Table 4A-1. Disk Diffusion QC Ranges for Nonfastidious Organisms and Antimicrobial Agents Excluding β-Lactam Combination Agents[a]

Antimicrobial Agent	Disk Content	Disk Diffusion QC Ranges, mm		
		Escherichia coli ATCC®[b] 25922	*Pseudomonas aeruginosa* ATCC® 27853	*Staphylococcus aureus* ATCC® 25923
Amikacin	30 µg	19-26	20-26	20-26
Ampicillin	10 µg	15-22	-	27-35
Azithromycin	15 µg	-	-	21-26
Azlocillin	75 µg	-	24-30	-
Aztreonam	30 µg	28-36	23-29	-
Carbenicillin	100 µg	23-29	18-24	-
Cefaclor	30 µg	23-27	-	27-31
Cefamandole	30 µg	26-32	-	26-34
Cefazolin	30 µg	21-27	-	29-35
Cefdinir	5 µg	24-28	-	25-32
Cefditoren	5 µg	22-28	-	20-28
Cefepime	30 µg	31-37	25-31	23-29
Cefetamet	10 µg	24-29	-	-
Cefiderocol	30 µg	25-31	22-31	-
Cefixime	5 µg	20-26	-	-
Cefmetazole	30 µg	26-32	-	25-34
Cefonicid	30 µg	25-29	-	22-28
Cefoperazone	75 µg	28-34	23-29	24-33
Cefotaxime	30 µg	29-35	18-22	25-31
Cefotetan	30 µg	28-34	-	17-23
Cefoxitin	30 µg	23-29	-	23-29
Cefpodoxime	10 µg	23-28	-	19-25
Cefprozil	30 µg	21-27	-	27-33
Ceftaroline	30 µg	26-34	-	26-35
Ceftazidime	30 µg	25-32	22-29	16-20
Ceftibuten	30 µg	27-35	-	-
Ceftizoxime	30 µg	30-36	12-17	27-35
Ceftobiprole	5 µg	25-31	-	20-27
Ceftriaxone	30 µg	29-35	17-23	22-28
Cefuroxime	30 µg	20-26	-	27-35
Cephalothin	30 µg	15-21	-	29-37
Chloramphenicol	30 µg	21-27	-	19-26
Cinoxacin	100 µg	26-32	-	-

Table 4A-1. (Continued)

Antimicrobial Agent	Disk Content	Disk Diffusion QC Ranges, mm		
		Escherichia coli ATCC®[b] 25922	*Pseudomonas aeruginosa* ATCC® 27853	*Staphylococcus aureus* ATCC® 25923
Ciprofloxacin	5 µg	29-38	25-33	22-30
Clarithromycin	15 µg	-	-	26-32
Clinafloxacin	5 µg	31-40	27-35	28-37
Clindamycin[c]	2 µg	-	-	24-30
Colistin	10 µg	11-17	11-17	-
Delafloxacin[d]	5 µg	28–35	23–29	32–40
Dirithromycin	15 µg	-	-	18-26
Doripenem	10 µg	27-35	28-35	33-42
Doxycycline	30 µg	18-24	-	23-29
Enoxacin	10 µg	28-36	22-28	22-28
Eravacycline	20 µg	17-24	-	19-26
Ertapenem	10 µg	29-36	13-21	24-31
Erythromycin[c]	15 µg	-	-	22-30
Faropenem	5 µg	20-26	-	27-34
Fleroxacin	5 µg	28-34	12-20	21-27
Fosfomycin[e]	200 µg	22-30	-	25-33
Fusidic acid	10 µg	-	-	24-32
Garenoxacin	5 µg	28-35	19-25	30-36
Gatifloxacin	5 µg	30-37	20-28	27-33
Gemifloxacin	5 µg	29-36	19-25	27-33
Gentamicin[f]	10 µg	19-26	17-23	19-27
Gepotidacin	10 µg	18-26	-	23-29
Grepafloxacin	5 µg	28-36	20-27	26-31
Iclaprim	5 µg	14-22	-	25-33
Imipenem[g]	10 µg	26-32	20-28	-
Kanamycin	30 µg	17-25	-	19-26
Lefamulin	20 µg	-	-	26-32
Levofloxacin	5 µg	29-37	19-26	25-30
Levonadifloxacin	10 µg	27-33[d]	17-23[d]	32-39[d]
Linezolid	30 µg	-	-	25-32[h]
Lomefloxacin	10 µg	27-33	22-28	23-29
Loracarbef	30 µg	23-29	-	23-31
Mecillinam	10 µg	24-30	-	-
Meropenem	10 µg	28-35	27-33	29-37
Minocycline	30 µg	19-25	-	25-30
Moxalactam	30 µg	28-35	17-25	18-24

Table 4A-1. (Continued)

