

# **BBL CRYSTAL™ IDENTIFICATION SYSTEMS**

## **RAPID STOOL/ENTERIC ID KIT**

CLIA COMPLEXITY: HIGH  
CDC IDENTIFIER CODES  
ANALYTE: 0412  
TEST SYSTEM: 07484

### **INTENDED USE**

The **BBL CRYSTAL™** Rapid Stool/Enteric (RS/E) identification system is a miniaturized identification method employing modified conventional and chromogenic substrates. It is intended for the identification of aerobic gram-negative bacteria that belong to the families *Enterobacteriaceae* and *Vibrionaceae*.

### **SUMMARY AND EXPLANATION**

Micromethods for the biochemical identification of microorganisms were reported as early as 1918.<sup>5</sup> Several publications reported on the use of the reagent-impregnated paper discs and micro-tube methods for differentiating enteric bacteria.<sup>1,2,5,12,13,22,25,26,28</sup> The interest in miniaturized identification systems led to the introduction of several commercial systems in the late 1960s, and they provided advantages in requiring little storage space, extended shelf life, standardized quality control and ease of use.

In general, many of the tests used in the **BBL CRYSTAL** ID systems are modifications of classical methods. These include tests for fermentation, oxidation, degradation and hydrolysis of various substrates. In addition, there are chromogen linked substrates to detect enzymes that microbes use to metabolize various substrates.<sup>7,14,15,18,21</sup>

The **BBL CRYSTAL** RS/E kit is comprised of (i) **BBL CRYSTAL** RS/E panel lids, (ii) **BBL CRYSTAL** bases and (iii) **BBL CRYSTAL** Enteric/Stool ID Inoculum Fluid (IF) tubes. The lid contains 30 dehydrated substrates on tips of plastic prongs. The base has 30 reaction wells. Test inoculum is prepared with the inoculum fluid and is used to fill all 30 wells in the base. When the lid is aligned with the base and snapped in place, the test inoculum rehydrates the dried substrates and initiates test reactions.

Following an incubation period, the wells are examined for color changes. Color changes result from metabolic activities of the microorganisms. The resulting pattern of the 30 reactions is converted into a ten digit profile number that is used as the basis for identification.<sup>24</sup> Biochemical and enzymatic reaction patterns for the 30 **BBL CRYSTAL** RS/E substrates with a wide variety of microorganisms are stored in the **BBL CRYSTAL** RS/E data base. Identification is derived from a comparative analysis of the reaction pattern of the

test isolate to those held in the data base. A complete list of taxa that comprises the current **BBL CRYSTAL RS/E** data base is provided in Table 1.<sup>3,10,11,19,27</sup>

## **PRINCIPLES OF THE PROCEDURE**

The **BBL CRYSTAL ID** panels contain 30 dried biochemical and enzymatic substrates. A bacterial suspension in the inoculum fluid is used for rehydration of the substrates. The tests used in the **BBL CRYSTAL RS/E** Identification System are based on microbial utilization and degradation of specific substrates detected by various indicator systems. Fermentation reactions detect the ability of an isolate to metabolize carbohydrates in the absence of atmospheric oxygen, and oxidation reactions are based on the ability of an organism to metabolize the substrate with oxygen as the final electron acceptor. Both reactions are usually detected by the use of a pH indicator in the test substrate. Chromogenic substrates upon hydrolysis produce color changes that can be detected visually. In addition, there are other tests that detect the ability of an organism to hydrolyze, degrade, reduce or otherwise utilize a substrate in the **BBL CRYSTAL ID** Systems.

Reactions employed by various substrates and a brief explanation of the principles employed in the system are described in Table 2. Panel location in referred tables indicates the row and column where the well is located (example: 1J refers to Row 1 in column J).

## **REAGENTS**

The **BBL CRYSTAL RS/E** panel contains 30 enzymatic and biochemical substrates. Refer to Table 3 for a list of active ingredients.

### **Precautions:** *in vitro* Diagnostic

After review by the Centers for Disease Control and Prevention (CDC), and the Food and Drug Administration (FDA) under CLIA '88, this product has been identified as high complexity. The CDC Analyte Identifier Code is 0412; the CDC Test System Identifier Code is 07484.

