11.3. Quality assurance

Table 11.3.a. Reference strains: *Gram Positive Organisms*

Antibiotics, disc potencies and acceptable zones of inhibition for reference strains [a].

Antibiotic reported	Disc potency (µg)	Annular radii (mm)
***Enterococcus faecalis* ATCC 29212 (Blood Sensitest, CO_2, 35°C)**		
Ampicillin	5	6.2 - 9.8
Chloramphenicol	30	6.9 - 9.8
Doxycycline	30	5.7 - 8.2
Fosfomycin	200	9.6 - 12.3
Gentamicin	200	8.0 - 11.0
Linezolid	10	6.9 - 9.7
Nitrofurantoin	200	6.1 - 8.7
Streptomycin	300	7.1 – 8.6
Teicoplanin	15	3.7 - 6.1
Tetracycline	10	- [b]
Tigecycline	15	6.8 - 10.6
Vancomycin	5	2.5 - 4.0

Note: The acceptable range (95% confidence limits) is the mean ± 2 standard deviations. The mean was derived from > 120 measurements with different operators using different batches of both agar and discs. It is statistically acceptable to use one hundred measurements to represent the "normal distribution" and this gives a confidence limit of 95%, meaning an in-built MU of 5% for the test.

a Reference strain testing must be performed: (i) In conjunction with the clinical isolate, or at least once weekly; (ii) When a new batch of medium is used; (iii) When a new batch of discs is used.

b Tetracycline should be tested against *Staphylococcus aureus* NCTC 6571 or *Escherichia coli* ATCC 25922.

Table 11.3.a. Reference strains: *Gram Positive Organisms* cont.

Antibiotics, disc potencies and acceptable zones of inhibition for reference strains [a].

Antibiotic reported	Disc potency (µg)	Annular radii (mm)	
***Staphylococcus aureus* NCTC 6571 (Sensitest & Blood Sensitest, air 35°C)**			
		Sensitest	**Blood Sensitest**
Amoxycillin [b]	2	10.6 – 17.4	9.0 - 11.6
Ampicillin	5	11.9 – 18.7	10.8 - 14.5
Benzylpenicillin	0.5 u	10.7 – 16.7	9.5 - 12.7
Cefoxitin	10	7.1 – 10.5	7.9 - 9.7
Ceftaroline	5	11.0 – 16.6	10.2 - 13.2
Cephalexin	100	12.0 – 15.7	11.9 - 14.7
Chloramphenicol	30	8.6 – 11.7	8.6 - 10.7
Ciprofloxacin	2.5	9.8 – 11.9	9.2 - 11.8
Clindamycin	2	9.4 – 11.5	8.1 - 11.2
Cotrimoxazole	25	10.9 – 13.6	10.9 - 13.1
Erythromycin	5	8.5 – 11.8	9.0 - 10.6
Fusidic acid	2.5	9.4 – 12.2	6.3 - 8.0
Gentamicin	10	7.7 – 9.9	7.5 - 8.9
Linezolid	10	8.4 – 11.4	8.5 - 11.5
Marbofloxacin [c]	5	9.5 – 11.5	8.9 - 10.5
Moxifloxacin	2.5	11.2 – 14.0	10.8 - 13.0
Mupirocin	5	7.8 – 11.0	8.1 - 11.6
Neomycin [c]	30	7.2 – 9.6	7.6 - 9.3
Nitrofurantoin	200	6.2 – 8.3	6.3 - 8.1
Novobiocin [c]	5	8.8 – 11.3	6.4 - 9.2
Oxacillin	1	9.0 – 11.3	7.9 - 10.6
Quinupristin/Dalfopristin	15	8.5 – 11.5	7.0 - 10.0
Rifampicin	1	9.1 – 12.6	9.4 - 11.6
Rifampicin [b]	5	11.0 – 14.6	10.5 - 14.2
Teicoplanin	15	3.9 – 6.1	4.1 - 6.0
Tetracycline	10	10.1 – 13.7	10.1 - 13.3
Tigecycline	15	9.4 – 11.7	9.2 - 11.6
Trimethoprim	5	9.2 – 12.0	9.2 - 11.0
Vancomycin	5	3.4 – 4.9	3.0 - 4.8

