

EUCAST recommended strains for internal quality control

<i>Escherichia coli</i>	ATCC 25922
<i>Pseudomonas aeruginosa</i>	ATCC 27853
<i>Staphylococcus aureus</i>	ATCC 29213
<i>Enterococcus faecalis</i>	ATCC 29212
<i>Haemophilus influenzae</i>	NCTC 8468*
<i>Streptococcus pneumoniae</i>	ATCC 49619

*NCTC 8468 is susceptible to beta-lactam antibiotics and easier to read on MH-F than the commonly recommended ATCC 49247 which is a BLNAR with variable inhibition zones for beta-lactam antibiotics.

Errata 2009-09-26. A new table is published because the disk strength of erythromycin was erroneously given as 2 mcg (instead of 15 mcg) in one table and ciprofloxacin 30 mcg (instead of 5 mcg) in one table.

***Escherichia coli* ATCC 25922**
(NCTC 12241, CIP 76.24, DSM 1103, CCUG 17620)

Mueller-Hinton agar, McFarland 0.5, air, 35±1°C, 18±2h. Read zone edges as the point showing no growth from the back of the plate against a black background illuminated with reflected light.

Antimicrobial agent	MIC (mg/L)		Disk content (µg)	Inhibition zone size (mm)	
	Target ¹	Range ²		Target ¹	Range ³
Amikacin	1-2	0.5-4	30	23	19-26
Amoxicillin-clavulanic acid	4/2	2/1-8/4	20/10	21	18-24
Ampicillin	4	2-8	10	19	16-22 ⁴
Aztreonam	0.12	0.06-0.25	30	32	28-36
Cefadroxil	-	-	30	18	15-21
Cefepime	0.03-0.06	0.015-0.12	30	34	31-37
Cefotaxime	0.06	0.03-0.12	5	28	25-31
Cefoxitin	4	2-8	30	26	23-29
Cefpodoxime	0.5	0.25-1	10	26	23-28
Ceftazidime	0.12-0.25	0.06-0.5	10	26	23-29
Ceftibuten	0.25	0.12-0.5	30	31	27-35
Cefuroxime	4	2-8	30	23	20-26
Chloramphenicol	4	2-8	30	24	21-27
Ciprofloxacin	0.008	0.004-0.015	5	35	30-40
Doripenem	0.03	0.015-0.06	10	32	28-35
Ertapenem	0.008	0.004-0.015	10	33	29-36
Gentamicin	0.5	0.25-1	10	23	19-26
Imipenem	0.12	0.06-0.25	10	29	26-32
Mecillinam	0.06-0.12	0.03-0.25	10	27	24-30
Meropenem	0.015-0.03	0.008-0.06	10	31	28-34
Moxifloxacin	0.015-0.03	0.008-0.06	5	32	28-35
Nalidixic acid	2	1-4	30	25	22-28
Nitrofurantoin	8	4-16	100	21	18-24
Norfloxacin	0.06	0.03-0.12	10	32	28-35
Piperacillin-tazobactam	2/4	1/4-4/4	30/6	24	21-27
Tetracycline	1	0.5-2	30	22	18-25
Tigecycline	0.12	0.03-0.25	15	24	20-27
Tobramycin	0.5	0.25-1	10	22	18-26
Trimethoprim	1	0.5-2	5	25	21-28
Trimethoprim-sulfamethoxazole	≤0.5/9.5 ^c	-	1.25/23.75	26	23-29

¹ Calculated by EUCAST

² International Standard ISO 20776-1: 2006.

³ Clinical and Laboratory Standards Institute, M100-S19: 29:3, 2009. (Data in bold/italics from repeated testing by EUCAST. Inhibition zone diameters were measured on at least 20 different occasions on more than five batches of Mueller-Hinton agar from several manufacturers.)

⁴ Ignore growth that may appear as a thin inner zone with ampicillin on some batches of Mueller-Hinton agars.