After use, all infectious materials including plates, cotton swabs, inoculum tubes, filter papers used for oxidase or indole tests and panels must be autoclaved prior to disposal or incinerated.

It is important during the short incubation period that the temperature of the incubator be maintained at 35 – 37° C. If possible, avoid repeated opening and closing of the incubator during this time.

## **STORAGE AND HANDLING/SHELF LIFE**

**Lids:** Lids are individually packaged and must be stored at 2 – 25°C. **DO NOT FREEZE.** Visually inspect the package for holes or cracks in the foil package. Do not use if the packaging appears to be damaged. Lids in the original packaging, if stored as recommended, will retain expected reactivity until the date of expiration.

**Bases:** Bases are packaged in two sets of ten, in **BBL CRYSTAL** incubation trays. The bases are stacked facing down to minimize air contamination. Store in a dust free environment at 2 – 25°C, until ready to use. Store unused bases in the tray, in plastic bag. Empty trays should be used to incubate panels.

**Inoculum Fluid:** **BBL CRYSTAL** Enteric/Stool ID Inoculum Fluid (IF) is packaged in two sets of ten tubes. Visually inspect the tubes for cracks, leaks, etc. Do not use if there appears to be a leak, tube or cap damage or visual evidence of contamination (i.e., haziness, turbidity). Store tubes at 2 – 25°C. Expiration dating is shown on the tube label. **BBL CRYSTAL** Enteric/Stool ID Inoculum Fluid may be used with either **BBL CRYSTAL** E/NF or RS/E panels.

On receipt, store **BBL CRYSTAL** RS/E kit at 2 – 25°C. If the kit or any components are stored refrigerated, each should be brought to room temperature prior to use. The remaining components of the kit may be stored at 2 – 25° C.

### **SPECIMEN COLLECTION AND PROCESSING**

**BBL CRYSTAL** ID Systems are **not** for use directly with clinical specimens. Use isolates from a blood agar plate such as **Trypticase™** Soy Agar with 5% Sheep Blood. Use of a MacConkey Agar plate is also acceptable. The test isolate must be a pure culture no more than 24 h old. Only cotton-tipped applicator swabs should be used to prepare inoculum as some polyester swabs may cause problems with inoculation of the panels. (See “Limitations of The Procedure”.) Once lids are removed from the sealed pouches, they must be used within 1 h to ensure adequate performance. The plastic cover should remain on the lid until used.

The incubator used should be humidified to prevent evaporation of fluid from the wells during incubation. The recommended humidity level is 40 – 60%. The usefulness of **BBL CRYSTAL** ID Systems or any other diagnostic procedure performed on clinical specimens is directly influenced by the quality of the specimens themselves. It is strongly recommended that laboratories employ methods discussed in the *Manual of Clinical Microbiology* for specimen collection, transport and placement on primary isolation media<sup>3</sup>.

### **TEST PROCEDURE**

**Materials Provided:** **BBL CRYSTAL** Rapid Stool/Enteric kit:

- 20 **BBL CRYSTAL** Rapid Stool/Enteric Panel Lids,
- 20 **BBL CRYSTAL** Bases,
- 20 **BBL CRYSTAL** Enteric/Stool ID Inoculum Fluid Tubes. Each tube has approximately 2.2 ± 0.1 mL of Inoculum Fluid containing: NaCl 8.50 g, 3-Morpholinopropanesulfonic acid 0.8372 g, Purified water to 1000 ml.
- 2 Incubation trays,
- 1 **BBL CRYSTAL** RS/E ID Report Pad.

**Materials Not Provided:** Sterile cotton swabs (*do not use polyester swabs*), Incubator (35 – 37° C) non - CO<sub>2</sub> (40 – 60% humidity), **BBL CRYSTAL** Light Box/Panel Viewer (includes **BBL CRYSTAL** Color Reaction Charts), McFarland standards No. 0.5 and No. 1, **BBL CRYSTAL** ID System Electronic Codebook or **BBL CRYSTAL** RS/E Manual Codebook (see “Availability”), nonselective culture plate (e.g., **Trypticase** Soy Agar with 5% Sheep Blood), **BBL™** DMACA Indole Reagent Droppers, **BBL** Oxidase Reagent Droppers (see “Availability”).

