



MIC Test Strip Application Guide

AEROBES

Organism	Specific phenotype	Agar media	INOCULUM		Example of MIC panel	INCUBATION		Notes
			Suspension medium	Turbidity		Temperature/Time	Atmosphere	
Staphylococci MRSA, methicillin (oxacillin)-resistant <i>Staphylococcus aureus</i> (mec A+) BORSA, borderline ORSA, i.e. oxacillin-resistant <i>Staphylococcus aureus</i> (non-mec A resistance) MRCNS, methicillin-resistant coagulase-negative Staphylococci (mec A+) VISA/hVISA, vancomycin intermediate/ hetero-intermediate <i>Staphylococcus aureus</i>		MHA	0.85% NaCl	0.5 McFarland		35 ± 2°C 16-20 h	Ambient air	
	MRSA	MHA	0.85% NaCl	0.5 McFarland	Cefoxitin (FOX)	35 ± 2°C 16-20 h	Ambient air	
		MHA + 2% NaCl	0.85% NaCl	0.5-1 McFarland	Oxacillin(OX) Amoxicillin-clavulanic acid (AUG)	35 ± 2°C 24 h	Ambient air	Heavier inoculum improves detection of low level resistance
	BORSA	MHA + 2% NaCl	0.85% NaCl	0.5-1 McFarland	Oxacillin(OX) Amoxicillin-clavulanic acid (AUG)	35 ± 2°C 24 h	Ambient air	
	MRCNS	MHA + 2% NaCl	0.85% NaCl	0.5-1 McFarland	Oxacillin(OX)	35 ± 2°C 48 h	Ambient air	
	VISA/hVISA (macro gradient test)	BHI agar	MHB	2 McFarland	Vancomycin (VA) Teicoplanin (TEC)	35 ± 2°C 24 h Confirm at 48 h	Ambient air	
	VISA/hVISA	MHA + 5% blood	MHB	0.5 McFarland	GRD Vancomycin / Teicoplanin (VA/TEC)	35 ± 2°C 18-24 h Confirm at 48 h	Ambient air	Intended for phenotype detection, not intended for MIC determination (see MTS28)
	VISA/hVISA (standard method)	MHA	0.85% NaCl	0.5 McFarland	Vancomycin (VA)	35 ± 2°C 24 h	Ambient air	

Organism	Specific phenotype	Agar media	INOCULUM		Example of MIC panel	INCUBATION		Notes
			Suspension medium	Turbidity		Temperature/Time	Atmosphere	
	MRSA secondary panel	MHA	0.85% NaCl	0.5 McFarland	Clindamycin (CD) Daptomycin (DAP) Linezolid (LNZ) Vancomycin (VA) Teicoplanin (TEC) Quinupristin-dalfopristin (QDA) Rifampicin (RD)	35 ± 2°C 16-20 h (VA, TE 24 h)	Ambient air	
	Non-MRSA secondary panel	MHA	0.85% NaCl	0.5 McFarland	Penicillin G (P) Erythromycin (E) Linezolid (LNZ) Trimethoprim-sulfamethoxazole (SXT) Vancomycin (VA) Teicoplanin (TEC) Ciprofloxacin (CIP)	35 ± 2°C 16-20 h (VA, TE 24 h)	Ambient air	
Enterococci		MHA	0.85% NaCl	0.5 McFarland	Ampicillin (AMP) Daptomycin (DAP) Linezolid (LNZ) Quinupristin-dalfopristin (QDA) Vancomycin (VA) Teicoplanin (TEC) Minocycline (MN)	35 ± 2°C 16-20 h (VA, TE 24 h)	Ambient air	
VRE, vancomycin-resistant enterococci	VRE (macro gradient test)	BHI agar	MHB	2 McFarland	Vancomycin (VA) Teicoplanin (TEC)	35 ± 2°C 24 h Confirm at 48 h	Ambient air	Intended for phenotype detection, not intended for MIC determination (see MTS34)
HLAR, high-level aminoglycoside resistance	HLAR	MHA	0.85% NaCl	0.5-1 McFarland	Gentamicin (CN) Streptomycin (S)	35 ± 2°C 24 h (S 48 h)	Ambient air	CN high range. S high range.