***Pseudomonas aeruginosa* ATCC 27853**

(NCTC 12903, CIP 76.110, DSM 1117, CCUG 17619)

Mueller-Hinton agar, McFarland 0.5, air, 35±1°C, 18±2h. Read zone edges as the point showing no growth from the back of the plate against a black background illuminated with reflected light.

Antimicrobial agent	MIC (mg/L)		Disk content (µg)	Inhibition zone size (mm)	
	Target ¹	Range ²		Target ¹	Range ³
Amikacin	2	1-4	30	22	18-26
Aztreonam	4	2-8	30	26	23-29
Cefepime	2-4	1-8	30	27	24-30
Ceftazidime	2	1-4	10	24	21-27
Ciprofloxacin	0.5	0.25-1	5	29	25-33
Doripenem	0.25	0.12-0.5	10	32	29-35
Gentamicin	1	0.5-2	10	19	16-21
Imipenem	2	1-4	10	24	20-28
Meropenem	0.5	0.25-1	10	30	27-33
Piperacillin-tazobactam	2-4/4	1/4-8/4	30/6	26	23-29
Tobramycin	0.5	0.25-1	10	22	19-25

¹ Calculated by EUCAST

² International Standard ISO 20776-1: 2006.

³ Clinical and Laboratory Standards Institute, M100-S19: 29:3, 2009. (Data in bold/italics from repeated testing by EUCAST. Inhibition zone diameters were measured on at least 20 different occasions on more than five batches of Mueller-Hinton agar from several manufacturers.)

Staphylococcus aureus* ATCC 29213
(NCTC 12973, CIP 103429, DSM 2569, CCUG 15915)

* β -lactamase-producing strain (weak)

Mueller-Hinton agar, McFarland 0.5, air, 35±1°C, 18±2h. Read zone edges as the point showing no growth from the back of the plate against a black background illuminated with reflected light.

Antimicrobial agent	MIC (mg/L)		Disk content (μ g)	Inhibition zone size (mm)	
	Target ¹	Range ²		Target ¹	Range ³
Amikacin	2	1-4	30	21	18-24
Amoxicillin/clavulanic acid	0.25/0.12	0.12/0.06-0.5/0.25	20/10	30	27-33
Benzylpenicillin	-	-	1 unit	15	12-18
Cefepime	2	1-4	30	24	21-27
Cefotaxime	2	1-4	5	18	15-21
Cefoxitin	2	1-4	30	27	24-30
Cefpodoxime	2-4	1-8	10	21	18-24
Cefuroxime	1	0.5-2	30	30	27-33
Chloramphenicol	4-8	2-16	30	24	20-28
Ciprofloxacin	0.25	0.12-0.5	5	24	21-27
Clindamycin	0.12	0.06-0.25	2	26	23-29
Ertapenem	0.12	0.06-0.25	10	30	27-33
Erythromycin	0.5	0.25-1	15	26	23-29
Fusidic acid	0.12	0.06-0.25	10	29	26-32
Gentamicin	0.25-0.5	0.12-1	10	22	19-25
Linezolid	2	1-4	10	24	21-27
Meropenem	0.06	0.03-0.12	10	36	33-39
Moxifloxacin	0.03-0.06	0.015-0.12	5	27	24-30
Nitrofurantoin	16	8-32	100	20	17-23
Norfloxacin	1	0.5-2	10	21	18-24
Oxacillin	0.25	0.12-0.5	1	22	19-25
Piperacillin/tazobactam	0.5-1/4	0.25/4-2/4	30/6	25	22-28
Rifampicin	0.008	0.004-0.015	5	33	30-36
Tetracycline	0.25-0.5	0.12-1	30	27	23-31
Tigecycline	0.06-0.12	0.03-0.25	15	22	19-25
Tobramycin	0.25-0.5	0.12-1	10	23	20-26
Trimethoprim	2	1-4	5	25	22-28
Trimethoprim-sulfamethoxazole	$\leq 0.5/9.5^2$	-	1.25/23.75	29	26-32
Vancomycin	1	0.5-2	5	15	12-18

¹ Calculated by EUCAST

² International Standard ISO 20776-1: 2006.

