European Committee on Antimicrobial Susceptibility Testing

Breakpoint tables for interpretation of MICs and zone diameters

Version 15.0, valid from 2025-01-01

This document should be cited as "The European Committee on Antimicrobial Susceptibility Testing. Breakpoint tables for interpretation of MICs and zone diameters. Version 15.0, 2025. https://www.eucast.org."

Content	Page	Additional information
Bacillus anthracis	106	
Brucella melitensis	108	
Burkholderia pseudomallei	110	
Burkholderia cepacia complex	112	Link to Guidance Document on *Burkholderia cepacia* complex
Legionella pneumophila	113	Link to Guidance Document on *Legionella pneumophila*
Mycobacterium tuberculosis	114	
Topical agents	115	Link to Guidance Document on Topical Agents
PK-PD cut-off values	116	
Expert Rules	-	Link to EUCAST Expert Rules and Expected Phenotypes
Detection of Resistance Mechanisms	-	Link to EUCAST Guidelines on Detection of Resistance Mechanisms
Antimicrobial susceptibility tests on groups of organisms or agents for which there are no EUCAST breakpoints	-	Link to Guidance Document on how to test and interpret results when there are no breakpoints
Guidance on breakpoints in brackets	-	Link to Guidance Document on breakpoints in brackets
Guidance on screening tests	-	Link to Guidance Document on screening tests
Guidance on endocarditis breakpoints		Link to Guidance Document on endocarditis breakpoints
EUCAST Reading Guide for broth microdilution	-	Link to EUCAST Reading Guide for broth microdilution
EUCAST Reading Guide for disk diffusion	-	Link to EUCAST Reading Guide for disk diffusion

European Committee on Antimicrobial Susceptibility Testing

Breakpoint tables for interpretation of MICs and zone diameters

Version 15.0, valid from 2025-01-01

Version 15.0, 2025-01-01	**Changes (cells containing a change, a deletion or an addition) from v.14.0 are marked yellow.** **Changed comments are underlined. Removed comments are shown in strikethrough font style.**
General	• Cefepime-enmetazobactam and aztreonam-avibactam added. The new agents are not listed as new breakpoints in the changes list when added as dash, IE or Note. • Link to guidance documents added at the top of each table. • Unless otherwise stated, breakpoints are valid also for special situations such as endocarditis and meningitis for relevant species and agents. Breakpoints for endocarditis and meningitis are listed on separate lines only when they differ from the general breakpoints. For information on species and agents for endocarditis, see https://www.eucast.org/eucastguidancedocuments/. • Specific comments on endocarditis and meningitis in the flow charts for screening for beta-lactam resistance in *S. pneumoniae* and *H. influenzae* are only kept if the recommendations are not covered by the general recommendations.
Notes	**New notes** • Note 7 **Revised notes** • Note 2 • Note 9 • Note 19
Dosages	**General** • Information on EUCAST breakpoints and dosing for challenging infection sites and on special situations for antimicrobial treatment is added below the dosages table **New dosages** • Cefepime-enmetazobactam • Aztreonam-avibactam **Revised dosages** • Benzylpenicillin **New comments** • Cefazolin, cefepime and cefuroxime iv **Revised comments** • Benzylpenicillin • Cefaclor

Version 15.0, 2025-01-01	**Changes (cells containing a change, a deletion or an addition) from v.14.0 are marked yellow. Changed comments are underlined. Removed comments are shown in strikethrough font style.**
Enterobacterales	**New breakpoints** • Cefepime-enmetazobactam (MIC and zone diameter) • Aztreonam-avibactam (MIC and zone diameter) **Revised breakpoints** • Amoxicillin oral (other indications) [MIC] • Amoxicillin-clavulanic acid oral (other indications) [MIC and zone diameter] • Ceftriaxone (zone diameter) **New ATUs** • Cefepime-enmetazobactam (zone diameter) • Aztreonam-avibactam (zone diameter) **New comments** • Cephalosporins comment 3 • Monobactams comment 2 • Macrolides comment B **Revised comments** • Penicillins comment E **Removed comments** • Aminoglycosides comment 2 (information moved to EUCAST expected resistant phenotypes)
***Pseudomonas* spp.**	**New ATUs** • Cefepime (zone diameter) **New comments** • Cephalosporins comment 1/A
Stenotrophomonas maltophilia	**General** • General information updated • Ceftazidime, cefepime, aztreonam, aztreonam-avibactam, ciprofloxacin, levofloxacin, minocycline and tigecycline added to the table **Revised breakpoints** • Trimethoprim-sulfamethoxazole (MIC) **New comments** • Fluoroquinolones comment 1 and A • Tetracyclines comment 1, 2 and A **Revised comments** • Cephalosporins comment 2/A
***Acinetobacter* spp.**	**General** • Information on species updated **New comments** • Tetracyclines comment 1 **Revised comments** • Cephalosporins comment 2/A
***Staphylococcus* spp.**	**Revised breakpoints** • Dalbavancin (MIC) **New comments** • Cephalosporins comment 2 added to cefazolin, cefepime and cefuroxime iv • Cephalosporins comment 3 • Carbapenems comment 2 **Removed comments** • Glycopeptides and lipoglycopeptides comment 4 • Glycopeptides and lipoglycopeptides comment 5 • Glycopeptides and lipoglycopeptides comment 6

Version 15.0, 2025-01-01	**Changes (cells containing a change, a deletion or an addition) from v.14.0 are marked yellow. Changed comments are underlined. Removed comments are shown in strikethrough font style.**
Enterococcus spp.	**General** • Referral to national guidelines for breakpoints in endocarditis removed • Information on species for which breakpoints are valid updated • Species information added for imipenem • Species information added for vancomycin • Information on species relating to pictures with reading examples for vancomycin updated **Revised breakpoints** • Several penicillin breakpoints (including new indications) • Imipenem-relebactam (changed from Note to dash) • Vancomycin, other enterococci (zone diameter) • Eravacycline (MIC and zone diameter) • Tigecycline (MIC and zone diameter) **Revised/new comments** • Penicillins comments 1/B, 2, 3/C, 4/D and 5 • Fluoroquinolones comment 1/B • Glycopeptides and lipoglycopeptides comment A • Miscellaneous agents comment 4/C **Removed comments** • Carbapenems comment 1/A • Glycopeptides and lipoglycopeptides previous comment 1/A
Streptococcus groups A, B, C and G	**Revised breakpoints** • Benzylpenicillin (MIC and zone diameter) • Rifampicin (MIC) **Revised comments** • Penicillins comments 1/A
Streptococcus pneumoniae	**General** • Indications updated for benzylpenicillin, ampicillin, amoxicillin, cefotaxime and ceftriaxone (endocarditis added) • Flow chart updated with new recommendations on benzylpenicillin disk diffusion testing and recommendations relating to endocarditis **New breakpoints** • Benzylpenicillin (indications other than endocarditis and meningitis) [zone diameter, see Note B] **Revised breakpoints** • Benzylpenicillin (indications other than endocarditis and meningitis) [MIC] • Oxacillin, cloxacillin, dicloxacillin, flucloxacillin (changed from NA or dash to IE) **New comments** • Penicillins comment A • Cephalosporins comment 2/B **Removed comments** • Penicillins previous comment 2

Version 15.0, 2025-01-01	**Changes (cells containing a change, a deletion or an addition) from v.14.0 are marked yellow. Changed comments are underlined. Removed comments are shown in strikethrough font style.**
Viridans group streptococci	**General** • Referral to national guidelines for breakpoints in endocarditis removed • Indications updated for benzylpenicillin, ampicillin and amoxicillin (endocarditis added) **New breakpoints** • Benzylpenicillin (endocarditis) [MIC and zone diameter] • Ampicillin (endocarditis) [MIC and zone diameter] • Amoxicillin (endocarditis) [MIC] **Revised breakpoints** • Benzylpenicillin (indications other than endocarditis and meningitis) [MIC] • Oxacillin, cloxacillin, dicloxacillin, flucloxacillin (changed from NA or dash to IE) **New comments** • Penicillins comment 2/B • Penicillins comment D • Oxazolidinones comment 1
Haemophilus influenzae	**General** • Indications updated for ampicillin and amoxicillin (endocarditis added) • Indications removed for cefotaxime and ceftriaxone (breakpoints valid for all indications) • Flow chart updated with recommendations relating to meningitis (MIC determination recommended only for meropenem) **Revised breakpoints** • Ciprofloxacin (MIC and zone diameter) [breakpoints valid for all indications] **New comments** • Cephalosporins comment 2/D **Removed comments** • Cephalosporins previous comment D • Fluoroquinolones previous comment B
Moraxella catarrhalis	**New comments** • Cephalosporins comment 1/A
Neisseria meningitidis	**Revised breakpoints** • Aztreonam (changed from dash to IE)
Anaerobic bacteria	**General** • Incubation time for agar dilution updated (typo in previous versions) **Revised breakpoints** • *Fusobacterium necrophorum* and benzylpenicillin (MIC) **New comments** • *Bacteroides* spp. comment 3
Kingella kingae	**New breakpoints** • Amoxicillin-clavulanic acid (zone diameter) **Revised comments** • Penicillins comment 3
Achromobacter xylosoxidans	**Antimicrobial agent added** • Cefiderocol **New comments** • Cephalosporins comment 1 • Cephalosporins comment 2/A
Topical agents	**General** • Species-agent combinations without cut-off values are left blank **Revised cut-off values** • *S. aureus* and fusidic acid (zone)
PK/PD cut-off values	• Information on the use, and limitations of, PK/PD cut-off values in breakpoint setting updated.

European Committee on Antimicrobial Susceptibility Testing

Breakpoint tables for interpretation of MICs and zone diameters

Version 15.0, valid from 2025-01-01

Notes

1. The EUCAST clinical breakpoint tables contain clinical MIC breakpoints (determined or revised during 2002-2024) and their inhibition zone diameter correlates. The EUCAST breakpoint tables version 15.0 includes corrected typographical errors, clarifications, breakpoints for new agents and/or organisms, revised MIC breakpoints and revised and new zone diameter breakpoints. Changes are best seen on screen or on a colour printout since cells containing a change are yellow. New or revised comments are underlined. Removed comments are shown in strikethrough font style.

2. The use and limitations of PK/PD cut-off values in breakpoint setting are described separately in the tab "PK/PD cut-off values".

3. Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.

4. Antimicrobial agent names in blue are linked to EUCAST rationale documents. MIC and zone diameter breakpoints in blue are linked to the search page of the EUCAST MIC and zone diameter distribution database.

5. The document is released as an Excel file suitable for viewing on screen and as an Acrobat pdf file suitable for printing. To utilize all functions in the Excel file, use Microsoft original programs only. The Excel file enables users to alter the list of agents to suit the local range of agents tested. The content of single cells cannot be changed. Hide lines by right-clicking on the line number and choose "hide". Hide columns by right-clicking on the column letter and choose "hide".

6. EUCAST breakpoints are used to categorise results into three susceptibility categories:
S - Susceptible, standard dosing regimen: A microorganism is categorised as *Susceptible, standard dosing regimen,* when there is a high likelihood of therapeutic success using a standard dosing regimen of the agent.
I - Susceptible, increased exposure: A microorganism is categorised as *Susceptible, increased exposure** when there is a high likelihood of therapeutic success because exposure to the agent is increased by adjusting the dosing regimen or by its concentration at the site of infection.
R - Resistant: A microorganism is categorised as *Resistant* when there is a high likelihood of therapeutic failure even when there is increased exposure.
*Exposure is a function of how the mode of administration, dose, dosing interval, infusion time, as well as distribution and excretion of the antimicrobial agent will influence the infecting organism at the site of infection.

7. Unless otherwise stated, breakpoints are valid for all indications. For information on species and agents for endocarditis, see https://www.eucast.org/eucastguidancedocuments/.

8. Dash in breakpoint tables indicates that the agent is unsuitable for treatment of infections caused by the organism or group of organisms and that testing and clinical use should be avoided. If included, report resistant without prior testing.

9. "IE" indicates that there is insufficient evidence that the organism or group is a good target for therapy with the agent. In these situations, follow the guidance in "When there are no breakpoints" (https://www.eucast.org/eucastguidancedocuments).

10. A screening test uses one agent to predict resistance or susceptibility to one or more antimicrobial agents in the same class. The screening test is often more sensitive and/or robust than testing individual agents. Using a screening test will often reduce the number of tests needed in primary susceptibility testing since it will predict susceptibility and/or resistance to several agents. Guidance on how to act on the screening test result is described in the Note related to each specific screening test.
Negative screening test: MIC below or equal to or zone diameter above or equal to the susceptible breakpoint for the screening agent. No resistance mechanisms to the antimicrobial class detected.
Positive screening test: MIC above or zone diameter below the resistant breakpoint for the screening agent. Resistance mechanisms to the antimicrobial class detected.

Notes

11. For an agent and a species, the ECOFF (epidemiological cut-off) value is the highest MIC (or the smallest inhibition zone diameter) for organisms devoid of phenotypically detectable acquired resistance mechanisms. Breakpoints in brackets are based on ECOFF values for relevant species. They are used to distinguish between organisms with and without acquired resistance mechanisms. ECOFFs do not predict clinical susceptibility but in some situations and/or when the agent is combined with another active agent, therapy may be considered.

12. Breakpoints in brackets distinguish between isolates without and with phenotypically detectable resistance mechanisms. They are based on ECOFFs but since they may serve more than one species, the value may represent a best fit. For these agents, clinical evidence as monotherapy is usually lacking but for a specific indication or in combination with another active agent or measure they may still be used. Isolates with resistance can be reported R (resistant). Reporting S or I should be avoided and if considered necessary, there should be a comment to explain the need for adjunctive measures as mentioned above.

13. An MIC breakpoint of S ≤ 0.001 mg/L is an arbitrary, "off scale" breakpoint (corresponding to a zone diameter breakpoint of "S ≥ 50 mm") which categorises wild-type organisms (organisms without phenotypically detectable resistance mechanisms to the agent) as "Susceptible, increased exposure" (I). For these organism-agent combinations, never report "Susceptible, standard dosing regimen" (S).

14. For some organism-agent combinations, results may be in an area where the interpretation is uncertain. EUCAST has designated this an Area of Technical Uncertainty (ATU). It corresponds to an MIC value and/or zone diameter interval where the categorisation is doubtful. See separate page for more information on ATU and how to deal with results in the ATU.

15. In order to simplify the EUCAST tables, the "Susceptible, increased exposure" (I category) is not listed. It is interpreted as values between the S and the R breakpoints. For example, for MIC breakpoints listed as S ≤ 1 mg/L and R > 8 mg/L, the I category is 2-8 (technically >1-8) mg/L, and for zone diameter breakpoints listed as S ≥ 22 mm and R < 18 mm, the I category is 18-21 mm.

16. For *Escherichia coli* with fosfomycin, *Staphylococcus aureus* with benzylpenicillin, enterococci with vancomycin, *Haemophilus influenzae* with beta-lactam agents, *Stenotrophomonas maltophilia* , *Aeromonas* spp., *Achromobacter xylosoxidans* and *Burkholderia pseudomallei* with trimethoprim-sulfamethoxazole, and for anaerobic bacteria in general, it is crucial to follow specific reading instructions for correct interpretation of the disk diffusion test. For these, pictures with reading examples are included at the end of the corresponding breakpoint table. For general and other specific reading instructions, please refer to the EUCAST Reading Guide.

17. With a few exceptions, EUCAST recommends the use of the broth microdilution reference method as described by the International Standards Organisation for MIC determination of non-fastidious organisms. For fastidious organisms, EUCAST recommends the use of the same methodology but with the use of MH-F broth (Mueller-Hinton broth with lysed horse blood and beta-NAD), see EUCAST media preparation file at www.eucast.org. There are a number of commercially available surrogate methods, for which it is the responsibility of the manufacturer to guarantee the accuracy of the system and the responsibility of the user to quality control the results.

18. By international convention, MIC dilution series are based on twofold dilutions up and down from 1 mg/L. At dilutions below 0.25 mg/L, this leads to concentrations with multiple decimal places. To avoid having to use these in tables and documents, EUCAST has decided to use the following format (in bold): 0.125→**0.125**, 0.0625→**0.06**, 0.03125→**0.03**, 0.015625→**0.016**, 0.0078125→**0.008**, 0.00390625→**0.004** and 0.001953125→**0.002** mg/L.

19. Definitions of "uncomplicated UTI" and "Infections originating from the urinary tract" used with EUCAST breakpoints:
Uncomplicated UTI: Acute, sporadic or recurrent lower urinary tract infections (uncomplicated cystitis) in patients with no known relevant anatomical or functional abnormalities within the urinary tract or comorbidities.
Infections originating from the urinary tract: Infections originating from, but not confined to, the urinary tract, including acute pyelonephritis and bloodstream infections, except severe sepsis. For oral agents, the breakpoints mainly apply to non-severe infections and oral step-down therapy.

Abbeviations
NA = Not Applicable
IP = In Preparation

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium:
Inoculum:
Incubation:
Reading:
Quality control:

EUCAST methodology and quality control for MIC determination

Disk diffusion (EUCAST standardised disk diffusion method)
Medium:
Inoculum:
Incubation:
Reading:
Quality control:

EUCAST methodology and quality control for disk diffusion

An arbitrary "off scale" breakpoint which categorises wild-type organisms as "Susceptible, increased exposure (I)".

Breakpoints with a species name apply only to that particular species (in this example *S. aureus*)

The I category is not listed but is interpreted as the values between the S and the R breakpoints. If the S and R breakpoints are the same value there is no I category.

Agent A: No I category
Agent B: I category: 4 mg/L, 23-25 mm
Agent H: I category: 1-2 mg/L, 24-29 mm

Area of Technical Uncertainty
See specific information on how to handle technical uncertainty in antimicrobial susceptibility testing.

Antimicrobial agent	MIC breakpoint (mg/L)			Disk content (µg)	Zone diameter breakpoint (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Antimicrobial agent A	1[1]	1[1]		X	20[A]	20[A]		**1.** Notes that are general comments and/or relating to MIC breakpoints.
Antimicrobial agent B	2[2]	4		Y	26	23		**2.** New comment
Antimicrobial agent C	0.001	8		X	50	18		~~Removed comment~~
Antimicrobial agent D, *S. aureus*	IE	IE			IE	IE		**A.** Comment on disk diffusion
Antimicrobial agent E	-	-			-	-		
Antimicrobial agent F	IP	IP			IP	IP		
Antimicrobial agent G (screen only)	NA	NA		Y	25	25		
Antimicrobial agent H	0.5	2		Z	30	24		
Antimicrobial agent I	(8)[1]	(8)[1]		30	(18)[A]	(18)[A]		

Changes from previous version highlighted in yellow

A screening test that uses one agent to predict resistance or susceptibility to one or more antimicrobial agents in the same class

Not Applicable

The agent is unsuitable for treatment. Susceptibility testing is not recommended

In Preparation

MIC breakpoints in blue are linked to MIC distributions

Zone diameter breakpoints in blue are linked to zone diameter distributions

Antimicrobial agents in blue are linked to EUCAST rationale documents

Breakpoints in brackets are used to distinguish between organisms with and without acquired resistance mechanisms (see Notes)

Insufficient evidence that the organism or group is a good target for therapy with the agent

Dosages used to define breakpoints

EUCAST breakpoints are based on the following dosages. Alternative dosing regimens may result in equivalent exposure. The table should not be used as a guidance for dosing in clinical practice as dosages can vary widely by indication. It does not replace specific national, regional or local dosing guidelines. However, if national practices significantly differ from those listed below, EUCAST breakpoints may not be valid. Situations where less antibiotic is given as standard or high dose should be discussed locally or regionally. Information on EUCAST breakpoints and dosing for challenging infection sites and on special situations for antimicrobial treatment is available below the dosages table.

Uncomplicated UTI: acute, sporadic or recurrent lower urinary tract infections (uncomplicated cystitis) in patients with no known relevant anatomical or functional abnormalities within the urinary tract or comorbidities.

Penicillins	Standard dosage	High dosage	Uncomplicated UTI	Special situations
Benzylpenicillin	0.6 g (1 MU) x 4 iv	1.2 g (2 MU) x 6 iv		**Meningitis:** 2.4 g (4 MU) x 6 iv ~~Meningitis caused by *S. pneumoniae*:~~ ~~For a dose of 2.4 g (4 MU) x 6 iv, isolates with MIC ≤0.06 mg/L are susceptible~~ ~~**Pneumonia caused by *S. pneumoniae*: breakpoints are related to dosage:**~~ ~~For a dose of 1.2 g (2 MU) x 4 iv, isolates with MIC ≤ 0.5 mg/L are susceptible.~~ ~~For a dose of 2.4 (4 MU) g x 4 iv or 1.2 g (2 MU) x 6 iv, isolates with MIC ≤1 mg/L are susceptible.~~ ~~For a dose of 2.4 g (4 MU) x 6 iv, isolates with MIC ≤2 mg/L are susceptible.~~
Ampicillin iv	2 g x 3 iv	2 g x 4 iv		**Meningitis:** 2 g x 6 iv
Ampicillin-sulbactam iv	(2 g ampicillin + 1 g sulbactam) x 3 iv	(2 g ampicillin + 1 g sulbactam) x 4 iv		
Ampicillin-sulbactam oral	None	None	0.75 g x 2 oral	
Amoxicillin iv	1 g x 3-4 iv	2 g x 6 iv		**Meningitis:** 2 g x 6 iv
Amoxicillin oral	0.5 g x 3 oral	0.75-1 g x 3 oral	0.5 g x 3 oral	
Amoxicillin-clavulanic acid iv	(1 g amoxicillin + 0.2 g clavulanic acid) x 3-4 iv	(2 g amoxicillin + 0.2 g clavulanic acid) x 3 iv		
Amoxicillin-clavulanic acid oral	(0.5 g amoxicillin + 0.125 g clavulanic acid) x 3 oral	(0.875 g amoxicillin + 0.125 g clavulanic acid) x 3 oral	(0.5 g amoxicillin + 0.125 g clavulanic acid) x 3 oral	Amoxicillin-clavulanic acid has separate breakpoints for systemic infections and uncomplicated UTI. When amoxicillin-clavulanic acid is reported for uncomplicated UTI, the report must make clear that the susceptibility category is only valid for uncomplicated UTI.
Piperacillin	4 g x 4 iv	4 g x 4 iv by extended 3-hour infusion		High dosage for more serious infections.
Piperacillin-tazobactam	(4 g piperacillin + 0.5 g tazobactam) x 4 iv 30-minute infusion or x 3 iv by extended 4-hour infusion	(4 g piperacillin + 0.5 g tazobactam) x 4 iv by extended 3-hour infusion		A lower dosage of (4 g piperacillin + 0.5 g tazobactam) x 3 iv, 30-minute infusion, is adequate for some infections such as complicated UTI, intraabdominal infections and diabetic foot infections, but not for infections caused by isolates resistant to third-generation cephalosporins.
Ticarcillin-clavulanic acid	(3 g ticarcillin + 0.1-0.2 g clavulanic acid) x 4 iv	(3 g ticarcillin + 0.1 g clavulanic acid) x 6 iv		
Temocillin	2 g x 2 iv	2 g x 3 iv		The 2 g x 2 iv dose has been used in the treatment of uncomplicated UTI caused by bacteria with beta-lactam resistance mechanisms.
Phenoxymethylpenicillin	0.5-2 g x 3-4 oral depending on species and/or infection type	None		
Oxacillin	1 g x 4 iv	Dosages vary by indication		
Cloxacillin	0.5 g x 4 oral or 1 g x 4 iv	Dosages vary by indication		**Meningitis:** 2 g x 6 iv
Dicloxacillin	0.5-1 g x 4 oral or 1 g x 4 iv	Dosages vary by indication		
Flucloxacillin	1 g x 3 oral or 2 g x 4 iv (or 1 g x 6 iv)	Dosages vary by indication		**Meningitis:** 2 g x 6 iv
Mecillinam oral (pivmecillinam)	None	None	0.2-0.4 g x 3 oral	

Dosages used to define breakpoints

Cephalosporins	Standard dosage	High dosage	Uncomplicated UTI	Special situations
Cefaclor	0.25-0.5 g x 3 oral depending on species and/or infection type	1 g x 3 oral		***S. aureus*** **:** Minimum dose 0.5 g x 3 oral
Cefadroxil	0.5-1 g x 2 oral	None	0.5-1 g x 2 oral	
Cefalexin	0.25-1 g x 2-3 oral	None	0.25-1 g x 2-3 oral	
Cefazolin	1 g x 3 iv	2 g x 3 iv		***S. aureus:*** High dose only
Cefepime	1 g x 3 iv or 2 g x 2 iv	2 g x 3 iv		**Severe *P. aeruginosa* infections:** 2 g x 3 with extended 4-hour infusion ***S. aureus:*** High dose only
Cefepime-enmetazobactam (UTI)	(2 g cefepime + 0.5 g enmetazobactam) x 3 iv over 2 hours			
Cefepime-enmetazobactam (hospital-acquired pneumonia, including ventilator-associated pneumonia)	(2 g cefepime + 0.5 g enmetazobactam) x 3 iv over 4 hours			
Cefiderocol	2 g x 3 iv over 3 hours	None		
Cefixime	0.2-0.4 g x 2 oral	None	0.2-0.4 g x 2 oral	**Uncomplicated gonorrhoea:** 0.4 g oral as a single dose
Cefotaxime	1 g x 3 iv	2 g x 3 iv		**Meningitis:** 2 g x 4 iv ***S. aureus:*** High dose only
Cefpodoxime	0.1-0.2 g x 2 oral	None	0.1-0.2 g x 2 oral	
Ceftaroline	0.6 g x 2 iv over 1 hour	0.6 g x 3 iv over 2 hours		***S. aureus*** **in complicated skin and skin structure infections:** There is some PK-PD evidence to suggest that isolates with MICs of 4 mg/L could be treated with high dose.
Ceftazidime	1 g x 3 iv	2 g x 3 iv or 1 g x 6 iv		
Ceftazidime-avibactam	(2 g ceftazidime + 0.5 g avibactam) x 3 iv over 2 hours			
Ceftibuten	0.4 g x 1 oral	None		
Ceftobiprole	0.5 g x 3 iv over 2 hours	None		
Ceftolozane-tazobactam (intra-abdominal infections and UTI)	(1 g ceftolozane + 0.5 g tazobactam) x 3 iv over 1 hour	None		
Ceftolozane-tazobactam (hospital-acquired pneumonia, including ventilator-associated pneumonia)	(2 g ceftolozane + 1 g tazobactam) x 3 iv over 1 hour	None		
Ceftriaxone	2 g x 1 iv	2 g x 2 iv or 4 g x 1 iv		**Meningitis:** 2 g x 2 iv or 4 g x 1 iv ***S. aureus:*** High dose only **Uncomplicated gonorrhoea:** 0.5-1 g im as a single dose
Cefuroxime iv	0.75 g x 3 iv	1.5 g x 3 iv		***S. aureus:*** High dose only
Cefuroxime oral	0.25 g x 2 oral	0.5 g x 2 oral	0.25 g x 2 oral	

Dosages used to define breakpoints

Carbapenems	Standard dosage	High dosage	Uncomplicated UTI	Special situations
Doripenem	0.5 g x 3 iv over 1 hour	1 g x 3 iv over 1 hour		HAP/VAP* due to non-fermenting Gram-negative pathogens (such as *Pseudomonas* spp. and *Acinetobacter* spp.) should be treated with 1 g x 3 iv over 4 hours.
Ertapenem	1 g x 1 iv over 30 minutes	None		
Imipenem	0.5 g x 4 iv over 30 minutes	1 g x 4 iv over 30 minutes		
Imipenem-relebactam	(0.5 g imipenem + 0.25 g relebactam) x 4 iv over 30 minutes	None		
Meropenem	1 g x 3 iv over 30 minutes	2 g x 3 iv over 3 hours		**Meningitis:** 2 g x 3 iv over 30 minutes (or 3 hours)
Meropenem-vaborbactam	(2 g meropenem + 2 g vaborbactam) x 3 iv over 3 hours			

* HAP/VAP = hospital-acquired pneumonia/ventilator-associated pneumonia

Monobactams	Standard dosage	High dosage	Uncomplicated UTI	Special situations
Aztreonam	1 g x 3 iv	2 g x 4 iv		**Severe *P. aeruginosa* infections:** 2 g x 4 with extended 3-hour infusion
Aztreonam-avibactam	(2 g aztreonam + 0.67 g avibactam) x 1 followed by (1.5 g aztreonam + 0.5 g avibactam) x 4 iv over 3 hours			

Fluoroquinolones	Standard dosage	High dosage	Uncomplicated UTI	Special situations
Ciprofloxacin	0.5 g x 2 oral or 0.4 g x 2 iv	0.75 g x 2 oral or 0.4 g x 3 iv		**Meningitis:** 0.4 g x 3 iv
Delafloxacin	0.45 g x 2 oral or 0.3 g x 2 iv	None		
Levofloxacin	0.5 g x 1 oral or 0.5 g x 1 iv	0.5 g x 2 oral or 0.5 g x 2 iv		
Moxifloxacin	0.4 g x 1 oral or 0.4 g x 1 iv	None		**Meningitis:** 0.4 g x 1 iv
Norfloxacin	None	None	0.4 g x 2 oral	
Ofloxacin	0.2 g x 2 oral or 0.2 g x 2 iv	0.4 g x 2 oral or 0.4 g x 2 iv		

Aminoglycosides	Standard dosage	High dosage	Uncomplicated UTI	Special situations
Amikacin	25-30 mg/kg x 1 iv	None		
Gentamicin	6-7 mg/kg x 1 iv	None		
Netilmicin	6-7 mg/kg x 1 iv	None		
Tobramycin	6-7 mg/kg x 1 iv	None		

Glycopeptides and lipoglycopeptides	Standard dosage	High dosage	Uncomplicated UTI	Special situations
Dalbavancin	1 g x 1 iv over 30 minutes on day 1 If needed, 0.5 g x 1 iv over 30 minutes on day 8	None		
Oritavancin	1.2 g x 1 (single dose) iv over 3 hours	None		
Teicoplanin	0.4 g x 1 iv	Dosages vary by indication		
Telavancin	10 mg/kg x 1 iv over 1 hour	None		
Vancomycin	0.5 g x 4 iv or 1 g x 2 iv or 2 g x 1 by continuous infusion	None		Based on body weight. Therapeutic drug monitoring should guide dosing.