Also required are the necessary equipment and labware used for preparation, storage and handling of clinical specimens.

**Test Procedure:** **BBL CRYSTAL** RS/E ID System requires oxidase and indole test results. Prior to **BBL CRYSTAL** RS/E panel set-up, oxidase and indole tests should be performed from a nonselective isolation plate no more than 24 h old. Perform oxidase and indole tests per instructions provided in the package insert for these reagents.

1. Remove lids from pouch. Discard desiccant. Once removed from the pouch, covered lids should be used within 1 h. Do not use panel if there is no desiccant in the pouch.
2. Take an inoculum tube and label with patient’s specimen number. Using aseptic technique, with the tip of a sterile cotton swab (*do not use a polyester swab*) or a wooden applicator stick or disposable plastic loop, pick several well isolated colonies of the same morphology from a blood plate such as **Trypticase** Soy Agar with 5% Sheep Blood. Use of a MacConkey Agar plate is acceptable.
3. Suspend colonies in a tube of **BBL CRYSTAL** Enteric/Stool Inoculum Fluid.
4. Recap tube and vortex for approximately 10 – 15 sec. The turbidity should be at least equivalent to a McFarland No. 0.5 standard without exceeding a McFarland No. 1 standard. During the process of inoculum preparation, if the inoculum concentration is in excess of the McFarland standard, one of the following steps is recommended.
  - a. Prepare a new inoculum with a fresh tube of Inoculum Fluid equivalent to the McFarland No. 0.5 – 1 standard.
  - b. If additional colonies are unavailable for preparation of a new inoculum, dilute the inoculum by adding the minimum required volume (not to exceed 1.0 mL) of 0.85% sterile saline to bring down the turbidity equivalent to a McFarland No. 1, using aseptic techniques. Remove the excess amount added to the tube with a sterile pipet so that the final volume of inoculum is approximately equivalent to that of the original volume in tube ( $2.2 \pm 0.1$  mL). Failure to do this will result in spilling of the inoculum over the black portion of the base rendering the panel unusable.
5. Take a base, and mark the patient’s specimen number on the side wall.
6. Pour entire contents of inoculum fluid into target area of the base.

7. Hold base in both hands and roll inoculum gently along the tracks until all of the wells are filled. Roll *back* any excess fluid to the target area and place the base on a bench top.
8. Align the lid so that the labeled end of the lid is on top of the target area of the base.
9. Push down until a slight resistance is felt. Place thumb on edge of lid towards middle of panel on each side and push downwards simultaneously until the lid snaps into place (listen for two “clicks”).

**Purity Plate:** Using a sterile loop, recover a small drop from the inoculum fluid tube either before or after inoculating the base and inoculate an agar slant or plate (any appropriate media) for purity check. Discard inoculum tube and cap in a biohazard disposal container. Incubate the slant or plate for 18 – 24 h at 35 – 37°C in a non-CO<sub>2</sub> incubator. The purity plate or slant may also be used for any supplementary tests or serology, if required.

**Incubation:** Place inoculated panels in incubation trays. Ten panels can fit in one tray (5 rows of 2 panels). All panels should be incubated **face down** (larger windows facing up; label facing down) in a non-CO<sub>2</sub> incubator with 40 to 60% **humidity**. Trays should not be stacked more than two high during incubation. The incubation time for RS/E panels is **3 h** (not to exceed 3.5 h) at 35 – 37°C. The incubator should not be opened repeatedly (preferably less than 3 times) during the incubation period.

**Reading:** After the recommended period of incubation, remove the panels from the incubator. All panels should be read **face down** (larger windows up; label facing down) using the **BBL CRYSTAL** light box or Panel Viewer. Refer to the color reaction chart and/or Table 3 for an interpretation of the reactions. Use the **BBL CRYSTAL** RS/E Report Pad to record reactions.

**Calculation of BBL CRYSTAL Profile Number:** Each test result that is scored positive is given a value of 4, 2, or 1, corresponding to the row where the test is located. A value of 0 (zero) is given to any negative result. The numbers (values) resulting from each positive in each column are then added together. A 10-digit number is generated; this is the profile number.