Note: The acceptable range (95% confidence limits) is the mean ± 2 standard deviations. The mean was derived from > 120 measurements with different operators using different batches of agar, discs and measuring devices. It is statistically acceptable to use one hundred measurements to represent the "normal distribution" and this gives a confidence limit of 95%, meaning an in-built MU of 5% for the test.

a Reference strain testing must be performed: (i) In conjunction with the clinical isolate, or at least once weekly; (ii) When a new batch of medium is used; (iii) When a new batch of discs is used.

b The amoxycillin 2 µg and rifampicin 5 µg discs are used for the susceptibility testing of *H. pylori* only.

c Antibiotic used in veterinary medicine only.

Table 11.3.a. Reference strains: *Gram Positive Organisms* cont.

Antibiotics, disc potencies and acceptable zones of inhibition for reference strains [a].

Antibiotic reported	Disc potency (µg)	Annular radii (mm)
***Streptococcus pneumoniae* ATCC 49619 (Blood Sensitest, 5% CO_2, 35°C)**		
Ampicillin	5	10.7 - 15.4
Benzylpenicillin	0.5 u	2.8 - 6.9
Cefotaxime	0.5	7.1 - 10.3
Cefotaxime	5	10.7 - 14.7
Ceftriaxone	0.5	7.3 - 10.8
Ceftriaxone	5	10.4 - 14.8
Chloramphenicol	30	9.3 - 14.1
Clindamycin	2	7.6 - 11.5
Cotrimoxazole	25	7.2 - 10.7
Erythromycin	5	8.7 - 12.6
Moxifloxacin	2.5	8.3 - 12.1
Quinupristin/Dalfopristin	15	7.1 - 9.4
Rifampicin	1	8.2 - 12.5
Teicoplanin	15	5.4 - 9.9
Tetracycline	10	9.5 - 14.8
Tigecycline	15	8.2 - 13.7
Vancomycin	5	5.4 - 8.9

Note: The acceptable range (95% confidence limits) is the mean ± 2 standard deviations. The mean was derived from > 120 measurements with different operators using different batches of both agar, discs and measuring devices. It is statistically acceptable to use one hundred measurements to represent the "normal distribution" and this gives a confidence limit of 95%, meaning an in-built MU of 5% for the test.

a Reference strain testing must be performed: (i) In conjunction with the clinical isolate, or at least once weekly; (ii) When a new batch of medium is used; (iii) When a new batch of discs is used.

Table 11.3.b. Reference strains: *Gram Negative Organisms*

Antibiotics, disc potencies and acceptable zones of inhibition for reference strains [a].

Antibiotic reported	Disc potency (µg)	Annular radii (mm)
***Bacteroides fragilis* ATCC 25285 (Blood Sensitest, anaerobic, 35-37°C)**		
Metronidazole [b]	5	10.2 - 13.8
***Campylobacter jejuni* ATCC 33560 (Blood Sensitest, microaerophilic, 42°C)**		
Ciprofloxacin	2.5	9.3 - 12.8
Erythromycin	5	7.2 - 9.4
Gentamicin	10	6.8 - 8.9
Tetracycline	10	8.5 - 10.8

Note: The acceptable range (95% confidence limits) is the mean ± 2 standard deviations. The mean was derived from > 120 measurements with different operators using different batches of both agar, discs and measuring devices. It is statistically acceptable to use one hundred measurements to represent the "normal distribution" and this gives a confidence limit of 95%, meaning an in-built MU of 5% for the test.

a Reference strain testing must be performed: (i) In conjunction with the clinical isolate, or at least once weekly; (ii) When a new batch of medium is used; (iii) When a new batch of discs is used.

b *Bacteroides fragilis* ATCC 25285 may be used as the reference strain when testing *H. pylori* against metronidazole. When testing anaerobic organisms, *Clostridium perfringens* ATCC 13124 should be used as the reference organism.

Table 11.3.b. Reference strains: *Gram Negative Organisms* cont.

Antibiotics, disc potencies and acceptable zones of inhibition for reference strains [a].

