**Purpose**

The purpose of this procedure is to provide instructions for comprehensive Quality Control using the VITEK® 2 system. Using Quality control organisms to monitor the performance of a test system to insure reliable results.

The goal of QC is to monitor the following:

* The precision and accuracy of susceptibility and identification test procedures
* The performance of equipment and reagents
* The performance of personnel who perform testing and report results

**A. Recording Card Shipments**

**B. Testing and Storage of QC Organisms**

**C. QC of Specific Organisms to Verify Identification Test Procedure**

**D. QC of Specific Organisms to Verify Susceptibility Test Procedure**

**E. QC Results Review**

**F. Frequency of Quality Control Testing**

**G. Troubleshooting and Corrective Action**

**H. Verification of Patient Test Results**

**I. Printing QC Cumulative Report**

**Materials**

|  |  |  |
| --- | --- | --- |
| **Reagents** | **Supplies** | **Equipment** |
| * Trypticase soy agar with 5% sheep blood.
* Sterile saline (0.45% to 0.50% NaCl, pH 4.5 to 7.0)
 | * VITEK® 2 GN card , GP card
* VITEK® 2 Cassette
* Sterile swabs
* 12mm x 75mm plastic disposable test tubes

Test tube caps | * VITEK® 2 instrument
* DensiCHEK™ Calibrator
* Adjustable volume saline dispenser.
* Vortex
 |

**A. Recording Card Shipments**

To record a shipment of cards, you must enter the following information into the system software:

* Lot number
* Date of receipt
* Quantity of boxes in the shipment

Adding the QC shipment information to the system software:

* From the View QC Results view, click the Record Shipment icon (picture of a truck).
* The Record Shipment window appears.
* Enter the lot number by manually entering or scanning the bar code number located on the box. NOTE: a box can have more than one barcode printed on it. Only the barcode containing the lot number, lot expiration date and card type will be utilized for recording a shipment.
* If the shipment information already exists in the software, if there is a problem with the bar code, or if the ID or AST card type is not known, the system software does not allow you to proceed.
* Enter the Quantity Received. NOTE: if a previous shipment was received, the information displays in the bottom of the window.
* Select the Date Shipment was received. NOTE: if you change the date received, you will create a new shipment. If you enter the same received lot, you will update the shipment.
* When the appropriate information is entered, click **OK** to record the new card information.
* The system software updates the user QC inventory with the new shipment information.

**B. Testing and Storage of QC Organisms**

|  |  |
| --- | --- |
| **Step** | **Action** |
| 1. | Rehydrate the organism according to the manufacturer’s instructions. |
| 2. | Subculture to trypticase soy agar with 5% sheep blood. |
| 3. | Incubate aerobically at 35ºC to 37ºC for 18 to 24 hrs. Organisms for AST cards are incubated in non-CO2 incubator. |
| 4. | Check for purity |
| 5. | Perform a second subculture for testing. |
| **Short Term Storage** |
| 1. | Streak to SBA agar |
| 2. | Incubate 24hrs at 35ºC to 37ºC |
| 3. | Refrigerate at 2ºC to 8ºC for up to two weeks |
| 4. | Subculture once as described above and use for QC |
| **Long Term Storage** |
| 1. | Make a heavy suspension in tryptic soy broth with 15% glycerol |
| 2. | Label each TSB broth with the appropriate organism |
| 3. | Freeze at -70ºC |
| 4. | Subculture to SBA twice before using for QC |
| *Avoid repeated thawing and refreezing by either freezing in single-use aliquots or removing a small portion of frozen organism preparation with a sterile applicator stick.* |

**C. Quality Control Organisms and Procedures for GN and GP ID**

Organisms for GN ID Quality Control

|  |  |
| --- | --- |
| **Organism** | **ATCC #** |
| Enterobacter hormaechei/cloacae | 700323 |
| Stenotrophomonas maltophila | 17666 |
| Acinetobacter baumannii | BAA-747 |
| Elizabethkingia menigoseptica | 13253 |
| Klebsiella oxytoca | 700324 |
| Ochrobactrum anthropi | BAA-749 |
| Proteus vulgaris | 6380 |
| Pseudomonas aeruginosa | 9721 |
| Pseudomonas aeruginosa | BAA-1744 |
| Shigella sonnei | 25931 |

Organisms for GP ID Quality Control

|  |  |
| --- | --- |
| **Organism** | **ATCC #** |
| Enterococcus casseliflavus | 700327 |
| Streptococcus thermophilus | 19258 |
| Kocuris kristinae | BAA-752 |
| Listeria monocytogenes | BAA-751 |
| Streptococcus pneumoniae | 49619 |
| Staphylococcus saprophyticus | BAA-750 |
| Staphylococcus sciuri | 29061 |
| Streptococcus equi ssp. Zooepidemicus | 43079 |
| Enterococcus saccharolyticus | 43076 |

**Streamlined QC**

The Streamlined QC procedure may be followed after a review of QC performance of at least three consecutive lot numbers of the Microbial Identification System, from three shipments that span at least three consecutive seasons with satisfactory performance (at least 95% of the reagent/substrate results are within the results specified by the manufacturer.