Macrolides, lincosamides and streptogramins	Standard dosage	High dosage	Uncomplicated UTI	Special situations
Azithromycin	0.5 g x 1 oral or 0.5 g x 1 iv	None		**Uncomplicated gonorrhoea:** 2 g oral as a single dose
Clarithromycin	0.25 g x 2 oral	Dosages vary by indication		In some countries clarithromycin is available for intravenous administration at a dose of 0.5 g x 2, principally for treating pneumonia.
Erythromycin	0.5 g x 2-4 oral or 0.5 g x 2-4 iv	Dosages vary by indication		
Roxithromycin	0.15 g x 2 oral	None		
Clindamycin	0.3 g x 2 oral or 0.6 g x 3 iv	Dosages vary by indication		The high exposure dosing regimen pertains to the severity of the infection or drug exposure at the site of infection.
Quinupristin-dalfopristin	7.5 mg/kg x 2 iv	Dosages vary by indication		

Tetracyclines	Standard dosage	High dosage	Uncomplicated UTI	Special situations
Doxycycline	0.1 g x 1 oral	Dosages vary by indication		
Eravacycline	1 mg/kg x 2 iv	None		
Minocycline	0.1 g x 2 oral	None		
Tetracycline	0.25 g x 4 oral	Dosages vary by indication		
Tigecycline	0.1 g loading dose followed by 50 mg x 2 iv	None		

Oxazolidinones	Standard dosage	High dosage	Uncomplicated UTI	Special situations
Linezolid	0.6 g x 2 oral or 0.6 g x 2 iv	None		**Meningitis:** 0.6 g x 2 iv
Tedizolid	0.2 g x 1 oral or 0.2 g x 1 iv	None		

Dosages used to define breakpoints

Miscellaneous agents	Standard dosage	High dosage	Uncomplicated UTI	Special situations
Chloramphenicol	1 g x 4 oral or 1 g x 4 iv	2 g x 4 oral or 2 g x 4 iv		**Meningitis**: 2 g x 4 iv
Colistin	4.5 MU x 2 iv with a loading dose of 9 MU	None		
Daptomycin (cSSTI without concurrent *S. aureus* bacteraemia)**	4 mg/kg x 1 iv	None	.	.
Daptomycin (cSSTI with concurrent *S. aureus* bacteraemia; right-sided infective endocarditis due to *S. aureus*)**	6 mg/kg x 1 iv	None		**Enterococcal bloodstream infection and endocarditis,** see https://www.eucast.org/eucastguidancedocuments.
Fidaxomicin	0.2 g x 2 oral	None		
Fosfomycin iv	16-18 g/day divided in 3-4 doses	Dosages vary by indication		
Fosfomycin oral	None	None	3 g x 1 oral as a single dose	
Fusidic acid	0.5 g x 2 oral or 0.5 g x 2 iv	Dosages vary by indication		
Lefamulin	0.15 g x 2 iv or 0.6 g x 2 oral	None		
Metronidazole	0.4 g x 3 oral or 0.4 g x 3 iv	Dosages vary by indication		
Nitrofurantoin	None	None	50-100 mg x 3-4 oral	Dosing is dependent on drug formulation.
Nitroxoline	None	None	0.25 g x 3 oral	
Rifampicin	0.6 g x 1 oral or 0.6 g x 1 iv	None		
Spectinomycin	2 g x 1 im	None		
Trimethoprim	None	None	0.16 g x 2 oral	
Trimethoprim-sulfamethoxazole	(0.16 g trimethoprim + 0.8 g sulfamethoxazole) x 2 oral or (0.16 g trimethoprim + 0.8 g sulfamethoxazole) x 2 iv	(0.24 g trimethoprim + 1.2 g sulfamethoxazole) x 2 oral or (0.24 g trimethoprim + 1.2 g sulfamethoxazole) x 2 iv	(0.16 g trimethoprim + 0.8 g sulfamethoxazole) x 2 oral	**Meningitis**: (5 mg/kg up to 0.48 g trimethoprim + 25 mg/kg up to 2.4 g sulfamethoxazole) x 3 iv

** cSSTI = complicated skin and skin structure infection

Information on EUCAST breakpoints and dosing for challenging infection sites and on special situations for antimicrobial treatment

EUCAST breakpoints are based on standard and, if applicable, high exposure to antimicrobial agents. The dosing regimens are either those listed in the Summary of Product Characteristics approved by EMA (European Medicines Agency) or, especially with older agents, doses that are commonly administered in European countries. For some more common infections or when the usual severity of the infection requires special attention, EUCAST has produced additional dosing guidance (e.g. urinary tract infections) and/or breakpoints (e.g. meningitis).

There are other sites and infections where the antibiotic exposure of the organism may be impaired and where therapy may require higher dosing or a change in the mode of administration to ensure the desired exposure. Such situations include, but are not limited to, endocarditis, bone and joint infections, and abscesses in the central nervous system.

Since EUCAST is a breakpoint committee it will not give dosing or other treatment recommendations for such conditions, but will list specific breakpoints for challenging infections when applicable. Refer to textbooks or national/international treatment guidelines for more information on dosing regimens in challenging infections.

In addition to these clinical situations, rare resistance mechanisms may require tailored or unusual therapeutic approaches and often these therapies are still discussed in the community. Examples include borderline resistant *S. aureus* (BORSA), vancomycin-variable enterococci and *A. baumannii* producing KPC. For such isolates, EUCAST currently does not give specific recommendations, neither for testing nor for selection of the appropriate antimicrobial agent.

How to handle technical uncertainty in antimicrobial susceptibility testing

All measurements are affected by random variation and some by systematic variation. Systematic variation can normally be avoided and random variation should be reduced as much as possible. Antimicrobial susceptibility testing (AST), irrespective of method, is no exception.

EUCAST strives to minimise variation by providing standardised methods for MIC determination and disk diffusion and by avoiding setting breakpoints which seriously affect the reproducibility of AST. Variation in AST can be further reduced by setting more stringent standards for manufacturers of AST material (broth, agar, antimicrobial disks) and criteria for quality control of manufacturing processes and laboratory practices.

It is tempting to think that generating an MIC value will solve all problems. However, MIC measurements also have variation and a single value is not automatically accurate. Even when using the reference method, MICs might vary between days and technicians. Under the best of circumstances, an MIC of 1.0 mg/L should be considered as a value between 0.5 and 2.0 mg/L, although the probability of getting any one of these three values is not equal and will vary among strains and antimicrobial agents. Not infrequently, EUCAST discovers problems with commercial testing systems including quality of disks and media for disk diffusion, commercial panels for broth microdilution tests, gradient tests and semi-automated AST devices. Some of these affect accuracy (poorly calibrated concentration series) and others precision (poor general quality,

Although AST is straightforward for most agents and species, there are problematic situations even when testing is performed to a high standard. It is important to warn laboratories about these and the uncertainty of susceptibility categorisation. Analysis of EUCAST data (readily available at https://www.eucast.org/ast_of_bacteria/calibration_and_validation/) that have been generated over the years has identified such situations, named by EUCAST "**Area of Technical Uncertainty (ATU)**". The ATUs are **warnings to laboratory staff** that there is an uncertainty that needs to be addressed before reporting AST results to clinical colleagues. The ATU is not a susceptibility category and does not prevent the laboratory from interpreting the susceptibility test result.

Below are alternatives for how the ATUs can be dealt with by the laboratory. Which of these actions are chosen will depend on the situation. The type of sample (blood culture vs. urine culture), the number of alternative agents available, the severity of the disease, whether or not a consultation with clinical colleagues is feasible, will

- **Repeat the test**
  To ONLY repeat the test is relevant if there is reason to suspect a technical problem in the primary AST. To repeat the test while confirming the result with another test is good laboratory practice. If an MIC test is performed, the chances are that this result may also end up in the ATU. If so, a primary test and an alternative test may both point to a result and an interpretation in the ATU. In this case, interpret the result according to the breakpoints and report.
- **Use an alternative test (perform an MIC or a genotypic test)**
  This may be relevant if the susceptibility report otherwise leaves only few therapeutic alternatives. If the organism is multi-resistant, perform an MIC determination for several antibiotics, possibly extending the AST to include new beta-lactam inhibitor combinations, cefiderocol and colistin for Gram-negative bacteria. Sometimes it may be necessary to perform genotypic or phenotypic characterisation of the resistance mechanism to obtain more information, some of which may be of importance for epidemiological decisions. When performing an MIC, this result may end up in the ATU. In this case, interpret the result according to the breakpoints and report.
- **Downgrade the susceptibility category**
  If there are other therapeutic alternatives in the AST report, it is permissible to downgrade the result (from S to I, or from I to R or from S to R). However, a comment should be included and the isolate saved for further testing.

How to handle technical uncertainty in antimicrobial susceptibility testing

- **Include the uncertainty as part of the report**
  It is common practice in many other laboratory settings to include information on the uncertainty of the reported result. This can be dealt with in several alternative ways:
  - Report results in the ATU as "uncertain". This can be achieved by leaving the interpretation "blank + a comment".
  - Develop the LIS system to deliver an asterix or Note (instead of an S, I or R) which refers to a comment explaining the uncertainty.
  - Categorise the result according to the breakpoints but include information about the technical difficulties and/or the uncertainty of the interpretation. In many instances, an “R” is less ambiguous than other alternatives, especially when there are alternative agents. Do not report "S" unless you have confirmed the result.
  For serious situations, take the opportunity to contact the clinical colleague to explain and discuss the results.
- **Omit an uncertain result**
  When there are several therapeutic options, or when an ambiguous interpretation cannot be readily resolved in a timely manner, an ATU result is best left either unreported or downgraded (see above).

The Area of Technical Uncertainty is typically listed as a defined MIC value or in disk diffusion a range of zone diameters. ATUs are only listed when obviously needed. The absence of an ATU (MIC and/or zone diameter) means that there is no immediate need for a warning. The ATUs introduced in 2019 (v. 9.0) will be evaluated and ATUs may be added as more information develops.
Link to the guidance material available on the EUCAST website.

Enterobacterales *

Expert Rules and Expected Phenotypes | **Guidance documents**

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1 except for mecillinam and fosfomycin where agar dilution is used)
Medium: Cation-adjusted Mueller-Hinton broth (for cefiderocol, see https://www.eucast.org/eucastguidancedocuments/)
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Escherichia coli* ATCC 25922. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor combinations, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar
Inoculum: McFarland 0.5
Incubation: Air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the back of the plate against a dark background illuminated with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Escherichia coli* ATCC 25922. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor-combination disks, see EUCAST QC Tables.

*** Recent taxonomic studies have narrowed the definition of the family Enterobacteriaceae. Some previous members of this family are now included in other families within the order *Enterobacterales*. Breakpoints in this table apply to all members of the *Enterobacterales*.**

Penicillins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)		
	S ≤	R >	ATU		S ≥	R <	ATU
Benzylpenicillin	-	-			-	-	
Ampicillin iv[1]	8	8		10	14[A]	14[A]	
Ampicillin oral (uncomplicated UTI only)[1]	8	8		10	14[A]	14[A]	
Ampicillin-sulbactam iv[1]	8[2]	8[2]		10-10	14[A]	14[A]	
Ampicillin-sulbactam oral (uncomplicated UTI only)[1]	8[2]	8[2]		10-10	14[A]	14[A]	
Amoxicillin iv[1]	8	8		-	Note[B]	Note[B]	
Amoxicillin oral (infections originating from the urinary tract)[1]	0.001	8		-	Note[C]	Note[C]	
Amoxicillin oral (uncomplicated UTI only)[1]	8	8		-	Note[B]	Note[B]	
Amoxicillin oral (other indications)[1]	(0.001)[3]	(8)[3]		-	Note[D,E]	Note[D,E]	
Amoxicillin-clavulanic acid iv[1]	8[4]	8[4]		20-10	19[A]	19[A]	19-20
Amoxicillin-clavulanic acid oral (infections originating from the urinary tract)[1]	0.001[4]	8[4]		20-10	50[A]	19[A]	19-20
Amoxicillin-clavulanic acid oral (uncomplicated UTI only)[1]	32[4]	32[4]		20-10	16[A]	16[A]	
Amoxicillin-clavulanic acid oral (other indications)[1]	(0.001)[3,4]	(8)[3,4]		20-10	(50)[A,D]	(19)[A,D]	19-20
Piperacillin	8	8		30	20	20	
Piperacillin-tazobactam	8[5]	8[5]	16	30-6	20	20	19
Ticarcillin-clavulanic acid	8[4]	16[4]		75-10	23	20	
Temocillin (infections originating from the urinary tract), *E. coli*, *Klebsiella* spp. (except *K. aerogenes*) and *P. mirabilis*	0.001	16		30	50[F]	17[F]	
Phenoxymethylpenicillin	-	-			-	-	
Oxacillin	-	-			-	-	
Cloxacillin	-	-			-	-	
Dicloxacillin	-	-			-	-	
Flucloxacillin	-	-			-	-	
Mecillinam oral (pivmecillinam) (uncomplicated UTI only), *E. coli*, *Citrobacter* spp., *Klebsiella* spp., *Raoultella* spp., *Enterobacter* spp. and *P. mirabilis*	8[6]	8[6]		10	15[F]	15[F]	

Notes

Numbered notes relate to general comments and/or MIC breakpoints.
Lettered notes relate to the disk diffusion method.

1. For information on how to implement the new aminopenicillin breakpoints, see https://www.eucast.org/eucastguidancedocuments/.
2. For susceptibility testing purposes, the concentration of sulbactam is fixed at 4 mg/L.
3/D. For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.
4. For susceptibility testing purposes, the concentration of clavulanic acid is fixed at 2 mg/L.
5. For susceptibility testing purposes, the concentration of tazobactam is fixed at 4 mg/L.
6. Agar dilution is the reference method for mecillinam MIC determination.

A. Ignore growth that may appear as a thin inner zone on some batches of Mueller-Hinton agars.
B. Susceptibility inferred from ampicillin (iv or oral).
C. Isolates susceptible to ampicillin (iv or oral) can be reported "susceptible, increased exposure" (I) to "amoxicillin oral (infections originating from the urinary tract)". Isolates resistant to ampicillin (iv or oral) can be reported resistant to "amoxicillin oral (infections originating from the urinary tract)".
E. Isolates susceptible to ampicillin are without phenotypically detectable resistance mechanisms and "amoxicillin oral (other indications)" can be used in high exposure in combination therapy (**see Note 3/D**). Isolates resistant to ampicillin can be reported resistant.
F. Ignore isolated colonies within the inhibition zone.

Cephalosporins[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)		
	S ≤	R >	ATU		S ≥	R <	ATU
Cefaclor (uncomplicated UTI only)	IE	IE			IE	IE	
Cefadroxil (uncomplicated UTI only)	16	16		**30**	12	12	
Cefalexin (uncomplicated UTI only)	16	16		**30**	14	14	
Cefazolin (infections originating from the urinary tract), *E. coli* and *Klebsiella* spp. (except *K. aerogenes*)	0.001[2]	4[2]		**30**	50[A]	20[A]	
Cefepime	1	4		**30**	27	24	
Cefepime-enmetazobactam	4[3]	4[3]		**30-20**	22	22	21-22
Cefiderocol	2[4]	2[4]		**30**	23	23	21-23
Cefixime (uncomplicated UTI only)	1	1		**5**	17	17	
Cefotaxime (indications other than meningitis)	1	2		**5**	20	17	
Cefotaxime (meningitis)	1	1		**5**	20	20	
Cefoxitin (screen only)[5]	Note[5]	Note[5]		**30**	19	19	
Cefpodoxime (uncomplicated UTI only)	1	1		**10**	21	21	
Ceftaroline	0.5	0.5		**5**	23	23	22-23
Ceftazidime	1	4		**10**	22	19	
Ceftazidime-avibactam	8[6]	8[6]		**10-4**	13	13	
Ceftibuten (infections originating from the urinary tract)	1	1		**30**	23	23	
Ceftobiprole	0.25	0.25		**5**	23	23	
Ceftolozane-tazobactam[7]	2[8]	2[8]		**30-10**	22	22	19-21
Ceftriaxone (indications other than meningitis)	1	2		**30**	27	24	
Ceftriaxone (meningitis)	1	1		**30**	27	27	
Cefuroxime iv, *E. coli*, *Klebsiella* spp. (except *K. aerogenes*), *Raoultella* spp. and *P. mirabilis*	0.001	8		**30**	50	19	
Cefuroxime oral (uncomplicated UTI only), *E. coli, Klebsiella* spp. (except *K. aerogenes*), *Raoultella* spp. and *P. mirabilis*	8	8		**30**	19	19	

Notes

Numbered notes relate to general comments and/or MIC breakpoints.

Lettered notes relate to the disk diffusion method.

1. The cephalosporin breakpoints for *Enterobacterales* will detect all clinically important resistance mechanisms (including ESBL and plasmid mediated AmpC). Some isolates that produce beta-lactamases are susceptible to 3rd or 4th generation cephalosporins with these breakpoints and should be reported as tested, i.e. the presence or absence of an ESBL does not in itself influence the categorisation of susceptibility. ESBL detection and characterisation are recommended for public health and infection control purposes.

2/A. Isolates susceptible to cefadroxil and/or cefalexin can be reported "susceptible, increased exposure" (I) to cefazolin.

3. For susceptibility testing purposes, the concentration of enmetazobactam is fixed at 8 mg/L.

4. Broth microdilution MIC determination must be performed in iron-depleted Mueller-Hinton broth and specific reading instructions must be followed. For testing conditions and reading instructions, see https://www.eucast.org/eucastguidancedocuments/.

5. The cefoxitin cut-off value (8 mg/L) has a high sensitivity but poor specificity for identification of AmpC-producing *Enterobacterales* as this agent is also affected by permeability alterations and some carbapenemases. Classical non-AmpC producers are wild type, whereas plasmid AmpC producers or chromosomal AmpC hyperproducers are non-wild type.

6. For susceptibility testing purposes, the concentration of avibactam is fixed at 4 mg/L.

7. See table of dosages for dosing for different indications.

8. For susceptibility testing purposes, the concentration of tazobactam is fixed at 4 mg/L.

Carbapenems[1]	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doripenem	1	2		**10**	24	21		**1.** Some isolates that produce carbapenemase are categorised as susceptible with the current breakpoints and should be reported as tested, i.e. the presence or absence of a carbapenemase does not in itself influence the categorisation of susceptibility. Carbapenemase detection and characterisation are recommended for public health and infection control purposes. For carbapenemase screening, a meropenem screening cut-off of >0.125 mg/L (zone diameter <28 mm) is recommended. **2.** The intrinsically low activity of imipenem against *Morganella morganii* , *Proteus* spp. and *Providencia* spp. requires the high exposure of imipenem. **3**. For susceptibility testing purposes, the concentration of relebactam is fixed at 4 mg/L. **4.** For susceptibility testing purposes, the concentration of vaborbactam is fixed at 8 mg/L. **A.** For isolates in the ATU, if resistant to meropenem report resistant to meropenem-vaborbactam. If not resistant to meropenem, investigate further.
Ertapenem	0.5	0.5		**10**	23	23		
Imipenem, *Enterobacterales* except *Morganellaceae*	2	4		**10**	22	19		
Imipenem[2]**,** *Morganellaceae*	0.001	4		**10**	50	19		
Imipenem-relebactam, *Enterobacterales* except *Morganellaceae*	2[3]	2[3]		**10-25**	22	22	20-22	
Meropenem (indications other than meningitis)	2	8		**10**	22	16		
Meropenem (meningitis)	2	2		**10**	22	22		
Meropenem-vaborbactam	8[4]	8[4]		**20-10**	20	20	15-19[A]	

Monobactams	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Aztreonam[1]	1	4		**30**	26	21		**1.** The aztreonam breakpoints for *Enterobacterales* will detect clinically important resistance mechanisms (including ESBL). Some isolates that produce beta-lactamases are susceptible to aztreonam with these breakpoints and should be reported as tested, i.e. the presence or absence of an ESBL does not in itself influence the categorisation of susceptibility. ESBL detection and characterisation are recommended for public health and infection control purposes. **2.** For susceptibility testing purposes, the concentration of avibactam is fixed at 4 mg/L.
Aztreonam-avibactam	4[2]	4[2]		**30-20**	25	25	22-24	

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin, *Salmonella* spp.[1]	0.06	0.06			Note[A]	Note[A]		**1.** There is clinical evidence for ciprofloxacin to indicate a poor response in systemic infections caused by *Salmonella* spp. with any detectable fluoroquinolone resistance mechanisms. The available data relate mainly to *Salmonella* Typhi but there are also case reports of poor response with other *Salmonella* species. **2/B.** In meningitis, where all fluoroquinolone resistance mechanisms must be excluded, either perform an MIC test, or infer susceptibility from the pefloxacin 5 µg screening test. **3.** Fluoroquinolone breakpoints are available for other agents. **A.** Tests with a ciprofloxacin 5 µg disk will not reliably exclude all fluoroquinolone resistance mechanisms in *Salmonella* spp. Perform an MIC test, or infer susceptibility from the pefloxacin 5 µg screening test. **C.** The pefloxacin screening test can also be used to detect fluoroquinolone resistance mechanisms in other *Enterobacterales* such as *E. coli*, *K. pneumoniae* and *Shigella* spp. **D.** A disk diffusion test awaits action from the responsible pharmaceutical company.
Ciprofloxacin (indications other than meningitis)	0.25	0.5	0.5	**5**	25	22	22-24	
Ciprofloxacin (meningitis)[2]	0.125	0.125			Note[B]	Note[B]		
Pefloxacin (screen only)	NA	NA		**5**	24[A,B,C]	24[A,B,C]		
Delafloxacin, *E. coli*	0.125	0.125			Note[D]	Note[D]		
Levofloxacin	0.5	1		**5**	23	19		
Moxifloxacin, *Enterobacterales* except *Morganella morganii, Proteus* spp. and *Serratia* spp.[3]	0.25	0.25		**5**	22	22		
Nalidixic acid (screen only)	NA	NA			NA	NA		
Norfloxacin (uncomplicated UTI only)	0.5	0.5		**10**	24	24		
Ofloxacin	0.25	0.5		**5**	24	22		

Aminoglycosides[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Amikacin (systemic infections)	(8)[1]	(8)[1]		30	(18)[A]	(18)[A]		**1/A.** For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.
Amikacin (infections originating from the urinary tract)	8	8		30	18	18		**2.** ~~Breakpoints do not apply to *Plesiomonas shigelloides* since aminoglycosides have low intrinsic activity against this species.~~
Gentamicin (systemic infections)	(2)[1]	(2)[1]		10	(17)[A]	(17)[A]		
Gentamicin (infections originating from the urinary tract)	2	2		10	17	17		
Netilmicin	IE	IE			IE	IE		
Tobramycin (systemic infections)	(2)[1]	(2)[1]		10	(16)[A]	(16)[A]		
Tobramycin (infections originating from the urinary tract)	2	2		10	16	16		

Glycopeptides and lipoglycopeptides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Dalbavancin	-	-			-	-		
Oritavancin	-	-			-	-		
Teicoplanin	-	-			-	-		
Telavancin	-	-			-	-		
Vancomycin	-	-			-	-		

Macrolides, lincosamides and streptogramins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin[1]	Note[1]	Note[1]			Note[A,B]	Note[A,B]		**1/A.** Azithromycin has been used in the treatment of enteric infections, primarily with *Salmonella* Typhi and *Shigella* species and although wild type distributions vary somewhat, isolates with MICs above 16 mg/L (azithromycin 15 µg disk zone diameters <12 mm) are likely to have azithromycin resistance mechanisms.
Clarithromycin	-	-			-	-		**B.** When reading azithromycin zone diameters, take growth appearing as a thin inner zone on some batches of Mueller-Hinton agar into account.
Erythromycin	-	-			-	-		
Roxithromycin	-	-			-	-		
Clindamycin	-	-			-	-		
Quinupristin-dalfopristin	-	-			-	-		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	-	-			-	-		**1.** Tetracycline can be used to predict doxycycline susceptibility for the treatment of *Yersinia enterocolitica* infections (tetracycline MIC ≤4 mg/L for wild-type isolates). The corresponding zone diameter for the tetracycline 30 µg disk is ≥19 mm. **2.** For tigecycline broth microdilution MIC determination, the medium must be prepared fresh on the day of use. **3/A.** For other *Enterobacterales* , the activity of tigecycline varies from insufficient in *Serratia* spp., *Proteus* spp., *Morganella morganii* and *Providencia* spp. to variable in other species. For more information, see https://www.eucast.org/eucastguidancedocuments/. **B.** Zone diameter breakpoints validated for *E. coli* only. For *C. koseri,* use an MIC method.
Eravacycline, *E. coli*	0.5	0.5		**20**	17	17		
Minocycline	-	-			-	-		
Tetracycline[1]	-	-			-	-		
Tigecycline, *E. coli* and *C. koseri*	0.5[2,3]	0.5[2,3]		**15**	18[A,B]	18[A,B]		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	-	-			-	-		
Tedizolid	-	-			-	-		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)		
	S ≤	R >	ATU		S ≥	R <	ATU
Chloramphenicol	Note[1]	Note[1]			Note[A]	Note[A]	
Colistin[2]	(2)[3]	(2)[3]			Note[B]	Note[B]	
Daptomycin	-	-			-	-	
Fosfomycin iv (infections originating from the urinary tract), *E. coli*	8[4]	8[4]		200[C]	24[D]	24[D]	
Fosfomycin iv (other indications), *E. coli*	Note[5]	Note[5]			Note[E]	Note[E]	
Fosfomycin iv, other *Enterobacterales*	Note[6]	Note[6]			Note[F]	Note[F]	
Fosfomycin oral (uncomplicated UTI only), *E. coli*	8[4]	8[4]		200[C]	24[D]	24[D]	
Fusidic acid	-	-			-	-	
Lefamulin	-	-			-	-	
Metronidazole	-	-			-	-	
Nitrofurantoin (uncomplicated UTI only), *E. coli*	64	64		100	11	11	
Nitroxoline (uncomplicated UTI only), *E. coli*	16	16		30	15	15	
Rifampicin	-	-			-	-	
Spectinomycin	-	-			-	-	
Trimethoprim (uncomplicated UTI only)	4	4		5	15	15	
Trimethoprim-sulfamethoxazole[7]	2	4		1.25-23.75	14	11	

Notes

Numbered notes relate to general comments and/or MIC breakpoints.

Lettered notes relate to the disk diffusion method.

1/A. Efficacy for *Enterobacterales* is uncertain. Screening cut-off values can be used to distinguish wild-type isolates from isolates with acquired resistance (MIC >16 mg/L; zone diameter <17 mm for the chloramphenicol 30 µg disk). For chloramphenicol treatment in meningitis, see table of dosages.