Example:	A	B	C	D	E	F	G	H	I	J
4	+	+	+	-	-	+	+	-	+	-
2	-	-	+	-	+	-	-	+	+	-
1	+	-	-	-	-	-	-	+	+	+
Profile	5	4	6	0	2	4	4	3	7	1

The resulting profile number and off-line test results (indole and oxidase) should be entered on a PC in which the **BBL CRYSTAL** ID System Electronic Codebook has been installed, to obtain the identification. A manual codebook is also available. If a PC is not available contact

Becton Dickinson Microbiology Systems Technical Services for assistance with the identification.

### **QUALITY CONTROL**

**User Quality Control:** Quality control testing is recommended for each lot of panels as follows:

1. Set up a **BBL CRYSTAL RS/E** panel with *Klebsiella pneumoniae* ATCC® 33495 per recommended procedure (refer to “Test Procedure”).
2. Prior to incubation, let panel remain at room temperature optimally for 3 min (but less than 5 min).
3. Read and record reactions with the aid of the light box or panel viewer and **BBL CRYSTAL RS/E Color Reaction Chart**.
4. If any of the wells are positive per color chart (after 3 – 5 min), DO NOT USE PANELS from this lot. Contact Becton Dickinson Microbiology Systems Technical Services.
5. If all wells are negative, then incubate panel for 3 h at 35 – 37°C.
6. Read panel with **BBL CRYSTAL Light Box** or Panel Viewer and **BBL CRYSTAL RS/E Color Reaction Chart**; record reactions using the **BBL CRYSTAL Report Pad**.
7. Compare recorded reactions with those listed in Table 4. If discrepant results are obtained, confirm purity of quality control strain before contacting Becton Dickinson Microbiology Systems Technical Services.

Expected test results for additional quality control test strains are listed in Table 5.

### **LIMITATIONS OF THE PROCEDURE**

The **BBL CRYSTAL RS/E ID System** is designed for the RS/E taxa provided. Taxa other than those listed in Table 1 are not intended for use in this system.

**BBL CRYSTAL** Identification Systems use a modified microenvironment; therefore, expected values for its individual tests may differ from information previously established with conventional test reactions. The accuracy of the **BBL CRYSTAL RS/E Identification System** is based on statistical use of specially designed tests and an exclusive database.

When antisera are available, the biochemical identification of selected organisms, such as *Salmonella*, *Salmonella* subgroup 3, *Shigella*, enteropathogenic *Escherichia coli* A-D, and *Vibrio cholerae*, should be extended by antigenic analysis.<sup>3,8</sup>

**BBL CRYSTAL** Identification Systems are NOT for use directly with clinical specimens.

The incubator should not be opened repeatedly (preferably less than 3 times) during the incubation period.

Only cotton-tipped applicator swabs, or wooden applicator sticks, or disposable plastic loops should be used to prepare the inoculum suspension as some polyester swabs may cause the inoculum fluid to become viscous. This may result in insufficient inoculum fluid to fill the wells. Once lids are removed from the sealed pouches they must be used within 1 h to ensure adequate performance. The plastic cover should remain on the lids until used.

The incubator where panels are placed should be humidified to prevent evaporation of inoculum fluid from the wells during incubation. The recommended humidity level is 40 – 60%.

The panels, after inoculation, should only be incubated **face down** (larger windows facing up; label facing down) to maximize the effectiveness of substrates.

Colonies should be taken from a blood agar plate such as **Trypticase Soy Agar with 5% Sheep Blood**. Use of a MacConkey Agar Plate is also acceptable.

## PERFORMANCE CHARACTERISTICS

**Reproducibility:** In an external study, involving two (2) clinical laboratories, the reproducibility of RS/E substrates' (30) reactions was studied by replicate testing. The reproducibility of individual substrate reactions ranged from 94.4 – 100%. The overall reproducibility of **BBL CRYSTAL RS/E** panel was determined to be 99.4%.

**Accuracy of Identification:** The performance of **BBL CRYSTAL RS/E ID System** was compared to currently available commercial systems using clinical isolates and stock cultures.