Antibiotic reported	Disc potency (µg)	Annular radii (mm)
***Escherichia coli* ATCC 25922** [c] **(Sensitest, air, 35–37°C)**		
Amikacin	30	6.7 - 8.9
Ampicillin	25	7.1 - 9.1
Azithromycin	15	4.7 - 7.2
Apramicin [d]	15	4.6 – 5.9
Aztreonam	30	11.2 - 14.9
Cefazolin	30	7.7 - 10.6
Cefepime	10	10.7 - 14.0
Cefotaxime	5	9.5 - 13.2
Cefotetan	30	10.3 - 14.4
Cefoxitin	30	8.2 - 11.1
Cefpodoxime	10	8.1 - 11.2
Ceftazidime	10	8.9 - 12.3
Ceftriaxone	5	8.9 - 13.1
Cefuroxime	30	7.0 - 9.5
Cephalexin	100	7.1 - 9.6
Chloramphenicol	30	8.4 - 10.8
Ciprofloxacin	2.5	11.9 - 15.4
Cotrimoxazole	25	8.7 - 12.3
Doripenem	10	8.8 - 13.4
Ertapenem	10	8.8 - 14.2
Fosfomycin	200	8.4 - 11.7
Gentamicin	10	7.0 - 9.7
Imipenem	10	9.0 - 13.1
Marbofloxacin [d]	5	11.5 - 15.6
Meropenem	5	10.2 - 14.0
Moxifloxacin	2.5	10.3 - 13.5
Nalidixic acid	30	9.0 - 11.6
Neomycin [d]	30	5.9 - 8.5
Nitrofurantoin	200	5.9 - 8.9
Norfloxacin	10	10.9 - 14.4
Polymyxin B	300 u	4.7 - 6.7
Spectinomycin	25	4.7 - 6.4
Streptomycin [d]	25	5.6 - 7.1
Tetracycline	10	3.9 - 7.8
Tigecycline	15	7.9 - 10.8
Tobramycin	10	6.1 - 8.6
Trimethoprim	5	7.7 - 10.9
***Escherichia coli* ATCC 35218 (Sensitest, air, 35-37°C)**		
Augmentin	60	6.9 - 9.3
Timentin	85	7.2 - 9.5
Tazocin	55	7.3 – 11.0

Note: The acceptable range (95% confidence limits) is the mean ± 2 standard deviations. The mean was derived from > 120 measurements with different operators using different batches of both agar, discs and measuring devices. It is statistically acceptable to use one hundred measurements to represent the "normal distribution" and this gives a confidence limit of 95%, meaning an in-built MU of 5% for the test.

a Reference strain testing must be performed: (i) In conjunction with the clinical isolate, or at least once weekly; (ii) When a new batch of medium is used; (iii) When a new batch of discs is used.

c If antibiotic discs are tested with *Escherichia coli* ATCC 25922, there is no need to test these against *Pseudomonas aeruginosa* ATCC 27853 as well and vice versa.

d Antibiotic used in veterinary medicine only.

Table 11.3.b. Reference strains: *Gram Negative Organisms* cont.

Antibiotics, disc potencies and acceptable zones of inhibition for reference strains [a].

Antibiotic reported	Disc potency (µg)	Annular radii (mm)
***Haemophilus influenzae* ATCC 49766 (HTM [e] agar, 5% CO_2, 35-37°C)**		
Ampicillin	5	5.9 - 10.7
Cefaclor	30	8.9 - 13.0
Cefotaxime	0.5	9.9 - 12.6
Cefotaxime	5	13.1 - 16.2
Cefpodoxime	10	11.1 - 15.1
Ceftriaxone	0.5	10.6 - 13.8
Ceftriaxone	5	13.5 - 16.6
Cefuroxime	30	9.9 - 13.5
Chloramphenicol	10	11.4 - 13.8
Ciprofloxacin	2.5	12.6 - 16.7
Cotrimoxazole	25	9.8 - 15.0
Moxifloxacin	2.5	11.6 - 15.0
Tetracycline	10	8.9 - 12.2
***Haemophilus influenzae* ATCC 49247 (HTM [e] agar, 5% CO_2, 35-37°C)**		
Augmentin	15	4.6 - 7.7