2. Colistin MIC determination should be performed with broth microdilution. Quality control must be performed with both a susceptible QC strain (*E. coli* ATCC 25922 or *P. aeruginos* a ATCC 27853) and the colistin resistant *E. coli* NCTC 13846 (*mcr-1* positive).

3. For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.

4. Agar dilution is the reference method for fosfomycin. MICs must be determined in the presence of glucose-6-phosphate (25 mg/L in the medium). Follow the manufacturers' instructions for commercial systems.

5/E. There is currently a lack of clinical evidence to support clinical breakpoints.

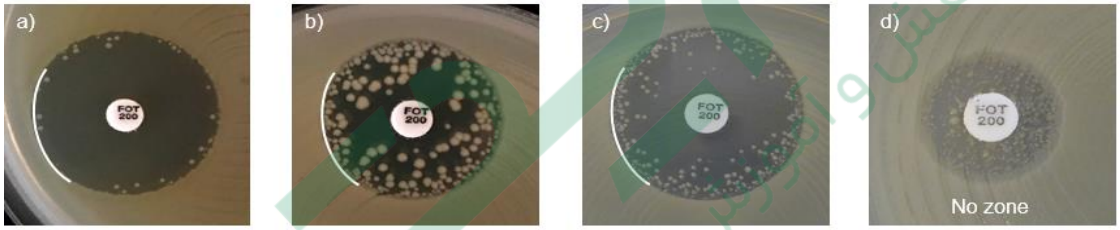
6/F. Antimicrobial susceptibility testing is discouraged. For information on the use of fosfomycin iv in combination therapy in other *Enterobacterales* , see https://www.eucast.org/eucastguidancedocuments/.

7. Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.

B. Use an MIC method (broth microdilution only).

C. Fosfomycin 200 µg disks must contain 50 µg glucose-6-phosphate.

D. Ignore isolated colonies within the inhibition zone (**see pictures below**).



Examples of inhibition zones for *Escherichia coli* with fosfomycin.
a-c) Ignore all colonies and read the outer zone edge.
d) Record as no inhibition zone.

Pseudomonas spp.

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | **Guidance documents** | **For abbreviations and explanations of breakpoints, see the Notes sheet**

MIC determination (broth microdilution according to ISO standard 20776-1
Medium: Cation-adjusted Mueller-Hinton broth (for cefiderocol, see https://www.eucast.org/eucastguidancedocuments/
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Pseudomonas aeruginosa* ATCC 27853. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor combinations, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar
Inoculum: McFarland 0.5
Incubation: Air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the back of the plate against a dark background illuminated with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Pseudomonas aeruginosa* ATCC 27853. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor-combination disks, see EUCAST QC Tables.

Pseudomonas aeruginosa **is the most frequent species of this genus. Other less frequent** ***Pseudomonas*** **species recovered in clinical samples are:** ***P. fluorescens*** **group,** ***P. putida*** **group and** ***P. stutzeri*** **group.**

Penicillins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin	-	-			-	-		**1.** For susceptibility testing purposes, the concentration of tazobactam is fixed at 4 mg/L.
Ampicillin	-	-			-	-		**2.** For susceptibility testing purposes, the concentration of clavulanic acid is fixed at 2 mg/L.
Ampicillin-sulbactam	-	-			-	-		
Amoxicillin	-	-			-	-		
Amoxicillin-clavulanic acid	-	-			-	-		
Piperacillin	0.001	16		30	50	18	18-19	
Piperacillin-tazobactam	0.001[1]	16[1]		30-6	50	18	18-19	
Ticarcillin-clavulanic acid	0.001[2]	16[2]		75-10	50	18		
Temocillin	-	-			-	-		
Phenoxymethylpenicillin	-	-			-	-		
Oxacillin	-	-			-	-		
Cloxacillin	-	-			-	-		
Dicloxacillin	-	-			-	-		
Flucloxacillin	-	-			-	-		
Mecillinam oral (pivmecillinam) (uncomplicated UTI only)	-	-			-	-		

Cephalosporins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefaclor	-	-			-	-		**1/A.** The addition of a beta-lactamase inhibitor does not add clinical benefit. The beta-lactamases produced by the organisms either do not modify the parent cephalosporin or are insufficiently inhibited by the inhibitor.
Cefadroxil	-	-			-	-		**2.** Broth microdilution MIC determination must be performed in iron-depleted Mueller-Hinton broth and specific reading instructions must be followed. For testing conditions and reading instructions, see https://www.eucast.org/eucastguidancedocuments/.
Cefalexin	-	-			-	-		**3.** For susceptibility testing purposes, the concentration of avibactam is fixed at 4 mg/L.
Cefazolin	-	-			-	-		**4.** See table of dosages for dosing for different indications.
Cefepime	0.001	8		**30**	50	21	19-23	**5.** For susceptibility testing purposes, the concentration of tazobactam is fixed at 4 mg/L.
Cefepime-enmetazobactam	Note[1]	Note[1]			Note[A]	Note[A]		
Cefiderocol, *P. aeruginosa*	2[2]	2[2]		**30**	22	22	20-21	
Cefixime	-	-			-	-		
Cefotaxime	-	-			-	-		
Cefoxitin	-	-			-	-		
Cefpodoxime	-	-			-	-		
Ceftaroline	-	-			-	-		
Ceftazidime	0.001	8		**10**	50	17		
Ceftazidime-avibactam, *P. aeruginosa*	8[3]	8[3]		**10-4**	17	17	16-17	
Ceftibuten	-	-			-	-		
Ceftobiprole	IE	IE			IE	IE		
Ceftolozane-tazobactam[4]**,** *P. aeruginosa*	4[5]	4[5]		**30-10**	23	23		
Ceftriaxone	-	-			-	-		
Cefuroxime iv	-	-			-	-		
Cefuroxime oral	-	-			-	-		

Carbapenems	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doripenem	0.001	2		**10**	50	22		**1.** For susceptibility testing purposes, the concentration of relebactam is fixed at 4 mg/L.
Ertapenem	-	-			-	-		**2.** For susceptibility testing purposes, the concentration of vaborbactam is fixed at 8 mg/L.
Imipenem	0.001	4		**10**	50	20		
Imipenem-relebactam, *P. aeruginosa*	2[1]	2[1]		**10-25**	22	22		
Meropenem (indications other than meningitis), *P. aeruginosa*	2	8		**10**	20	14		
Meropenem (indications other than meningitis), Pseudomonas other than *P. aeruginosa*	2	8		**10**	24	18		
Meropenem (meningitis), *P. aeruginosa*	2	2		**10**	20	20		
Meropenem-vaborbactam, *P. aeruginosa*	8[2]	8[2]		**20-10**	14	14		

Monobactams	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Aztreonam	0.001	16		30	50	18		
Aztreonam-avibactam	IE	IE			IE	IE		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.001	0.5		5	50	26		
Delafloxacin	IE	IE			IE	IE		
Levofloxacin	0.001	2		5	50	18		
Moxifloxacin	-	-			-	-		
Nalidixic acid (screen only)	NA	NA			NA	NA		
Norfloxacin (uncomplicated UTI only)	-	-			-	-		
Ofloxacin	-	-			-	-		

Aminoglycosides[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Amikacin (systemic infections)	(16)[1]	(16)[1]		30	(15)[A]	(15)[A]		**1/A.** For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.
Amikacin (infections originating from the urinary tract)	16	16		30	15	15		
Gentamicin (systemic infections)	IE	IE			IE	IE		
Gentamicin (infections originating from the urinary tract)	IE	IE			IE	IE		
Netilmicin	IE	IE			IE	IE		
Tobramycin (systemic infections)	(2)[1]	(2)[1]		10	(18)[A]	(18)[A]		
Tobramycin (infections originating from the urinary tract)	2	2		10	18	18		

Glycopeptides and lipoglycopeptides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Dalbavancin	-	-			-	-		
Oritavancin	-	-			-	-		
Teicoplanin	-	-			-	-		
Telavancin	-	-			-	-		
Vancomycin	-	-			-	-		

Macrolides, lincosamides and streptogramins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin	-	-			-	-		
Clarithromycin	-	-			-	-		
Erythromycin	-	-			-	-		
Roxithromycin	-	-			-	-		
Clindamycin	-	-			-	-		
Quinupristin-dalfopristin	-	-			-	-		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	-	-			-	-		
Eravacycline	-	-			-	-		
Minocycline	-	-			-	-		
Tetracycline	-	-			-	-		
Tigecycline	-	-			-	-		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	-	-			-	-		
Tedizolid	-	-			-	-		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Chloramphenicol	-	-			-	-		**1.** Colistin MIC determination should be performed with broth microdilution. Quality control must be performed with both a susceptible QC strain (*E. coli* ATCC 25922 or *P. aeruginosa* ATCC 27853) and the colistin resistant *E. coli* NCTC 13846 (*mcr-1* positive). **2**. For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/. **3/B.** Antimicrobial susceptibility testing is discouraged. For information on the use of fosfomycin iv in combination therapy, see https://www.eucast.org/eucastguidancedocuments/. **A.** Use an MIC method (broth microdilution only).
Colistin[1]	(4)[2]	(4)[2]			Note[A]	Note[A]		
Daptomycin	-	-			-	-		
Fosfomycin iv	Note[3]	Note[3]			Note[B]	Note[B]		
Fosfomycin oral	-	-			-	-		
Fusidic acid	-	-			-	-		
Lefamulin	-	-			-	-		
Metronidazole	-	-			-	-		
Nitrofurantoin (uncomplicated UTI only)	-	-			-	-		
Nitroxoline (uncomplicated UTI only)	-	-			-	-		
Rifampicin	-	-			-	-		
Spectinomycin	-	-			-	-		
Trimethoprim (uncomplicated UTI only)	-	-			-	-		
Trimethoprim-sulfamethoxazole	-	-			-	-		

For further information, see EUCAST Guidance Document for *S. maltophilia*.

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth (for cefiderocol, see https://www.eucast.org/eucastguidancedocuments/)
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h
Reading: For trimethoprim-sulfamethoxazole, the MIC should be read at the lowest concentration that inhibits approximately 80% of growth as compared with the growth control well. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Escherichia coli* ATCC 25922

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar
Inoculum: McFarland 0.5
Incubation: Air, 35±1ºC, 18±2h
Reading: Read zone edges from the back of the plate against a dark background illuminated with reflected light (see below for specific instructions). See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Escherichia coli* ATCC 25922

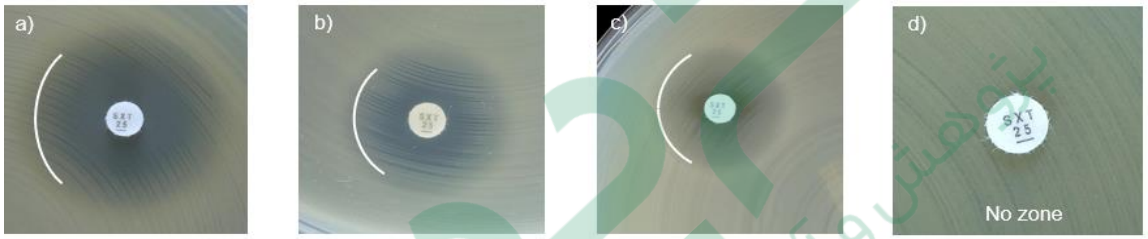
Cephalosporins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ceftazidime	-	-			-	-		**1.** Broth microdilution MIC determination must be performed in iron-depleted Mueller-Hinton broth and specific reading instructions must be followed. For testing conditions and reading instructions, see https://www.eucast.org/eucastguidancedocuments/. **2/A.** The *in vitro* activity of cefiderocol against *Stenotrophomonas maltophilia* is comparable to the activity of the agent against *Enterobacterales* and there is also animal data to suggest efficacy. However, there is insufficient clinical data to determine a clinical breakpoint. Isolates with MIC values ≤0.5 mg/L (zone diameter ≥28 mm) are mostly devoid of resistance mechanisms. Isolates with MICs 1-2 mg/L have acquired resistance mechanisms which may result in impaired clinical response. Isolates with MIC values >2 mg/L (zone diameter <22 mm) will likely be resistant.
Cefepime	-	-			-	-		
Cefiderocol[1]	Note[2]	Note[2]		30	Note[A]	Note[A]		

Monobactams	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Aztreonam	-	-			-	-		
Aztreonam-avibactam	IE	IE			IE	IE		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	Note[1]	Note[1]			Note[A]	Note[A]		**1.** Fluoroquinolones have been used in combination therapy. The ECOFF can be used to exclude acquired resistance mechanisms. **A.** Disk diffusion criteria are not available.
Levofloxacin	Note[1]	Note[1]			Note[A]	Note[A]		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Minocycline	Note[1,2]	Note[1,2]			Note[A]	Note[A]		**1.** Tetracyclines have been used in combination therapy. The ECOFF can be used to exclude acquired resistance mechanisms. **2.** Pertains to intravenous therapy. Oral therapy will lead to insufficient exposure. **A.** Disk diffusion criteria are not available.
Tigecycline	Note[1]	Note[1]			Note[A]	Note[A]		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Trimethoprim-sulfamethoxazole[1]	0.001	2		1.25-23.75	50[A]	16[A,B]		**1.** Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration. **A.** There may be growth within the inhibition zone. The density of growth may vary from a fine haze to substantial growth (**see pictures below**). If any zone edge can be seen, ignore growth within the inhibition zone and read the zone diameter. **B.** Trimethoprim-sulfamethoxazole resistance in *S. maltophilia* is rare and should be confirmed with an MIC test.



Examples of inhibition zones for *Stenotrophomonas maltophilia* with trimethoprim-sulfamethoxazole.
a-c) An outer zone can be seen. Read the outer zone edge and interpret according to the breakpoints.
d) Growth up to the disk **and** no sign of inhibition zone. Report resistant.

Acinetobacter spp.

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | **Guidance documents** | **For abbreviations and explanations of breakpoints, see the Notes sheet**

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth (for cefiderocol, see https://www.eucast.org/eucastguidancedocuments/)
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Pseudomonas aeruginosa* ATCC 27853. For agents not covered by this strain, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar
Inoculum: McFarland 0.5
Incubation: Air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the back of the plate against a dark background illuminated with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Pseudomonas aeruginosa* ATCC 27853. For agents not covered by this strain, see EUCAST QC Tables.

This genus includes several species. The most frequent *Acinetobacter* species recovered in clinical samples are those included in the *A. baumannii* group, which includes *A. baumannii, A. nosocomialis, A. pittii, A. dijkshoorniae* and *A. seifertii*. Other species are *A. haemolyticus, A. junii, A. lwoffii, A. ursingii* and *A. variabilis*. In the EUCAST tables *Acinetobacter* are referred to as *Acinetobacter* spp. since the studies on which EUCAST breakpoints are based have varied in their ability to distinguish between species.

Penicillins[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin	-	-			-	-		**1.** Susceptibility testing of *Acinetobacter* spp. to penicillins is unreliable. In most instances, *Acinetobacter* spp. are resistant to penicillins.
Ampicillin	-	-			-	-		
Ampicillin-sulbactam	IE	IE			IE	IE		
Amoxicillin	-	-			-	-		
Amoxicillin-clavulanic acid	-	-			-	-		
Piperacillin	IE	IE			IE	IE		
Piperacillin-tazobactam	IE	IE			IE	IE		
Ticarcillin-clavulanic acid	IE	IE			IE	IE		
Temocillin	-	-			-	-		
Phenoxymethylpenicillin	-	-			-	-		
Oxacillin	-	-			-	-		
Cloxacillin	-	-			-	-		
Dicloxacillin	-	-			-	-		
Flucloxacillin	-	-			-	-		
Mecillinam oral (pivmecillinam) (uncomplicated UTI only)	-	-			-	-		

Cephalosporins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefaclor	-	-			-	-		**1.** Broth microdilution MIC determination must be performed in iron-depleted Mueller-Hinton broth and specific reading instructions must be followed. For testing conditions and reading instructions, see https://www.eucast.org/eucastguidancedocuments/.
Cefadroxil	-	-			-	-		
Cefalexin	-	-			-	-		
Cefazolin	-	-			-	-		
Cefepime	-	-			-	-		
Cefepime-enmetazobactam	-	-			-	-		
Cefiderocol[1]	Note[2]	Note[2]		30	Note[A]	Note[A]		**2/A.** The *in vitro* activity of cefiderocol against *Acinetobacter* spp. is comparable to the activity of the agent against *Enterobacterales* and there is also animal data to suggest efficacy. However, there is insufficient clinical data to determine a clinical breakpoint. Isolates with MIC values ≤0.5 mg/L (zone diameter ≥21 mm) are mostly devoid of resistance mechanisms. Isolates with MICs 1-2 mg/L have acquired resistance mechanisms which may result in impaired clinical response. Isolates with MIC values >2 mg/L (zone diameter <17 mm) will likely be resistant.
Cefixime	-	-			-	-		
Cefotaxime	-	-			-	-		
Cefoxitin	-	-			-	-		
Cefpodoxime	-	-			-	-		
Ceftaroline	-	-			-	-		
Ceftazidime	-	-			-	-		
Ceftazidime-avibactam	-	-			-	-		
Ceftibuten	-	-			-	-		
Ceftobiprole	-	-			-	-		
Ceftolozane-tazobactam	-	-			-	-		
Ceftriaxone	-	-			-	-		
Cefuroxime iv	-	-			-	-		
Cefuroxime oral	-	-			-	-		

Carbapenems	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doripenem	0.001	2		10	50	22		**1/A.** The addition of a beta-lactamase inhibitor does not add clinical benefit. The beta-lactamases produced by the organisms either do not modify the parent carbapenem or are insufficiently inhibited by the inhibitor.
Ertapenem	-	-			-	-		
Imipenem	2	4		10	24	21		
Imipenem-relebactam[1]	Note[1]	Note[1]			Note[A]	Note[A]		
Meropenem (indications other than meningitis)	2	8		10	21	15		
Meropenem (meningitis)	2	2		10	21	21		
Meropenem-vaborbactam[1]	Note[1]	Note[1]			Note[A]	Note[A]		

Monobactams	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Aztreonam	-	-			-	-		
Aztreonam-avibactam	-	-			-	-		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.001	1		5	50	21		
Delafloxacin	IE	IE			IE	IE		
Levofloxacin	0.5	1		5	23	20		
Moxifloxacin	-	-			-	-		
Nalidixic acid (screen only)	NA	NA			NA	NA		
Norfloxacin (uncomplicated UTI only)	-	-			-	-		
Ofloxacin	-	-			-	-		

Aminoglycosides[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Amikacin (systemic infections)	(8)[1]	(8)[1]		30	(19)[A]	(19)[A]		**1/A.** For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.
Amikacin (infections originating from the urinary tract)	8	8		30	19	19		
Gentamicin (systemic infections)	(4)[1]	(4)[1]		10	(17)[A]	(17)[A]		
Gentamicin (infections originating from the urinary tract)	4	4		10	17	17		
Netilmicin	IE	IE			IE	IE		
Tobramycin (systemic infections)	(4)[1]	(4)[1]		10	(17)[A]	(17)[A]		
Tobramycin (infections originating from the urinary tract)	4	4		10	17	17		

Glycopeptides and lipoglycopeptides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Dalbavancin	-	-			-	-		
Oritavancin	-	-			-	-		
Teicoplanin	-	-			-	-		
Telavancin	-	-			-	-		
Vancomycin	-	-			-	-		

Macrolides, lincosamides and streptogramins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin	-	-			-	-		
Clarithromycin	-	-			-	-		
Erythromycin	-	-			-	-		
Roxithromycin	-	-			-	-		
Clindamycin	-	-			-	-		
Quinupristin-dalfopristin	-	-			-	-		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	-	-			-	-		**1.** Minocycline has been discussed as alternative therapy in *Acinetobacter* infections. The "IE" in the table pertains to intravenous therapy only. Oral administration will not accomplish sufficient exposure.
Eravacycline	IE	IE			IE	IE		
Minocycline	IE[1]	IE[1]			IE	IE		
Tetracycline	-	-			-	-		
Tigecycline	IE	IE			IE	IE		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	-	-			-	-		
Tedizolid	-	-			-	-		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Chloramphenicol	-	-			-	-		**1.** Colistin MIC determination should be performed with broth microdilution. Quality control must be performed with both a susceptible QC strain (*E. coli* ATCC 25922 or *P. aeruginosa* ATCC 27853) and the colistin resistant *E. coli* NCTC 13846 (*mcr-1* positive). **2.** For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/. **3/B**. Antimicrobial susceptibility testing is discouraged. For information on the use of fosfomycin iv in combination therapy, see https://www.eucast.org/eucastguidancedocuments/. **4.** Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration. **A.** Use an MIC method (broth microdilution only).
Colistin[1]	(2)[2]	(2)[2]			Note[A]	Note[A]		
Daptomycin	-	-			-	-		
Fosfomycin iv	Note[3]	Note[3]			Note[B]	Note[B]		
Fosfomycin oral	-	-			-	-		
Fusidic acid	-	-			-	-		
Lefamulin	-	-			-	-		
Metronidazole	-	-			-	-		
Nitrofurantoin (uncomplicated UTI only)	-	-			-	-		
Nitroxoline (uncomplicated UTI only)	-	-			-	-		
Rifampicin	-	-			-	-		
Spectinomycin	-	-			-	-		
Trimethoprim (uncomplicated UTI only)	-	-			-	-		
Trimethoprim-sulfamethoxazole[4]	2	4		1.25-23.75	14	11		

Staphylococcus spp.

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h (for glycopeptides 24h)
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Staphylococcus aureus* ATCC 29213. For agents not covered by this strain, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar
Inoculum: McFarland 0.5
Incubation: Air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the back of the plate against a dark background illuminated with reflected light (except for benzylpenicillin, see below). See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Staphylococcus aureus* ATCC 29213. For agents not covered by this strain, see EUCAST QC Tables.

Unless otherwise indicated, breakpoints apply to all members of the *Staphylococcus* genus. Where such information exists, specific breakpoints are provided.
- **For coagulase-positive species other than *S. aureus* (*S. argenteus, S. schweitzeri, S. intermedius, S. pseudintermedius* and *S. coagulans*) there is limited information on the performance of breakpoints for most agents. For *S. argenteus*, breakpoints for *S. aureus* can be used without caveats.**
- **Coagulase-negative staphylococci include *S. capitis, S. cohnii, S. epidermidis, S. haemolyticus, S. hominis, S. hyicus, S. lugdunensis, S. pettenkoferi, S. saprophyticus, S. schleiferi, S. sciuri, S. simulans, S. warneri* and *S. xylosus*.**
- **For *S. saccharolyticus*, use methodology for anaerobic bacteria and consult EUCAST Guidance Document on how to interpret results when there are no breakpoints, https://www.eucast.org/eucastguidancedocuments/.**

Penicillins[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)		
	S ≤	R >	ATU		S ≥	R <	ATU
Benzylpenicillin, *S. aureus*	0.125[1]	0.125[1]		**1 unit**	26[A,B]	26[A,B]	
Benzylpenicillin, *S. lugdunensis*	0.125	0.125		**1 unit**	26	26	
Benzylpenicillin, other staphylococci	Note[2]	Note[2]			Note[C]	Note[C]	
Ampicillin, *S. saprophyticus*	Note[2,3]	Note[2,3]		**2**	18[C,D]	18[C,D]	
Ampicillin-sulbactam	Note[1,2,3]	Note[1,2,3]			Note[A,C,D]	Note[A,C,D]	
Amoxicillin	Note[1,2,3]	Note[1,2,3]			Note[A,C,D]	Note[A,C,D]	
Amoxicillin-clavulanic acid	Note[1,2,3]	Note[1,2,3]			Note[A,C,D]	Note[A,C,D]	
Piperacillin	Note[1,2,3]	Note[1,2,3]			Note[A,C,D]	Note[A,C,D]	
Piperacillin-tazobactam	Note[1,2,3]	Note[1,2,3]			Note[A,C,D]	Note[A,C,D]	
Ticarcillin-clavulanic acid	Note[1,2]	Note[1,2]			Note[A,C]	Note[A,C]	
Temocillin	-	-			-	-	
Phenoxymethylpenicillin, *S. aureus*	Note[1]	Note[1]			Note[A]	Note[A]	
Phenoxymethylpenicillin, Coagulase-negative staphylococci	-[2]	-[2]			Note[C]	Note[C]	
Oxacillin (screen only), *S. pseudintermedius, S. intermedius, S. schleiferi* and *S. coagulans*	NA	NA		**1**	20[E]	20[E]	
Oxacillin[4], other staphylococci	Note[1,4]	Note[1,4]			Note[A]	Note[A]	
Cloxacillin	Note[1,2]	Note[1,2]			Note[A,C]	Note[A,C]	
Dicloxacillin	Note[1,2]	Note[1,2]			Note[A,C]	Note[A,C]	
Flucloxacillin	Note[1,2]	Note[1,2]			Note[A,C]	Note[A,C]	
Mecillinam oral (pivmecillinam) (uncomplicated UTI only)	-	-			-	-	

Notes
Numbered notes relate to general comments and/or MIC breakpoints.
Lettered notes relate to the disk diffusion method.

1/A. Most *S. aureus* are penicillinase producers and some are methicillin resistant. Either mechanism renders them resistant to benzylpenicillin, phenoxymethylpenicillin, ampicillin, amoxicillin, piperacillin and ticarcillin. Isolates that test susceptible to benzylpenicillin and cefoxitin can be reported susceptible to all penicillins. Isolates that test resistant to benzylpenicillin but susceptible to cefoxitin are susceptible to β-lactam β-lactamase inhibitor combinations, the isoxazolylpenicillins (oxacillin, cloxacillin, dicloxacillin and flucloxacillin) and nafcillin. For agents given orally, care to achieve sufficient exposure at the site of the infection should be exercised. Isolates that test resistant to cefoxitin are resistant to all penicillins.

2/C. Most staphylococci are penicillinase producers and some are methicillin resistant. Either mechanism renders them resistant to benzylpenicillin, phenoxymethylpenicillin, ampicillin, amoxicillin, piperacillin and ticarcillin. No currently available method can reliably detect penicillinase production in all species of staphylococci but methicillin resistance can be detected with cefoxitin as described.

3/D. Ampicillin susceptible *S. saprophyticus* are *mecA*-negative and susceptible to ampicillin, amoxicillin and piperacillin (without or with a beta-lactamase inhibitor).

4. *S. aureus*, *S. lugdunensis* and *S. saprophyticus* with oxacillin MIC values >2 mg/L are mostly methicillin resistant due to the presence of the *mecA* or *mecC* gene. Occasionally oxacillin MIC values are high in *S. aureus* in absence of *mec*-gene mediated resistance. These isolates have been called BORSA (borderline oxacillin resistant *S. aureus*). EUCAST does not recommend systematic screening for BORSA. For coagulase-negative staphylococci other than *S. saprophyticus* and *S. lugdunensis*, the oxacillin MIC in methicillin resistant isolates is >0.25 mg/L.

B. For *S. aureus*, disk diffusion is more reliable than MIC determination for detection of penicillinase producers, provided the zone diameter is measured AND the zone edge for isolates with zone diameters ≥26 mm is closely inspected (**see pictures below**). Examine the zone edge with transmitted light (plate held up to light). If the zone diameter is <26 mm, then report resistant. If the zone diameter is ≥26 mm AND the zone edge is sharp (no reduction of growth towards zone edge, like a "cliff"), then report resistant. If not sharp (reduction of growth towards zone edge, like a "beach"), then report susceptible and if uncertain, then report resistant. Chromogenic cephalosporin-based beta-lactamase tests do not reliably detect staphylococcal penicillinase.

