

Table 2E. *Enterococcus* spp. (Continued)

- ³ Murray BE, Arias CA, Nannini EC. Glycopeptides (vancomycin and teicoplanin), streptogramins (quinupristin-dalfopristin), lipopeptides (daptomycin), and lipoglycopeptides (telavancin). In: Bennett JE, Dolin R, Blaser MJ. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases*. 8th ed. Philadelphia, PA: Elsevier Saunders; 2015:377-400.

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Table 2F. Zone Diameter and MIC Breakpoints for *Bordetella bronchiseptica*

Testing Conditions		Routine QC Recommendations (see Tables 4A and 5A for acceptable QC ranges)	
Medium:	Disk diffusion: MHA Broth dilution: CAMHB Agar dilution: MHA	<i>Escherichia coli</i> ATCC®a 25922 <i>Staphylococcus aureus</i> ATCC® 25923 (disk diffusion) <i>S. aureus</i> ATCC® 29213 (MIC)	
Inoculum:	Broth culture method or colony suspension, equivalent to a 0.5 McFarland standard		
Incubation:	35°C±2°C; ambient air Disk diffusion: 16–20 hours Dilution methods: 16–20 hours		
		When a commercial test system is used for susceptibility testing, refer to the manufacturer’s instructions for QC test recommendations and QC ranges.	

General Comments

- (1) *B. bronchiseptica*–specific breakpoints are currently only available for ampicillin, florfenicol, tildipirosin, and tulathromycin.
- (2) Unless otherwise listed in the comments, the dose used for evaluation of each breakpoint is the approved dose by regulatory authorities in the country in which the antimicrobial agent is approved.

NOTE: Information in boldface type is new or modified since the previous edition.

Test/ Report Group	Body Site	Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Interpretive Categories and MIC Breakpoints, µg/mL			Comments
				S	I	R	S	I	R	
Penicillins										
Swine										
A	Respiratory	Ampicillin		–	–	–	≤0.5	1	≥2	(3) Ampicillin is the class representative for the aminopenicillins and should be tested. (4) Breakpoints were derived from microbiological data using ampicillin, PK data from a dose of 15 mg/kg, IM, of amoxicillin once daily, and PD data. ¹
Macrolides										
Swine										
A	Respiratory	Tulathromycin	30 µg	≥18	15–17	≤14	≤16	32	≥64	
A	Respiratory	Tildipirosin	60 µg	≥18	–	–	≤8	–	–	

Table 2F. *Bordetella bronchiseptica* (Continued)

Test/ Report Group	Body Site	Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Interpretive Categories and MIC Breakpoints, µg/mL			Comments
				S	I	R	S	I	R	
Phenicol										
Swine										
A	Respiratory	Florfenicol	30 µg	≥22	19–21	≤18	≤2	4	≥8	(5) For premix product only.

Abbreviations: ATCC®, American Type Culture Collection; CAMHB, cation-adjusted Mueller-Hinton broth; I, intermediate; IM, intramuscularly; MHA, Mueller-Hinton agar; MIC, minimal inhibitory concentration; PD, pharmacodynamic; PK, pharmacokinetic; QC, quality control; R, resistant; S, susceptible.

Footnote

- a. ATCC® is a registered trademark of the American Type Culture Collection.

Reference for Table 2F

- ¹ Schwarz S, Böttner A, Goossens L, et al. A proposal of clinical breakpoints for amoxicillin applicable to porcine respiratory tract pathogens. *Vet Microbiol.* 2008;126(1-3):178-188.