 Organisms for GP ID Streamlined Quality Control

|  |  |
| --- | --- |
|  **Organism** |  **ATCC® Number** |
| Enterococcus casseliflavus |  700327 |
| Staphylococcus saprophyticus |  BAA-750 |

 Organisms for GN ID Streamlined Quality Control

|  |  |
| --- | --- |
|  **Organism** |  **ATCC® Number** |
| Enterobacter hormaechei |  700323 |
| Stenotrophomonas maltophilia |  17666 |

**Procedure**

|  |  |
| --- | --- |
| 1. | Remove required number of GN ID or GP ID cards from refrigerator allowing them to come to room temperature before removing from package liner. |
| 2. | Label required number of 12 X 75 mm plastic tubes and place in cassette holder. |
| 3. | Dispense 3.0 ml of sterile saline into each plastic tube using the Dispensette pipette. |
| 4. | Prepare a homogeneous organism suspension using DensiCHEK ™ Plus |
| 5. | Suspension must read between 0.5 – 0.63 McFarland. |
| 6. | Remove cards from package liner. |
| 7. | Place card into designated slot with “blue straw” immersed in the suspension. |
| 8. | Load cassette into the filling station.  |
| 9. | Press Start Fill. |
| 10. | Transfer cassette to the loading station. |
| 11. | Enter QC organism information in the Vitek 2 computer when the process is completed and instrument sounds the Cassette Success alert. In “set up tests post entry”, Click on the QC box and select the correct QC organism from the list. |
| 12. | Remove cassette from load station, make purity plates from organism sensitivity suspension. |

**D. Quality Control Organisms and Procedure for GN and GP AST**

Organisms for GN AST Quality Control

|  |  |
| --- | --- |
| **Organism** | **ATCC #** |
| Escherichia coli | ATCC 25922 |
| Pseudomonas aeruginosa | ATCC 27853 |
| Escherichia coli | ATCC 35218 |
| Klebsiella pneumoniae ssp.pneumoniae | ATCC 700603 |

Organisms for GP AST Quality Control

|  |  |
| --- | --- |
| **Organism** | **ATCC #** |
| Enterococcus faecalis | ATCC 29212 |
| Staphylococcus aureus | ATCC 29213 |
| Enterococcus faecalis | ATCC 51299 |
| Staphylococcus aureus | ATCC BAA-1026 |
| Staphylococcus aureus | ATCC BAA-976 |
| Staphylococcus aureus | ATCC BAA-977 |

 Organisms for AST-ST01 Quality Control

|  |  |
| --- | --- |
|  **Organism** |  **ATCC#** |
| Streptococcus pneumoniae |  ATCC 49619 |

**Procedure**

|  |  |
| --- | --- |
| **Step** | **Action** |
| 1. | Remove required number of AST-GN51 or AST-GP70 cards from refrigerator allowing them to come to room temperature before removing from package liner. |
| 2. | Label required number of 12 X 75 mm plastic tubes and place in cassette holder. |
| 3. | Dispense 3.0 ml of sterile saline into each plastic tube using the Dispensette pipette. |
| 4. | Prepare a homogeneous organism suspension using DensiCHEK ™ Plus |
| 5. | Suspension must read between 0.5 – 0.63 McFarland. |
| 6. | In a second tube containing 3.0 mL of saline, transfer 145 µL of the suspension for AST-GN cards, or 280 µL of the suspension for AST-GP cards.  |
| 7. | Remove cards from package liner. |
| 8. | Place card into designated slot with “gray straw” immersed in the suspension. |
| 9. | Load cassette into the filling station.  |
| 10. | Press Start Fill. |
| 11. | Transfer cassette to the loading station. |
| 12. | Enter QC organism information when the process is completed and instrument sounds the Cassette Success alert. In “set up tests post entry”, Click on the QC box and select the correct QC organism from the list. |
| 13. | Remove cassette from load station, make purity plates from organism sensitivity suspension. |

**E. QC Results Review**

All QC isolates must be reviewed for GN and GP cards. If an ID analysis returns a **Low Discrimination** result, the QC isolate is considered **Qualified**, and you will need to review the isolate and provide additional information to allow the isolate to become **Final**.

