plasma, using the Access Immunoassay Systems.

Summary and Explanation

The Access HBc Ab Calibrators are used to establish calibration (determine the cut-off value) for the Access HBc Ab assay. By comparing the light intensity generated by a sample to the cut-off value, it is possible to determine the presence or absence of anti-HBc Ab antibody in the sample.

Traceability

The measurand (analyte) in the Access HBc Ab Calibrators is traceable to the manufacturer's working calibrators. Traceability process is based on EN ISO 17511.

The assigned values were established using representative samples from this lot of calibrator and are specific to the assay methodologies of the Access reagents. Values assigned by other methodologies may be different. Such differences, if present, may be caused by inter-method bias.

Product Information

Access HBc Ab Calibrators

Cat. No. 34245: C0 and C1, 1.0 mL/vial

- Provided ready to use.
- Store upright and refrigerate at 2 to 10°C.
- Mix contents by gently inverting before use. Avoid bubble formation.
- Stable until the expiration date stated on the label when stored at 2 to 10°C.
- Open vial stability is typically until the expiration date stated on the vial labels when properly handled and stored.
- Signs of possible deterioration are quality control values out of range.

C0:	Negative calibrator: human serum negative for anti-HBc antibody, < 0.1% sodium azide, 0.5% ProClin** 300.
C1:	Positive calibrator: human defibrinated plasma and serum, positive for anti-HBc antibody, < 0.1% sodium azide, 0.5% ProClin 300.
Calibration Card:	1

Warnings and Precautions

- For *in vitro* diagnostic use.
- Patient samples and blood-derived products may be routinely processed with minimum risk using the procedure described. However, handle these products as potentially infectious according to universal precautions and good clinical laboratory practices, regardless of their origin, treatment, or prior certification. Use an appropriate disinfectant for decontamination. Store and dispose of these materials and their containers in accordance with local regulations and guidelines.
- Human source material used in the preparation of the reagent has been tested and found negative or non-reactive for Hepatitis B, Hepatitis C (HCV), and Human Immunodeficiency

Virus (HIV-1 and HIV-2). Because no known test method can offer complete assurance that infectious agents are absent, handle reagents and patient samples as if capable of transmitting infectious disease.[10]

- Sodium azide may react with lead and copper plumbing to form highly explosive metal azides. On disposal of liquids, flush with a large volume of water to prevent azide build-up.[11]
- Xi. Irritant: 0.5% ProClin 300.

R 43: May cause sensitization by skin contact.
S 28-37: After contact with skin, wash immediately with plenty of soap and water. Wear suitable gloves.

- The Material Safety Data Sheet (MSDS) is available upon request.

Procedure

Refer to the appropriate system manuals and/or Help system for information on calibration theory, configuring calibrators, calibrator test request entry, and reviewing calibration data.

Calibration Details

A calibration of this assay should be performed every 28 days in order to have an active calibration allowing to determine the cut-off value from which results are interpreted.

The Access HBc Ab Calibrators are provided as:

C0 negative for anti-HBc antibody
C1 positive for anti-HBc antibody.

A calibration requires approximately 150 µL (4 drops/cup) of each calibrator (determination in triplicate for C0 and C1). Refer to the appropriate system manuals and/or Help system for the minimum sample volume required.

Limitations of the Procedure

If there is evidence of microbial contamination or excessive turbidity in a reagent, discard the vial.

© 2011 Beckman Coulter, Inc.

Access
Immunoassay Systems

HBc Ab QC

REF 34249

Intended Use

The Access HBc Ab QC is intended for monitoring system performance of the Access HBc Ab assay.

Summary and Explanation

The Access HBc Ab QC is intended for monitoring system performance of the Access HBc Ab assay for anti-HBc antibody detection. It is recommended to use a quality control material to detect and correct procedure errors inherent to kit handling, quality or instrument use, and that is an integral part of good laboratory practices.[13,16,17,18,19,20] A negative quality control and a low positive quality control are provided to allow performance monitoring in the most relevant areas of the assay range.