In an internal study, the performance of the **BBL CRYSTAL Rapid Stool/Enteric** was evaluated. Results from 118 enteric and nonenteric isolates (representing 23 species) tested were analyzed. Discrepant identifications were resolved by the use of other commercial systems. These results are shown below:

N = 118	ID without Supplemental Testing	ID With Supplemental Testing	No ID or Misidentified
<b>BBL CRYSTAL RS/E</b>	115 (97.5%)	117 (99.1%)	1 (0.9%)

The performance of the **BBL CRYSTAL™ Rapid Stool/Enteric ID** test was evaluated in two independent clinical laboratories.<sup>29</sup> Both routine isolates arriving in the clinical laboratory as

well as previously identified isolates of the clinical trial sites' choice were utilized to establish performance characteristics.

Out of the 195 fresh clinical isolates tested by the laboratories' current identification methods, the **BBL CRYSTAL ID System** correctly reported 97.9% (191) including 15 instances where two or three organisms were reported and required supplemental testing to resolve.

Out of the 195 previously identified challenge strains confirmed by the laboratories' current identification methods, the **BBL CRYSTAL ID System** correctly reported 92.3% (180) including 25 instances where two organisms were reported and required supplemental testing to resolve.<sup>29</sup>

**TABLE 1**  
**Taxa in BBL CRYSTAL RS/E System\***

<i>Aeromonas hydrophila</i> group (includes <i>A. caviae</i> , <i>A. hydrophila</i> and <i>A. sobria</i> )	<i>Providencia alcalifaciens</i>
<i>Aeromonas veronii</i>	<i>Providencia rettgeri</i>
<i>Aeromonas schubertii</i>	<i>Providencia stuartii</i>
<i>Cedecea davisae</i>	<i>Pseudomonas aeruginosa</i>
<i>Citrobacter amalonaticus</i>	<i>Rahnella aquatilis</i>
<i>Citrobacter freundii</i>	<i>Salmonella arizonae</i>
<i>Citrobacter koseri</i> ( <i>C. diversus</i> )	<i>Salmonella choleraesuis</i>
<i>Edwardsiella hoshinae</i>	<i>Salmonella paratyphi</i> A
<i>Edwardsiella tarda</i>	<i>Salmonella</i> species
<i>Enterobacter aerogenes</i>	<i>Salmonella typhi</i>
<i>Enterobacter cloacae</i>	<i>Serratia marcescens</i>
<i>Enterobacter gergoviae</i>	<i>Serratia liquefaciens</i>
<i>Enterobacter taylorae</i>	<i>Serratia odorifera</i> 1
<i>Escherichia coli</i>	<i>Serratia odorifera</i> 2
<i>Escherichia coli</i> AD	<i>Serratia rubidaea</i>
<i>Escherichia coli</i> serogroup 0111	<i>Shewanella putrefaciens</i>
<i>Escherichia coli</i> serogroup 0157	<i>Shigella dysenteriae</i>
<i>Escherichia fergusonii</i>	<i>Shigella</i> species (includes <i>S. boydii</i> and <i>S. flexneri</i> )
<i>Escherichia hermanii</i>	<i>Shigella sonnei</i>
<i>Escherichia vulneris</i>	<i>Stenotrophomonas maltophilia</i> ( <i>Xanthomonas maltophilia</i> )
<i>Hafnia alvei</i>	<i>Vibrio cholerae</i>
<i>Klebsiella oxytoca</i>	<i>Vibrio damsela</i>
<i>Klebsiella ozaenae</i>	<i>Vibrio fluvialis</i>
<i>Klebsiella pneumoniae</i>	<i>Vibrio hollisae</i>
<i>Klebsiella rhinoscleromatis</i>	<i>Vibrio mimicus</i>
<i>Kluyvera ascorbata</i>	<i>Vibrio parahaemolyticus</i>
<i>Leclercia adecarboxylata</i>	<i>Vibrio vulnificus</i>
<i>Moellerella wisconsensis</i>	<i>Yersinia enterocolitica</i> group (includes <i>Y. enterocolitica</i> , <i>Y. frederikseni</i> , <i>Y. intermedia</i> and <i>Y. kirstensenii</i> )
<i>Morganella morganii</i>	<i>Yersinia pseudotuberculosis</i>
<i>Plesiomonas shigelloides</i>	
<i>Proteus mirabilis</i>	
<i>Proteus penneri</i>	
<i>Proteus vulgaris</i>	

\*Includes recent name change; older name is in parenthesis. (Holt, J.G., N.R. Kreig, P.H.A. Sneath, J.T. Staley, and S.T. Williams [ed.]. 1994. Bergey's manual of determinative bacteriology, 9th ed. Williams & Wilkins, Baltimore.)