E. For screening for methicillin resistance in *S. pseudintermedius, S. intermedius, S. schleiferi* and *S. coagulans*.

Cephalosporins[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)		
	S ≤	R >	ATU		S ≥	R <	ATU
Cefaclor[2]	Note[1]	Note[1]			Note[A]	Note[A]	
Cefadroxil	Note[1]	Note[1]			Note[A]	Note[A]	
Cefalexin	Note[1]	Note[1]			Note[A]	Note[A]	
Cefazolin[2]	Note[1]	Note[1]			Note[A]	Note[A]	
Cefepime[2]	Note[1]	Note[1]			Note[A]	Note[A]	
Cefepime-enmetazobactam[3]	Note[1]	Note[1]			Note[A]	Note[A]	
Cefiderocol	-	-			-	-	
Cefixime	-	-			-	-	
Cefotaxime[2]	Note[1]	Note[1]			Note[A]	Note[A]	
Cefoxitin (screen only), *S. aureus* and coagulase-negative staphylococci except *S. epidermidis* and *S. lugdunensis*	Note[4,5]	Note[4,5]		**30**	22[A,B]	22[A,B]	
Cefoxitin (screen only), *S. epidermidis* and *S. lugdunensis*	Note[4,5]	Note[4,5]		**30**	27[A,B]	27[A,B]	27
Cefoxitin (screen only), *S. pseudintermedius, S. intermedius, S. schleiferi* and *S. coagulans*	Note[6]	Note[6]			Note[C]	Note[C]	
Cefpodoxime	Note[1]	Note[1]			Note[A]	Note[A]	
Ceftaroline (indications other than pneumonia), *S. aureus*	1[7]	2[7,8]	1	**5**	20[D]	17[D,E]	19-20
Ceftaroline (pneumonia), *S. aureus*	1[7]	1[7]	1	**5**	20[D]	20[D]	19-20
Ceftazidime	-	-			-	-	
Ceftazidime-avibactam	-	-			-	-	
Ceftibuten	-	-			-	-	
Ceftobiprole, *S. aureus*	2[9]	2[9]	2	**5**	17[F]	17[F]	16-17
Ceftolozane-tazobactam	-	-			-	-	
Ceftriaxone[2]	Note[1]	Note[1]			Note[A]	Note[A]	
Cefuroxime iv[2]	Note[1]	Note[1]			Note[A]	Note[A]	
Cefuroxime oral	Note[1]	Note[1]			Note[A]	Note[A]	

Notes
Numbered notes relate to general comments and/or MIC breakpoints.
Lettered notes relate to the disk diffusion method.

1/A. Susceptibility of staphylococci to cephalosporins is inferred from the cefoxitin susceptibility except for cefixime, ceftazidime, ceftazidime-avibactam, ceftibuten and ceftolozane-tazobactam, which do not have breakpoints and should not be used for staphylococcal infections. For agents given orally, care to achieve sufficient exposure at the site of the infection should be exercised. If cefotaxime and ceftriaxone are reported for methicillin-susceptible staphylococci, these should be reported "Susceptible, increased exposure" (I). Some methicillin-resistant *S. aureus* are susceptible to ceftaroline and ceftobiprole**, see Notes 7/D and 9/F.**

2. See table of dosages.

3. The addition of a beta-lactamase inhibitor does not add clinical benefit.

4. *S. aureus* and *S. lugdunensis* with cefoxitin MIC values >4 mg/L and *S. saprophyticus* with cefoxitin MIC values >8 mg/L are methicillin resistant, mostly due to the presence of the *mecA* or *mecC* gene. Disk diffusion reliably predicts methicillin resistance.

5. For staphylococci other than *S. aureus, S. lugdunensis* and *S. saprophyticus* , the cefoxitin MIC is a poorer predictor of methicillin resistance than the disk diffusion test.

6/C. In *S. pseudintermedius,S. intermedius, S. schleiferi* and *S. coagulans* the cefoxitin disk is less predictive for the detection of methicillin resistance than in other staphylococci. Use the oxacillin 1 µg disk with zone diameter breakpoints S≥20, R<20 mm.

7/D. Methicillin-susceptible isolates can be reported susceptible to ceftaroline without further testing.

8/E. Resistant isolates are rare.

9/F. Methicillin-susceptible isolates can be reported susceptible to ceftobiprole without further testing.

B. If coagulase-negative staphylococci are not identified to species level, use zone diameter breakpoints S≥25, R<25 mm, with an ATU of 22-24 mm. For isolates with results inside the ATU: identify species, perform PCR for *mecA/mecC* or report resistant.

Carbapenems[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doripenem	Note[1]	Note[1]			Note[A]	Note[A]		**1/A.** Susceptibility of staphylococci to carbapenems is inferred from the cefoxitin susceptibility.
Ertapenem	Note[1]	Note[1]			Note[A]	Note[A]		**2.** The addition of a beta-lactamase inhibitor does not add clinical benefit.
Imipenem	Note[1]	Note[1]			Note[A]	Note[A]		
Imipenem-relebactam[2]	Note[1]	Note[1]			Note[A]	Note[A]		
Meropenem	Note[1]	Note[1]			Note[A]	Note[A]		
Meropenem-vaborbactam[2]	Note[1]	Note[1]			Note[A]	Note[A]		

Monobactams	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Aztreonam	-	-			-	-		
Aztreonam-avibactam	-	-			-	-		

Fluoroquinolones[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin, *S. aureus*	(0.001)[2]	(2)[2]		5	(50)[A,B]	(17)[A,B]		**1.** For breakpoints for other fluoroquinolones (*e.g.* pefloxacin and enoxacin), refer to breakpoints set by national breakpoint committees.
Ciprofloxacin, Coagulase-negative staphylococci	(0.001)[2]	(2)[2]		5	(50)[A,B]	(22)[A,B]		**2/A.** For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.
Delafloxacin (community-acquired pneumonia), *S. aureus*	0.016	0.016			Note[C]	Note[C]		**3/E.** Ofloxacin breakpoints for *Staphylococcus* spp. have been removed since in systemic infections with staphylococci the agent is inferior to other fluoroquinolones. For topical use of ofloxacin, see tables of topical agents.
Delafloxacin (skin and skin structure infections), *S. aureus*	0.25	0.25			Note[C]	Note[C]		**B.** The norfloxacin disk diffusion test can be used to screen for fluoroquinolone resistance. **See Note D.**
Levofloxacin, *S. aureus*	0.001	1		5	50[B]	22[B]		**C.** A disk diffusion test awaits action from the responsible pharmaceutical company.
Levofloxacin, Coagulase-negative staphylococci	0.001	1		5	50[B]	24[B]		**D.** Isolates categorised as screen negative can be reported susceptible to moxifloxacin and "susceptible increased exposure" (I) to levofloxacin. For ciprofloxacin, the isolate is without phenotypically detectable resistance mechanisms and can be used in high exposure in combination therapy (**see Note 2/A**). Isolates categorised as screen positive should be tested for susceptibility to individual agents or reported resistant.
Moxifloxacin[3], *S. aureus*	0.25	0.25		5	25[B]	25[B]		
Moxifloxacin[3], Coagulase-negative staphylococci	0.25	0.25		5	28[B]	28[B]		
Nalidixic acid (screen only)	NA	NA			NA	NA		
Norfloxacin (screen only)	NA	NA		10	17[D]	17[D]		
Ofloxacin	Note[3]	Note[3]			Note[E]	Note[E]		

Aminoglycosides[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Amikacin, *S. aureus*	(16)[1]	(16)[1]		30	(15)[A]	(15)[A]		**1/A.** For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.
Amikacin, Coagulase-negative staphylococci	(16)[1]	(16)[1]		30	(15)[A]	(15)[A]		
Gentamicin, *S. aureus*	(2)[1]	(2)[1]		10	(18)[A]	(18)[A]		
Gentamicin, Coagulase-negative staphylococci	(2)[1]	(2)[1]		10	(22)[A]	(22)[A]		
Netilmicin	IE	IE			IE	IE		
Tobramycin, *S. aureus*	(2)[1]	(2)[1]		10	(18)[A]	(18)[A]		
Tobramycin, Coagulase-negative staphylococci	(2)[1]	(2)[1]		10	(20)[A]	(20)[A]		

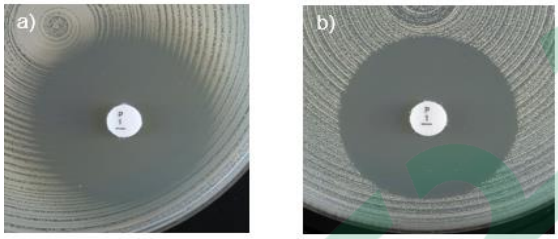
Glycopeptides and lipoglycopeptides[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Dalbavancin[2]	0.25[3]	0.25[3]			Note[A]	Note[A]		**1.** Glycopeptide MICs are method dependent and should be determined by broth microdilution (ISO standard 20776-1).
Oritavancin[2], *S. aureus*	0.125[3]	0.125[3]			Note[A]	Note[A]		*S. aureus* with vancomycin MIC values of 2 mg/L are on the border of the wild-type distribution and there may be an impaired clinical response.
Teicoplanin[2], *S. aureus*	2	2			Note[A]	Note[A]		**2.** Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory.
Teicoplanin, Coagulase-negative staphylococci	4	4			Note[A]	Note[A]		**3.** MICs must be determined in the presence of polysorbate-80 (0.002% in the medium for broth dilution methods; agar dilution methods have not been validated). Follow the manufacturers' instructions for commercial systems.
Telavancin[2], MRSA	0.125[3]	0.125[3]			Note[A]	Note[A]		~~**4.** Coagulase-negative staphylococci susceptible to both vancomycin and teicoplanin can be reported susceptible to dalbavancin.~~
Vancomycin[2], *S. aureus*	2	2			Note[A]	Note[A]		~~**5.** *S. aureus* isolates susceptible to vancomycin can be reported susceptible to dalbavancin and oritavancin.~~
Vancomycin[2], Coagulase-negative staphylococci	4	4			Note[A]	Note[A]		~~**6.** MRSA isolates susceptible to vancomycin can be reported susceptible to telavancin.~~
								A. Disk diffusion is unreliable and cannot distinguish between wild-type isolates and those with non-*vanA* -mediated glycopeptide resistance.

Macrolides, lincosamides and streptogramins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin	2[1]	2[1]			Note[A]	Note[A]		**1/A.** Erythromycin can be used to screen for macrolide resistance in staphylococci. Isolates categorised as susceptible can be reported susceptible to azithromycin, clarithromycin and roxithromycin. Isolates categorised as resistant should be tested for susceptibility to individual agents or reported resistant. **2.** Inducible clindamycin resistance can be detected by antagonism of clindamycin activity by a macrolide agent. If not detected, then report as tested according to the clinical breakpoints. If detected, then report as resistant and consider adding this comment to the report: "Clindamycin may still be used for short-term therapy of less serious skin and soft tissue infections as constitutive resistance is unlikely to develop during such therapy". **B.** Place the erythromycin and clindamycin disks 12-20 mm apart (edge to edge) and look for antagonism (the D phenomenon) to detect inducible clindamycin resistance. **C.** Isolates resistant by disk diffusion should be confirmed by MIC testing.
Clarithromycin	1[1]	1[1]			Note[A]	Note[A]		
Erythromycin	1[1]	1[1]		15	21[A]	21[A]		
Roxithromycin	1[1]	1[1]			Note[A]	Note[A]		
Clindamycin[2]	0.25	0.25		2	22[B]	22[B]		
Quinupristin-dalfopristin	1	1		15	21	21[C]		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	1[1]	1[1]			Note[A]	Note[A]		**1/A.** Tetracycline can be used to screen for resistance in tetracycline agents. Isolates categorised as susceptible can be reported susceptible to doxycycline and minocycline. Isolates categorised as resistant should be tested for susceptibility to individual agents or reported resistant. **2.** Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory. **3.** For tigecycline broth microdilution MIC determination, the medium must be prepared fresh on the day of use. **B.** For MRSA that test susceptible with disk diffusion, the results should be confirmed with an MIC test.
Eravacycline, *S. aureus*	0.25	0.25		20	20[B]	20[B]		
Minocycline	0.5[1]	0.5[1]		30	23[A]	23[A]		
Tetracycline	1[1]	1[1]		30	22[A]	22[A]		
Tigecycline[2]	0.5[3]	0.5[3]		15	19	19		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	4	4		10	21	21		**1/A.** Isolates susceptible to linezolid can be reported susceptible to tedizolid.
Tedizolid	0.5[1]	0.5		2	20[A]	20	19	

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Chloramphenicol	IE	IE			IE	IE		**1.** Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory.
Colistin	-	-			-	-		**2.** Daptomycin MICs must be determined in the presence of Ca^{2+} (50 mg/L in the medium for broth dilution methods; agar dilution methods have not been validated). Follow the manufacturers' instructions for commercial systems.
Daptomycin[1]	1[2]	1[2]			Note[A]	Note[A]		**3/B.** Antimicrobial susceptibility testing is discouraged. For information on the use of fosfomycin iv in combination therapy, see https://www.eucast.org/eucastguidancedocuments/.
Fosfomycin iv	Note[3]	Note[3]			Note[B]	Note[B]		**4.** Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.
Fosfomycin oral	-	-			-	-		
Fusidic acid	1	1		**10**	24	24		**A.** Use an MIC method.
Lefamulin, *S. aureus*	0.25	0.25		**5**	23	23		
Metronidazole	-	-			-	-		
Nitrofurantoin (uncomplicated UTI only), *S. saprophyticus*	64	64		**100**	13	13		
Nitroxoline (uncomplicated UTI only), *S. saprophyticus*	IE	IE			IE	IE		
Rifampicin, *S. aureus*	0.06	0.06		**5**	26	26		
Rifampicin, Coagulase-negative staphylococci	0.06	0.06		**5**	30	30		
Spectinomycin	-	-			-	-		
Trimethoprim (uncomplicated UTI only)	4	4		**5**	14	14		
Trimethoprim-sulfamethoxazole[4]	2	4		**1.25-23.75**	17	14		



Examples of inhibition zones for *Staphylococcus aureus* with benzylpenicillin.
a) Fuzzy zone edge (reduction of growth towards zone edge, like a "beach") and zone diameter ≥ 26 mm. Report susceptible.
b) Sharp zone edge (no reduction of growth towards zone edge, like a "cliff") and zone diameter ≥ 26 mm. Report resistant.

Enterococcus spp.

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | **Guidance documents** | **For abbreviations and explanations of breakpoints, see the Notes sheet**

~~**In endocarditis, refer to national or international endocarditis guidelines for breakpoints for *Enterococcus* spp.**~~

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth
Inoculum: 5x10^5 CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h (for glycopeptides 24h)
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Enterococcus faecalis* ATCC 29212. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor combinations, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar
Inoculum: McFarland 0.5
Incubation: Air, 35±1ºC, 18±2h (for glycopeptides 24h)
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the back of the plate against a dark background illuminated with reflected light (except for vancomycin, see below). See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Enterococcus faecalis* ATCC 29212. For agents not covered by this strain see EUCAST QC Tables.

The *Enterococcus* genus includes several species besides those most commonly recovered from clinical samples, e.g. *E. faecalis* and *E. faecium*, namely *E. avium, E. casseliflavus, E. durans, E. gallinarum, E. hirae, E. lactis, E. mundtii* and *E. raffinosus*. Unless otherwise stated, breakpoints listed below are valid for all mentioned species.

Penicillins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)		
	S ≤	R >	ATU		S ≥	R <	ATU
Benzylpenicillin	-	-			-	-	
Ampicillin iv	4	4		2	10[A]	10[A]	
Ampicillin-sulbactam iv[2]	Note[1]	Note[1]			Note[B]	Note[B]	
Amoxicillin iv	4[1]	4[1]			Note[B]	Note[B]	
Amoxicillin oral (uncomplicated UTI only)	4[1]	4[1]			Note[B]	Note[B]	
Amoxicillin oral (other indications), *E. faecalis*	(0.001)[3,4]	(4)[3,4]			Note[C,D]	Note[C,D]	
Amoxicillin-clavulanic acid iv[2]	Note[1]	Note[1]			Note[B]	Note[B]	
Amoxicillin-clavulanic acid oral[2] (uncomplicated UTI only)	Note[1]	Note[1]			Note[B]	Note[B]	
Amoxicillin-clavulanic acid oral[2] (other indications), *E. faecalis*	Note[3,4]	Note[3,4]			Note[C,D]	Note[C,D]	
Piperacillin, *E. faecalis*	0.001	16		30	50	18	
Piperacillin-tazobactam[2], *E. faecalis*	0.001[5]	16[5]		30-6	50	18	
Ticarcillin-clavulanic acid	-	-			-	-	
Temocillin	-	-			-	-	
Phenoxymethylpenicillin	-	-			-	-	
Oxacillin	-	-			-	-	
Cloxacillin	-	-			-	-	
Dicloxacillin	-	-			-	-	
Flucloxacillin	-	-			-	-	
Mecillinam oral (pivmecillinam) (uncomplicated UTI only)	-	-			-	-	

Notes
Numbered notes relate to general comments and/or MIC breakpoints.
Lettered notes relate to the disk diffusion method.

1/B. Susceptibility can be inferred from ampicillin.
2. The addition of a beta-lactamase inhibitor does not add clinical benefit. Beta-lactamase producing enterococci are extremely rare.
3/C. Isolates susceptible to ampicillin are without phenotypically detectable resistance mechanisms and the specified agents can be used in high exposure in combination therapy (**see Note 4/D**). Isolates resistant to ampicillin can be reported resistant.
4/D. For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.
5. For susceptibility testing purposes, the concentration of tazobactam is fixed at 4 mg/L.

A. For *E. faecalis* that test resistant to ampicillin with disk diffusion, confirm with an MIC test.

Cephalosporins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefaclor	-	-			-	-		
Cefadroxil	-	-			-	-		
Cefalexin	-	-			-	-		
Cefazolin	-	-			-	-		
Cefepime	-	-			-	-		
Cefepime-enmetazobactam	-	-			-	-		
Cefiderocol	-	-			-	-		
Cefixime	-	-			-	-		
Cefotaxime	-	-			-	-		
Cefoxitin	-	-			-	-		
Cefpodoxime	-	-			-	-		
Ceftaroline	-	-			-	-		
Ceftazidime	-	-			-	-		
Ceftazidime-avibactam	-	-			-	-		
Ceftibuten	-	-			-	-		
Ceftobiprole	-	-			-	-		
Ceftolozane-tazobactam	-	-			-	-		
Ceftriaxone	-	-			-	-		
Cefuroxime iv	-	-			-	-		
Cefuroxime oral	-	-			-	-		

Carbapenems	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doripenem	-	-			-	-		~~**1/A.** The addition of a beta-lactamase inhibitor does not add clinical benefit.~~
Ertapenem	-	-			-	-		
Imipenem, *E. faecalis*	0.001	4		10	50	21		
Imipenem-relebactam	-	-			-	-		
Meropenem	-	-			-	-		
Meropenem-vaborbactam	-	-			-	-		

Monobactams	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Aztreonam	-	-			-	-		
Aztreonam-avibactam	-	-			-	-		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
	S ≤	R >	ATU		S ≥	R <	ATU	
Ciprofloxacin (uncomplicated UTI only)	4	4		5	15[A]	15[A]		**1/B.** Moxifloxacin has been used in oral follow-up treatment of endocarditis caused by *Enterococcus faecalis* There are no clinical breakpoints but acquired resistance should be excluded (isolates with MIC >1 mg/L). The norfloxacin disk diffusion screen test can be used to exclude resistance mechanisms. When acquired resistance has been excluded, the isolate should be reported "devoid of fluoroquinolone resistance mechanisms", but not as susceptible to moxifloxacin. **A.** The norfloxacin disk diffusion test can be used to screen for fluoroquinolone resistance. **See Note C.** **C.** Susceptibility to ciprofloxacin and levofloxacin can be inferred from the norfloxacin disk diffusion screening test. For moxifloxacin, **see comment 1/B**.
Delafloxacin	IE	IE			IE	IE		
Levofloxacin (uncomplicated UTI only)	4	4		5	15[A]	15[A]		
Moxifloxacin	Note[1]	Note[1]			Note[B]	Note[B]		
Nalidixic acid (screen only)	NA	NA			NA	NA		
Norfloxacin (screen only)	NA	NA		10	12[C]	12[C]		
Ofloxacin	-	-			-	-		

Aminoglycosides[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
	S ≤	R >	ATU		S ≥	R <	ATU	
Amikacin	Note[2]	Note[2]			Note[A]	Note[A]		**1.** Enterococci are resistant to aminoglycosides when used in monotherapy. However, synergy with beta-lactams or glycopeptides is still likely if the isolate does not express an acquired aminoglycoside-modifying enzyme. **2/A.** Gentamicin can be used to screen for the presence of aminoglycoside-modifying enzymes (high-level aminoglycoside resistance). **Negative test**: Isolates with gentamicin MIC ≤128 mg/L or a zone diameter ≥8 mm. The isolate is wild type for gentamicin (i.e. does not contain aminoglycoside-modifying enzymes). Therefore, synergy with penicillins or glycopeptides can be expected if the isolate is susceptible to the penicillin or glycopeptide. For other aminoglycosides, this may not be the case. **Positive test:** Isolates with gentamicin MIC >128 mg/L or a zone diameter <8 mm denote presence of aminoglycoside-modifying enzymes. Combinations between penicillins or glycopeptides and aminoglycosides will not be synergistic, except streptomycin which must be tested separately if required (**see note 3/B**). **3/B**. Isolates screening positive with gentamicin for aminoglycoside-modifying enzymes may still exhibit synergy with streptomycin. This can be screened for with streptomycin testing. **Negative test:** Isolates with streptomycin MIC ≤512 mg/L or a zone diameter ≥14 mm. The isolate is wild type for streptomycin and synergy with penicillins or glycopeptides can be expected if the isolate is susceptible to the penicillin or glycopeptide. **Positive test:** Isolates with streptomycin MIC >512 mg/L or a zone diameter <14 mm. Combinations between penicillins or glycopeptides and streptomycin will not be synergistic.
Gentamicin (test for acquired aminoglycoside-modifying enzyme)	Note[2]	Note[2]		30	Note[A]	Note[A]		
Netilmicin	Note[2]	Note[2]			Note[A]	Note[A]		
Streptomycin (test for acquired aminoglycoside-modifying enzyme)	Note[3]	Note[3]		300	Note[B]	Note[B]		
Tobramycin	Note[2]	Note[2]			Note[A]	Note[A]		

Glycopeptides and lipoglycopeptides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Dalbavancin	IE	IE			IE	IE		~~**1/A.** Vancomycin resistance is the expected phenotype for *E. casseliflavus* and *E. gallinarum* and therefore susceptibility testing should not be performed.~~
Oritavancin	IE	IE			IE	IE		
Teicoplanin	2	2		30	16	16		**A.** Vancomycin susceptible *E. faecalis* and *E. faecium* exhibit sharp zone edges and do not exhibit colonies in the inhibition zone. Examine zone edges with transmitted light (plate held up to light). If the zone edge is fuzzy, colonies grow within the zone or if you are uncertain, then perform confirmatory testing with PCR or report resistant (**see pictures below**) even if the zone diameter is ≥ 12 mm. Isolates must not be reported susceptible before 24 h incubation.
Telavancin	IE	IE			IE	IE		
Vancomycin, *E. faecalis* and *E. faecium*	4	4		5	12[A]	12[A]		
Vancomycin, *E. casseliflavus* and *E. gallinarum*	-	-			-	-		
Vancomycin, other enterococci	4	4		5	15	15		

Macrolides, lincosamides and streptogramins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin	-	-			-	-		
Clarithromycin	-	-			-	-		
Erythromycin	-	-			-	-		
Roxithromycin	-	-			-	-		
Clindamycin	-	-			-	-		
Quinupristin-dalfopristin, *E. faecium*	1	1		15	22	22		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	-	-			-	-		**1.** Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory.
Eravacycline	0.25	0.25		20	22	22		**2.** For tigecycline broth microdilution MIC determination, the medium must be prepared fresh on the day of use.
Minocycline	-	-			-	-		
Tetracycline	-	-			-	-		
Tigecycline[1]	0.5[2]	0.5[2]		15	20	20		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	4	4		10	20	20		
Tedizolid	IE	IE			IE	IE		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)		
	S ≤	R >	ATU		S ≥	R <	ATU
Chloramphenicol	-	-			-	-	
Colistin	-	-			-	-	
Daptomycin[1]	IE	IE			IE	IE	
Fosfomycin iv	Note[2]	Note[2]			Note[A]	Note[A]	
Fosfomycin oral	-	-			-	-	
Fusidic acid	-	-			-	-	
Lefamulin	Note[3]	Note[3]			Note[B]	Note[B]	
Metronidazole	-	-			-	-	
Nitrofurantoin (uncomplicated UTI only), *E. faecalis*	64	64		100	15	15	
Nitroxoline (uncomplicated UTI only)	IE	IE			IE	IE	
Rifampicin	-	-			-	-	
Spectinomycin	-	-			-	-	
Trimethoprim (uncomplicated UTI only)	Note[4]	Note[4]		5	Note[C]	Note[C]	
Trimethoprim-sulfamethoxazole[5]	Note[4]	Note[4]		1.25-23.75	Note[C]	Note[C]	

Notes

Numbered notes relate to general comments and/or MIC breakpoints.
Lettered notes relate to the disk diffusion method.

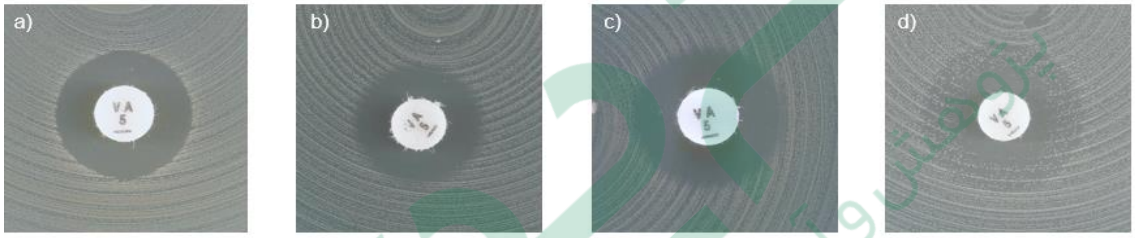
1. For more information, see https://www.eucast.org/eucastguidancedocuments/.

2/A. Antimicrobial susceptibility testing is discouraged. For information on the use of fosfomycin iv in combination therapy, see https://www.eucast.org/eucastguidancedocuments/.

3/B. Lefamulin has insufficient activity against *E. faecalis* . For *E. faecium* , the ECOFF of 0.5 mg/L can be used to distinguish wild type from non-wild type isolates.

4/C. The activity of trimethoprim and trimethoprim-sulfamethoxazole is uncertain against enterococci, and it is not possible to predict clinical outcome. Isolates with MICs >1 mg/L most likely have resistance mechanisms against trimethoprim and trimethoprim-sulfamethoxazole. For *E. faecalis* and *E. faecium* this corresponds to a zone diameter <21 mm for trimethoprim and <23 mm for trimethoprim-sulfamethoxazole.

5. Trimethoprim-sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.



Examples of inhibition zones for *Enterococcus faecalis* and *E. faecium* with vancomycin.

a) Sharp zone edge **and** zone diameter ≥ 12 mm. Report susceptible.

b-d) Fuzzy zone edge or colonies within zone. Perform confirmatory testing with PCR or report resistant even if the zone diameter ≥ 12 mm.

Streptococcus groups A, B, C and G

Expert Rules and Expected Phenotypes | **Guidance documents**

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth + 5% lysed horse blood and 20 mg/L β-NAD (MH-F broth)
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h (for glycopeptides 24h)
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F)
Inoculum: McFarland 0.5
Incubation: 5% CO_2, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.

This group of bacteria includes many species, which can be grouped as follows:
Group A: *S. pyogenes*
Group B: *S. agalactiae*
Group C: *S. dysgalactiae* (plus the more rarely isolated *S. equi*)
Group G: *S. dysgalactiae* and *S. canis*
S. dysgalactiae includes the subspecies *equisimilis* and *dysgalactiae*, *S. equi* includes the subspecies *equi* and *zooepidemicus*.

Penicillins[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)		
	S ≤	R >	ATU		S ≥	R <	ATU
Benzylpenicillin[2], Streptococcus groups A, C and G	0.03	0.03		**1 unit**	23	23	
Benzylpenicillin[2], *S. agalactiae* (group B streptococci)	0.125	0.125		**1 unit**	18	18	
Ampicillin	Note[1]	Note[1]			Note[A]	Note[A]	
Ampicillin-sulbactam[3]	Note[1]	Note[1]			Note[A]	Note[A]	
Amoxicillin	Note[1]	Note[1]			Note[A]	Note[A]	
Amoxicillin-clavulanic acid[3]	Note[1]	Note[1]			Note[A]	Note[A]	
Piperacillin	Note[1]	Note[1]			Note[A]	Note[A]	
Piperacillin-tazobactam[3]	Note[1]	Note[1]			Note[A]	Note[A]	
Ticarcillin-clavulanic acid	-	-			-	-	
Temocillin	-	-			-	-	
Phenoxymethylpenicillin Streptococcus groups A, C and G	Note[1]	Note[1]			Note[A]	Note[A]	
Oxacillin Streptococcus groups A, C and G	Note[1]	Note[1]			Note[A]	Note[A]	
Cloxacillin Streptococcus groups A, C and G	Note[1]	Note[1]			Note[A]	Note[A]	
Dicloxacillin Streptococcus groups A, C and G	Note[1]	Note[1]			Note[A]	Note[A]	
Flucloxacillin Streptococcus groups A, C and G	Note[1]	Note[1]			Note[A]	Note[A]	
Mecillinam oral (pivmecillinam) (uncomplicated UTI only)	-	-			-	-	

Notes
Numbered notes relate to general comments and/or MIC breakpoints.
Lettered notes relate to the disk diffusion method.