Traceability

The measurand (analyte) in the Access HBc Ab QC is traceable to the manufacturer's working calibrators. Traceability process is based on EN ISO 17511.

The assigned values were established using representative samples from this lot of QC and are specific to the assay methodologies of the Access reagents. Values assigned by other methodologies may be different. Such differences, if present, may be caused by inter-method bias.

Product Information

Access HBc Ab QC

Cat. No. 34249: 2.0 mL/vial, 3 vials each level

- Provided ready to use.
- Store upright and refrigerate at 2 to 10°C.
- Mix contents by gently inverting before use. Avoid bubble formation.
- Stable until the expiration date stated on the label when stored at 2 to 10°C.
- After initial use, vials are stable for 30 days when correctly handled and stored.
- Signs of possible deterioration are quality control values out of range.
- Refer to the QC value card for mean values and standard deviations (SD).

QC 1:	Human serum negative (non-reactive) for anti-HBc antibody, < 0.1% sodium azide and 0.5% ProClin** 300.
QC 2:	Human defibrinated plasma and serum, positive (reactive) for anti-HBc antibody, < 0.1% sodium azide and 0.5% ProClin 300.
QC Value Card:	1

Warnings and Precautions

- For *in vitro* diagnostic use.
- Patient samples and blood-derived products may be routinely processed with minimum risk using the procedure described. However, handle these products as potentially infectious according to universal precautions and good clinical laboratory practices, regardless of their origin, treatment, or prior certification. Use an appropriate disinfectant for decontamination. Store and dispose of these materials and their containers in accordance with local regulations and guidelines.

- Human source material used in the preparation of the reagent has been tested and found negative or non-reactive for Hepatitis B, Hepatitis C (HCV), and Human Immunodeficiency Virus (HIV-1 and HIV-2). Because no known test method can offer complete assurance that infectious agents are absent, handle reagents and patient samples as if capable of transmitting infectious disease.[10]
- Sodium azide may react with lead and copper plumbing to form highly explosive metal azides. On disposal of liquids, flush with a large volume of water to prevent azide build-up.[11]
- Xi. Irritant: 0.5% ProClin 300.

R 43: May cause sensitization by skin contact.
S 28-37: After contact with skin, wash immediately with plenty of soap and water. Wear suitable gloves.

- The Material Safety Data Sheet (MSDS) is available upon request.

Procedure

The Access HBc Ab QC should be treated in the same manner as patient specimen and tested in accordance with the instructions provided in the kit accompanying the instrument being used. Because samples can be processed at any time in a "random access" format rather than a "batch" format, quality control materials should be included in each 24-hour time period.[13] More frequent use of controls or the use of additional controls is left to the discretion of the user based on good laboratory practices or laboratory accreditation requirements and applicable laws.

Note: For the Access Immunoassay Systems, refer to the appropriate system manuals and/or Help system for information on quality control theory, configuring controls, quality control sample test request entry, and reviewing quality control data.

To process a single determination of the Access HBc Ab QC on the Access Immunoassay Systems, approximately 150 µL (4 drops/cup) are required (determination performed in duplicate). Refer to the appropriate system manuals and/or Help system for the minimum sample volume required.

Limitations of the Procedure

If there is evidence of microbial contamination or excessive turbidity in a reagent, discard the vial.

Expected Values

The expected values of the quality control for the Access HBc Ab assay are provided on the QC value card contained in the Access HBc Ab QC assay kit. Results obtained by the user laboratories should fall within the stated ranges. Variations, such as in technique, equipment, or reagents may result in values different from those listed. However, each laboratory should establish its own mean value and acceptable ranges after sufficient data has been collected.[20]

© 2011 Beckman Coulter, Inc.

References

1 Hoffnagle JH, Gerety RJ, Barjer LF. Antibodies to hepatitis B-virus core. En Lancet 1973; 2: 869-873.

2 Szmuness W, Hoffnagle JH, Stevens CE, Strick N, Harley EJ. Antibodies against the hepatitis type B core antigen. Am J of Epidemiology 1976; 104(3): 256-262.