**TABLE 2**

**Principles of Tests Employed In The BBL CRYSTAL RS/E System**

Panel Location	Test Feature	Code	Principle (Reference)
4A	Lactose	LAC	Utilization of carbohydrate results in lower pH and change in indicator (Phenol red). <sup>4, 6, 8, 16</sup>
4B	Mannose	MNS	
4C	Sucrose	SUC	
4D	Melibiose	MEL	
4E	Rhamnose	RHA	
4F	Sorbitol	SOR	
4G	Mannitol	MNT	
4H	Adonitol	ADO	
4I	Dextrose	DEX	
4J	Cellobiose	CEL	
2A	Trehalose	TRE	Utilization of carbohydrate results in lower pH and change in indicator (Phenol red). <sup>6, 8, 16</sup>
2B	0129 (2,4 Diamino-6,7-diisopropyl pteridine phosphate salt)	129	Species not inhibited by 0129 utilize carbohydrate resulting in lower pH and change in indicator (Phenol red). <sup>4,6,8,16</sup>
2C	p-nitrophenyl β-glucoside	BGL	Enzymatic hydrolysis of the colorless aryl substituted glycoside or phosphate ester releases yellow p-nitrophenol. <sup>7, 14, 15, 18, 21</sup>
2D	p-nitrophenyl β-galactoside	NPG	
2E	p-nitrophenyl-N-acetyl glucosaminide	NAG	
2F	p-nitrophenyl bis-phosphate	BPH	
2G	p-nitrophenyl xyloside	BXY	
2H	p-nitrophenyl α-galactoside	AGA	
2I	p-nitrophenyl β-glucuronide	GLR	
2J	γ-L-glutamyl p-nitroanilide	GGL	Enzymatic hydrolysis of the colorless, amide substrate releases yellow p-nitroaniline. <sup>7, 14, 15, 18, 21</sup>
1A	Urea	URE	Hydrolysis of urea and the resulting ammonia changes the pH indicator color (Bromthymol blue). <sup>4, 9, 17</sup>
1B	Indoxyl phosphate	IPH	Hydrolysis of indoxyl phosphate results in blue indigo. <sup>29</sup>
1C	p-nitro-DL-phenylalanine	PHE	Oxidative deamination of phenylalanine results in a brown color in the presence of ferric ion. <sup>4,17</sup>
1D	Esculin	ESC	Hydrolysis of esculin, results in a black precipitate in the presence of ferric ion. <sup>17</sup>
1E	H <sub>2</sub> S	H <sub>2</sub> S	Reduction of thiosulfate results in a black precipitate in the presence of ferric ion. <sup>17</sup>
1F	Tetrazolium	TTC	Reduction of the tetrazolium compound results in formation of a red formazan. <sup>29</sup>
1G	Malonate	MLO	Utilization of malonate results in alkaline metabolites that change the color of the pH indicators (Bromcresol purple and Bromthymol blue). <sup>17,23</sup>
1H	Arginine	ARG	Anaerobic catabolism results in pH rise and change in the color of the indicator (Bromcresol purple and Cresol red). <sup>4, 20</sup>
1I	Ornithine	ORN	
1J	Lysine	LYS	