Note: The acceptable range (95% confidence limits) is the mean ± 2 standard deviations. The mean was derived from > 120 measurements with different operators using different batches of both agar, discs and measuring devices. It is statistically acceptable to use one hundred measurements to represent the "normal distribution" and this gives a confidence limit of 95%, meaning an in-built MU of 5% for the test.

a Reference strain testing must be performed: (i) In conjunction with the clinical isolate, or at least once weekly; (ii) When a new batch of medium is used; (iii) When a new batch of discs is used.

e Haemophilus Test Medium Base containing 15 mg/L freshly prepared Haematin and NAD.

Table 11.3.b. Reference strains: *Gram Negative Organisms* cont.

Antibiotics, disc potencies and acceptable zones of inhibition for reference strains [a].

Antibiotic reported	Disc potency (µg)	Annular radii (mm)
***Pseudomonas aeruginosa* ATCC 27853 [f] (Sensitest, air, 35-37°C)**		
Amikacin	30	7.4 - 8.9
Aztreonam	30	8.1 - 10.8
Cefepime	10	7.1 - 10.5
Ceftazidime	10	7.6 - 10.4
Ciprofloxacin	2.5	9.9 - 12.6
Doripenem	10	9.8 - 15.4
Ertapenem	10	- [g]
Fosfomycin	200	6.8 - 10.0
Gentamicin	10	6.2 - 7.8
Imipenem	10	8.0 - 10.0
Meropenem	5	9.9 - 12.7
Moxifloxacin	2.5	- [g]
Norfloxacin	10	10.1 - 12.1
Polymyxin B	300 u	4.4 - 6.3
Ticarcillin	75	7.9 - 10.3
Tobramycin	10	7.5 - 9.2

Note: The acceptable range (95% confidence limits) is the mean ± 2 standard deviations. The mean was derived from > 120 measurements with different operators using different batches of both agar, discs and measuring devices. It is statistically acceptable to use one hundred measurements to represent the "normal distribution" and this gives a confidence limit of 95%, meaning an in-built MU of 5% for the test.

a Reference strain testing must be performed: (i) In conjunction with the clinical isolate, or at least once weekly; (ii) When a new batch of medium is used; (iii) When a new batch of discs is used.

f If antibiotic discs are tested with *Escherichia coli* ATCC 25922 there is no need to test these against *Pseudomonas aeruginosa* ATCC 27853 as well and vice versa.

g Ertapenem and moxifloxacin should be tested against *Escherichia coli* ATCC 25922.

Table 11.3.c. Reference strains: *Anaerobic Organisms*

Antibiotics, disc potencies and acceptable zones of inhibition for reference strains [a].

Antibiotic reported	Disc potency (µg)	Annular radii (mm)
***Clostridium perfringens* ATCC 13124 (Supplemented Brucella Medium Base, anaerobic, 35-37°C)** [b]		
Benzylpenicillin	0. 5 u	6.1 - 8.2
Cefoxitin	10	6.7 - 10.4
Clindamycin	2	6.2 - 8.7
Meropenem	5	10.5 - 14.3
Metronidazole	5	4.8 - 8.6
Moxifloxacin	2.5	4.8 - 6.9
***Bacteroides fragilis* ATCC 25285 (Supplemented Brucella medium Base, anaerobic, 35-37°C)** [b]		
Augmentin	3	7.3 - 10.1
Tazocin	55	10.3 - 14.2
Timentin	85	13.9 - 19.0

Note: The acceptable range (95% confidence limits) is the mean ± 2 standard deviations. The mean was derived from > 120 measurements with different operators using different batches of both agar, discs and measuring devices. It is statistically acceptable to use one hundred measurements to represent the "normal distribution" and this gives a confidence limit of 95%, meaning an in-built MU of 5% for the test.

a Reference strain testing must be performed: (i) In conjunction with the clinical isolate, or at least once weekly; (ii) When a new batch of medium is used; (iii) When a new batch of discs is used.

b Brucella Medium Base containing 5% defibrinated horse blood, haemin 5 mg/L and vitamin K 1 mg/L.