 I. Action:

1. Click on Quality Control View Icon (looks like a graph)
2. The View QC Results view appears.
3. QC isolates appear in the navigation tree in the View QC Results window.
4. If needed, provide the system software with additional information or perform a task to bring the results to final.
5. When an isolate is stopped for review or qualified, the icon beside the isolate represents the state of the test or isolate.
6. The isolate states and icons, that appear beside them in the navigation tree, are described in the table below:

|  |  |
| --- | --- |
| **Icon** | **Description** |
| Folder | All QC parameters are within range. Indicates that none of the QC isolates associated with this level contains a deviation. |
| Brown Square w/ Pencil | A QC parameter is out of range for one or more QC isolates. Indicates that one or more of the QC isolates associated with this level contains a deviation. |
| Green Carrot Symbol in a Box (pointed right) | Preliminary – Card is still processing, analysis not yet complete |
| Orange Square | Final, Qualified – Analysis is complete but the isolate needs additional information to become complete. |
| Green Square | Final, Not Qualified (Complete) – Analysis is complete, NO additional QC isolate information or review is needed. |
| Green Carrot Symbol (pointing down) | To be Reviewed – All isolates need to be reviewed. |

 II. Viewing **Selected** QC Results

1. From View QC Results view, you can filter the isolates that appear in the navigation tree.
2. Select Date Tested from **View By** options.
3. Select from the following **Filter By** options:
	* Current, All Isolates
	* Current, Deviation Only. A corrective action must be entered for any deviation before reviewing, viewing, and/or printing.
	* Current, To be Reviewed
4. Once you have selected how you would like to view the QC Results, select a specific QC Result.
5. The selected result information appears in the active workspace.

III. Viewing QC Results

You may need to review current QC results for both ID and AST cards and mark them as **Reviewed**. QC results waiting to be reviewed are preceded by the **To Be Reviewed** icon. Isolate group analysis must be complete before reviewing QC results.

Reviewing QC Results:

* Deviations must be printed and a corrective action entered.
* Select a QC isolate group preceded by the **To Be Reviewed** icon.
* Click the Review Results icon (checkmark w/cards in the background).
* If system software is configured based on the default setting, Review Critical Isolates:
	+ The system software flags the QC isolate as **Reviewed**. The **QC Isolate** icon changes to green.
	+ The system software transfers the QC isolate into the QC cumulative workspace for long-term storage.
* If system software is configured for Review and Approve:
	+ The system software flags the isolate as **To Be Approved**. The **QC Isolate** icon changes to the **To Be Approved** icon.
* To create batches of isolate results:
	+ To select results that you want to view, click the result and hold down the **Shift** key to select multiple results in a row or hold down the **Ctrl** key to individually click different isolate group results not listed in a particular order.
	+ As you make your selections, the isolate groups appear in the active workspace.
* The list of selected isolates displays in the active workspace.
	+ If the status of all of the selected results is **To Be Reviewed**, you can perform a batch review at this point. Click **Review**.

See Appendix for GP and GN Quality Control Result Tablesor on Vitek 2C computer under Product

 Information.

**F. Frequency of Quality Control Testing**

Antimicrobial Susceptibility Tests

* **Quality Control Testing must be performed on each new lot number and/or new shipment of disks or cards.**
* **For new antibiotic susceptibility (AST) cards used routinely, quality control testing must be performed for 20 to 30 consecutive days before proceeding to weekly testing.**
* **Weekly Quality Control Testing for AST cards**:

 1) Test all applicable control strains for 20 to 30 consecutive test days and

 document the results.

 2) To convert from daily to weekly quality control testing, no more than 1 out

 of 20 or 3 out of 30 instrument test results may be outside the acceptable limits for each

 antimicrobial/organism combinations as stated in Tables 3 and 3A CLSI Standards or the

 manufacturers limits.

3) Perform quality control testing once per week and whenever any testing or other test component (e.g. new lot of cards from the same or different manufacturer) is changed.

4) If a new antimicrobial agent is added, a major change in the method of reading test results is implemented, or a different manufacturer is used, it must be tested for 20 or 30 consecutive days with satisfactory results before weekly testing can be implemented.

 5) If any of the weekly quality control results are out of the acceptable range corrective action is

 required.

Identification Systems:

**Quality Control Testing is performed with each new shipment and/or lot number received.**

 1) Testing is performed according to the manufacturers procedure.

 2) If results are out of the acceptable range, corrective action is required.

**G. Troubleshooting and Corrective Action**

Antimicrobial Susceptibility Testing

* **Out-of-Control Result Due to an Obvious Error**: document the reason and retest on the day that the error is observed. If the repeated result is within range, no further corrective action is required.

 Obvious reasons for out-of-control results:

* Use of the wrong control strain
* Obvious contamination of the strain or medium
* Inadvertent use of the wrong incubation temperature or conditions
* Inadequate volume of saline in tubes, or inadequate filling of the Vitek card.
* **Out-of-Control Result Not Due to an Obvious Error**

1) Test the out-of-control antimicrobial agent/organism combination on the day the error was observed, and monitor for a total of 5 consecutive days. Document all results. Use purity plate, if pure, for first day and a fresh subculture from the refrigerator (mother plate) each additional day.

2) If any of the 5 MIC results are outside the acceptable range, daily quality control testing must be continued until the problem is resolved. Contact the lead technologist. Do not report patient results for out of control antibiotics. If the problem has not been resolved, an alternative method may be used.