1/A. The susceptibility of streptococcus groups A, B, C and G to penicillins is inferred from the benzylpenicillin susceptibility ~~(indications other than meningitis)~~ with the exception of phenoxymethylpenicillin and isoxazolylpenicillins for streptococcus group B, where there is insufficient evidence for clinical efficacy.
2. Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory.
3. The addition of a beta-lactamase inhibitor does not add clinical benefit.

Cephalosporins[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefaclor	Note[1]	Note[1]			Note[A]	Note[A]		**1/A**. The susceptibility of streptococcus groups A, B, C and G to cephalosporins is inferred from the benzylpenicillin susceptibility. **2/B.** The addition of a beta-lactamase inhibitor does not add clinical benefit.
Cefadroxil	Note[1]	Note[1]			Note[A]	Note[A]		
Cefalexin	Note[1]	Note[1]			Note[A]	Note[A]		
Cefazolin	Note[1]	Note[1]			Note[A]	Note[A]		
Cefepime	Note[1]	Note[1]			Note[A]	Note[A]		
Cefepime-enmetazobactam[2]	Note[2]	Note[2]			Note[B]	Note[B]		
Cefiderocol	IE	IE			IE	IE		
Cefixime	-	-			-	-		
Cefotaxime	Note[1]	Note[1]			Note[A]	Note[A]		
Cefoxitin	IE	IE			IE	IE		
Cefpodoxime	Note[1]	Note[1]			Note[A]	Note[A]		
Ceftaroline	Note[1]	Note[1]			Note[A]	Note[A]		
Ceftazidime	-	-			-	-		
Ceftazidime-avibactam	-	-			-	-		
Ceftibuten	Note[1]	Note[1]			Note[A]	Note[A]		
Ceftobiprole	IE	IE			IE	IE		
Ceftolozane-tazobactam[2]	IE	IE			IE	IE		
Ceftriaxone	Note[1]	Note[1]			Note[A]	Note[A]		
Cefuroxime iv	Note[1]	Note[1]			Note[A]	Note[A]		
Cefuroxime oral	Note[1]	Note[1]			Note[A]	Note[A]		

Carbapenems[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doripenem	Note[1]	Note[1]			Note[A]	Note[A]		**1/A**. The susceptibility of streptococcus groups A, B, C and G to carbapenems is inferred from the benzylpenicillin susceptibility. **2/B.** The addition of a beta-lactamase inhibitor does not add clinical benefit.
Ertapenem	Note[1]	Note[1]			Note[A]	Note[A]		
Imipenem	Note[1]	Note[1]			Note[A]	Note[A]		
Imipenem-relebactam[2]	Note[2]	Note[2]			Note[B]	Note[B]		
Meropenem	Note[1]	Note[1]			Note[A]	Note[A]		
Meropenem-vaborbactam[2]	Note[2]	Note[2]			Note[B]	Note[B]		

Monobactams	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Aztreonam	-	-			-	-		
Aztreonam-avibactam	-	-			-	-		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	-	-			-	-		**A.** A disk diffusion test awaits action from the responsible pharmaceutical company. **B.** The norfloxacin disk diffusion test can be used to screen for fluoroquinolone resistance. **See Note C.** **C.** Isolates categorised as screen negative can be reported susceptible to moxifloxacin and as "susceptible increased exposure" (I) to levofloxacin. Isolates categorised as screen positive should be tested for susceptibility to individual agents or reported resistant.
Delafloxacin	0.03	0.03			Note[A]	Note[A]		
Levofloxacin	0.001	2		5	50[B]	17[B]		
Moxifloxacin	0.5	0.5		5	19[B]	19[B]		
Nalidixic acid (screen only)	NA	NA			NA	NA		
Norfloxacin (screen only)	NA	NA		10	12[C]	12[C]		
Ofloxacin	-	-			-	-		

Aminoglycosides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Amikacin	-	-			-	-		
Gentamicin	-	-			-	-		
Netilmicin	-	-			-	-		
Tobramycin	-	-			-	-		

Glycopeptides and lipoglycopeptides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Dalbavancin[1]	0.125[2,3]	0.125[2]			Note[A]	Note[A]		**1.** Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory. **2.** MICs must be determined in the presence of polysorbate-80 (0.002% in the medium for broth dilution methods; agar dilution methods have not been validated). Follow the manufacturers' instructions for commercial systems. **3.** Isolates susceptible to vancomycin can be reported susceptible to dalbavancin and oritavancin. **A.** Disk diffusion criteria have not been defined and an MIC method should be used. **B.** Non-wild type isolates were not available when developing the disk diffusion method.
Oritavancin[1]	0.25[2,3]	0.25[2]			Note[A]	Note[A]		
Teicoplanin[1]	2	2		30	15[B]	15[B]		
Telavancin	IE	IE			IE	IE		
Vancomycin[1]	2	2		5	13[B]	13[B]		

Macrolides, lincosamides and streptogramins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin	0.25[1]	0.25[1]			Note[A]	Note[A]		**1/A.** Erythromycin can be used to screen for macrolide resistance in Streptococcus groups A, B, C and G. Isolates categorised as susceptible can be reported susceptible to azithromycin, clarithromycin and roxithromycin. Isolates categorised as resistant should be tested for susceptibility to individual agents or reported resistant. **2.** Inducible clindamycin resistance can be detected by antagonism of clindamycin activity by a macrolide agent. If not detected, then report as tested according to the clinical breakpoints. If detected, then report as resistant and consider adding this comment to the report: "Clindamycin may still be used for short-term therapy of less serious skin and soft tissue infections as constitutive resistance is unlikely to develop during such therapy". The clinical importance of inducible clindamycin resistance in combination treatment of severe *S. pyogenes* infections is not known. **B.** Place the erythromycin and clindamycin disks 12-16 mm apart (edge to edge) and look for antagonism (the D phenomenon) to detect inducible clindamycin resistance.
Clarithromycin	0.25[1]	0.25[1]			Note[A]	Note[A]		
Erythromycin	0.25[1]	0.25[1]		15	21[A]	21[A]		
Roxithromycin	0.5[1]	0.5[1]			Note[A]	Note[A]		
Clindamycin[2]	0.5	0.5		2	17[B]	17[B]		
Quinupristin-dalfopristin	-	-			-	-		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	1[1]	1[1]			Note[A]	Note[A]		**1/A.** Tetracycline can be used to screen for resistance in tetracycline agents. Isolates categorised as susceptible can be reported susceptible to doxycycline and minocycline. Isolates categorised as resistant should be tested for susceptibility to individual agents or reported resistant. **2.** Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory. **3.** For tigecycline broth microdilution MIC determination, the medium must be prepared fresh on the day of use.
Eravacycline	IE	IE			IE	IE		
Minocycline	0.5[1]	0.5[1]		30	23[A]	23[A]		
Tetracycline	1[1]	1[1]		30	23[A]	23[A]		
Tigecycline[2]	0.125[3]	0.125[3]		15	19	19		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid[1]	2	2		10	19	19		**1.** Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory. **2/A.** Isolates susceptible to linezolid can be reported susceptible to tedizolid.
Tedizolid[1]	0.5[2]	0.5		2	18[A]	18[A]		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)		
	S ≤	R >	ATU		S ≥	R <	ATU
Chloramphenicol	IE	IE			IE	IE	
Colistin	-	-			-	-	
Daptomycin[1]	1[2]	1[2]			Note[A]	Note[A]	
Fosfomycin iv	-	-			-	-	
Fosfomycin oral	-	-			-	-	
Fusidic acid	IE	IE			IE	IE	
Lefamulin	IE	IE			IE	IE	
Metronidazole	-	-			-	-	
Nitrofurantoin (uncomplicated UTI only), *S. agalactiae* (group B streptococci)	64	64		100	15	15	
Nitroxoline (uncomplicated UTI only)	-	-			-	-	
Rifampicin	0.25	0.25		5	21	21	
Spectinomycin	-	-			-	-	
Trimethoprim (uncomplicated UTI only), *S. agalactiae* (group B streptococci)	Note[3]	Note[3]			Note[B]	Note[B]	
Trimethoprim-sulfamethoxazole[4]	1	2		1.25-23.75	18	15	

Notes

Numbered notes relate to general comments and/or MIC breakpoints.

Lettered notes relate to the disk diffusion method.

1. Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory.

2. Daptomycin MICs must be determined in the presence of Ca^{2+} (50 mg/L in the medium for broth dilution methods; agar dilution methods have not been validated). Follow the manufacturers' instructions for commercial systems.

3/B. The activity of trimethoprim is uncertain against *S. agalactiae* and it is not possible to predict clinical outcome. The ECOFF to categorise isolates as wild type or non-wild type is 2 mg/L.

4. Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.

A. Use an MIC method.

Streptococcus pneumoniae

Expert Rules and Expected Phenotypes | **Guidance documents**

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth + 5% lysed horse blood and 20 mg/L β-NAD (MH-F broth)
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h (for glycopeptides 24h)
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F)
Inoculum: McFarland 0.5 from blood agar or McFarland 1.0 from chocolate agar
Incubation: 5% CO_2, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.

Penicillins[1]	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)		
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU
Benzylpenicillin (indications other than endocarditis and meningitis)	0.06	1		1 unit[A]	Note[A,B]	Note[A,B]	
Benzylpenicillin (endocarditis and meningitis)	0.06	0.06			Note[B]	Note[B]	
Ampicillin (indications other than endocarditis and meningitis)	0.5	1		2	22	19	
Ampicillin iv (endocarditis and meningitis)	0.5	0.5			Note[B]	Note[B]	
Ampicillin-sulbactam[2]	Note[1,3]	Note[1,3]			Note[B,C]	Note[B,C]	
Amoxicillin iv (indications other than endocarditis and meningitis)	Note[1,3]	Note[1,3]			Note[B,C]	Note[B,C]	
Amoxicillin iv (endocarditis and meningitis)	0.5	0.5			Note[B]	Note[B]	
Amoxicillin oral	0.5	1			Note[B,C]	Note[B,C]	
Amoxicillin-clavulanic acid iv[2]	Note[1,3]	Note[1,3]			Note[B,C]	Note[B,C]	
Amoxicillin-clavulanic acid oral[2]	0.5[4]	1[4]			Note[B,C]	Note[B,C]	
Piperacillin	Note[1,3]	Note[1,3]			Note[B,C]	Note[B,C]	
Piperacillin-tazobactam[2]	Note[1,3]	Note[1,3]			Note[B,C]	Note[B,C]	
Ticarcillin-clavulanic acid	-	-			-	-	
Temocillin	-	-			-	-	
Phenoxymethylpenicillin	Note[1]	Note[1]			Note[B]	Note[B]	
Oxacillin (screen only)[1]	NA	NA		1	20[D]	20[D]	
Oxacillin	IE	IE			IE	IE	
Cloxacillin	IE	IE			IE	IE	
Dicloxacillin	IE	IE			IE	IE	
Flucloxacillin	IE	IE			IE	IE	
Mecillinam oral (pivmecillinam) (uncomplicated UTI only)	-	-			-	-	

Notes
Numbered notes relate to general comments and/or MIC breakpoints.
Lettered notes relate to the disk diffusion method.

1/B. The oxacillin 1 µg disk diffusion screening test or a benzylpenicillin MIC test shall be used to exclude beta-lactam resistance mechanisms. When the screen is negative (oxacillin zone diameter ≥20 mm, or benzylpenicillin MIC ≤0.06 mg/L) all beta-lactam agents for which clinical breakpoints are available, including those with "Note" can be reported susceptible without further testing, except for cefaclor, which if reported, should be reported as "susceptible, increased exposure" (I). When the screen is positive (zone diameter <20 mm, or benzylpenicillin MIC >0.06 mg/L), **see flow chart below**.
~~**2.** For breakpoints and dosing in pneumonia, see table of dosages.~~
2. The addition of a beta-lactamase inhibitor does not add clinical benefit.
3/C. Susceptibility inferred from ampicillin (indications other than endocarditis and meningitis).
4. For susceptibility testing purposes, the concentration of clavulanic acid is fixed at 2 mg/L.

A. Read and interpret the benzylpenicillin disk only for isolates with oxacillin 1 µg zone diameters <20 mm. If benzylpenicillin zone ≥14 mm, report benzylpenicillin "susceptible, increased exposure" (I). If zone <14 mm, report benzylpenicillin resistant (R), **see flow chart below.**
D. For interpretation of the oxacillin disk screen, see flow chart below.

Cephalosporins[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefaclor	0.001	0.5		30	50	28		**1/A.** The oxacillin 1 µg disk diffusion screening test or a benzylpenicillin MIC test shall be used to exclude beta-lactam resistance mechanisms. When the screen is negative (oxacillin zone diameter ≥20 mm, or benzylpenicillin MIC ≤0.06 mg/L) all beta-lactam agents for which clinical breakpoints are available, including those with "Note" can be reported susceptible without further testing, except for cefaclor, which if reported, should be reported as "susceptible, increased exposure" (I). When the screen is positive (oxacillin zone diameter <20 mm, or benzylpenicillin MIC >0.06 mg/L), **see flow chart below**.
Cefadroxil	-	-			-	-		
Cefalexin	-	-			-	-		
Cefazolin	-	-			-	-		
Cefepime	1	2			Note[A]	Note[A]		
Cefepime-enmetazobactam[2]	Note[2]	Note[2]			Note[B]	Note[B]		**2/B.** The addition of a beta-lactamase inhibitor does not add clinical benefit.
Cefiderocol	IE	IE			IE	IE		
Cefixime	-	-			-	-		
Cefotaxime (indications other than endocarditis and meningitis)	0.5	2			Note[A]	Note[A]		
Cefotaxime (endocarditis and meningitis)	0.5	0.5			Note[A]	Note[A]		
Cefoxitin	IE	IE			IE	IE		
Cefpodoxime	0.25	0.25			Note[A]	Note[A]		
Ceftaroline	0.25	0.25			Note[A]	Note[A]		
Ceftazidime	-	-			-	-		
Ceftazidime-avibactam	-	-			-	-		
Ceftibuten	-	-			-	-		
Ceftobiprole	0.5	0.5			Note[A]	Note[A]		
Ceftolozane-tazobactam	-	-			-	-		
Ceftriaxone (indications other than endocarditis and meningitis)	0.5	2			Note[A]	Note[A]		
Ceftriaxone (endocarditis and meningitis)	0.5	0.5			Note[A]	Note[A]		
Cefuroxime iv	0.5	1			Note[A]	Note[A]		
Cefuroxime oral	0.25	0.25			Note[A]	Note[A]		

Carbapenems[1,2]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doripenem	1	1			Note[A]	Note[A]		**1/A.** The oxacillin 1 µg disk diffusion screening test or a benzylpenicillin MIC test shall be used to exclude beta-lactam resistance mechanisms. When the screen is negative (oxacillin zone diameter ≥20 mm, or benzylpenicillin MIC ≤0.06 mg/L) all beta-lactam agents for which clinical breakpoints are available, including those with "Note" can be reported susceptible without further testing, except for cefaclor, which if reported, should be reported as "susceptible, increased exposure" (I). When the screen is positive (oxacillin zone diameter <20 mm, or benzylpenicillin MIC >0.06 mg/L), **see flow chart below**.
Ertapenem	0.5	0.5			Note[A]	Note[A]		
Imipenem	2	2			Note[A]	Note[A]		
Imipenem-relebactam[3]	Note[3]	Note[3]			Note[B]	Note[B]		
Meropenem (indications other than meningitis)	2	2			Note[A]	Note[A]		**2.** Meropenem is the only carbapenem used for meningitis.
Meropenem (meningitis)	0.25	0.25			Note[A]	Note[A]		**3/B.** The addition of a beta-lactamase inhibitor does not add clinical benefit.
Meropenem-vaborbactam[3]	Note[3]	Note[3]			Note[B]	Note[B]		

Monobactams	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Aztreonam	-	-			-	-		
Aztreonam-avibactam	-	-			-	-		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	-	-			-	-		**A.** The norfloxacin disk diffusion test can be used to screen for fluoroquinolone resistance. **See Note B.**
Delafloxacin	IE	IE			IE	IE		**B.** Isolates categorised as screen negative can be reported susceptible to moxifloxacin and as "susceptible increased exposure" (I) to levofloxacin. Isolates categorised as screen positive should be tested for susceptibility to individual agents or reported resistant.
Levofloxacin	0.001	2		5	50[A]	16[A]		
Moxifloxacin	0.5	0.5		5	22[A]	22[A]		
Nalidixic acid (screen only)	NA	NA			NA	NA		
Norfloxacin (screen only)	NA	NA		10	10[B]	10[B]		
Ofloxacin	-	-			-	-		

Aminoglycosides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Amikacin	-	-			-	-		
Gentamicin	-	-			-	-		
Netilmicin	-	-			-	-		
Tobramycin	-	-			-	-		

Glycopeptides and lipoglycopeptides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Dalbavancin	IE	IE			IE	IE		**1.** Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory.
Oritavancin	IE	IE			IE	IE		
Teicoplanin[1]	2	2		30	17[A]	17[A]		**A.** Non-wild type isolates were not available when developing the disk diffusion method.
Telavancin	IE	IE			IE	IE		
Vancomycin[1]	2	2		5	16[A]	16[A]		

Macrolides, lincosamides and streptogramins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin	0.25[1]	0.25[1]			Note[A]	Note[A]		**1/A.** Erythromycin can be used to screen for macrolide resistance in *Streptococcus pneumoniae* . Isolates categorised as susceptible can be reported susceptible to azithromycin, clarithromycin and roxithromycin. Isolates categorised as resistant should be tested for susceptibility to individual agents or reported resistant. **2.** Inducible clindamycin resistance can be detected by antagonism of clindamycin activity by a macrolide agent. If not detected, then report as tested according to the clinical breakpoints. If detected, then report as resistant. **B.** Place the erythromycin and clindamycin disks 12-16 mm apart (edge to edge) and look for antagonism (the D phenomenon) to detect inducible clindamycin resistance.
Clarithromycin	0.25[1]	0.25[1]			Note[A]	Note[A]		
Erythromycin	0.25[1]	0.25[1]		15	22[A]	22[A]		
Roxithromycin	0.5[1]	0.5[1]			Note[A]	Note[A]		
Clindamycin[2]	0.5	0.5		2	19[B]	19[B]		
Quinupristin-dalfopristin	-	-			-	-		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	1[1]	1[1]			Note[A]	Note[A]		**1/A.** Tetracycline can be used to screen for resistance in tetracycline agents. Isolates categorised as susceptible can be reported susceptible to doxycycline and minocycline. Isolates categorised as resistant should be tested for susceptibility to individual agents or reported resistant.
Eravacycline	IE	IE			IE	IE		
Minocycline	0.5[1]	0.5[1]		30	24[A]	24[A]		
Tetracycline	1[1]	1[1]		30	25[A]	25[A]		
Tigecycline	IE	IE			IE	IE		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	2	2		10	22	22		
Tedizolid	IE	IE			IE	IE		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Chloramphenicol[1]	Note[1]	Note[1]			Note[A]	Note[A]		**1/A.** Efficacy for this species is uncertain. ECOFFs can be used to distinguish wild-type isolates from isolates with acquired resistance (MIC >8 mg/L; zone diameter <21 mm for the chloramphenicol 30 µg disk). For chloramphenicol treatment in meningitis, see table of dosages.
Colistin	-	-			-	-		**2.** Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.
Daptomycin	IE	IE			IE	IE		
Fosfomycin iv	IE	IE			IE	IE		
Fosfomycin oral	-	-			-	-		
Fusidic acid	-	-			-	-		
Lefamulin	0.5	0.5		5	12	12		
Metronidazole	-	-			-	-		
Nitrofurantoin (uncomplicated UTI only)	-	-			-	-		
Nitroxoline (uncomplicated UTI only)	-	-			-	-		
Rifampicin	0.125	0.125		5	22	22		
Spectinomycin	-	-			-	-		
Trimethoprim (uncomplicated UTI only)	-	-			-	-		
Trimethoprim-sulfamethoxazole[2]	1	2		1.25-23.75	13	10		

Streptococcus pneumoniae: Flow chart based on screen tests for beta-lactam resistance mechanisms

Following the flow chart avoids delays in reporting benzylpenicillin susceptibility in *S. pneumoniae*.
Include both the oxacillin (1 µg) and the benzylpenicillin (1 unit) disks already from the beginning.
Read and interpret the benzylpenicillin disk **only** for isolates with oxacillin zones <20 mm.

See the EUCAST warning on the use of benzylpenicillin gradient tests at **https://www.eucast.org/warnings/.**

Oxacillin 1 µg zone diameter ≥20 mm (or benzylpenicillin MIC ≤0.06 mg/L)

Mechanism: excludes all beta-lactam resistance mechanisms

Report susceptible **(S)** to beta-lactam agents for which clinical breakpoints are available, including those with "Note".
Exception: Cefaclor is reported "susceptible, increased exposure" **(I).**

No further testing required.

Oxacillin 1 µg zone diameter <20 mm (or benzylpenicillin MIC >0.06 mg/L)

Mechanism: beta-lactam resistance detected

Report resistant **(R)** to benzylpenicillin in endocarditis and meningitis and to phenoxymethylpenicillin (all indications).

For benzylpenicillin in indications other than endocarditis and meningitis,
read and interpret the benzylpenicillin disk:
If zone ≥14 mm, report benzylpenicillin "susceptible, increased exposure" (I),
If zone <14 mm, report benzylpenicillin resistant (R).

For other beta-lactam agents, see below.

Oxacillin 1 µg zone diameter 9-19 mm

Report susceptible **(S)** without further testing to: ampicillin, amoxicillin and piperacillin (without and with beta-lactamase inhibitor), cefepime, cefotaxime, ceftaroline, ceftobiprole, ceftriaxone, imipenem and meropenem.

For beta-lactam agents not listed, perform susceptibility test and interpret according to breakpoints.

Oxacillin 1 µg zone diameter <9 mm

For beta-lactam agents other than benzylpenicillin, perform susceptibility testing and interpret according to breakpoints.

Viridans group streptococci

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

~~**In endocarditis, refer to national or international endocarditis guidelines for breakpoints for viridans group streptococci.**~~

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth + 5% lysed horse blood and 20 mg/L β-NAD (MH-F broth)
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h (for glycopeptides 24h)
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F)
Inoculum: McFarland 0.5
Incubation: 5% CO_2, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.

This group of bacteria includes many species, which can be grouped as follows:
***S. anginosus* group:** *S. anginosus, S. constellatus, S. intermedius*
***S. mitis* group:** *S. australis, S. cristatus, S. infantis, S. massiliensis, S. mitis, S. oligofermentans, S. oralis, S. peroris, S. pseudopneumoniae, S. sinensis*
***S. sanguinis* group:** *S. sanguinis, S. parasanguinis, S. gordonii*
***S. bovis* group:** *S. equinus, S. gallolyticus (S. bovis), S. infantarius, S. lutetiensis, S. pasteurianus*
***S. salivarius* group:** *S. salivarius, S. vestibularis, S. thermophilus*
***S. mutans* group:** *S. mutans, S. sobrinus*

Viridans group streptococci

Expert Rules and Expected Phenotypes | Guidance documents

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

For abbreviations and explanations of breakpoints, see the Notes sheet

Penicillins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin (screen only)	0.25[1]	0.25[1]		1 unit	21[A]	21[A]		**1/A.** Benzylpenicillin (MIC or disk diffusion) can be used to screen for beta-lactam resistance in viridans group streptococci. Isolates categorised as screen negative can be reported susceptible to beta-lactam agents for which clinical breakpoints are listed (including those with "Note"). Isolates categorised as screen positive should be tested for susceptibility to individual agents or reported resistant.
Benzylpenicillin (indications other than endocarditis)	0.25	1		1 unit	21	12		**2/B.** For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.
Benzylpenicillin (endocarditis)	0.25	0.25			21	21		**3.** The addition of a beta-lactamase inhibitor does not add clinical benefit.
Benzylpenicillin (endocarditis, in combination with other antimicrobial treatment)	(1)[2]	(1)[2]			(12)[B]	(12)[B]		**4/C.** For benzylpenicillin screen negative isolates, susceptibility can be inferred from benzylpenicillin or ampicillin. For benzylpenicillin screen positive isolates, susceptibility is inferred from ampicillin.
Ampicillin (indications other than endocarditis)	0.5	2		2	21	15		**D.** Susceptibility can be inferred from the benzylpenicillin screen test or from "Ampicillin iv (endocarditis)".
Ampicillin iv (endocarditis)	0.5	0.5		2	21	21		
Ampicillin-sulbactam[3]	Note[1,4]	Note[1,4]			Note[A,C]	Note[A,C]		
Amoxicillin (indications other than endocarditis)	0.5	2			Note[A,C]	Note[A,C]		
Amoxicillin iv (endocarditis)	0.5	0.5			Note[A,D]	Note[A,D]		
Amoxicillin-clavulanic acid[3]	Note[1,4]	Note[1,4]			Note[A,C]	Note[A,C]		
Piperacillin	Note[1,4]	Note[1,4]			Note[A,C]	Note[A,C]		
Piperacillin-tazobactam[3]	Note[1,4]	Note[1,4]			Note[A,C]	Note[A,C]		
Ticarcillin-clavulanic acid[3]	IE	IE			IE	IE		
Temocillin	-	-			-	-		
Phenoxymethylpenicillin	IE	IE			IE	IE		
Oxacillin	IE	IE			IE	IE		
Cloxacillin	IE	IE			IE	IE		
Dicloxacillin	IE	IE			IE	IE		
Flucloxacillin	IE	IE			IE	IE		
Mecillinam oral (pivmecillinam) (uncomplicated UTI only)	-	-			-	-		

Cephalosporins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefaclor	-	-			-	-		**1.** The addition of a beta-lactamase inhibitor does not add clinical benefit.
Cefadroxil	-	-			-	-		
Cefalexin	-	-			-	-		**A**. Benzylpenicillin (MIC or disk diffusion) can be used to screen for beta-lactam resistance in viridans group streptococci. **See Note 1/A on penicillins.**
Cefazolin	IE	IE			IE	IE		
Cefepime	0.5	0.5		30	25[A]	25[A]		
Cefepime-enmetazobactam[1]	Note[1]	Note[1]			Note[A]	Note[A]		
Cefiderocol	IE	IE			IE	IE		
Cefixime	-	-			-	-		
Cefotaxime	0.5	0.5		5	23[A]	23[A]		
Cefoxitin	IE	IE			IE	IE		
Cefpodoxime	-	-			-	-		
Ceftaroline	-	-			-	-		
Ceftazidime	-	-			-	-		
Ceftazidime-avibactam	-	-			-	-		
Ceftibuten	-	-			-	-		
Ceftobiprole	-	-			-	-		
Ceftolozane-tazobactam[1], *S. anginosus* group	IE	IE			IE	IE		
Ceftriaxone	0.5	0.5		30	27[A]	27[A]		
Cefuroxime iv	0.5	0.5		30	26[A]	26[A]		
Cefuroxime oral	-	-			-	-		

Carbapenems	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doripenem	1	1			Note[A]	Note[A]		**1.** For susceptibility testing purposes, the concentration of relebactam is fixed at 4 mg/L.
Ertapenem	0.5	0.5			Note[A]	Note[A]		**2/B.** The addition of a beta-lactamase inhibitor does not add clinical benefit.
Imipenem	2	2			Note[A]	Note[A]		
Imipenem-relebactam[2]	2[1]	2[1]			Note[A,B]	Note[A,B]		**A.** Benzylpenicillin (MIC or disk diffusion) can be used to screen for beta-lactam resistance in viridans group streptococci. **See Note 1/A on penicillins.**
Meropenem	2	2			Note[A]	Note[A]		
Meropenem-vaborbactam[2]	Note[2]	Note[2]			Note[B]	Note[B]		

Monobactams	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Aztreonam	-	-			-	-		
Aztreonam-avibactam	-	-			-	-		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	-	-			-	-		**1/B.** Moxifloxacin has been used in oral follow-up treatment of endocarditis caused by viridans group streptococci. There are no clinical breakpoints but acquired resistance (isolates with MIC >0.5 mg/L; zone diameter <21 mm for the moxifloxacin 5 µg disk) should be excluded. When acquired resistance has been excluded, the isolate should be reported "devoid of fluoroquinolone resistance mechanisms", but not as susceptible to moxifloxacin. **A.** A disk diffusion test awaits action from the responsible pharmaceutical company.
Delafloxacin, *S. anginosus* group	0.03	0.03			Note[A]	Note[A]		
Levofloxacin	IE	IE			IE	IE		
Moxifloxacin	Note[1]	Note[1]			Note[B]	Note[B]		
Nalidixic acid (screen only)	NA	NA			NA	NA		
Norfloxacin (uncomplicated UTI only)	-	-			-	-		
Ofloxacin	-	-			-	-		