**Table 3**

**Reagents used in the BBL CRYSTAL RS/E ID System**

LOCATION	SUBSTRATE	CODE	POS	NEG	ACTIVE INGREDIENTS	Approx. Amt (g/10 mL)
4A	Lactose	LAC	Gold/Yellow	Orange/Red	Lactose	1.0
4B	Mannose	MNS	Gold/Yellow	Orange/Red	Mannose	1.0
4C	Sucrose	SUC	Gold/Yellow	Orange/Red	Sucrose	2.8
4D	Melibiose	MEL	Gold/Yellow	Orange/Red	Melibiose	1.0
4E	Rhamnose	RHA	Gold/Yellow	Orange/Red	Rhamnose	2.0
4F	Sorbitol	SOR	Gold/Yellow	Orange/Red	Sorbitol	2.0
4G	Mannitol	MNT	Gold/Yellow	Orange/Red	Mannitol	1.8
4H	Adonitol	ADO	Gold/Yellow	Orange/Red	Adonitol	2.5
4I	Dextrose	DEX	Gold/Yellow	Orange/Red	Dextrose	2.0
4J	Cellobiose	CEL	Gold/Yellow	Orange/Red	Cellobiose	1.0
2A	Trehalose	TRE	Gold/Yellow	Orange/Red	Trehalose	1.0
2B	0129	129	Gold/Yellow	Orange/Red	0129 (2,4 diamino-6,7-diisopropyl pteridine phosphate salt)	0.02
2C	p-n-p-β-glucoside	BGL	Yellow	Colorless	p-n-p-β-glucoside	0.02
2D	p-n-p-β-galactoside	NPG	Yellow	Colorless	p-n-p-β-galactoside	0.06
2E	p-n-p-N-acetyl glucosaminide	NAG	Yellow	Colorless	p-n-p-N-acetyl glucosaminide	0.04
2F	p-n-p bis-phosphate	BPH	Yellow	Colorless	p-n-p bis-phosphate	0.02
2G	p-n-p-xyloside	BXY	Yellow	Colorless	p-n-p-xyloside	0.03
2H	p-n-p-α-galactoside	AGA	Yellow	Colorless	p-n-p-α-galactoside	0.02
2I	p-n-p-β-glucuronide	GLR	Yellow	Colorless	p-n-p-β-glucuronide	0.02
2J	γ-L-glutamyl p-nitroanilide	GGL	Yellow	Colorless	γ-L-glutamyl p-nitroanilide	0.01
1A	Urea	URE	Aqua/Blue	Yellow/Green	Urea	0.2
1B	Indoxyl phosphate	IPH	Blue precipitate	Colorless	Indoxyl phosphate	0.25
1C	Phenylalanine	PHE	Gold/Rust	Clear/Pale Yellow	p-nitro-DL-phenylalanine	0.1
1D	Esculin	ESC	Brown	Clear/Tan	Esculin	0.07
1E	H <sub>2</sub> S	H <sub>2</sub> S	Olive/Black	Clear/Tan	Sodium thiosulfate	0.03
1F	Tetrazolium	TTC	Pink/Red*	Clear	Triphenyl tetrazolium chloride	0.15
1G	Malonate	MLO	Blue/Purple	Yellow/Green	Malonic acid	0.75
1H	Arginine	ARG	Purple	Yellow/Green	Arginine	1.5
1I	Ornithine	ORN	Purple	Yellow/Green	Ornithine	1.0
1J	Lysine	LYS	Purple	Yellow/Green	Lysine	0.8

\* Precipitate may or may not be visible.

**Table 4****User Quality Control Chart for CRYSTAL RS/E System**

PANEL LOCATION	SUBSTRATE	CODE	Klebsiella pneumoniae ATCC® 33495
4A	Lactose	LAC	+
4B	Mannose	MNS	+
4C	Sucrose	SUC	+
4D	Melibiose	MEL	+
4E	Rhamnose	RHA	+
4F	Sorbitol	SOR	+
4G	Mannitol	MNT	+
4H	Adonitol	ADO	+
4I	Dextrose	DEX	+
4J	Cellobiose	CEL	+
2A	Trehalose	TRE	+
2B	0129	129	+
2C	p-n-p-β-glucoside	BGL	+
2D	p-n-p-β-galactoside	NPG	V
2E	p-n-p-N-acetyl glucosaminide	NAG	-
2F	p-n-p bis-phosphate	BPH	V
2G	p-n-p-xyloside	BXY	+
2H	p-n-p-α-galactoside	AGA	(+)
2I	p-n-p-β-glucuronide	GLR	-
2J	γ-L-glutamyl p-nitroanilide	GGL	V
1A	Urea	URE	V
1B	Indoxyl phosphate	IPH	+
1C	p-nitro-DL-phenylalanine	PHE	-
1D	Esculin	ESC	+
1E	H <sub>2</sub> S	H <sub>2</sub> S	-
1F	Tetrazolium	TTC	+
1G	Malonate	MLO	(+)
1H	Arginine	ARG	-
1I	Ornithine	ORN	-
1J	Lysine	LYS	+