* Obtain a new quality control strain (either from freezer storage or a new lyophilized organism).
* If necessary obtain new lots of materials (including turbidity standards).

3) Once the problem is corrected, satisfactory performance for another 20 or 30 consecutive days is required in order to return to weekly quality control testing.

* **Additional Corrective Action**

 When immediate corrective action does not resolve the problem, the

 Following common sources of error should be investigated to verify that:

* + All materials are within their expiration dates and stored at the proper

temperature.

* + The incubator was at the proper temperature and atmosphere.
	+ Other equipment used (e.g., pipettes) were functioning properly.
	+ The control strain has not changed and was not contaminated.
	+ Inoculum suspensions were prepared and adjusted correctly.
	+ Inoculum for the test was prepared from a plate incubated for the correct length of time and in no case more than 24 hours old.
	+ Plates were stored at the proper temperature.
	+ Make sure saline is sterile.

If the problem persists, contact the manufacturer and provide them with the test results. Until the problem is resolved, it may be necessary to use an alternate test method. Refer to Vitek Reference Manual Section 28-8 for troubleshooting Vitek QC discrepancies.

 **Reporting of Patient Results**

An assessment of whether to report patient results when an out of control result occurs should be made on an individual basis, taking into account if the source of the error is likely to have affected relevant patient test results.

Options include:

* Suppressing results for an individual antimicrobial agent.
* Retrospectively reviewing individual patient or cumulative data for unusual patterns.
* Use an alternate test method or a reference laboratory.

  **Identification Systems Corrective Action**

For out of control results on identification systems:

* Repeat testing with a fresh isolate that has been subcultured twice.
* Make sure that the proper turbidity standard has been used and the manufacturer’s instructions have been followed.
* If necessary contact the manufacturer and provide them with the test results.
* It may be necessary to use an alternative identification system or a reference lab until the problem is resolved.
* There must be a positive and a negative result for each biochemical tested on the card.

**H. Verification of Patient Test Results**

It is important to review all of the results obtained from all drugs tested on a patient isolate prior to reporting the results. This should include but not be limited to ensuring that:

* The antimicrobial susceptibility results are consistent with organism identification
* The results from individual agents within a specific drug class follow the established hierarchy of established rules (e.g. 3rd generation cephalosporins are more active than 1st or 2nd generation cephalosporins against Enterobacteriaceae
* The isolate is susceptible to those agents for which resistance has not been documented

Unusual or inconsistent results should be verified by checking for the following:

* Transcription errors
* MIC: use of a defective card (< 3 ml of saline in plastic tube or under-filled well).
* Previous results on the patient (same isolate with previous unusual antibiogram)

If a reason for the unusual or inconsistent results cannot be ascertained, repeat the susceptibility test and/or the identification. An alternative test method may be used for the repeat test or isolate may be referred to a Reference Laboratory.

**I. Printing Monthly QC Cumulative Report**

1. In “View QC Results” under “View By” select date tested.
2. Under “Filter By” select custom, then enter the date range, and click OK.
3. At the top of the page, select the printer icon.
4. Click on the QC Cumulative Report.
5. At the bottom of the page, click the “Print All” button.

**Safety**

* Treat all specimens as potentially infectious.
* Dispose of all Biohazard items in properly labeled biohazard containers (eg. sharps go in sharps container).

**Backup Procedure**

See Kirby Bauer Procedure or refer testing to a Reference Laboratory (Mayo, MDH,).

**References**

1. Clinical and Laboratory Standards Institute M100-S16, Performance Standards for Antimicrobial Susceptibility Testing; 16th Informational Supplement.
2. M7-A7, Methods for Dilution Antimicrobic Susceptibility Tests for Bacteria

 that Grow Aerobically.

1. Vitek 2 Systems Product Information, 510809- 2EN 8/2008, BioMerieux, Durham, NC 27712

**Appendix**

**GN Quality Control Tables**

+ = 95-100% Pos; V = 6-94% Pos; - = 0-5% Pos

 **Acinetobacter baumannii ATCC BAA-747**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| APPA | **-** | AGLTp | v | BXYL | - | SAC | - | SUCT | **+** | CMT | v |
| ADO | - | dGLU | **+** | BSlap | **-** | dTAG | **-** | NAGA | **-** | BGUR | **-** |
| PyrA | - | GGT | v | ProA | v | dTRE | **-** | AGAL | **-** | O129R | v |
| IARL | - | OFF | - | LIP | v | CIT | **+** | PHOS | **-** | GGAA | **-** |
| dCEL | **v** | BGLU | **-** | PLE | **-** | MNT | **+** | GlyA | v | IMLTa | v |
| BGAL | **-** | dMAL | **-** | TyrA | **+** | 5KG | v | ODC | v | ELLM | **-** |
| H2S | - | dMAN | **-** | URE | v | ILATk | **+** | LDC | **-** | ILATa | v |
| BNAG | - | dMNE | **+** | dSOR | **-** | AGLU | **-** | IHISa | v |  |  |