Table 2G. Zone Diameter and MIC Breakpoints for *Mannheimia haemolytica*

Testing Conditions		Routine QC Recommendations (See Tables 4A, 4B, 5A, and 5B for acceptable QC ranges.)	
Medium:	Disk diffusion and agar dilution: MHA supplemented with 5% defibrinated sheep blood Broth dilution: CAMHB Strains of <i>M. haemolytica</i> that fail to grow in CAMHB may be retested using the reference method for <i>Streptococcus</i> spp. (which incorporates 2.5% to 5% LHB) and <i>S. pneumoniae</i> ATCC® 49619	<i>Escherichia coli</i> ATCC® 25922 <i>Staphylococcus aureus</i> ATCC® 25923 (disk diffusion) <i>S. aureus</i> ATCC® 29213 (MIC) <i>Streptococcus pneumoniae</i> ATCC® 49619 <i>M. haemolytica</i> ATCC® 33396 as additional QC strain for ceftiofur, gamithromycin, and tulathromycin.	
Inoculum:	Colony suspension, equivalent to a 0.5 McFarland standard using colonies from an overnight (18- to 24-hour) sheep blood agar plate incubated in ambient air or 5% CO₂	When a commercial test system is used for susceptibility testing, refer to the manufacturer's instructions for QC test recommendations and QC ranges.	
Incubation:	Disk diffusion and dilution methods: 35°C ± 2°C; ambient air; 18–24 hours		

General Comment

- (1) Unless otherwise listed in the comments, the dose used for evaluation of each breakpoint is the approved dose by regulatory authorities in the country in which the antimicrobial agent is approved.

NOTE: Information in boldface type is new or modified since the previous edition.

Test/ Report Group	Body Site	Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Interpretive Categories and MIC Breakpoints, µg/mL			Comments
				S	I	R	S	I	R	
Aminoglycosides/Aminocyclitols										
Cattle										
A	Respiratory	Spectinomycin	100 µg	≥ 14	11–13	≤ 10	≤ 32	64	≥ 128	
Penicillins										
Cattle										
A	Respiratory	Ampicillin	–	–	–	–	≤ 0.03	0.06– 0.12	≥ 0.25	(2) Breakpoints were derived from microbiological and PK-PD data. The dose of ampicillin trihydrate used to derive this breakpoint was 11 mg/kg every 24 hours IM.
A	Respiratory	Penicillin G	–	–	–	–	≤ 0.25	0.5	≥ 1.0	(3) Breakpoints were derived from microbiological, PK data (using accepted clinical but extra-label doses), and PD data. The dose of procaine penicillin G modeled was 22 000 U/kg every 24 hours IM.

Table 2G. *Mannheimia haemolytica* (Continued)

Test/ Report Group	Body Site	Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Interpretive Categories and MIC Breakpoints, µg/mL			Comments
				S	I	R	S	I	R	
Cephalosporins										
Cattle										
A	Respiratory	Ceftiofur	30 µg	≥21	18–20	≤17	≤2	4	≥8	
Fluoroquinolones ^b										
Cattle										
A	Respiratory	Danofloxacin	5 µg	≥22	18–21	≤17	≤0.25	0.5	≥1	(4) The dose of 1.25 mg/kg is not assured to meet currently accepted PK-PD targets, and the breakpoints and interpretive categories are limited to the two approved doses (6 mg/kg twice, or 8 mg/kg once). (5) This breakpoint applies to approved labeled dosage of 6 mg/kg and 8 mg/kg.
A	Respiratory	Enrofloxacin	5 µg	≥21	17–20	≤16	≤0.25	0.5–1	≥2	
Macrolides										
Cattle										
A	Respiratory	Gamithromycin	15 µg	≥15	12–14	≤11	≤4	8	≥16	
A	Respiratory	Tildipirosin	60 µg	≥20	17–19	≤16	≤4	8	≥16	
A	Respiratory	Tilmicosin	15 µg	≥14	11–13	≤10	≤8	16	≥32	(6) For injection product only.
A	Respiratory	Tulathromycin	30 µg	≥18	15–17	≤14	≤16	32	≥64	
Phenicol										
Cattle										
A	Respiratory	Florfenicol	30 µg	≥19	15–18	≤14	≤2	4	≥8	
Tetracyclines										
Cattle										
A	Respiratory	Tetracycline	–	–	–	–	≤2	4	≥8	(7) Breakpoints were derived from PK data of oxytetracycline at 20 mg/kg IM, once, and PD data. (8) These breakpoints are applicable only for the injectable formulations. Tetracycline is the class representative.