+ = positive reaction - = negative reaction V = variable reaction (+) = usually positive, but occasionally negative

**Table 5**

**Additional Quality Control Strains for BBL CRYSTAL RS/E System**

PANEL LOCATION	CODE	Escherichia coli ATCC® 33605	Pseudomonas aeruginosa ATCC® 27853	Proteus vulgaris ATCC® 8427	Plesiomonas shigelloides ATCC® 14029
4A	LAC	+	-	-	-
4B	MNS	+	-	-	-
4C	SUC	V	-	+	-
4D	MEL	V	-	-	-
4E	RHA	+	-	-	-
4F	SOR	+	-	-	-
4G	MNT	+	-	-	-
4H	ADO	-	-	-	-
4I	DEX	+	-	+	+
4J	CEL	V	-	-	-
2A	TRE	+	-	-	V
2B	129	V	-	V	-
2C	BGL	-	-	+	-
2D	NPG	+	-	-	-
2E	NAG	-	-	-	+
2F	BPH	V	-	+	+
2G	BXY	-	-	-	-
2H	AGA	V	-	-	-
2I	GLR	+	-	-	-
2J	GGL	-	+	V	-
1A	URE	-	-	+	-
1B	IPH	-	-	V	-
1C	PHE	-	-	+	-
1D	ESC	-	-	V	-
1E	H <sub>2</sub> S	-	-	V	-
1F	TTC	V	-	V	-
1G	MLO	-	-	-	-
1H	ARG	-	-	-	+
1I	ORN	+	-	-	+
1J	LYS	+	-	-	+

+ = positive reaction - = negative reaction V = variable reaction (+) = usually positive, but occasionally negative

**AVAILABILITY**

- | <b>Cat. No.</b> | <b>Description</b>   |
|-----------------|--|
| 245050          | <b>BBL CRYSTAL™</b> Rapid Stool/Enteric ID Kit, containing 20 each: <b>BBL CRYSTAL</b> Rapid Stool/Enteric Panel Lids, <b>BBL CRYSTAL</b> Bases, <b>BBL CRYSTAL</b> Enteric/Stool ID Inoculum Fluid tubes. |
|                 | <b>BBL CRYSTAL™</b> Light Box, Domestic Model, 110V, 60 Hz.  |
|                 | <b>BBL CRYSTAL™</b> Light Box, European Model, 220 V, 50 Hz.   |
|                 | <b>BBL CRYSTAL™</b> Light Bulb.  |
|                 | <b>BBL CRYSTAL™</b> Panel Viewer, Domestic model, 110 V, 60 Hz.  |

**BBL CRYSTAL™** Panel Viewer, European model, 220 V, 50 Hz.

**BBL CRYSTAL™** Panel Viewer, Japanese model, 100 V, 50/60 Hz.

**BBL CRYSTAL™** Panel Viewer Longwave UV Tube.

**BBL CRYSTAL™** Panel Viewer White Light Tube.

**BBL CRYSTAL™** ID System Electronic Codebook.

**BBL CRYSTAL™** Identification Systems Rapid Stool/Enteric Manual Codebook.

**Trypticase™** Soy Agar with 5% Sheep Blood, pkg of 20 plates.

**Trypticase™** Soy Agar with 5% Sheep Blood, ctn of 100 plates.

**BBL™** DMACA Indole Reagent Droppers, 50s.

**BBL™** Oxidase Reagent Droppers, 50s.

**BBL CRYSTAL™** Enteric/Stool ID Inoculum Fluid, ctn of 10.

**For specific catalog number information, visit our website <http://www.bd.com/microbiology>, or contact the nearest Becton Dickinson Microbiology Systems office.**

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**TECHNICAL INFORMATION:** In the United States telephone Technical Services, toll free (800)638-8663.

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