Aminoglycosides[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Amikacin	Note[2]	Note[2]			-	-		**1.** Viridans group streptococci are resistant to aminoglycosides when used in monotherapy. However, synergy with beta-lactams or glycopeptides is still likely if the isolate does not express an acquired aminoglycoside-modifying enzyme. **2.** Gentamicin can be used to screen for the presence of aminoglycoside-modifying enzymes (high-level aminoglycoside resistance). **Negative test:** Isolates with gentamicin MIC ≤128 mg/L. The isolate is wild type for gentamicin (i.e. does not contain aminoglycoside-modifying enzymes). Therefore, synergy with penicillins or glycopeptides can be expected if the isolate is susceptible to the penicillin or glycopeptide. **Positive test:** Isolates with gentamicin MIC >128 mg/L denote presence of aminoglycoside-modifying enzymes. Combinations between penicillins or glycopeptides and aminoglycosides will not be synergistic.
Gentamicin (test for acquired aminoglycoside-modifying enzyme)	Note[2]	Note[2]			-	-		
Netilmicin	Note[2]	Note[2]			-	-		
Tobramycin	Note[2]	Note[2]			-	-		

Glycopeptides and lipoglycopeptides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Dalbavancin[1], *S. anginosus* group	0.125[2,3]	0.125[2]			Note[A]	Note[A]		**1.** Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory. **2.** MICs must be determined in the presence of polysorbate-80 (0.002% in the medium for broth dilution methods; agar dilution methods have not been validated). Follow the manufacturers' instructions for commercial systems. **3.** Isolates susceptible to vancomycin can be reported susceptible to dalbavancin and oritavancin. **A.** Disk diffusion criteria have not been defined and an MIC method should be used. **B.** Non-wild type isolates were not available when developing the disk diffusion method.
Oritavancin[1], *S. anginosus* group	0.25[2,3]	0.25[2]			Note[A]	Note[A]		
Teicoplanin[1]	2	2		30	16[B]	16[B]		
Telavancin	IE	IE			IE	IE		
Vancomycin[1]	2	2		5	15[B]	15[B]		

Macrolides, lincosamides and streptogramins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin	IE	IE			IE	IE		**1.** Inducible clindamycin resistance can be detected by antagonism of clindamycin activity by a macrolide agent. If not detected, then report as tested according to the clinical breakpoints. If detected, then report as resistant.
Clarithromycin	IE	IE			IE	IE		
Erythromycin	IE	IE		15	IE	IE		**A.** Place the erythromycin and clindamycin disks 12-16 mm apart (edge to edge) and look for antagonism (the D phenomenon) to detect inducible clindamycin resistance.
Roxithromycin	IE	IE			IE	IE		
Clindamycin[1]	0.5	0.5		2	19[A]	19[A]		
Quinupristin-dalfopristin	IE	IE			IE	IE		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	-	-			-	-		
Eravacycline	0.125	0.125		20	17	17		
Minocycline	-	-			-	-		
Tetracycline	-	-			-	-		
Tigecycline	IE	IE			IE	IE		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	IE[1]	IE[1]			IE	IE		**1.** Linezolid has been used in oral follow-up treatment of endocarditis caused by viridans group streptococci. There are no clinical breakpoints but acquired resistance (isolates with MIC >2 mg/L) should be excluded. When excluded, the isolate should be reported "devoid of linezolid resistance mechanisms", but not as susceptible to linezolid.
Tedizolid, *S. anginosus* group	0.5	0.5		2	18	18		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Chloramphenicol	-	-			-	-		**1/A.** Rifampicin has been used in oral follow-up treatment of endocarditis caused by viridans group streptococci. There are no clinical breakpoints but acquired resistance (isolates with MIC >0.25 mg/L; zone diameter <21 mm for the rifampicin 5 µg disk) should be excluded. When excluded, the isolate should be reported "devoid of rifampicin resistance mechanisms", but not as susceptible to rifampicin.
Colistin	-	-			-	-		
Daptomycin	-	-			-	-		
Fosfomycin iv	-	-			-	-		
Fosfomycin oral	-	-			-	-		
Fusidic acid	-	-			-	-		
Lefamulin	IE	IE			IE	IE		
Metronidazole	-	-			-	-		
Nitrofurantoin (uncomplicated UTI only)	-	-			-	-		
Nitroxoline (uncomplicated UTI only)	-	-			-	-		
Rifampicin	Note[1]	Note[1]			Note[A]	Note[A]		
Spectinomycin	-	-			-	-		
Trimethoprim (uncomplicated UTI only)	-	-			-	-		
Trimethoprim-sulfamethoxazole	-	-			-	-		

Haemophilus influenzae

Expert Rules and Expected Phenotypes | **Guidance documents**

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth + 5% lysed horse blood and 20 mg/L β-NAD (MH-F broth)
Inoculum: 5x10^5 CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Haemophilus influenzae* ATCC 49766. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor combinations, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F)
Inoculum: McFarland 0.5
Incubation: 5% CO_2, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Haemophilus influenzae* ATCC 49766. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor-combination disks, see EUCAST QC Tables.

EUCAST breakpoints have been defined for *H. influenzae* only. Clinical data for other *Haemophilus* species are scarce. MIC distributions for *H. parainfluenzae* are similar to those for *H. influenzae*. In the absence of specific breakpoints, the *H. influenzae* MIC breakpoints can be applied to *H. parainfluenzae*.

Penicillins[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)		
	S ≤	R >	ATU		S ≥	R <	ATU
Benzylpenicillin	IE	IE			IE	IE	
Benzylpenicillin (screen only)[1]	NA	NA		1 unit	12[A,B]	12[A,B]	
Ampicillin (indications other than endocarditis and meningitis)[2]	1	1		2	18[A,B]	18[A,B]	
Ampicillin iv (endocarditis and meningitis)[2]	IE	IE			IE	IE	
Ampicillin-sulbactam	1[3,4]	1[3,4]			Note[A,D]	Note[A,D]	
Amoxicillin iv (indications other than endocarditis and meningitis)[2]	2	2			Note[A,E]	Note[A,E]	
Amoxicillin iv (endocarditis and meningitis)[2]	IE	IE			IE	IE	
Amoxicillin oral[2]	0.001	2			Note[A,F]	Note[A,F]	
Amoxicillin-clavulanic acid iv	2[5]	2[5]		2-1	15[A,B]	15[A,B]	
Amoxicillin-clavulanic acid oral	0.001[5]	2[5]		2-1	50[A,B]	15[A,B]	
Piperacillin[2]	IE	IE			IE	IE	
Piperacillin-tazobactam	0.25[6]	0.25[6]		30-6	27[A,B]	27[A,B]	26-28[B,C]
Ticarcillin-clavulanic acid	IE	IE			IE	IE	
Temocillin	IE	IE			IE	IE	
Phenoxymethylpenicillin	IE	IE			IE	IE	
Oxacillin	-	-			-	-	
Cloxacillin	-	-			-	-	
Dicloxacillin	-	-			-	-	
Flucloxacillin	-	-			-	-	
Mecillinam oral (pivmecillinam) (uncomplicated UTI only)	-	-			-	-	

Notes

Numbered notes relate to general comments and/or MIC breakpoints.
Lettered notes relate to the disk diffusion method.

1/A. The benzylpenicillin 1 unit disk diffusion screening test shall be used to exclude beta-lactam resistance mechanisms. When the screen is negative (zone diameter ≥12 mm) all penicillins for which clinical breakpoints are available, including those with "Note", can be reported susceptible without further testing, except for amoxicillin oral and amoxicillin-clavulanic acid oral, which if reported, should be reported "susceptible, increased exposure" (I). When the screen is positive (zone diameter <12 mm), **see flow chart below.**
2. Beta-lactamase positive isolates can be reported resistant to ampicillin, amoxicillin and piperacillin without inhibitors. Tests based on a chromogenic cephalosporin can be used to detect the beta-lactamase.
3. For susceptibility testing purposes, the concentration of sulbactam is fixed at 4 mg/L.
4/D. Susceptibility can be inferred from amoxicillin-clavulanic acid iv.
5. For susceptibility testing purposes, the concentration of clavulanic acid is fixed at 2 mg/L.
6. For susceptibility testing purposes, the concentration of tazobactam is fixed at 4 mg/L.

B. Read the outer edge of zones where an otherwise clear inhibition zone contains an area of growth around the disk, **see pictures below.**
C. ATU relevant only if the benzylpenicillin 1 unit disk screen is positive (zone diameter <12 mm).
E. Susceptibility can be inferred from ampicillin.
F. Isolates susceptible to ampicillin can be reported "susceptible, increased exposure" (I) to amoxicillin oral. Isolates resistant to ampicillin can be reported resistant to amoxicillin oral.

Haemophilus influenzae

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

Cephalosporins[1]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefaclor	-	-			-	-		**1/A.** The benzylpenicillin 1 unit disk diffusion screening test shall be used to exclude beta-lactam resistance mechanisms. When the screen is negative (zone diameter ≥12 mm) all cephalosporins for which clinical breakpoints are available, including those with "Note", can be reported susceptible without further testing, except for cefuroxime oral, which if reported, should be reported "susceptible, increased exposure" (I). When the screen is positive (zone diameter <12 mm), **see flow chart below**.
Cefadroxil	-	-			-	-		
Cefalexin	-	-			-	-		
Cefazolin	-	-			-	-		
Cefepime	0.25	0.25		30	28[A,B]	28[A,B]	28-33[B,C]	
Cefepime-enmetazobactam[2]	Note[2]	Note[2]			Note[D]	Note[D]		**2/D.** The addition of a beta-lactamase inhibitor does not add clinical benefit. The beta-lactamases produced by the organism either do not modify the parent cephalosporin or are not affected by the inhibitor.
Cefiderocol	IE	IE			IE	IE		**3.** See table of dosages for dosing for different indications.
Cefixime	0.125	0.125		5	26[A,B]	26[A,B]		**4/C.** ATU relevant only if the benzylpenicillin 1 unit disk screen is positive (zone diameter <12 mm).
Cefotaxime	0.125	0.125		5	27[A,B]	27[A,B]	25-27[B,C]	
Cefoxitin	IE	IE			IE	IE		**B.** Read the outer edge of zones where an otherwise clear inhibition zone contains an area of growth around the disk, **see pictures below.**
Cefpodoxime	0.25	0.25		10	26[A,B]	26[A,B]	26-29[B,C]	~~**D.** For benzylpenicillin screen positive isolates (zone <12 mm), determine the MIC in meningitis.~~
Ceftaroline	0.03	0.03			Note[A]	Note[A]		
Ceftazidime	-	-			-	-		
Ceftazidime-avibactam	-	-			-	-		
Ceftibuten	1	1		30	25[A,B]	25[A,B]		
Ceftobiprole	IE	IE			IE	IE		
Ceftolozane-tazobactam (pneumonia)[3]	0.5	0.5		30-10	23[A,B]	23[A,B]	22-23[B,C]	
Ceftriaxone	0.125	0.125		30	32[A,B]	32[A,B]	31-33[B,C]	
Cefuroxime iv	1	2	2[4]	30	27[A,B]	25[A,B]	25-27[B,C]	
Cefuroxime oral	0.001	1		30	50[A,B]	27[A,B]	25-27[B,C]	

Carbapenems[1,2]	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doripenem	1	1		10	23[A,B]	23[A,B]		**1/A.** The benzylpenicillin 1 unit disk diffusion screening test shall be used to exclude beta-lactam resistance mechanisms. When the screen is negative (zone diameter ≥12 mm) all carbapenems for which clinical breakpoints are available, including those with "Note", can be reported susceptible without further testing. When the screen is positive (zone diameter <12 mm), **see flow chart below**. **2.** Meropenem is the only carbapenem used for meningitis. **3/E.** The addition of the beta-lactamase inhibitor does not add clinical benefit. The beta-lactamases produced by the organism either do not modify the parent carbapenem or are not affected by the inhibitor. **B.** Read the outer edge of zones where an otherwise clear inhibition zone contains an area of growth around the disk, **see pictures below.** **C.** ATU relevant only if the benzylpenicillin 1 unit disk screen is positive (zone diameter <12 mm). **D.** For benzylpenicillin screen positive isolates (zone <12 mm), determine the MIC in meningitis.
Ertapenem	0.5	0.5		10	23[A,B]	23[A,B]		
Imipenem	2	2		10	20[A,B]	20[A,B]	6-19[B,C]	
Imipenem-relebactam[3]	Note[3]	Note[3]			Note[E]	Note[E]		
Meropenem (indications other than meningitis)	2	2		10	20[A,B]	20[A,B]		
Meropenem (meningitis)	0.25	0.25			Note[A,D]	Note[A,D]		
Meropenem-vaborbactam[3]	Note[3]	Note[3]			Note[E]	Note[E]		

Monobactams	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Aztreonam	IE	IE			IE	IE		
Aztreonam-avibactam	IE	IE			IE	IE		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.03	0.03		5	32[A]	32[A]		**A.** The nalidixic acid disk diffusion test can be used to screen for fluoroquinolone resistance. **See Note B.** **B.** ~~Susceptibility can be inferred from the nalidixic acid screening test.~~ **B.** Isolates categorised as screen negative can be reported susceptible to ciprofloxacin, levofloxacin, moxifloxacin and ofloxacin. Isolates categorised as screen positive should be tested for susceptibility to individual agents or reported resistant.
Delafloxacin	IE	IE			IE	IE		
Levofloxacin	0.06	0.06		5	30[A]	30[A]		
Moxifloxacin	0.125	0.125		5	28[A]	28[A]		
Nalidixic acid (screen only)	NA	NA		30	23[B]	23[B]		
Norfloxacin (uncomplicated UTI only)	-	-			-	-		
Ofloxacin	0.06	0.06		5	30[A]	30[A]		

Aminoglycosides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Amikacin	IE	IE			IE	IE		
Gentamicin	IE	IE			IE	IE		
Netilmicin	IE	IE			IE	IE		
Tobramycin	IE	IE			IE	IE		

Glycopeptides and lipoglycopeptides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Dalbavancin	-	-			-	-		
Oritavancin	-	-			-	-		
Teicoplanin	-	-			-	-		
Telavancin	-	-			-	-		
Vancomycin	-	-			-	-		

Macrolides[1], lincosamides and streptogramins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin	Note[1]	Note[1]			Note[A]	Note[A]		**1/A.** Clinical evidence for the efficacy of macrolides in *H. influenzae* respiratory infections is conflicting due to high spontaneous cure rates. Should there be a need to test any macrolide against this species, the epidemiological cut-offs (ECOFFs) should be used to detect strains with acquired resistance. The ECOFFs for each agent are: azithromycin 4 mg/L, clarithromycin 32 mg/L and erythromycin 16 mg/L. There are insufficient data available to establish an ECOFF for roxithromycin.
Clarithromycin	Note[1]	Note[1]			Note[A]	Note[A]		
Erythromycin	Note[1]	Note[1]			Note[A]	Note[A]		
Roxithromycin	Note[1]	Note[1]			Note[A]	Note[A]		
Clindamycin	-	-			-	-		
Quinupristin-dalfopristin	-	-			-	-		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	1[1]	1[1]			Note[A]	Note[A]		**1/A.** Tetracycline can be used to screen for resistance in tetracycline agents. Isolates categorised as susceptible to tetracycline can be reported susceptible to doxycycline and minocycline. Isolates categorised as resistant to tetracycline should be tested for susceptibility to individual agents or reported resistant.
Eravacycline	IE	IE			IE	IE		
Minocycline	1[1]	1[1]		30	24[A]	24[A]		
Tetracycline	2[1]	2[1]		30	25[A]	25[A]		
Tigecycline	IE	IE			IE	IE		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	-	-			-	-		
Tedizolid	-	-			-	-		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Chloramphenicol[1]	2	2		30	28	28		**1.** For chloramphenicol treatment in meningitis, see table of dosages.
Colistin	-	-			-	-		**2.** Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.
Daptomycin	-	-			-	-		
Fosfomycin iv	IE	IE			IE	IE		
Fosfomycin oral	-	-			-	-		
Fusidic acid	-	-			-	-		
Lefamulin	IE	IE			IE	IE		
Metronidazole	-	-			-	-		
Nitrofurantoin (uncomplicated UTI only)	-	-			-	-		
Nitroxoline (uncomplicated UTI only)	-	-			-	-		
Rifampicin (for prophylaxis only)	1	1		5	18	18		
Spectinomycin	-	-			-	-		
Trimethoprim (uncomplicated UTI only)	-	-			-	-		
Trimethoprim-sulfamethoxazole[2]	0.5	1		1.25-23.75	23	20		

Examples of inhibition zones for *H. influenzae* and a beta-lactam agent where an otherwise clear inhibition zone contains an area of growth around the disk.
Read the outer edge of zones where an otherwise clear inhibition zone contains an area of growth around the disk.

Haemophilus influenzae: Flow chart based on the benzylpenicillin (PCG) screen test for beta-lactam resistance mechanisms to reduce the number of specific tests for beta-lactam agents

To take full advantage of the procedure, include the amoxicillin-clavulanic acid 2-1 µg disk, but read and interpret only on beta-lactamase positive isolates.

PCG 1 unit zone diameter ≥12 mm

Mechanism: excludes all beta-lactam resistance mechanisms

Report susceptible **(S)** to beta-lactam agents for which clinical breakpoints are available, including those with "Note". **Exception:** Oral amoxicillin, oral amoxicillin-clavulanic acid and oral cefuroxime are reported "susceptible, increased exposure**" (I).**

No further testing required.

PCG 1 unit zone diameter <12 mm

Mechanism: beta-lactamase and/or PBP3 mutations

Further testing: test for beta-lactamase.

For meropenem in meningitis, determine the MIC and interpret according to the clinical breakpoints.

Beta-lactamase positive

Mechanisms: beta-lactamase with or without PBP3 mutations

Report resistant **(R)** to ampicillin, amoxicillin and piperacillin (without beta-lactamase inhibitor)**.**

For other beta-lactam agents, read the amoxicillin-clavulanic acid 2-1 µg disk and interpret as below.

Beta-lactamase negative

Mechanism: PBP3 mutations

Perform susceptibility testing for the relevant agents and interpret according to breakpoints.

For cefepime, cefpodoxime and imipenem, if PCG 1 unit <12 mm and susceptible by agent disk diffusion test, determine the MIC of the agent and interpret according to the clinical breakpoints.

Amoxicillin-clavulanic acid 2-1 µg ≥15 mm

Mechanism: beta-lactamase only

Report susceptible **(S)** to agents (other than ampicillin, amoxicillin and piperacillin) for which clinical breakpoints are available, including those with "Note". **Exception:** Oral amoxicillin-clavulanic acid and oral cefuroxime are reported "susceptible, increased exposure**" (I).**

Amoxicillin-clavulanic acid 2-1 µg <15 mm

Mechanisms: beta-lactamase **and** PBP3 mutations

Perform susceptibility testing for the relevant agents and interpret according to breakpoints.

For cefepime, cefpodoxime and imipenem, if PCG 1 unit <12 mm and susceptible by agent disk diffusion test, determine the MIC of the agent and interpret according to the clinical breakpoints.

Moraxella catarrhalis

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | **Guidance documents** | **For abbreviations and explanations of breakpoints, see the Notes sheet**

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth + 5% lysed horse blood and 20 mg/L β-NAD (MH-F broth)
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Haemophilus influenzae* ATCC 49766. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor combinations, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F)
Inoculum: McFarland 0.5
Incubation: 5% CO_2, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Haemophilus influenzae* ATCC 49766. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor-combination disks, see EUCAST QC Tables.

Penicillins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)		
	S ≤	R >	ATU		S ≥	R <	ATU
Benzylpenicillin	-	-			-	-	
Ampicillin	-[1]	-[1]			-	-	
Ampicillin-sulbactam	1[2,3]	1[2,3]			Note[A]	Note[A]	
Amoxicillin	-[1]	-[1]			-	-	
Amoxicillin-clavulanic acid	1[4]	1[4]		2-1	19	19	
Piperacillin	-[1]	-[1]			-	-	
Piperacillin-tazobactam	Note[3]	Note[3]			Note[A]	Note[A]	
Ticarcillin-clavulanic acid	IE	IE			IE	IE	
Temocillin	IE	IE			IE	IE	
Phenoxymethylpenicillin	-	-			-	-	
Oxacillin	-	-			-	-	
Cloxacillin	-	-			-	-	
Dicloxacillin	-	-			-	-	
Flucloxacillin	-	-			-	-	
Mecillinam oral (pivmecillinam) (uncomplicated UTI only)	-	-			-	-	

Notes
Numbered notes relate to general comments and/or MIC breakpoints.
Lettered notes relate to the disk diffusion method.

1. Most *M. catarrhalis* produce beta-lactamase, although beta-lactamase production is slow and may give weak results with *in vitro* tests. Beta-lactamase producers should be reported resistant to penicillins and aminopenicillins without inhibitors.
2. For susceptibility testing purposes, the concentration of sulbactam is fixed at 4 mg/L.
3/A. Susceptibility can be inferred from amoxicillin-clavulanic acid.
4. For susceptibility testing purposes, the concentration of clavulanic acid is fixed at 2 mg/L.

Cephalosporins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefaclor	-	-			-	-		**1/A.** The addition of a beta-lactamase inhibitor does not add clinical benefit. The beta-lactamases produced by the organism either do not modify the parent cephalosporin or are not affected by the inhibitor.
Cefadroxil	-	-			-	-		
Cefalexin	-	-			-	-		
Cefazolin	-	-			-	-		
Cefepime	4	4		30	20	20		
Cefepime-enmetazobactam[1]	Note[1]	Note[1]			Note[A]	Note[A]		
Cefiderocol	IE	IE			IE	IE		
Cefixime	0.5	0.5		5	21	21		
Cefotaxime	1	2		5	20	17		
Cefoxitin	IE	IE			IE	IE		
Cefpodoxime	IP	IP		10	IP	IP		
Ceftaroline	IE	IE			IE	IE		
Ceftazidime	-	-			-	-		
Ceftazidime-avibactam	-	-			-	-		
Ceftibuten	IE	IE			IE	IE		
Ceftobiprole	IE	IE			IE	IE		
Ceftolozane-tazobactam	IE	IE			IE	IE		
Ceftriaxone	1	2		30	24	21		
Cefuroxime iv	4	8		30	21	18		
Cefuroxime oral	0.001	4		30	50	21		

Carbapenems	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doripenem[1]	1	1		10	30	30		**1.** Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory.
Ertapenem[1]	0.5	0.5		10	29	29		**2/A.** The addition of a beta-lactamase inhibitor does not add clinical benefit. The beta-lactamases produced by the organism either do not modify the parent carbapenem or are not affected by the inhibitor.
Imipenem[1]	2	2		10	29	29		
Imipenem-relebactam[2]	Note[2]	Note[2]			Note[A]	Note[A]		
Meropenem[1]	2	2		10	33	33		
Meropenem-vaborbactam[2]	Note[2]	Note[2]			Note[A]	Note[A]		

Monobactams	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Aztreonam	IE	IE			IE	IE		
Aztreonam-avibactam	IE	IE			IE	IE		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.125	0.125		5	31[A]	31[A]		**A.** The nalidixic acid disk diffusion test can be used to screen for fluoroquinolone resistance. **See Note B.** **B.** Isolates categorised as screen negative can be reported susceptible to ciprofloxacin, levofloxacin, moxifloxacin and ofloxacin. Isolates categorised as screen positive should be tested for susceptibility to individual agents or reported resistant.
Delafloxacin	IE	IE			IE	IE		
Levofloxacin	0.125	0.125		5	29[A]	29[A]		
Moxifloxacin	0.25	0.25		5	26[A]	26[A]		
Nalidixic acid (screen only)	NA	NA		30	23[B]	23[B]		
Norfloxacin (uncomplicated UTI only)	-	-			-	-		
Ofloxacin	0.25	0.25		5	28[A]	28[A]		

Aminoglycosides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Amikacin	IE	IE			IE	IE		
Gentamicin	IE	IE			IE	IE		
Netilmicin	IE	IE			IE	IE		
Tobramycin	IE	IE			IE	IE		

Glycopeptides and lipoglycopeptides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Dalbavancin	-	-			-	-		
Oritavancin	-	-			-	-		
Teicoplanin	-	-			-	-		
Telavancin	-	-			-	-		
Vancomycin	-	-			-	-		

Macrolides, lincosamides and streptogramins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin	0.25[1]	0.25[1]			Note[A]	Note[A]		**1/A.** Erythromycin can be used to screen for macrolide resistance in *Moraxella catarrhalis*. Isolates categorised as susceptible can be reported susceptible to azithromycin, clarithromycin and roxithromycin. Isolates categorised as resistant should be tested for susceptibility to individual agents or reported resistant.
Clarithromycin	0.25[1]	0.25[1]			Note[A]	Note[A]		
Erythromycin	0.25	0.25		15	23[A]	23[A]		
Roxithromycin	0.5[1]	0.5[1]			Note[A]	Note[A]		
Clindamycin	-	-			-	-		
Quinupristin-dalfopristin	-	-			-	-		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	1[1]	1[1]			Note[A]	Note[A]		**1/A.** Tetracycline can be used to screen for resistance in tetracycline agents. Isolates categorised as susceptible to tetracycline can be reported susceptible to doxycycline and minocycline. Isolates categorised as resistant to tetracycline should be tested for susceptibility to individual agents or reported resistant.
Eravacycline	IE	IE			IE	IE		
Minocycline	1[1]	1[1]		30	25[A]	25[A]		
Tetracycline	2[1]	2[1]		30	26[A]	26[A]		
Tigecycline	IE	IE			IE	IE		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	-	-			-	-		
Tedizolid	-	-			-	-		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Chloramphenicol	Note[1]	Note[1]			Note[A]	Note[A]		**1/A.** For topical use of chloramphenicol, see table of topical agents.
Colistin	-	-			-	-		**2.** Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.
Daptomycin	-	-			-	-		
Fosfomycin iv	IE	IE			IE	IE		
Fosfomycin oral	-	-			-	-		
Fusidic acid	-	-			-	-		
Lefamulin	IE	IE			IE	IE		
Metronidazole	-	-			-	-		
Nitrofurantoin (uncomplicated UTI only)	-	-			-	-		
Nitroxoline (uncomplicated UTI only)	-	-			-	-		
Rifampicin	-	-			-	-		
Spectinomycin	-	-			-	-		
Trimethoprim (uncomplicated UTI only)	-	-			-	-		
Trimethoprim-sulfamethoxazole[2]	0.5	1		1.25-23.75	18	15		

Neisseria gonorrhoeae

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

For comments on dosages related to breakpoints, see the table of dosages.

Disk diffusion criteria for antimicrobial susceptibility testing of *Neisseria gonorrhoeae* have not yet been defined and an MIC method should be used. If a commercial MIC method is used, follow the manufacturer´s instructions. Laboratories with few isolates are encouraged to refer these to a reference laboratory for testing.

Penicillins[1]	MIC breakpoints (mg/L)		
	S ≤	R >	ATU
Benzylpenicillin (surrogate agent)[1]	0.06[1]	1	
Ampicillin[1]	Note[1]	Note[1]	
Ampicillin-sulbactam	IE	IE	
Amoxicillin[1]	Note[1]	Note[1]	
Amoxicillin-clavulanic acid	IE	IE	
Piperacillin	-	-	
Piperacillin-tazobactam	-	-	
Ticarcillin-clavulanic acid	-	-	
Temocillin	IE	IE	
Phenoxymethylpenicillin	-	-	
Oxacillin	-	-	
Cloxacillin	-	-	
Dicloxacillin	-	-	
Flucloxacillin	-	-	
Mecillinam oral (pivmecillinam) (uncomplicated UTI only)	-	-	

Notes

Numbered notes relate to general comments and/or MIC breakpoints.

1. Always test for beta-lactamase (tests based on a chromogenic cephalosporin can be used). If beta-lactamase positive, report resistant to ampicillin and amoxicillin. If beta-lactamase negative, determine the MIC of benzylpenicillin. Infer the susceptibility to ampicillin and amoxicillin from the benzylpenicillin MIC (do not report benzylpenicillin susceptibility).