Abbreviations: ATCC®, American Type Culture Collection; CAMHB, cation-adjusted Mueller-Hinton broth; I, intermediate; IM, intramuscularly; MHA, Mueller-Hinton agar; MIC, minimal inhibitory concentration; PD, pharmacodynamic; PK, pharmacokinetic; PK-PD, pharmacokinetic-pharmacodynamic; QC, quality control; R, resistant; S, susceptible.

Table 2G. *Mannheimia haemolytica* (Continued)

Footnotes

- a. ATCC® is a registered trademark of the American Type Culture Collection.
- b. Testing and reporting ciprofloxacin is not recommended for any veterinary species as PK-PD analysis does not support its use. Additionally, isolates that are intermediate or resistant to any fluoroquinolone may be at increased risk of developing resistance to all fluoroquinolones.

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Table 2H. Zone Diameter and MIC Breakpoints for *Pasteurella multocida*

Testing Conditions		Routine QC Recommendations (see Tables 4A, 4B, 5A, and 5B for acceptable QC ranges)	
Medium:	Disk diffusion and agar dilution: MHA supplemented with 5% defibrinated sheep blood Broth dilution: CAMHB Strains of <i>P. multocida</i> that fail to grow in CAMHB may be retested using the reference method for <i>Streptococcus</i> spp. (which incorporates 2.5% to 5% LHB) and <i>Streptococcus pneumoniae</i> ATCC® 49619)	<i>Escherichia coli</i> ATCC® 25922 <i>S. aureus</i> ATCC® 25923 (disk diffusion) <i>S. aureus</i> ATCC® 29213 (MIC) <i>Staphylococcus pneumoniae</i> ATCC® 49619	
Inoculum:	Colony suspension, equivalent to a 0.5 McFarland standard using colonies from an overnight (18- to 24-hour) sheep blood agar plate incubated in ambient air or 5% CO₂	<i>Mannheimia haemolytica</i> ATCC® 33396 as additional QC strain for ceftiofur, gamithromycin, and tulathromycin.	
Incubation:	Disk diffusion and dilution methods: 35°C ± 2°C; ambient air; 18–24 hours	When a commercial test system is used for susceptibility testing, refer to the manufacturer's instructions for QC test recommendations and QC ranges.	

General Comment

- (1) Unless otherwise listed in the comments, the dose used for evaluation of each breakpoint is the approved dose by regulatory authorities in the country in which the antimicrobial agent is approved.

NOTE: Information in boldface type is new or modified since the previous edition.

Test/ Report Group	Body Site	Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Interpretive Categories and MIC Breakpoints, µg/mL			Comments
				S	I	R	S	I	R	
Aminoglycosides/Aminocyclitols										
Cattle										
A	Respiratory	Spectinomycin	100 µg	≥ 14	11–13	≤ 10	≤ 32	64	≥ 128	
β-Lactam Combination Agents										
Cats										
A	Skin, soft tissue, UTI	Amoxicillin- clavulanate	–	–	–	–	≤ 0.25/ 0.12	0.5/ 0.25	≥ 1/0.5	(2) Amoxicillin-clavulanate breakpoints were determined from an examination of MIC distribution data, efficacy data, and PK-PD analysis of amoxicillin in cats at a dosage of 12.5 mg/kg (amoxicillin) administered every 12 hours orally.