3 Neurath AR, Szmuness W, Stevens CE, Strick N, Harley EJ. Radioimmunoassay and some properties of human antibodies to hepatitis B core antigen. J Gen Virology 1978; 38: 549-559.

4 Trollais P, Pourcel C, Dejean A. The hepatitis B virus. Nature 1985; 31: 489-495.

5 Hoffnagle JH, Seef BL, Buskel Bales Z, Zimmermann HJ, y cols. Type B hepatitis after transfusion with blood containing antibody to hepatitis core antigen. N Engl J Med 1978; 298: 1379-1383.

6 Mushalwar IK, Dienstag JL, Polesky HF, McGrath LC, Decker RH, Overby LR. Interpretation of various serological profiles of hepatitis B virus infection. Am J Clin Pathol 1981; 7: 773-777.

7 Slade BA, Vroon DH. Anti-HBc to screen susceptibility to hepatitis B. Lancet 1984; I: 1246-1247.

8 Koziol DE, Holland PV, Alling DW, Melpoder JC, Solomon RE, Purcell RH, Hudson LM, Shoup FJ, Krakauer H, Alter RHJ. Antibody to hepatitis B core antigen as a paradoxal marker for non-A, non-B hepatitis agents in donated blood. Ann Int Med 1986; 104: 488-495.

9 Jullien AM, Courcouce AM, Massari V, Manniez M, Finetti P, Breviere D, Girard M, Andreani T, Habibi B. Impact of screening donor blood for alanine aminotransferase and antibody to hepatitis B core antigen on the risk of hepatitis virus C transmission. Eur J Clin Micriobiol Inf Dis 1993; 12(9): 668-672.

10 HHS Publication, 4th ed., April 1999. Biosafety in Microbiological and Biomedical Laboratories. Available http://www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4toc.htm

11 DHHS (NIOSH) Publication No. 78-127, August 1976. Current Intelligence Bulletin 13 - Explosive Azide Hazard. Available http://www.cdc.gov/niosh.

12 Approved Guideline – Procedures for the Handling and Processing of Blood Specimens, H18-A3. 2004. Clinical and Laboratory Standards Institute.

13 Cembrowski GS, Carey RN. Laboratory quality management: QC⇌QA. ASCP Press, Chicago, IL, 1989.

14 Kricka L. Interferences in immunoassays – still a threat. Clin Chem 2000; 46: 1037–1038.

15 Bjerner J, et al. Immunometric assay interference: incidence and prevention. Clin Chem 2002; 48: 613–621.

16 Büttner H. Fehler bei der Ausführung und Beurteilung von Laboratoriumsuntersuchungen. Dtsch Med Wschr 1963; 88:1050.

17 Benson ES, Freier EF. Quality control. Postgraduate Medicine 1963; 34: A-58.

18 Levy S, Jennings ER. The use of control charts in the clinical laboratory. Am J Cli Path 1959; 20: 1059.

19 Garrett PE. 1994. Quality is quantitative: so how do we QC qualitative tests. J of Clin Immunoassay. 17:231.

20 Approved Guideline – Statistical Quality Control for Quantitative Measurement Procedures: Principles and Definitions, C24-A3. June 2006. Clinical and Laboratory Standards Institute.

Beckman Coulter, Access, UniCel and DxI are trademarks of Beckman Coulter, Inc.; Beckman Coulter, Access, UniCel and DxI are registered in the USPTO and SIPO.

*Lumi-Phos is a trademark of Lumigen, Inc., a subsidiary of Beckman Coulter, Inc.

**ProClin is a trademark of Rohm and Haas Company or of its subsidiaries or affiliates.

Manufactured for:
Beckman Coulter, Inc.
250 S. Kraemer Blvd.
Brea, CA 92821 U.S.A.

EC REP
Beckman Coulter Ireland Inc.
Mervue Business Park,
Mervue, Galway,
Ireland 353 91 774068

Printed in U.S.A.
Made in France
Revised October 2011

CE 0459