 **Elizabethkingia meningoseptica ATCC 13253**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| APPA | **+** | AGLTp | + | BXYL | V | SAC | V | SUCT | **-** | CMT | V |
| ADO | v | dGLU | **-** | BSlap | **V** | dTAG | **V** | NAGA | **+** | BGUR | **V** |
| PyrA | + | GGT | v | ProA | V | dTRE | **V** | AGAL | **V** | O129R | V |
| IARL | v | OFF | - | LIP | V | CIT | **V** | PHOS | **V** | GGAA | **+** |
| dCEL | **v** | BGLU | **v** | PLE | **V** | MNT | **V** | GlyA | + | IMLTa | V |
| BGAL | **v** | dMAL | **v** | TyrA | **V** | 5KG | V | ODC | V | ELLM | **v** |
| H2S | v | dMAN | **v** | URE | V | ILATk | **-** | LDC | **V** | ILATa | v |
| BNAG | + | dMNE | **v** | dSOR | **v** | AGLU | **+** | IHISa | V |  |  |

 **Enterobacter hormaechei (cloacae) ATCC 700323**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| APPA | **-** | AGLTp | **-** | BXYL | **+** | SAC | **+** | SUCT | v | CMT | **-** |
| ADO | **+** | dGLU | **+** | BSlap | **-** | dTAG | **-** | NAGA | **+** | BGUR | **-** |
| PyrA | **-** | GGT | **+** | ProA | v | dTRE | **+** | AGAL | v | O129R | **+** |
| IARL | **-** | OFF | **+** | LIP | v | CIT | **+** | PHOS | v | GGAA | **-** |
| dCEL | **+** | BGLU | **-** | PLE | **+** | MNT | **+** | GlyA | v | IMLTa | **-** |
| BGAL | **+** | dMAL | **+** | TyrA | v | 5KG | **-** | ODC | **+** | ELLM | **-** |
| H2S | **-** | dMAN | **+** | URE | v | ILATk | v | LDC | **-** | ILATa | **-** |
| BNAG | **+** | dMNE | **+** | dSOR | **+** | AGLU | **-** | IHISa | **-** |  |  |

 **Klebsiella oxytoca ATCC 700324**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| APPA | v | AGLTp | **v** | BXYL | **-** | SAC | **v** | SUCT | **v** | CMT | **v** |
| ADO | **v** | dGLU | **v** | BSlap | **v** | dTAG | **v** | NAGA | **-** | BGUR | **-** |
| PyrA | **+** | GGT | **v** | ProA | **+** | dTRE | **v** | AGAL | **-** | O129R | **-** |
| IARL | **-** | OFF | **-** | LIP | **v** | CIT | **v** | PHOS | **-** | GGAA | **v** |
| dCEL | **v** | BGLU | **v** | PLE | **v** | MNT | **-** | GlyA | **+** | IMLTa | **v** |
| BGAL | **-** | dMAL | **v** | TyrA | **+** | 5KG | **-** | ODC | **-** | ELLM | **+** |
| H2S | **-** | dMAN | **-** | URE | **+** | ILATk | **v** | LDC | **-** | ILATa | **-** |
| BNAG | **-** | dMNE | **v** | dSOR | **-** | AGLU | **+** | IHISa | **-** |  |  |

 **Ochrobactrum anthropi ATCC BAA-749**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| APPA | **V** | AGLTp | **V** | BXYL | **-** | SAC | **V** | SUCT | **V** | CMT | **V** |
| ADO | **V** | dGLU | **V** | BSlap | **V** | dTAG | **V** | NAGA | **-** | BGUR | **-** |
| PyrA | **+** | GGT | **V** | ProA | **+** | dTRE | **V** | AGAL | **-** | O129R | **-** |
| IARL | **-** | OFF | **-** | LIP | **V** | CIT | **V** | PHOS | **-** | GGAA | **V** |
| dCEL | **V** | BGLU | **V** | PLE | **V** | MNT | **-** | GlyA | **+** | IMLTa | **V** |
| BGAL | **-** | dMAL | **V** | TyrA | **+** | 5KG | **-** | ODC | **-** | ELLM | **+** |
| H2S | **-** | dMAN | **-** | URE | **+** | ILATk | **V** | LDC | **-** | ILATa | **-** |
| BNAG | **-** | dMNE | **V** | dSOR | **-** | AGLU | **+** | IHISa | **-** |  |  |