Table 2H. *Pasteurella multocida* (Continued)

Test/ Report Group	Body Site	Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Interpretive Categories and MIC Breakpoints, µg/mL			Comments
				S	I	R	S	I	R	
Penicillins										
Cats										
A	Skin, soft tissue, UTI	Ampicillin	–	–	–	–	≤0.25	0.5	≥1	(3) Ampicillin breakpoints were determined from an examination of MIC distribution data and PK-PD analysis of amoxicillin in cats. The dosage regimen used for PK-PD analysis of amoxicillin was 12.5 mg/kg administered every 12 hours orally.
Swine										
A	Respiratory	Ampicillin	–	–	–	–	≤0.5	1	≥2	(4) Ampicillin is the class representative for the aminopenicillins and should be tested. (5) Breakpoints were derived from microbiological data using ampicillin, PK data from a dose of 15 mg/kg IM of amoxicillin once daily, and PD data. ¹
A		Penicillin G	–	–	–	–	≤0.25	0.5	≥1	(6) Breakpoints were derived from microbiological PK data (using accepted clinical but extra-label doses), and PD data. The dose of procaine penicillin G modeled was 33 000 U/kg every 24 hours IM by needle in the neck.
Cattle										
A	Respiratory	Ampicillin	–	–	–	–	≤0.03	0.06–0.12	≥0.25	(7) Breakpoints were derived from microbiological and PK-PD data. The dose of ampicillin trihydrate used to derive this breakpoint was 11 mg/kg every 24 hours IM.
A	Respiratory	Penicillin G	–	–	–	–	≤0.25	0.5	≥1	(8) Breakpoints were derived from microbiological, PK data (using accepted clinical but extra-label doses), and PD data. The dose of procaine penicillin G modeled was 22 000 U/kg every 24 hours IM.
Cephalosporins										
Dogs										
A	Skin, soft tissue, respiratory, urinary/genital	Cefazolin	–	–	–	–	≤2	4	≥8	
A	Wounds, abscesses	Cefpodoxime	10 µg	≥21	18–20	≤17	≤2	4	≥8	
Cats										
A	Skin, soft tissue	Cefovecin	30 µg	≥24	21–23	≤20	≤0.12	0.25	≥0.5	

Table 2H. *Pasteurella multocida* (Continued)

Test/ Report Group	Body Site	Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Interpretive Categories and MIC Breakpoints, µg/mL			Comments
				S	I	R	S	I	R	
Cephalosporins (Continued)										
Swine										
A	Respiratory	Ceftiofur	30 µg	≥21	18–20	≤17	≤2	4	≥8	
Cattle										
A	Respiratory	Ceftiofur	30 µg	≥21	18–20	≤17	≤2	4	≥8	
Fluoroquinolones ^b										
Cats										
A	Skin, respiratory	Pradofloxacin	5 µg	≥24	–	–	≤0.25	–	–	(9) The susceptible-only category is used for populations of organisms (usually one species) for which regression analysis (disk vs MIC) cannot be performed. This breakpoint will permit detection of strains with decreased susceptibility as compared with the original population. (10) Pradofloxacin breakpoints were determined using a dose of 3 mg/kg once daily of an oral tablet or 5 mg/kg once daily of an oral suspension for cats.
Swine										
A	Respiratory	Enrofloxacin	5 µg	≥23	19–22	≤18	≤0.25	0.5	≥1	
Cattle										
A	Respiratory	Danofloxacin	5 µg	≥22	18–21	≤17	≤0.25	0.5	≥1	(11) The dose of 1.25 mg/kg is not assured to meet currently accepted PK-PD targets and the breakpoints and interpretive categories are limited to the two approved doses (6 mg/kg twice, or 8 mg/kg once). (12) This breakpoint applies to approved labeled dosage of 6 mg/kg and 8 mg/kg.
A	Respiratory	Enrofloxacin	5 µg	≥21	17–20	≤16	≤0.25	0.5–1	≥2	
Macrolides										
Cattle										
A	Respiratory	Gamithromycin	15 µg	≥15	12–14	≤11	≤4	8	≥16	
A	Respiratory	Tildipirosin	60 µg	≥21	18–20	≤17	≤8	16	≥32	
A	Respiratory	Tulathromycin	30 µg	≥18	15–17	≤14	≤16	32	≥64	
Swine										
A	Respiratory	Tildipirosin	60 µg	≥19	–	–	≤4	–	–	See comment (9).