Cephalosporins	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Cefaclor	-	-		
Cefadroxil	-	-		
Cefalexin	-	-		
Cefazolin	-	-		
Cefepime	-	-		
Cefepime-enmetazobactam	-	-		
Cefiderocol	IE	IE		
Cefixime	0.125	0.125		
Cefotaxime	0.125	0.125		
Cefoxitin	IE	IE		
Cefpodoxime	-	-		
Ceftaroline	-	-		
Ceftazidime	-	-		
Ceftazidime-avibactam	-	-		
Ceftibuten	-	-		
Ceftobiprole	-	-		
Ceftolozane-tazobactam	-	-		
Ceftriaxone	0.125	0.125		
Cefuroxime iv	-	-		
Cefuroxime oral	-	-		

Carbapenems	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Doripenem	IE	IE		
Ertapenem	IE	IE		
Imipenem	IE	IE		
Imipenem-relebactam	IE	IE		
Meropenem	IE	IE		
Meropenem-vaborbactam	IE	IE		

Monobactams	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Aztreonam	IE	IE		
Aztreonam-avibactam	IE	IE		

Fluoroquinolones	MIC breakpoints (mg/L)			Notes Numbered notes relate to general comments and/or MIC breakpoints.
	S ≤	R >	ATU	
Ciprofloxacin	0.03	0.06		
Delafloxacin	IE	IE		
Levofloxacin	IE	IE		
Moxifloxacin	IE	IE		
Nalidixic acid (screen only)	NA	NA		
Norfloxacin (uncomplicated UTI only)	-	-		
Ofloxacin	0.125	0.25		

Aminoglycosides	MIC breakpoints (mg/L)			Notes Numbered notes relate to general comments and/or MIC breakpoints.
	S ≤	R >	ATU	
Amikacin	-	-		
Gentamicin	-	-		
Netilmicin	-	-		
Tobramycin	-	-		

Glycopeptides and lipoglycopeptides	MIC breakpoints (mg/L)			Notes Numbered notes relate to general comments and/or MIC breakpoints.
	S ≤	R >	ATU	
Dalbavancin	-	-		
Oritavancin	-	-		
Teicoplanin	-	-		
Telavancin	-	-		
Vancomycin	-	-		

Macrolides, lincosamides and streptogramins	MIC breakpoints (mg/L)			Notes Numbered notes relate to general comments and/or MIC breakpoints.
	S ≤	R >	ATU	
Azithromycin	Note[1]	Note[1]		**1.** Azithromycin is always used in conjunction with another effective agent. For testing purposes with the aim of detecting acquired resistance mechanisms, the ECOFF is 1 mg/L.
Clarithromycin	-	-		
Erythromycin	-	-		
Roxithromycin	-	-		
Clindamycin	-	-		
Quinupristin-dalfopristin	-	-		

Tetracyclines	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Doxycycline	IE	IE		
Eravacycline	IE	IE		
Minocycline	IE	IE		
Tetracycline	0.5	0.5		
Tigecycline	IE	IE		

Oxazolidinones	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Linezolid	-	-		
Tedizolid	-	-		

Miscellaneous agents	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Chloramphenicol	-	-		
Colistin	-	-		
Daptomycin	-	-		
Fosfomycin iv	-	-		
Fosfomycin oral	-	-		
Fusidic acid	-	-		
Lefamulin	IE	IE		
Metronidazole	-	-		
Nitrofurantoin (uncomplicated UTI only)	-	-		
Nitroxoline (uncomplicated UTI only)	-	-		
Rifampicin	-	-		
Spectinomycin	64	64		
Trimethoprim (uncomplicated UTI only)	-	-		
Trimethoprim-sulfamethoxazole	-	-		

Neisseria meningitidis

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

Disk diffusion criteria for antimicrobial susceptibility testing of *Neisseria meningitidis* have not yet been defined and an MIC method should be used. If a commercial MIC method is used, follow the manufacturer´s instructions.

Penicillins[1]	MIC breakpoints (mg/L)		
	S ≤	R >	ATU
Benzylpenicillin (all indications)	0.25	0.25	
Ampicillin (indications other than meningitis)	0.125	1	
Ampicillin (meningitis)	IE	IE	
Ampicillin-sulbactam	IE	IE	
Amoxicillin (indications other than meningitis)	0.125	1	
Amoxicillin (meningitis)	IE	IE	
Amoxicillin-clavulanic acid	-	-	
Piperacillin	-	-	
Piperacillin-tazobactam	-	-	
Ticarcillin-clavulanic acid	-	-	
Temocillin	-	-	
Phenoxymethylpenicillin	-	-	
Oxacillin	-	-	
Cloxacillin	-	-	
Dicloxacillin	-	-	
Flucloxacillin	-	-	
Mecillinam oral (pivmecillinam) (uncomplicated UTI only)	-	-	

Notes

Numbered notes relate to general comments and/or MIC breakpoints.

1. All breakpoints pertain to iv administration.

Cephalosporins	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Cefaclor	-	-		**1.** Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory.
Cefadroxil	-	-		
Cefalexin	-	-		
Cefazolin	-	-		
Cefepime	-	-		
Cefepime-enmetazobactam	-	-		
Cefiderocol	IE	IE		
Cefixime	-	-		
Cefotaxime (all indications)[1]	0.125	0.125		
Cefoxitin	-	-		
Cefpodoxime	-	-		
Ceftaroline	-	-		
Ceftazidime	-	-		
Ceftazidime-avibactam	-	-		
Ceftibuten	-	-		
Ceftobiprole	-	-		
Ceftolozane-tazobactam	-	-		
Ceftriaxone (all indications including prophylaxis)[1]	0.125	0.125		
Cefuroxime iv	-	-		
Cefuroxime oral	-	-		

Carbapenems[1,2]	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Doripenem	Note[2]	Note[2]		**1.** Resistant isolates are rare or not yet reported. The identification and antimicrobial susceptibility test result on any such isolate must be confirmed and the isolate sent to a reference laboratory.
Ertapenem	IE	IE		**2.** Breakpoints for serious *N. meningitidis* systemic infections (meningitis with or without septicemia) have been determined for meropenem only.
Imipenem	Note[2]	Note[2]		**3.** The addition of a beta-lactamase inhibitor does not add clinical benefit.
Imipenem-relebactam[3]	Note[2,3]	Note[2,3]		
Meropenem (all indications)[1,2]	0.25	0.25		
Meropenem-vaborbactam[3]	Note[2,3]	Note[2,3]		

Monobactams	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Aztreonam	IE	IE		
Aztreonam-avibactam	IE	IE		

Fluoroquinolones	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Ciprofloxacin (all indications, including meningitis and prophylaxis)	0.016	0.016		
Delafloxacin	IE	IE		
Levofloxacin	IE	IE		
Moxifloxacin	IE	IE		
Nalidixic acid (screen only)	NA	NA		
Norfloxacin (uncomplicated UTI only)	-	-		
Ofloxacin	IE	IE		

Aminoglycosides	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Amikacin	-	-		
Gentamicin	-	-		
Netilmicin	-	-		
Tobramycin	-	-		

Glycopeptides and lipoglycopeptides	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Dalbavancin	-	-		
Oritavancin	-	-		
Teicoplanin	-	-		
Telavancin	-	-		
Vancomycin	-	-		

Macrolides, lincosamides and streptogramins	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Azithromycin	-	-		
Clarithromycin	-	-		
Erythromycin	-	-		
Roxithromycin	-	-		
Clindamycin	-	-		
Quinupristin-dalfopristin	-	-		

Tetracyclines	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Doxycycline	-	-		**1.** Tetracycline can be used to predict susceptibility to minocycline for prophylaxis against *N. meningitidis* infections.
Eravacycline	IE	IE		
Minocycline (prophylaxis only)	1[1]	1[1]		
Tetracycline (screen only)	2[1]	2[1]		
Tigecycline	IE	IE		

Oxazolidinones	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Linezolid	-	-		
Tedizolid	-	-		

Miscellaneous agents	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Chloramphenicol (meningitis)[1]	2	2		**1.** For chloramphenicol treatment in meningitis, see table of dosages.
Colistin	-	-		
Daptomycin	-	-		
Fosfomycin iv	-	-		
Fosfomycin oral	-	-		
Fusidic acid	-	-		
Lefamulin	-	-		
Metronidazole	-	-		
Nitrofurantoin (uncomplicated UTI only)	-	-		
Nitroxoline (uncomplicated UTI only)	-	-		
Rifampicin (prophylaxis only)	0.25	0.25		
Spectinomycin	-	-		
Trimethoprim (uncomplicated UTI only)	-	-		
Trimethoprim-sulfamethoxazole	-	-		

MIC determination (agar dilution)
Medium: Fastidious Anaerobe Agar + 5% defibrinated horse blood (FAA-HB)
Inoculum: 10^5 CFU/spot
Incubation: Anaerobic environment, 35-37ºC, 42-48h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent where a noticeable difference is seen in visible growth between the test and control plate.
Quality control: *Bacteroides fragilis* ATCC 25285 and *Clostridium perfringens* ATCC 13124.
For control of the inhibitor component of beta-lactam inhibitor combinations, see EUCAST QC Tables.
See disk diffusion methodology for how to monitor the anaerobic atmosphere with *Clostridium perfringens* DSM 25589.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Fastidious Anaerobe Agar + 5% defibrinated horse blood (FAA-HB). The plates should be dried prior to inoculation (at 20-25°C overnight or at 35°C, with the lid removed, for 15 min).
Inoculum: McFarland 1.0
Incubation: Anaerobic environment, 35-37ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See pictures below and the EUCAST Reading Guide for disk diffusion of anaerobic bacteria for further information.
Quality control: *Bacteroides fragilis* ATCC 25285 and *Clostridium perfringens* ATCC 13124. For control of the inhibitor component of beta-lactam inhibitor combination disks, see EUCAST QC Tables.
Clostridium perfringens DSM 25589 with a metronidazole 5 µg disk to monitor the anaerobic atmosphere.

Bacteroides spp.

Breakpoints for *Bacteroides* spp. are also valid for *Parabacteroides* spp. and for *Phocaeicola dorei/vulgatus* (previously named *Bacteroides dorei/vulgatus*).

Antimicrobial agent	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ampicillin-sulbactam	2[1]	2[1]		10-10	25	25		**1.** For susceptibility testing purposes, the concentration of sulbactam is fixed at 4 mg/L.
Amoxicillin-clavulanic acid	2[2]	2[2]		2-1	14	14		**2.** For susceptibility testing purposes, the concentration of clavulanic acid is fixed at 2 mg/L.
Piperacillin-tazobactam[3]	2[4]	2[4]		30-6	24	24		**3.** Isolates susceptible to ampicillin-sulbactam and amoxicillin-clavulanic acid may be resistant to piperacillin-tazobactam.
Ertapenem	(2)[5]	(2)[5]		10	(23)[A]	(23)[A]		**4.** For susceptibility testing purposes, the concentration of tazobactam is fixed at 4 mg/L.
Imipenem	1	1		10	29	29		**5/A.** For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.
Meropenem	1	1		10	28	28		**B.** Examine zones carefully for colonies within zones. Colonies should be taken into account when reading.
Clindamycin	(4)[5]	(4)[5]		2	(10)[A,B]	(10)[A,B]		
Metronidazole	4	4		5	25	25		

Prevotella spp.

Antimicrobial agent	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin	0.5[1]	0.5[1]		1 unit	20[A]	20[A]		**1/A.** Isolates susceptible to benzylpenicillin can be reported susceptible to all beta-lactam agents with breakpoints (including those with Note) without further testing. Isolates resistant to benzylpenicillin should be tested for susceptibility to individual agents.
Ampicillin	0.5[1]	0.5[1]		2	25[A]	25[A]		
Ampicillin-sulbactam	Note[1,2]	Note[1,2]		10-10	33[A]	33[A]		**2.** At very low concentrations of ampicillin, amoxicillin and piperacillin when in inhibitor combinations, the *in vitro* antimicrobial activity of the fixed concentration of inhibitor (2 mg/L for clavulanic acid and 4 mg/L for sulbactam and tazobactam) is such that artefactually low MIC values may be obtained. Therefore no breakpoints can be given. This does not affect disk diffusion where the concentration of the inhibitor decreases proportionally with the concentration of the agent.
Amoxicillin	0.25[1]	0.25[1]			Note[A,B]	Note[A,B]		
Amoxicillin-clavulanic acid	Note[1,2]	Note[1,2]		2-1	24[A]	24[A]		
Piperacillin-tazobactam	Note[1,2]	Note[1,2]		30-6	26[A]	26[A]		
Ertapenem	0.5[1]	0.5[1]		10	29[A]	29[A]		**B.** Susceptibility can be inferred from ampicillin.
Imipenem	0.125[1]	0.125[1]		10	35[A]	35[A]		**C.** Examine zones carefully for colonies within zones. Colonies should be taken into account when reading.
Meropenem	0.25[1]	0.25[1]		10	34[A]	34[A]		
Clindamycin	0.25	0.25		2	31[C]	31[C]		
Metronidazole	4	4		5	22	22		

Fusobacterium necrophorum

Antimicrobial agent	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin	0.125[1]	0.125[1]		1 unit	25[A]	25[A]		**1/A.** Isolates susceptible to benzylpenicillin can be reported susceptible to all beta-lactam agents with breakpoints (including those with Note) without further testing. Isolates resistant to benzylpenicillin should be tested for susceptibility to individual agents.
Ampicillin	0.5[1]	0.5[1]		2	27[A]	27[A]		**2.** For susceptibility testing purposes, the concentration of sulbactam is fixed at 4 mg/L.
Ampicillin-sulbactam	0.5[1,2]	0.5[1,2]		10-10	33[A]	33[A]		**3.** For susceptibility testing purposes, the concentration of clavulanic acid is fixed at 2 mg/L.
Amoxicillin	0.5[1]	0.5[1]			Note[A,B]	Note[A,B]		**4.** For susceptibility testing purposes, the concentration of tazobactam is fixed at 4 mg/L.
Amoxicillin-clavulanic acid	0.5[1,3]	0.5[1,3]		2-1	23[A]	23[A]		
Piperacillin-tazobactam	0.5[1,4]	0.5[1,4]		30-6	32[A]	32[A]		**B.** Susceptibility can be inferred from ampicillin.
Ertapenem	0.06[1]	0.06[1]		10	35[A]	35[A]		**C.** Examine zones carefully for colonies within zones. Colonies should be taken into account when reading.
Imipenem	0.125[1]	0.125[1]		10	36[A]	36[A]		
Meropenem	0.03[1]	0.03[1]		10	35[A]	35[A]		
Clindamycin	0.25	0.25		2	30[C]	30[C]		
Metronidazole	0.5	0.5		5	30	30		

Clostridium perfringens

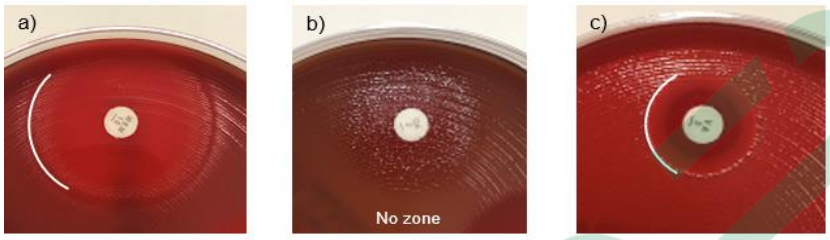
Antimicrobial agent	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin	0.5[1]	0.5[1]		1 unit	15[A]	15[A]		**1/A.** Isolates susceptible to benzylpenicillin can be reported susceptible to all beta-lactam agents with breakpoints (including those with Note) without further testing. Isolates resistant to benzylpenicillin should be tested for susceptibility to individual agents.
Ampicillin	0.25[1]	0.25[1]		2	23[A]	23[A]		**2.** For susceptibility testing purposes, the concentration of sulbactam is fixed at 4 mg/L.
Ampicillin-sulbactam	0.25[1,2]	0.25[1,2]		10-10	27[A]	27[A]		**3.** For susceptibility testing purposes, the concentration of clavulanic acid is fixed at 2 mg/L.
Amoxicillin	0.25[1]	0.25[1]			Note[A,B]	Note[A,B]		**4.** For susceptibility testing purposes, the concentration of tazobactam is fixed at 4 mg/L.
Amoxicillin-clavulanic acid	0.25[1,3]	0.25[1,3]		2-1	23[A]	23[A]		
Piperacillin-tazobactam	0.5[1,4]	0.5[1,4]		30-6	24[A]	24[A]		**B.** Susceptibility can be inferred from ampicillin.
Ertapenem	0.5[1]	0.5[1]		10	24[A]	24[A]		**C.** Examine zones carefully for colonies within zones. Colonies should be taken into account when reading.
Imipenem	0.5[1]	0.5[1]		10	25[A]	25[A]		
Meropenem	0.125[1]	0.125[1]		10	25[A]	25[A]		
Vancomycin	2	2		5	12	12		
Clindamycin	0.25	0.25		2	19[C]	19[C]		
Metronidazole	4	4		5	16	16		

Cutibacterium acnes

Antimicrobial agent	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin	0.06[1]	0.06[1]		1 unit	24[A]	24[A]		**1/A.** Isolates susceptible to benzylpenicillin can be reported susceptible to all beta-lactam agents with breakpoints (including those with Note) without further testing. Isolates resistant to benzylpenicillin should be tested for susceptibility to individual agents.
Ampicillin	0.25[1]	0.25[1]		2	23[A]	23[A]		**2.** At very low concentrations of ampicillin, amoxicillin and piperacillin when in inhibitor combinations, the *in vitro* antimicrobial activity of the fixed concentration of inhibitor (2 mg/L for clavulanic acid and 4 mg/L for sulbactam and tazobactam) is such that artefactually low MIC values may be obtained. Therefore no breakpoints can be given. This does not affect disk diffusion where the concentration of the inhibitor decreases proportionally with the concentration of the agent.
Ampicillin-sulbactam	Note[1,2]	Note[1,2]		10-10	33[A]	33[A]		
Amoxicillin	0.25[1]	0.25[1]			Note[A,B]	Note[A,B]		**B.** Susceptibility can be inferred from ampicillin.
Amoxicillin-clavulanic acid	Note[1,2]	Note[1,2]		2-1	24[A]	24[A]		**C.** Susceptibility to ceftriaxone can be inferred from the cefotaxime disk diffusion test.
Piperacillin-tazobactam	Note[1,2]	Note[1,2]		30-6	27[A]	27[A]		**D.** Examine zones carefully for colonies within zones. Colonies should be taken into account when reading.
Cefotaxime	NA	NA		5	26[A,C]	26[A,C]		
Ceftriaxone	0.06[1]	0.06[1]		30	33[A,C]	33[A,C]		
Ertapenem	0.25[1]	0.25[1]		10	28[A]	28[A]		
Imipenem	0.03[1]	0.03[1]		10	39[A]	39[A]		
Meropenem	0.125[1]	0.125[1]		10	28[A]	28[A]		
Vancomycin	2	2		5	22	22		
Clindamycin	0.25	0.25		2	26[D]	26[D]		
Linezolid	2	2		10	34	34		

Clostridioides difficile

Antimicrobial agent	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Vancomycin	2[1]	2[1]			IP	IP		**1.** The breakpoints are based on epidemiological cut-off values (ECOFFs) and apply to oral treatment of *C. difficile* infections. There are no conclusive clinical data regarding the relation between MICs and outcomes.
Fidaxomicin	0.5[1]	0.5[1]			IP	IP		
Metronidazole	2[1]	2[1]			IP	IP		



Examples of inhibition zones for anaerobic bacteria.
a) If haze within the zone occurs, read the most obvious zone edge. Tilt the plate towards you to better define the obvious zone edge.
b) Isolated colonies within the inhibition zone should be taken into account. For clindamycin, it is particularly important to examine zones carefully for colonies growing within the zone.
c) Ignore haemolysis when reading zones.

Helicobacter pylori

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

Disk diffusion criteria for antimicrobial susceptibility testing of *Helicobacter pylori* have not yet been defined and an MIC method should be used. If a commercial MIC method is used, follow the manufacturer´s instructions.

Penicillins	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Amoxicillin oral	0.125	0.125		

Fluoroquinolones	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Levofloxacin	1	1		

Macrolides	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Clarithromycin	0.25	0.25		

Tetracyclines	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Tetracycline	1	1		

Miscellaneous agents	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Metronidazole	8	8		
Rifampicin	1	1		

Listeria monocytogenes

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth + 5% lysed horse blood and 20 mg/L β-NAD (MH-F broth)
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F)
Inoculum: McFarland 0.5
Incubation: 5% CO_2, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619.

Penicillins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin (indications other than meningitis)	1	1		1 unit	13	13		
Benzylpenicillin (meningitis)	IE	IE			IE	IE		
Ampicillin iv (all indications)	1	1		2	16	16		

Carbapenems	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Meropenem (all indications)	0.25	0.25		10	26	26		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Moxifloxacin (meningitis)	IE	IE			IE	IE		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid (meningitis)	IE	IE			IE	IE		

Macrolides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
	S ≤	R >	ATU		S ≥	R <	ATU	
Erythromycin (indications other than meningitis)	1	1		15	25	25		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
	S ≤	R >	ATU		S ≥	R <	ATU	
Trimethoprim-sulfamethoxazole (all indications)[1]	0.06	0.06		1.25-23.75	29	29		**1.** Trimethoprim-sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.

Pasteurella spp.

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth + 5% lysed horse blood and 20 mg/L β-NAD (MH-F broth)
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Haemophilus influenzae* ATCC 49766. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor combinations, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F)
Inoculum: McFarland 0.5
Incubation: 5% CO_2, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Haemophilus influenzae* ATCC 49766. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor-combination disks, see EUCAST QC Tables.

EUCAST breakpoints are based mainly on data for *Pasteurella multocida*, although some data were included for other species (*P. canis*, *P. dagmatis* and *P. aerogenes*).

Penicillins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin	0.5	0.5		1 unit	17	17		**1.** For susceptibility testing purposes, the concentration of clavulanic acid is fixed at 2 mg/L.
Ampicillin	1	1			Note[A]	Note[A]		**A.** Infer susceptibility from benzylpenicillin susceptibility.
Amoxicillin	1	1			Note[A]	Note[A]		
Amoxicillin-clavulanic acid	1[1]	1[1]		2-1	15	15		

Cephalosporins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefotaxime	0.03	0.03		5	26	26		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.06	0.06		5	27[A]	27[A]		**A.** The nalidixic acid disk diffusion test can be used to screen for fluoroquinolone resistance. **See Note B.**
Levofloxacin	0.06	0.06		5	27[A]	27[A]		**B.** Isolates categorised as screen negative can be reported susceptible to ciprofloxacin and levofloxacin. Isolates categorised as screen positive should be tested for susceptibility to individual agents or reported resistant.
Nalidixic acid (screen only)	NA	NA		30	23[B]	23[B]		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	1	1			Note[A]	Note[A]		**A.** Susceptibility to doxycycline can be inferred from the tetracycline disk diffusion screening test.
Tetracycline (screen only)	NA	NA		30	24[A]	24[A]		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Trimethoprim-sulfamethoxazole[1]	0.25	0.25		1.25-23.75	23	23		**1.** Trimethoprim-sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth + 5% lysed horse blood and 20 mg/L β-NAD (MH-F broth)
Inoculum: $5x10^5$ CFU/mL
Incubation: Microaerobic environment, 41±1ºC, 24±1h. Isolates with insufficient growth after 24h incubation are reincubated immediately and MICs read after a total of 40-48h incubation.
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Staphylococcus aureus* ATCC 29213 (standard conditions for staphylococci)

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F). The MH-F plates should be dried prior to inoculation to reduce swarming (at 20-25°C overnight or at 35°C, with the lid removed, for 15 min).
Inoculum: McFarland 0.5
Incubation: Microaerobic environment, 41±1ºC, 24±1h. Isolates with insufficient growth after 24h incubation are reincubated immediately and inhibition zones read after a total of 40-48h incubation.
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Campylobacter jejuni* ATCC 33560

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.001	0.5		5	50	26		

Macrolides	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin	Note[1]	Note[1]			Note[A]	Note[A]		1/A. Susceptibility to azithromycin and clarithromycin can be inferred from erythromycin.
Clarithromycin	Note[1]	Note[1]			Note[A]	Note[A]		
Erythromycin, *C. jejuni*	4[1]	4[1]		15	20[A]	20[A]		
Erythromycin, *C. coli*	8[1]	8[1]		15	24[A]	24[A]		

Tetracyclines	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	Note[1]	Note[1]			Note[A]	Note[A]		1/A. Susceptibility to doxycycline can be inferred from tetracycline.
Tetracycline	2[1]	2[1]		30	30[A]	30[A]		

Corynebacterium spp.

other than *C. diphtheriae* and *C. ulcerans*

Expert Rules and Expected Phenotypes | **Guidance documents** | **For abbreviations and explanations of breakpoints, see the Notes sheet**

Breakpoints for *C. diphtheriae* and *C. ulcerans* are listed in a separate table.

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth + 5% lysed horse blood and 20 mg/L β-NAD (MH-F broth)
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h (for glycopeptides 24h). Isolates with insufficient growth after 16-20h incubation are reincubated immediately and MICs read after a total of 40-44h incubation.
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F)
Inoculum: McFarland 0.5
Incubation: 5% CO_2, 35±1ºC, 18±2h. Isolates with insufficient growth after 16-20h incubation are reincubated immediately and inhibition zones read after a total of 40-44h incubation.
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.

Penicillins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin	0.001	1		1 unit	50	12		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.001	1		5	50	25		
Moxifloxacin	0.5	0.5		5	25	25		

Aminoglycosides	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Gentamicin	IE	IE			IE	IE		

Glycopeptides	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Vancomycin	2	2		5	17[A]	17[A]		**A.** Non-wild type isolates were not available when developing the disk diffusion method.

Corynebacterium spp.

other than *C. diphtheriae* and *C. ulcerans*

Expert Rules and Expected Phenotypes

Guidance documents

For abbreviations and explanations of breakpoints, see the Notes sheet

Macrolides and lincosamides	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Clindamycin[1]	0.5	0.5		2	20	20		**1.** Inducible clindamycin resistance may occur in *Corynebacterium* spp. This can be detected by antagonism of clindamycin activity by a macrolide agent. The clinical significance is unknown. There is currently no recommendation for testing.

Tetracyclines	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Tetracycline	2	2		30	24	24		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	2	2		10	25	25		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Rifampicin	0.06	0.06		5	30	30		

Corynebacterium diphtheriae and *C. ulcerans*

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth + 5% lysed horse blood and 20 mg/L β-NAD (MH-F broth)
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h. Isolates with insufficient growth after 16-20h incubation are reincubated immediately and MICs read after a total of 40-44h incubation.
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F)
Inoculum: McFarland 0.5
Incubation: 5% CO_2, 35±1ºC, 18±2h. Isolates with insufficient growth after 16-20h incubation are reincubated immediately and inhibition zones read after a total of 40-44h incubation.
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.

Penicillins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin	0.001	1		1 unit	50	12		**1/A.** Isolates "susceptible, increased exposure" (I) to benzylpenicillin can be reported susceptible to amoxicillin. Isolates resistant to benzylpenicillin should be tested for susceptibility to amoxicillin or reported resistant.
Amoxicillin	1[1]	1[1]			Note[A]	Note[A]		

Cephalosporins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefotaxime	0.001[1]	2[1]		5	50[A]	15[A]		**1/A.** Isolates "susceptible, increased exposure" (I) to benzylpenicillin can be reported "susceptible, increased exposure" (I) to cefotaxime. Isolates resistant to benzylpenicillin should be tested for susceptibility to cefotaxime or reported resistant.

Carbapenems	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Meropenem	0.25[1]	0.25[1]		10	24[A]	24[A]		**1/A.** Isolates "susceptible, increased exposure" (I) to benzylpenicillin can be reported susceptible to meropenem. Isolates resistant to benzylpenicillin should be tested for susceptibility to meropenem or reported resistant.

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.001	0.5		5	50	24		

Macrolides and lincosamides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Erythromycin	0.06	0.06		15	24	24		**1.** Wild-type *C. ulcerans* is less susceptible to clindamycin.
Clindamycin, *C. diphtheriae* [1]	0.5	0.5		2	15	15		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	0.5[1]	0.5[1]			Note[A]	Note[A]		**1/A.** Isolates susceptible to tetracycline can be reported susceptible to doxycycline. Isolates resistant to tetracycline should be tested for susceptibility to doxycycline or reported resistant.
Tetracycline	1	1		30	24	24		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	2	2		10	25	25		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Rifampicin	0.06	0.06		5	24	24		**1.** Trimethoprim-sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.
Trimethoprim-sulfamethoxazole[1]	0.5	0.5		1.25-23.75	23	23		

Aerococcus sanguinicola and *A. urinae*

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1)[1]
Medium: Cation-adjusted Mueller-Hinton broth + 5% lysed horse blood and 20 mg/L β-NAD (MH-F broth)
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h (for glycopeptides 24h). Isolates with insufficient growth after 16-20h incubation are reincubated immediately and MICs read after a total of 40-44h incubation.
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.
[1] For fluoroquinolones, agar dilution may produce clearer endpoints.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F)
Inoculum: McFarland 0.5
Incubation: 5% CO_2, 35±1ºC, 18±2h. Isolates with insufficient growth after 16-20h incubation are reincubated immediately and inhibition zones read after a total of 40-44h incubation.
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.