 **Proteus vulgaris ATCC 6380**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| APPA | **-** | AGLTp | **-** | BXYL | **-** | SAC | **+** | SUCT | **V** | CMT | **V** |
| ADO | **-** | dGLU | **+** | BSlap | **-** | dTAG | **-** | NAGA | **-** | BGUR | **-** |
| PyrA | **-** | GGT | **V** | ProA | **V** | dTRE | **-** | AGAL | **-** | O129R | **V** |
| IARL | **-** | OFF | **V** | LIP | **V** | CIT | **V** | PHOS | **+** | GGAA | **V** |
| dCEL | **-** | BGLU | **+** | PLE | **V** | MNT | **-** | GlyA | **-** | IMLTa | **V** |
| BGAL | **-** | dMAL | **V** | TyrA | **V** | 5KG | **-** | ODC | **-** | ELLM | **+** |
| H2S | **+** | dMAN | **-** | URE | **+** | ILATk | **V** | LDC | **-** | ILATa | **V** |
| BNAG | **-** | dMNE | **-** | dSOR | **-** | AGLU | **V** | IHISa | **-** |  |  |

 **Pseudomonas aeruginosa ATCC 9721**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| APPA | **V** | AGLTp | v | BXYL | V | SAC | V | SUCT | **V** | CMT | V |
| ADO | V | dGLU | **V** | BSlap | **+** | dTAG | **V** | NAGA | **V** | BGUR | **V** |
| PyrA | V | GGT | V | ProA | V | dTRE | **V** | AGAL | **V** | O129R | V |
| IARL | V | OFF | V | LIP | V | CIT | **V** | PHOS | **V** | GGAA | **V** |
| dCEL | **V** | BGLU | **V** | PLE | **V** | MNT | **V** | GlyA | V | IMLTa | V |
| BGAL | **V** | dMAL | **-** | TyrA | **V** | 5KG | V | ODC | V | ELLM | **V** |
| H2S | V | dMAN | **V** | URE | V | ILATk | **+** | LDC | **V** | ILATa | v |
| BNAG | V | dMNE | **v** | dSOR | **V** | AGLU | **V** | IHISa | V |  |  |

 **Pseudomonas aeruginosa ATCC BAA-1744**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| APPA | **V** | AGLTp | V | BXYL | V | SAC | V | SUCT | **V** | CMT | + |
| ADO | V | dGLU | **V** | BSlap | **V** | dTAG | **V** | NAGA | **V** | BGUR | **V** |
| PyrA | V | GGT | V | ProA | V | dTRE | **V** | AGAL | **V** | O129R | V |
| IARL | V | OFF | V | LIP | V | CIT | **V** | PHOS | **V** | GGAA | **V** |
| dCEL | **V** | BGLU | **V** | PLE | **V** | MNT | **V** | GlyA | V | IMLTa | + |
| BGAL | **V** | dMAL | **V** | TyrA | **V** | 5KG | V | ODC | V | ELLM | **V** |
| H2S | V | dMAN | **V** | URE | V | ILATk | **V** | LDC | **V** | ILATa | V |
| BNAG | V | dMNE | **V** | dSOR | **V** | AGLU | **V** | IHISa | V |  |  |

 **Shigella sonnei ATCC 25931**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| APPA | **V** | AGLTp | V | BXYL | - | SAC | - | SUCT | **V** | CMT | + |
| ADO | V | dGLU | **V** | BSlap | **V** | dTAG | **V** | NAGA | **-** | BGUR | **+** |
| PyrA | V | GGT | - | ProA | V | dTRE | **V** | AGAL | **V** | O129R | V |
| IARL | V | OFF | V | LIP | V | CIT | **-** | PHOS | **V** | GGAA | **V** |
| dCEL | **V** | BGLU | **-** | PLE | **-** | MNT | **-** | GlyA | V | IMLTa | V |
| BGAL | **V** | dMAL | **+** | TyrA | **+** | 5KG | V | ODC | + | ELLM | **V** |
| H2S | V | dMAN | **V** | URE | V | ILATk | **V** | LDC | **V** | ILATa | V |
| BNAG | - | dMNE | **V** | dSOR | **V** | AGLU | **V** | IHISa | V |  |  |

 **Stenotrophomonas maltophilia ATCC 17666**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| APPA | **+** | AGLTp | **-** | BXYL | **-** | SAC | **-** | SUCT | **V** | CMT | **-** |
| ADO | **-** | dGLU | **V** | BSlap | **-** | dTAG | **-** | NAGA | **-** | BGUR | **-** |
| PyrA | **-** | GGT | **V** | ProA | **+** | dTRE | **-** | AGAL | **-** | O129R | **-** |
| IARL | **-** | OFF | **-** | LIP | **+** | CIT | **V** | PHOS | **+** | GGAA | **+** |
| dCEL | **-** | BGLU | **V** | PLE | **-** | MNT | **V** | GlyA | **-** | IMLTa | **-** |
| BGAL | **-** | dMAL | **-** | TyrA | **V** | 5KG | **-** | ODC | **-** | ELLM | **-** |
| H2S | **-** | dMAN | **-** | URE | **-** | ILATk | **V** | LDC | **-** | ILATa | **-** |
| BNAG | **V** | dMNE | **-** | dSOR | **-** | AGLU | **V** | IHISa | **-** |  |  |