³ Data in bold/italics from repeated testing by EUCAST. Inhibition zone diameters were measured on at least 20 different occasions on more than five batches of Mueller-Hinton agar from several manufacturers.

***Enterococcus faecalis* ATCC 29212**

(NCTC 12697, CIP 103214, DSM 2570, CCUG 9997)

Mueller-Hinton agar, McFarland 0.5, air, 35±1°C, 18±2h. Read zone edges as the point showing no growth from the back of the plate against a black background illuminated with reflected light.

Antimicrobial agent	MIC (mg/L)		Disk content (µg)	Inhibition zone size (mm)	
	Target ¹	Range ²		Target ¹	Range ³
Amoxicillin-clavulanic acid	0.5/0.25	0.25/0.12-1/0.5	20/10	28	25-31
Ampicillin	1	0.5-2	2	18	15-21
Chloramphenicol	8	4-16	30	23	20-26
Ciprofloxacin	0.5-1	0.25-2	5	22	19-25
Erythromycin	2	1-4	15	19	16-22
Gentamicin	8	4-16	10	11	8-14
Gentamicin	8	4-16	30	15	12-18
Imipenem	1	0.5-2	10	27	24-30
Linezolid	2	1-4	10	22	19-25
Moxifloxacin	0.12-0.25	0.06-0.5	5	25	22-28
Nitrofurantoin	8	4-16	100	21	18-24
Norfloxacin	4	2-8	10	19	16-22
Piperacillin-tazobactam	2/4	1/4-4/4	30/6	23	20-26
Rifampicin	1-2	0.5-4	5	19	16-22
Tetracycline	16	8-32	30	13	10-16
Tigecycline	0.06	0.03-0.12	15	23	20-26
Tobramycin	16	8-32	30	15	12-18
Trimethoprim	≤1 ²	-	5	28	24-32
Trimethoprim-sulfamethoxazole	≤0.5/9.5 ²	-	1.25/23.75	30	26-34
Vancomycin	2	1-4	5	13	10-16

¹ Calculated by EUCAST

² International Standard ISO 20776-1: 2006.

³ Data in bold/italics from repeated testing by EUCAST. Inhibition zone diameters were measured on at least 20 different occasions on more than five batches of Mueller-Hinton agar from several manufacturers.

Streptococcus pneumoniae* ATCC 49619*/*
(NCTC 12977, CIP 104340, DSM 11967, CCUG 33638)

* Penicillin-intermediate strain

** Zone edges for *S. pneumoniae* on MH-F may be accompanied by α -haemolysis extending approximately 1 mm into the zone. Read growth, not haemolysis. With some batches of agar and some antibiotics the colonies at the zone edge lyse and the apparent width of haemolysis is considerably greater. The zone edge should be read as the edge of the lysed colonies indicated by a haze just inside the α -haemolysis.

Mueller-Hinton agar + 5% horse blood and 20 mg/L β -NAD, McFarland 0.5, 5% CO₂, 35±1°C, 18±2h.
Read zone edges as the point showing no growth from the front with the lid removed and reflected light.