Penicillins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin	0.125	0.125		1 unit	21	21		**1/A.** Infer susceptibility from ampicillin susceptibility.
Ampicillin	0.25	0.25		2	26	26		
Amoxicillin	Note[1]	Note[1]			Note[A]	Note[A]		

Carbapenems	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Meropenem	0.25	0.25		10	31	31		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin (uncomplicated UTI only)	2	2		5	21[A]	21[A]		**1.** Susceptibility can be inferred from ciprofloxacin susceptibility.
Levofloxacin (uncomplicated UTI only)	2[1]	2[1]			Note[B]	Note[B]		
Norfloxacin (screen only)	NA	NA		10	17[C]	17[C]		**A.** Susceptibility can be inferred from the norfloxacin disk diffusion screening test. **See Note C.** **B.** Susceptibility can be inferred from the ciprofloxacin susceptibility or the norfloxacin disk diffusion screening test. **See Note C.** **C.** The norfloxacin disk diffusion test can be used to screen for fluoroquinolone resistance.

Glycopeptides	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Vancomycin	1	1		5	16[A]	16[A]		**A.** Non-wild type isolates were not available when developing the disk diffusion method.

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Nitrofurantoin (uncomplicated UTI only)	16	16		100	16	16		
Rifampicin	0.125	0.125		5	25	25		

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth + 5% lysed horse blood and 20 mg/L β-NAD (MH-F broth)
Inoculum: 5x10^5 CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h. Isolates with insufficient growth after 16-20h incubation are reincubated immediately and inhibition zones read after a total of 40-44h incubation.
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Haemophilus influenzae* ATCC 49766. For agents not covered by this strain, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F)
Inoculum: McFarland 0.5
Incubation: 5% CO_2, 35±1ºC, 18±2h. Isolates with insufficient growth after 16-20h incubation are reincubated immediately and inhibition zones read after a total of 40-44h incubation.
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Haemophilus influenzae* ATCC 49766. For agents not covered by this strain, see EUCAST QC Tables.

Penicillins[1]	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin	0.03	0.03		1 unit	25	25		**1.** Beta-lactamase positive isolates can be reported resistant to benzylpenicillin and to ampicillin and amoxicillin without inhibitors. Tests based on a chromogenic cephalosporin can be used to detect the beta-lactamase. Beta-lactam resistance mechanisms other than beta-lactamase production have not yet been described for *K. kingae* . **2/A.** Susceptibility can be inferred from benzylpenicillin susceptibility. **3.** The *in vitro* antimicrobial activity of the fixed concentration of 2 mg/L for clavulanic acid is such that artefactually low MIC values may be obtained. Therefore no breakpoints can be given. This does not affect disk diffusion where the concentration of the inhibitor decreases proportionally with the concentration of the agent.
Ampicillin	0.06[2]	0.06[2]			Note[A]	Note[A]		
Amoxicillin	0.125[2]	0.125[2]			Note[A]	Note[A]		
Amoxicillin-clavulanic acid	Note[3]	Note[3]		2-1	22	22		

Cephalosporins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefotaxime	0.125	0.125		5	27	27		
Ceftriaxone	0.06	0.06		30	30	30		
Cefuroxime iv	0.5	0.5		30	29	29		

Carbapenems	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Meropenem	0.03	0.03		10	30	30		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.06	0.06		5	28	28		
Levofloxacin	0.125	0.125		5	28	28		

Macrolides and lincosamides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin	0.25[1]	0.25[1]			Note[A]	Note[A]		**1.** Susceptibility can be inferred from erythromycin susceptibility.
Clarithromycin	0.5[1]	0.5[1]			Note[A]	Note[A]		**A.** Infer susceptibility from erythromycin susceptibility.
Erythromycin	0.5	0.5		15	20	20		
Clindamycin	-	-			-	-		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	0.5[1]	0.5[1]			Note[A]	Note[A]		**1/A.** Tetracycline can be used to screen for resistance in tetracycline agents. Isolates categorised as susceptible can be reported susceptible to doxycycline. Isolates categorised as resistant should be tested for susceptibility to doxycycline or reported resistant.
Tetracycline	0.5	0.5		30	28	28		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Rifampicin	0.5	0.5		5	20	20		**1.** Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.
Trimethoprim-sulfamethoxazole[1]	0.25	0.25		1.25-23.75	28	28		

Aeromonas spp.

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Pseudomonas aeruginosa* ATCC 27853. For agents not covered by this strain, see EUCAST QC Tables.

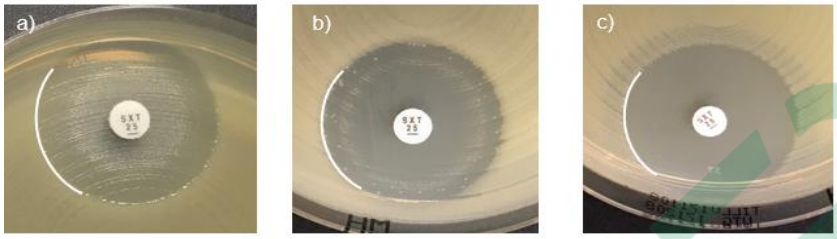
Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar
Inoculum: McFarland 0.5
Incubation: Air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the back of the plate against a dark background illuminated with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Pseudomonas aeruginosa* ATCC 27853. For agents not covered by this strain, see EUCAST QC Tables.

Cephalosporins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefepime	1	4		30	27	24		
Ceftazidime	1	4		10	24	21		

Monobactams	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Aztreonam	1	4		30	29	26		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.25	0.5		5	27	24		
Levofloxacin	0.5	1		5	27	24		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Trimethoprim-sulfamethoxazole[1]	2	4		1.25-23.75	19[A]	16[A]		**1.** Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration. **A.** Read the obvious zone edge and disregard haze or growth within the inhibition zone (**see pictures below**).



Examples of inhibition zones for *Aeromonas* spp. with trimethoprim-sulfamethoxazole.
a-c) Read the obvious zone edge and disregard haze or growth within the inhibition zone.

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth
Inoculum: 5x10^5 CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Pseudomonas aeruginosa* ATCC 27853. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor combinations, see EUCAST QC Tables.

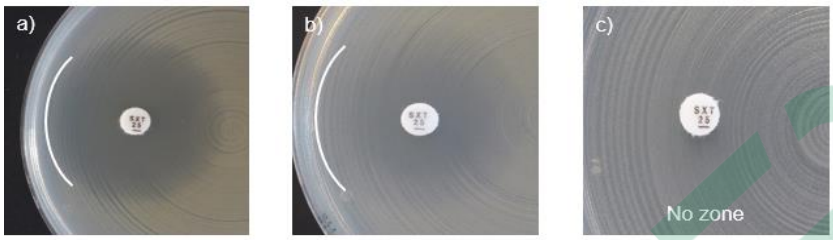
Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar
Inoculum: McFarland 0.5
Incubation: Air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the back of the plate against a dark background illuminated with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Pseudomonas aeruginosa* ATCC 27853. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor combination disks, see EUCAST QC Tables.

Penicillins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Piperacillin-tazobactam	4[1]	4[1]		30-6	26	26		**1.** For susceptibility testing purposes, the concentration of tazobactam is fixed at 4 mg/L.

Cephalosporins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefiderocol[1]	Note[2]	Note[2]		30	Note[A]	Note[A]		**1.** Broth microdilution MIC determination must be performed in iron-depleted Mueller-Hinton broth and specific reading instructions must be followed. For testing conditions and reading instructions, see https://www.eucast.org/eucastguidancedocuments/. **2/A.** The *in vitro* activity of cefiderocol against *Achromobacter xylosoxidans* is comparable to the activity of the agent against *Enterobacterales* and there is also animal data to suggest efficacy. However, there is insufficient clinical data to determine a clinical breakpoint. Isolates with MIC values ≤0.5 mg/L (zone diameter ≥26 mm) are mostly devoid of resistance mechanisms. Isolates with MICs 1-2 mg/L have acquired resistance mechanisms which may result in impaired clinical response. Isolates with MIC values >2 mg/L (zone diameter <22 mm) will likely be resistant.

Carbapenems	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Meropenem	1	4		10	26	20		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Trimethoprim-sulfamethoxazole[1]	0.125	0.125		1.25-23.75	26[A]	26[A]		**1.** Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration. **A.** There may be growth within the inhibition zone. The density of growth may vary from a fine haze to substantial growth (**see pictures below**). If any zone edge can be seen, ignore growth within the inhibition zone and read the zone diameter.



Examples of inhibition zones for *Achromobacter xylosoxidans* with trimethoprim-sulfamethoxazole.
a-b) An outer zone can be seen. Read the outer zone edge and interpret according to the breakpoints.
c) Growth up to the disk **and** no sign of inhibition zone. Report resistant.

Vibrio spp.

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Escherichia coli* ATCC 25922. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor combinations, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar
Inoculum: McFarland 0.5
Incubation: Air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the back of the plate against a dark background illuminated with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Escherichia coli* ATCC 25922. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor combination disks, see EUCAST QC Tables.

Breakpoints are valid for *V. alginolyticus, V. cholerae, V. fluvialis, V. parahaemolyticus* and *V. vulnificus*.

Penicillins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Piperacillin-tazobactam	1[1]	1[1]		30-6	26	26		**1.** For susceptibility testing purposes, the concentration of tazobactam is fixed at 4 mg/L.

Cephalosporins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Cefotaxime	0.25	0.25		5	21	21		
Cefotaxime, *V. fluvialis*	IE	IE			IE	IE		
Ceftazidime	1	1		10	22	22		

Carbapenems	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Meropenem	0.5	0.5		10	24	24		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.25	0.25		5	23[A]	23[A]		**A.** Susceptibility to ciprofloxacin and levofloxacin can be inferred from the pefloxacin disk diffusion screening test.
Levofloxacin	0.25	0.25		5	23[A]	23[A]		
Pefloxacin (screen only)	NA	NA		5	22[A]	22[A]		

Macrolides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Azithromycin	4	4		15	16[A]	16[A]		**1/A.** Susceptibility to azithromycin (and erythromycin when azithromycin is not available) is inferred from the erythromycin disk diffusion test.
Erythromycin (screen only)[1]	NA	NA		15	12[A]	12[A]		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	0.5	0.5			Note[A]	Note[A]		**1/A.** Susceptibility to doxycycline (and tetracycline when doxycycline is not available) is inferred from the tetracycline disk diffusion test.
Tetracycline (screen only)[1]	NA	NA		30	20[A]	20[A]		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Trimethoprim-sulfamethoxazole[1]	0.25	0.25		1.25-23.75	21	21		**1.** Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.

Bacillus spp.

except *B. anthracis*

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h (for glycopeptides 24h)
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Staphylococcus aureus* ATCC 29213. For agents not covered by this strain, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar
Inoculum: McFarland 0.5
Incubation: Air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the back of the plate against a dark background illuminated with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Staphylococcus aureus* ATCC 29213. For agents not covered by this strain, see EUCAST QC Tables.

This genus includes several species. The most frequent species belong to the *Bacillus cereus* complex (*B. cereus, B. thuringiensis, B. mycoides* and *B. weihenstephanensis*). The breakpoints are not valid for *B. anthracis*. Breakpoints for *B. anthracis* are listed in a separate table.

Carbapenems	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Imipenem	0.5	0.5		10	30	30		
Meropenem	0.25	0.25		10	25	25		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.001	0.5		5	50[A]	23[A]		**A.** The norfloxacin disk diffusion test can be used to screen for fluoroquinolone resistance. **See Note B.**
Levofloxacin	0.001	1		5	50[A]	23[A]		**B.** Isolates categorised as screen negative can be reported "susceptible increased exposure" (I) to ciprofloxacin and levofloxacin. Isolates categorised as screen positive can be reported resistant to ciprofloxacin and levofloxacin.
Norfloxacin (screen only)	NA	NA		10	21[B]	21[B]		

Glycopeptides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Vancomycin	2	2		5	10[A]	10[A]		**A.** Non-wild type isolates were not available when developing the disk diffusion method.

Macrolides and lincosamides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Erythromycin	0.5	0.5		15	24	24		
Clindamycin	1	1		2	17	17		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	2	2		10	22	22		

Bacillus anthracis

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | **Guidance documents** | **For abbreviations and explanations of breakpoints, see the Notes sheet**

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth
Inoculum: See Note below
Incubation: Sealed panels, air, 35±1ºC, 17±1h (for glycopeptides 24h)
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Staphylococcus aureus* ATCC 29213
Note: One CFU for this bacterium corresponds to a chain consisting of multiple cells rather than to a single cell. The inoculum should be based on dilutions made from the theoretical CFU/mL of a McF 0.5 solution (1-2x10^{8}CFU/mL) to reach a theoretical inoculum of 5x10^5 CFU/mL.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar
Inoculum: McFarland 0.5
Incubation: Air, 35±1ºC, 17±1h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the back of the plate against a dark background illuminated with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Staphylococcus aureus* ATCC 29213**.** For agents not covered by this strain, see EUCAST QC Tables.

Penicillins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Benzylpenicillin	0.001	0.5		1 unit	50	18		1/A. Isolates "susceptible, increased exposure" (I) to benzylpenicillin can be reported susceptible to amoxicillin. Isolates resistant to benzylpenicillin should be tested for susceptibility to amoxicillin or reported resistant.
Amoxicillin iv	0.125[1]	0.125[1]			Note[A]	Note[A]		

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.001	0.25		5	50	24		
Levofloxacin	0.001	0.5		5	50	23		

Glycopeptides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Vancomycin	(4)[1]	(4)[1]		5	(10)[A]	(10)[A]		1/A. For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.

Macrolides and lincosamides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Clindamycin	1	1		2	17	17		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	0.06[1]	0.06[1]			Note[A]	Note[A]		**1/A.** Isolates susceptible to tetracycline can be reported susceptible to doxycycline. Isolates resistant to tetracycline should be tested for susceptibility to doxycycline or reported resistant.
Tetracycline	0.125	0.125		30	26	26		

Oxazolidinones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Linezolid	2	2		10	20	20		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Rifampicin	(1)[1]	(1)[1]		5	(12)[A]	(12)[A]		**1/A.** For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.

Brucella melitensis

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | Guidance documents | For abbreviations and explanations of breakpoints, see the Notes sheet

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth*
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 48±2h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Staphylococcus aureus* ATCC 29213. For agents not covered by this strain, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar + 5% defibrinated horse blood and 20 mg/L β-NAD (MH-F)*
Inoculum: McFarland 0.5
Incubation: 5% CO_2, 35±1ºC, 48±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the front of the plate with the lid removed and with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Streptococcus pneumoniae* ATCC 49619. For agents not covered by this strain, see EUCAST QC Tables.

*** Different media for broth microdilution and disk diffusion for *Brucella melitensis* were chosen to increase the reliability of the disk diffusion test.**

Cephalosporins	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ceftriaxone (meningitis)	(2)[1]	(2)[1]		30	(30)[A]	(30)[A]		**1/A.** For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.

Fluoroquinolones	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ciprofloxacin	0.001	1		5	50	27		
Levofloxacin	0.001	1		5	50	28		

Aminoglycosides	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Gentamicin	(0.5)[1]	(0.5)[1]		10	(23)[A]	(23)[A]		**1/A.** For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/.
Streptomycin	(1)[1]	(1)[1]		10	(15)[A]	(15)[A]		

Tetracyclines	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	0.25[1]	0.25[1]			Note[A]	Note[A]		**1/A.** Isolates susceptible to tetracycline can be reported susceptible to doxycycline. Isolates resistant to tetracycline should be tested for susceptibility to doxycycline or reported resistant.
Tetracycline	0.5	0.5		30	42	42		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Rifampicin	(2)[1]	(2)[1]		5	(20)[A,B]	(20)[A,B]		**1/A.** For information on how to use breakpoints in brackets, see https://www.eucast.org/eucastguidancedocuments/. **B.** Examine zones carefully for colonies close to the zone edge. Colonies should be taken into account when reading. **C.** Read the obvious zone edges and disregard haze or faint growth within the inhibition zone. **2.** Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.
Trimethoprim-sulfamethoxazole[2]	0.125	0.125		1.25-23.75	29[C]	29[C]		

MIC determination (broth microdilution according to ISO standard 20776-1)
Medium: Cation-adjusted Mueller-Hinton broth
Inoculum: $5x10^5$ CFU/mL
Incubation: Sealed panels, air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely inhibits visible growth. See "EUCAST Reading Guide for broth microdilution" for further information.
Quality control: *Escherichia coli* ATCC 25922. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor combinations, see EUCAST QC Tables.

Disk diffusion (EUCAST standardised disk diffusion method)
Medium: Mueller-Hinton agar
Inoculum: McFarland 0.5
Incubation: Air, 35±1ºC, 18±2h
Reading: Unless otherwise stated, read zone edges as the point showing no growth viewed from the back of the plate against a dark background illuminated with reflected light. See "EUCAST Reading Guide for disk diffusion" for further information.
Quality control: *Escherichia coli* ATCC 25922. For agents not covered by this strain and for control of the inhibitor component of beta-lactam inhibitor combination disks, see EUCAST QC Tables.

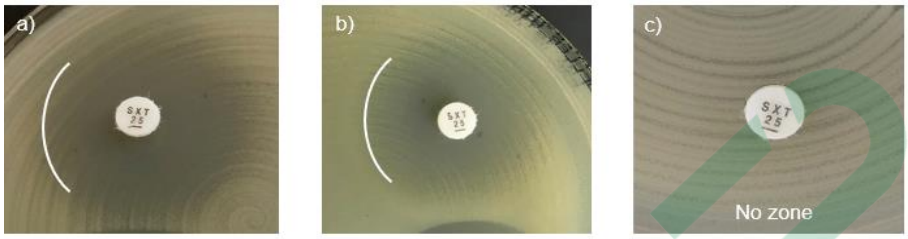
Penicillins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Amoxicillin-clavulanic acid	0.001[1]	8[1]		**20-10**	50	22		**1.** For susceptibility testing purposes, the concentration of clavulanic acid is fixed at 2 mg/L.

Cephalosporins	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Ceftazidime	0.001	8		**10**	50	18		

Carbapenems	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Imipenem	2	2		**10**	29	29		
Meropenem	2	2		**10**	24	24		

Tetracyclines	MIC breakpoints (mg/L)			Disk content	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU	(µg)	S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Doxycycline	0.001	2			Note[A]	Note[A]		**A.** Isolates categorised as screen negative can be reported "susceptible increased exposure" (I) to doxycyline. Isolates categorised as screen positive can be reported resistant to doxycycline.
Tetracycline (screen only)	NA	NA		**30**	23[A]	23[A]		

Miscellaneous agents	MIC breakpoints (mg/L)			Disk content (µg)	Zone diameter breakpoints (mm)			Notes
	S ≤	R >	ATU		S ≥	R <	ATU	Numbered notes relate to general comments and/or MIC breakpoints. Lettered notes relate to the disk diffusion method.
Chloramphenicol	0.001	8		30	50	22		**1.** Trimethoprim:sulfamethoxazole in the ratio 1:19. Breakpoints are expressed as the trimethoprim concentration.
Trimethoprim-sulfamethoxazole[1]	0.001	4		1.25-23.75	50[A]	17[A]		**A.** There may be growth within the inhibition zone. The density of growth may vary from a fine haze to substantial growth (**see pictures below**). If any zone edge can be seen, ignore growth within the inhibition zone and read the zone diameter.



Examples of inhibition zones for *Burkholderia pseudomallei* with trimethoprim-sulfamethoxazole.
a-b) An outer zone can be seen. Read the outer zone edge and interpret according to the breakpoints.
c) Growth up to the disk **and** no sign of inhibition zone. Report resistant.

Expert Rules and Expected Phenotypes

EUCAST has not determined breakpoints for *Burkholderia cepacia* complex organisms since accurate and reproducible methods for antimicrobial susceptibility testing are lacking due to technical difficulties encountered with these species and the lack of convincing clinical outcome correlates.
Users are referred to the EUCAST Guidance Document on *Burkholderia cepacia* complex.

***Burkholderia cepacia* complex currently includes at least 21 closely related species: *B. ambifaria* (genomovar VII), *B. anthina* (genomovar VIII), *B. arboris* (BCC3), *B. cepacia* (genomovar I), *B. cenocepacia* (genomovar III), *B. contaminans* (group K, BBC AT), *B. diffusa* (BCC2), *B. dolosa* (genomovar VI), *B. lata* (group K), *B. latens* (BCC1), *B. metallica* (BCC8), *B. multivorans* (genomovar II), *B. paludis* , *B. pseudomultivorans* , *B. pyrrocinia* (genomovar IX), *B. seminalis* (BCC7), *B. stabilis* (genomovar IV), *B. stagnalis* (BCC B), *B. territorii* (BCC L), *B. ubonensis* (genomovar X), *B. vietnamiensis* (genomovar V).**

EUCAST has not determined breakpoints for *Legionella pneumophila* as there is no established reference method or any documentation of clinical outcome related to antimicrobial susceptibility testing.
Users are referred to the EUCAST Guidance Document on *Legionella pneumophila* susceptibility testing.

Mycobacterium tuberculosis

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Expert Rules and Expected Phenotypes | **Guidance documents** | **For abbreviations and explanations of breakpoints, see the Notes sheet**

Listed breakpoints have been set in parallel with marketing authorisation by EMA. Breakpoints for other agents have not yet been established. Infections with *M. tuberculosis* are always treated with two or more agents.

MIC determination using broth microdilution according to the EUCAST reference method for the *Mycobacterium tuberculosis* complex
Medium: Middlebrook 7H9 with 10% OADC in polystyrene plates
Inoculum: $1x10^5$ CFU/mL
Incubation: Plates sealed with a plastic lid, air, 36±1°C, 7-21 days
Reading: At the earliest time point (7, 14 or 21 days) when the 1% growth control shows visible growth, read MICs at the lowest concentration of the agent that completely inhibits visible growth
Quality control: *Mycobacterium tuberculosis* H37Rv ATCC 27294

The *Mycobacterium tuberculosis* complex includes different species and variants such as *M. tuberculosis* var. *tuberculosis*, *M. tuberculosis* var. *africanum* and *M. tuberculosis* var. *bovis*. Breakpoints have only been established for *M. tuberculosis* var. *tuberculosis*.

Antimicrobial agent	MIC breakpoints (mg/L)			Notes
	S ≤	R >	ATU	Numbered notes relate to general comments and/or MIC breakpoints.
Bedaquiline	0.25[1]	0.25[1]		**1.** Breakpoints were not determined with the EUCAST reference method. Therefore they are provisory values that might change according to the results on ongoing studies using the EUCAST reference protocol for MIC determination.
Delamanid	0.06[1]	0.06[1]		**2.** A provisional screen value of 2 mg/L is advised according to published MIC data determined with MGIT.
Pretomanid	Note[1,2]	Note[1,2]		

Topical agents
Screening cut-off values for detection of phenotypic resistance

In the absence of clinical data on outcome related to MIC of infecting organisms, EUCAST has not been able to determine relevant clinical breakpoints for topical use of antimicrobial agents. Laboratories are advised to either use the regular breakpoints or the cut-off values listed below to distinguish between organisms without and with acquired resistance mechanisms (**for further details see EUCAST Guidance Document on www.eucast.org**). When reporting the susceptibility of agents for topical use, clarify that results refer to topical use only.

Organisms	Screening cut-off values for the detection and reporting of phenotypic resistance. Report resistant (R) for isolates with MIC above or inhibition zone diameter below the cut-off value. Otherwise report susceptible (S).		Gentamicin	Tobramycin	Pefloxacin (screen only)[1]	Norfloxacin (screen only)[1]	Nalidixic acid (screen only)[1]	Ciprofloxacin	Levofloxacin	Ofloxacin	Chloramphenicol	Colistin (for polymyxin B)	Fusidic acid	Neomycin (framycetin)	Bacitracin	Mupirocin	Retapamulin
	Disk content	(µg)	**10**	**10**	**5**	**10**	**30**	**5**	**5**	**5**	**30**	**-**	**10**	**10**	**-**	**200**	**-**
Enterobacterales	**MIC**	(mg/L)	2	2				0.125	0.25	0.25	16	2		8			
	Zone diameter	(mm)	17	16	24			Note[1]	Note[1]	Note[1]	17			12			
P. aeruginosa	**MIC**	(mg/L)	8	2				0.5	2	2		4					
	Zone diameter	(mm)	15	18				26	18								
***Acinetobacter* spp.**	**MIC**	(mg/L)	4	4				1	0.5	1		2					
	Zone diameter	(mm)	17	17				21	23								
S. aureus	**MIC**	(mg/L)	2	2				2	1	1	16		0.5	1		1[2]	0.5
	Zone diameter	(mm)	18	18		17		Note[1]	Note[1]	Note[1]	18		23	14		30[2]	
S. pneumoniae	**MIC**	(mg/L)						4	2	4	8						
	Zone diameter	(mm)				10		Note[1]	Note[1]	Note[1]	21						
Streptococcus groups A, B, C and G	**MIC**	(mg/L)						2	2	4	8		32			0.5	0.125
	Zone diameter	(mm)				12		Note[1]	Note[1]	Note[1]	21						
H. influenzae	**MIC**	(mg/L)	4	8				0.06	0.06	0.06	2						
	Zone diameter	(mm)					23	Note[1]	Note[1]	Note[1]	28						
M. catarrhalis	**MIC**	(mg/L)						0.125	0.125	0.25	2						
	Zone diameter	(mm)					23	Note[1]	Note[1]	Note[1]	31						

Notes

1. Screening agent for detection of fluoroquinolone resistance (pefloxacin for *Enterobacterales* , norfloxacin for Gram-positive organisms and nalidixic acid for *H. influenzae* and *M. catarrhalis)* .
2. Breakpoints for nasal decolonization in carriers of *S. aureus* , S ≤1, R >1 mg/L (disk diffusion with mupirocin 200 µg disk S ≥30, R <30 mm). For short term suppression of nasal colonization (usually as a perioperative practice) breakpoints of S ≤256, R >256 mg/L (disk diffusion S ≥18 mm, R <18 mm) can be used.

~~ND = No ECOFF available.~~

PK/PD cut-off values

EUCAST Clinical Breakpoint Tables v. 15.0, valid from 2025-01-01

Pharmacokinetics and pharmacodynamics (PK/PD) are important, but not the only tools for setting and revising clinical breakpoints. PK/PD targets are often based on a limited number of species. The selection of clinical PK/PD targets is highly dependent on the targeted patient population. Critically ill patients or immunocompromised patients will normally require higher antimicrobial exposure, and thus the PK/PD targets will be higher. As clinical PK/PD targets are often lacking, preclinical PK/PD targets determined in *in vitro* and animal models are often used. These models are not always validated with clinical data. Moreover, the animal models are usually limited to the neutropenic mouse thigh and lung infection model and may not have a translational value for all type of infections. Different PK/PD targets can be determined depending on i) the species, ii) the level of effect (stasis, 1-3 log kill, prevention of emergence of resistance), and iii) the within-species strain variation of PK/PD-targets.

Moreover, simulated pharmacokinetics (healthy vs. patients, different patient populations with different degree of renal/hepatic insufficiencies, levels of plasma proteins and other important covariates) will play a major role in determining PK/PD cut-offs. Critically ill patients have much higher variation in PK than other groups of patients. Calculations are usually made based on free drug concentrations in the plasma or epithelial lining fluid, which are presumed to relate to the concentration at the site of infection. Individual variations in protein binding may also affect the pharmacodynamically important drug exposure. Finally, PK/PD cut-offs may be based on various levels of probability of target attainment like 99%, 95% or 90%. All these factors may result in different PK/PD cut-off values that span in several two-fold dilutions.

A common misunderstanding is that PK/PD cut-offs can be used when clinical breakpoints are lacking. This is not the intention. Instead EUCAST has developed guidance on “When there are no breakpoints” (**see EUCAST guidance document**) and removed the PK/PD cut-offs from the breakpoint tables. This is to underline that these values should never be used when clinical breakpoints are lacking.