Antimicrobial Agent	Disk Content	Disk Diffusion QC Ranges, mm		
		Escherichia coli ATCC®[b] 25922	*Pseudomonas aeruginosa* ATCC® 27853	*Staphylococcus aureus* ATCC® 25923
Moxifloxacin	5 µg	28-35	17-25	28-35
Nafcillin	1 µg	-	-	16-22
Nafithromycin	15 µg	-	-	25-31[d]
Nalidixic acid	30 µg	22-28	-	-
Netilmicin	30 µg	22-30	17-23	22-31
Nitrofurantoin	300 µg	20-25	-	18-22
Norfloxacin	10 µg	28-35	22-29	17-28
Ofloxacin	5 µg	29-33	17-21	24-28
Omadacycline	30 µg	22-28	-	22-30
Oxacillin	1 µg	-	-	18-24
Pefloxacin	5 µg	25-33	-	-
Penicillin	10 units	-	-	26-37
Piperacillin	100 µg	24-30	25-33	-
Plazomicin	30 µg	21-27	15-21	19-25
Polymyxin B	300 units	13-19	14-18	-
Quinupristin-dalfopristin	15 µg	-	-	21-28
Razupenem	10 µg	21-26	-	-[i]
Rifampin	5 µg	8-10	-	26-34
Solithromycin	15 µg	-	-	22-30
Sparfloxacin	5 µg	30-38	21-29	27-33
Streptomycin[f]	10 µg	12-20	-	14-22
Sulfisoxazole[j]	250 µg or 300 µg	15-23	-	24-34
Sulopenem	2 µg	24-30[d]	-	-
Tebipenem[g]	10 µg	30-37	20-26	-
Tedizolid[k]	2 µg	-	-	18-24[h]
Teicoplanin	30 µg	-	-	15-21
Telithromycin	15 µg	-	-	24-30
Tetracycline	30 µg	18-25	-	24-30
Ticarcillin	75 µg	24-30	21-27	-
Tigecycline	15 µg	20-27	9-13	20-25
Tobramycin	10 µg	18-26	20-26	19-29
Trimethoprim[j]	5 µg	21-28	-	19-26
Trimethoprim-sulfamethoxazole[j]	1.25/23.75 µg	23-29	-	24-32
Trospectomycin	30 µg	10-16	-	15-20
Trovafloxacin	10 µg	29-36	21-27	29-35
Ulifloxacin (prulifloxacin)[l]	5 µg	32-38	27-33	20-26
Vancomycin	30 µg	-	-	17-21

Abbreviations: ATCC®, American Type Culture Collection, ICR, inducible clindamycin resistance; QC, quality control.

Table 4A-1. (Continued)

Footnotes

a. Refer to Table 4A-2 for QC of β-lactam combination agents.

b. ATCC® is a registered trademark of the American Type Culture Collection. Per ATCC® convention, the trademark symbol is used after "BAA" in each catalog number, in conjunction with the registered ATCC® name.

c. When disk approximation tests are performed with erythromycin and clindamycin, *S. aureus* ATCC® BAA-977™ (containing inducible *erm*A-mediated resistance) and *S. aureus* ATCC® BAA-976™ (containing *msr*A-mediated macrolide-only efflux) are recommended as supplemental QC strains (eg, for training, competence assessment, or test evaluation). *S. aureus* ATCC® BAA-977™ should demonstrate ICR (ie, a positive D-zone test), whereas *S. aureus* ATCC® BAA-976™ should not demonstrate ICR. *S. aureus* ATCC® 25923 should be used for routine QC (eg, weekly or daily) of erythromycin and clindamycin disks using standard Mueller-Hinton agar.

d. QC ranges were established using data from only one disk manufacturer. Disks from other manufacturers were not available at the time of testing.

e. The 200-µg fosfomycin disk contains 50 µg of glucose-6-phosphate.

f. For control ranges of gentamicin 120-µg and streptomycin 300-µg disks, use *E. faecalis* ATCC® 29212 (gentamicin: 16–23 mm; streptomycin: 14–20 mm).

g. *Klebsiella pneumoniae* ATCC® 700603 is a supplemental QC strain for testing QC of imipenem (25-33 mm) and tebipenem (26–32 mm).

h. Zones of inhibition for linezolid and tedizolid with *S. aureus* ATCC® 25923 should be read using transmitted light.

i. Razupenem tested with *S. aureus* ATCC® 25923 can often produce the double or target zone phenomenon. For accurate QC results, use *S. aureus* ATCC® 29213 (no double zones) with acceptable range 33–39 mm.

j. These agents can be affected by excess levels of thymidine and thymine. See M02,[1] Subchapter 3.1.1.2 for guidance, should a problem with QC occur.

k. *E. faecalis* ATCC® 29212 is a supplemental QC strain for testing QC of tedizolid (14–21 mm) to assist with reading.

l. Ulifloxacin is the active metabolite of the prodrug prulifloxacin. Only ulifloxacin should be used for antimicrobial susceptibility testing.

Reference for Table 4A-1

[1] CLSI. *Performance Standards for Antimicrobial Disk Susceptibility Tests*. 13th ed. CLSI standard M02. Clinical and Laboratory Standards Institute; 2018.