**GP Quality Control Tables**

+ = 95-100% Pos; V = 6-94% Pos; - = 0-5% Pos

 **Enterococcus casseliflavus ATCC 700327**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AMY | **+** | CDEX | **-** | BGURr | **-** | URE | **-** | dMAL | **+** | PUL | **-** |
| PIPLC | - | AspA | **+1** | AGAL | **+** | POLYB | **V** | BACI | **+** | dRAF | **+** |
| Dxyl | **+** | BGAR | **+** | PyRa | **+** | dGAL | **+** | NOVO | **+** | O129R | **V** |
| ADH1 | **V** | AMAN | **V** | BGUR | **-** | dRIB | **+** | NC6.5 | **+** | SAL | **+** |
| BGAL | **+** | PHOS | **-** | AlaA | **V** | ILATk | - | dMAN | **+** | SAC | **+** |
| AGLU | **V** | LeuA | **V** | TyrA | **V** | LAC | **+** | dMNE | **+** | dTRE | **+** |
| APPA | **V** | ProA | **-** | dSOR | **V** | NAG | **+** | MBdG | **+** | ADH2s | **V** |
|  |  |  |  |  |  |  |  |  |  | OPTO | **+** |

**1**Occasional negative reaction may occur with faster identification result

 **Kocuria kristinae ATCC BAA-752**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AMY | **-** | CDEX | **-** | BGURr | **-** | URE | **-** | dMAL | **V** | PUL | **-** |
| PIPLC | - | AspA | **-** | AGAL | **-** | POLYB | **V** | BACI | **V** | dRAF | **-** |
| Dxyl | **-** | BGAR | **-** | PyRa | **V** | dGAL | **-** | NOVO | **-** | O129R | **V** |
| ADH1 | **V** | AMAN | **-** | BGUR | **-** | dRIB | **-** | NC6.5 | **+** | SAL | **V** |
| BGAL | **-** | PHOS | **-** | AlaA | **+** | ILATk | V | dMAN | **-** | SAC | **+** |
| AGLU | **+** | LeuA | **+** | TyrA | **V** | LAC | **-** | dMNE | **+** | dTRE | **V** |
| APPA | **V** | ProA | **+** | dSOR | **V** | NAG | **-** | MBdG | **-** | ADH2s | **-** |
|  |  |  |  |  |  |  |  |  |  | OPTO | **+** |

**Listeria monocytogenes ATCC BAA-751**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AMY | **+** | CDEX | **+** | BGURr | **-** | URE | **-** | dMAL | **+** | PUL | **-** |
| PIPLC | V | AspA | **V** | AGAL | **-** | POLYB | **+** | BACI | **+** | dRAF | **-** |
| Dxyl | **-** | BGAR | **-** | PyRa | **-** | dGAL | **-** | NOVO | **V** | O129R | **+** |
| ADH1 | **-** | AMAN | **+** | BGUR | **-** | dRIB | **-** | NC6.5 | **+** | SAL | **+** |
| BGAL | **-** | PHOS | **-** | AlaA | **V** | ILATk | - | dMAN | **-** | SAC | **-** |
| AGLU | **+** | LeuA | **V** | TyrA | **+** | LAC | **V** | dMNE | **+** | dTRE | **+** |
| APPA | **V** | ProA | **-** | dSOR | **-** | NAG | **+** | MBdG | **+** | ADH2s | **-** |
|  |  |  |  |  |  |  |  |  |  | OPTO | **+** |

 **Streptococcus pneumoniae ATCC 49619**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AMY | **V** | CDEX | **V** | BGURr | **V** | URE | **V** | dMAL | **V** | PUL | **V** |
| PIPLC | V | AspA | **V** | AGAL | **V** | POLYB | **V** | BACI | **-** | dRAF | **+** |
| Dxyl | **V** | BGAR | **V** | PyRa | **V** | dGAL | **V** | NOVO | **V** | O129R | **-** |
| ADH1 | **V** | AMAN | **-** | BGUR | **V** | dRIB | **-** | NC6.5 | **-** | SAL | **+** |
| BGAL | **V** | PHOS | **V** | AlaA | **+** | ILATk | V | dMAN | **V** | SAC | **V** |
| AGLU | **V** | LeuA | **V** | TyrA | **V** | LAC | **V** | dMNE | **V** | dTRE | **V** |
| APPA | **+** | ProA | **V** | dSOR | **V** | NAG | **V** | MBdG | **V** | ADH2s | **V** |
|  |  |  |  |  |  |  |  |  |  | OPTO | **-** |