Antimicrobial agent	MIC (mg/L)		Disk content (μ g)	Inhibition zone size (mm)	
	Target ¹	Range ²		Target ¹	Range ³
Ampicillin	0.12	0.06-0.25	2	28	25-31
Azithromycin	0.12	0.06-0.25	15	24	21-27
Cefaclor	2	1-4	30	28	25-31
Cefepime	0.06-0.12	0.03-0.25	30	34	31-37
Cefotaxime	0.06	0.03-0.12	5	31	28-34
Cefpodoxime	0.06	0.03-0.12	10	32	29-35
Ceftriaxone	0.06	0.03-0.12	30	35	32-38
Cefuroxime	0.5	0.25-1	30	31	28-34
Chloramphenicol	4	2-8	30	27	24-30
Clarithromycin	0.06	0.03-0.12	15	30	27-33
Clindamycin	0.06	0.03-0.12	2	25	22-28
Doripenem	0.06	0.03-0.12	10	34	31-37
Ertapenem	0.06-0.12	0.03-0.25	10	31	28-34
Erythromycin	0.06	0.03-0.12	15	29	26-32
Imipenem	0.06	0.03-0.12	10	38	34-42
Levofloxacin	1	0.5-2	5	24	21-27
Linezolid	1	0.5-2	10	26	23-29
Meropenem	0.12	0.06-0.25	10	34	30-38
Moxifloxacin	0.12	0.06-0.25	5	27	24-30
Norfloxacin	4	2-8	10	21	18-24
Ofloxacin	2	1-4	5	21	18-24
Oxacillin	-	-	1	11	8-14
Piperacillin/tazobactam	-	-	30/6	29	26-32
Rifampicin	0.03	0.015-0.06	5	29	26-32
Tetracycline	0.25	0.12-0.5	30	30	27-33
Tigecycline	0.03-0.06	0.015-0.12	15	27	24-30
Trimethoprim-sulfamethoxazole	0.25/4.75-0.5/9.5	0.12/2.4-1/19	1.25/23.75	23	20-26
Vancomycin	0.25	0.12-0.5	5	20	17-23

¹ Calculated by EUCAST

² International Standard ISO 20776-1: 2006.

³ Data in bold/italics from repeated testing by EUCAST. Inhibition zone diameters were measured on at least 20 different occasions on more than five batches of Mueller-Hinton agar from several manufacturers.

***Haemophilus influenzae* NCTC 8468**

(CIP 54.94, CCUG 23946)

Mueller-Hinton agar + 5% horse blood and 20 mg/L β-NAD, McFarland 0.5, 5% CO₂, 35±1°C, 18±2h.

Read zone edges as the point showing no growth from the front with the lid removed and reflected light.

Antimicrobial agent	MIC ¹ (mg/L)		Disk content (µg)	Inhibition zone size (mm)	
	Target	Range		Target ²	Range ³
Amoxicillin-clavulanic acid			20/10	27	24-30
Ampicillin			2	22	19-25
Ampicillin			10	27	24-30
Azithromycin			15	18	15-21
Aztreonam			30	33	30-36
Cefaclor			30	27	24-30
Cefepime			30	32	29-35
Cefixime			5	30	27-33
Cefotaxime			5	32	29-35
Cefpodoxime			10	31	28-34
Ceftibuten			30	32	29-35
Ceftriaxone			30	37	33-41
Cefuroxime			30	28	25-31
Chloramphenicol			30	34	30-38
Ciprofloxacin			5	35	31-39
Clarithromycin			15	12	9-15
Doripenem			10	29	26-32
Ertapenem			10	30	27-33
Erythromycin			15	15	12-18
Imipenem			10	28	25-31
Levofloxacin			5	35	32-38
Meropenem			10	31	28-34
Moxifloxacin			5	32	29-35
Nalidixic acid			30	30	27-33
Ofloxacin			5	33	30-36
Phenoxymethylpenicillin			10	18	15-21
Piperacillin-tazobactam			30/6	33	29-37
Rifampicin			5	23	20-26
Tetracycline			30	31	28-34
Tigecycline			15	28	25-31
Trimethoprim-sulfamethoxazole			1.25/23.75	29	25-33

¹ Under development

² Calculated by EUCAST

³ Data in bold/italics from repeated testing by EUCAST. Inhibition zone diameters were measured on at least 20 different occasions on more than five batches of Mueller-Hinton agar from several manufacturers.