 **Staphylococcus saprophyticus ATCC BAA-750**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AMY | **-** | CDEX | **-** | BGURr | **-** | URE | **+** | dMAL | **+** | PUL | **-** |
| PIPLC | - | AspA | **-** | AGAL | **-** | POLYB | **-** | BACI | **+** | dRAF | **-** |
| Dxyl | **-** | BGAR | **-** | PyRa | **V** | dGAL | **V** | NOVO | **+** | O129R | **V** |
| ADH1 | **V** | AMAN | **-** | BGUR | **-** | dRIB | **V** | NC6.5 | **+** | SAL | **-** |
| BGAL | **+** | PHOS | **V** | AlaA | **-** | ILATk | V | dMAN | **+** | SAC | **+** |
| AGLU | **V** | LeuA | **-** | TyrA | **-** | LAC | **+** | dMNE | **V** | dTRE | **+** |
| APPA | **V** | ProA | **-** | dSOR | **-** | NAG | **V** | MBdG | **-** | ADH2s | **-** |
|  |  |  |  |  |  |  |  |  |  | OPTO | **+** |

 **Staphylococcus sciui ATCC 29061**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AMY | + | CDEX | **-** | BGURr | **+** | URE | **-** | dMAL | **+** | PUL | **-** |
| PIPLC | - | AspA | **-** | AGAL | **-** | POLYB | **-** | BACI | **V** | dRAF | **-** |
| Dxyl | **-** | BGAR | **V** | PyRa | **-** | dGAL | **V** | NOVO | **V** | O129R | **V** |
| ADH1 | **+** | AMAN | **V** | BGUR | **+** | dRIB | **V** | NC6.5 | **+** | SAL | **+** |
| BGAL | **V** | PHOS | **+** | AlaA | **V** | ILATk | V | dMAN | **+** | SAC | **+** |
| AGLU | **V** | LeuA | **V** | TyrA | **V** | LAC | **-** | dMNE | **+** | dTRE | **+** |
| APPA | **-** | ProA | **-** | dSOR | **V** | NAG | **V** | MBdG | **+** | ADH2s | **-** |
|  |  |  |  |  |  |  |  |  |  | OPTO | **+** |

 **Streptococcus equi ssp zooepidemicus ATCC 43079**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AMY | **-** | CDEX | **V** | BGURr | **V** | URE | **-** | dMAL | **+** | PUL | **+** |
| PIPLC | - | AspA | **-** | AGAL | **-** | POLYB | **V** | BACI | **V** | dRAF | **-** |
| Dxyl | **-** | BGAR | **-** | PyrA | **-** | dGAL | **+** | NOVO | **+** | O129R | **V** |
| ADH1 | **+** | AMAN | **-** | BGUR | **V** | dRIB | **V** | NC6.5 | **V** | SAL | **V** |
| BGAL | **V** | PHOS | **+** | AlaA | **+** | ILATk | - | dMAN | **V** | SAC | **+** |
| AGLU | **V** | LeuA | **+** | TyrA | **+** | LAC | **V** | dMNE | **+** | dTRE | **-** |
| APPA | **V** | ProA | **V** | dSOR | **V** | NAG | **+** | MBdG | **V** | ADH2s | **V** |
|  |  |  |  |  |  |  |  |  |  | OPTO | **+** |

 **Streptococcus thermophilus ATCC 19258**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AMY | **-** | CDEX | **-** | BGURr | **-** | URE | **V** | dMAL | **-** | PUL | **-** |
| PIPLC | - | AspA | **-** | AGAL | **-** | POLYB | **V** | BACI | **V** | dRAF | **V** |
| Dxyl | **-** | BGAR | **+** | PyrA | **-** | dGAL | **-** | NOVO | **+** | O129R | **+** |
| ADH1 | **-** | AMAN | **-** | BGUR | **-** | dRIB | **-** | NC6.5 | **-** | SAL | **-** |
| BGAL | **+** | PHOS | **-** | AlaA | **+** | ILATk | - | dMAN | **-** | SAC | **+** |
| AGLU | **-** | LeuA | **+** | TyrA | **+** | LAC | **+** | dMNE | **V** | dTRE | **-** |
| APPA | **+** | ProA | **V** | dSOR | **-** | NAG | **-** | MBdG | **-** | ADH2s | **-** |
|  |  |  |  |  |  |  |  |  |  | OPTO | **+** |

 **Enterococcus saccharolyticus ATCC 43076**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AMY | **V** | CDEX | **+** | BGURr | **V** | URE | **V** | dMAL | **V** | PUL | **V** |
| PIPLC | V | AspA | **V** | AGAL | **+** | POLYB | **V** | BACI | **V** | dRAF | **V** |
| Dxyl | **V** | BGAR | **V** | PyrA | **-** | dGAL | **V** | NOVO | **V** | O129R | **V** |
| ADH1 | **V** | AMAN | **V** | BGUR | **V** | dRIB | **V** | NC6.5 | **V** | SAL | **V** |
| BGAL | **V** | PHOS | **V** | AlaA | **V** | ILATk | V | dMAN | **+** | SAC | **V** |
| AGLU | **V** | LeuA | **V** | TyrA | **V** | LAC | **V** | dMNE | **V** | dTRE | **V** |
| APPA | **V** | ProA | **V** | dSOR | **+** | NAG | **V** | MBdG | **V** | ADH2s | **V** |
|  |  |  |  |  |  |  |  |  |  | OPTO | **V** |