Organism	Specific phenotype	Agar media	INOCULUM		Example of MIC panel	INCUBATION		Notes
			Suspension medium	Turbidity		Temperature/Time	Atmosphere	
Enterobacterales ESBL, extended spectrum beta-lactamase MBL, metallo beta-lactamase AmpC beta-lactamase resistance		MHA	0.85% NaCl	0.5 McFarland (1 if mucoid)	Gentamicin (CN) Piperacillin-tazobactam (TZP) Cefepime (FEP) Ciprofloxacin (CIP) Imipenem (IMI) Aztreonam (ATM)	35 ± 2°C 16-20 h	Ambient air	TZP low range
	ESBL	MHA	0.85% NaCl	0.5 McFarland (1 if mucoid)	Cefotaxime/ Cefotaxime+clavulanic acid (CTX/CTL) Ceftazidime/ Ceftazidime+clavulanic acid (CAZ/CAL) Cefepime/ Cefepime+clavulanic acid (FEP/FEL)	35 ± 2°C 16-20 h	Ambient air	Intended for phenotype detection, not intended for MIC determination (see MTS26)
	MBL	MHA	0.85% NaCl	0.5 McFarland (1 if mucoid)	Meropenem/ Meropenem+EDTA (MRP/MRD)	35 ± 2°C 16-20 h	Ambient air	Intended for phenotype detection, not intended for MIC determination (see MTS27)
	AmpC	MHA	0.85% NaCl	0.5 McFarland	Cefotetan/ Cefotetan+cloxacillin (CTT/CXT)	35 ± 2°C 16-20 h	Ambient air	Intended for phenotype detection, not intended for MIC determination (see MTS29)
<i>Pseudomonas spp.</i> MBL, metallo beta-lactamase		MHA	0.85% NaCl	0.5 McFarland (1 if mucoid)	Ceftazidime (CAZ) Gentamicin (CN) Aztreonam (AZM) Ciprofloxacin (CIP) Imipenem (IMI) Piperacillin-tazobactam (TZP)	35 ± 2°C 16-20 h 48 h for slow growers	Ambient air	TZP low range
	MBL	MHA	0.85% NaCl	0.5 McFarland (1 if mucoid)	Imipenem/Imipenem+EDTA (IMI/IMD)	35 ± 2°C 16-20 h	Ambient air	Intended for phenotype detection, not intended for MIC determination (see MTS27)

Organism	Specific phenotype	Agar media	INOCULUM		Example of MIC panel	INCUBATION		Notes
			Suspension medium	Turbidity		Temperature/Time	Atmosphere	
<i>Acinetobacter</i> spp.		MHA	0.85% NaCl	0.5 McFarland (1 if mucoid)	Ceftazidime (CAZ) Meropenem (MRP) Amikacin (AK) Ampicillin-sulbactam (AMS) Levofloxacin (LEV) Minocycline (MN)	35 ± 2°C 16-20 h 48 h for slow growers	Ambient air	
MBL, metallo beta-lactamase	MBL	MHA	0.85% NaCl	0.5 McFarland (1 if mucoid)	Imipenem/Imipenem+EDTA (IMI/IMD)	35 ± 2°C 16-20 h 48 h for slow growers	Ambient air	Intended for phenotype detection, not intended for MIC determination (see MTS27)
<i>Burkholderia cepacia</i>		MHA	0.85% NaCl	0.5 McFarland (1 if mucoid)	Trimethoprim-sulfamethoxazole (SXT) Ceftazidime (CAZ) Levofloxacin (LEV) Meropenem (MRP) Minocycline (MN)	35 ± 2°C 20-24 h 48 h for slow growers	Ambient air	
<i>Stenotrophomonas maltophilia</i>		MHA	0.85% NaCl	0.5 McFarland (1 if mucoid)	Trimethoprim-sulfamethoxazole (SXT) Ceftazidime (CAZ) Levofloxacin (LEV) Minocycline (MN) Ticarcillin-clavulanic acid (TTC)	35 ± 2°C 20-24 h 48 h for slow grower	Ambient air	

FASTIDIOUS ORGANISMS

Organism	Specific phenotype	Agar media	INOCULUM		Example of MIC panel	INCUBATION		Notes
			Suspension medium	Turbidity		Temperature/Time	Atmosphere	
Pneumococci		MHA + 5% blood (CLSI) MH-F (EUCAST)	MHB	0.5 McFarland (1 if mucoid)	Meropenem (MRP) Cefotaxime (CTX) Penicillin G (P) Clindamycin (CD) Vancomycin (VA) Trimethoprim-sulfamethoxazole (SXT)	35 ± 2°C 20-24 h	5% CO ₂	
Streptococci		MHA + 5% blood (CLSI) MH-F (EUCAST)	MHB	0.5 McFarland (1 if mucoid)	Penicillin G (P) Cefotaxime (CTX) Chloramphenicol (C) Ofloxacin (OFX) Lienzolid (LNZ) Vancomycin (VA) Daptomycin (DAP)	35 ± 2°C 20-24 h	5% CO ₂	
<i>Abiotrophia</i> and <i>Granulicatella</i> spp.		MH Chocolate + 0.001% pyridoxal HCl + 0.01% cysteine	MHB	1 McFarland		35 ± 2°C 20-24 h	5% CO ₂	
<i>Haemophilus</i> spp.		HTM (CLSI) MH-F (EUCAST)	MHB	0.5 McFarland (1 if mucoid)	Amoxicillin-clavulanic acid (AUG) Cefotaxime (CTX) Meropenem (MRP) Trimethoprim-sulfamethoxazole (SXT) Chloramphenicol (C)	35 ± 2°C 20-24 h	5% CO ₂	
<i>Moraxella catarrhalis</i>		MHA + 5% blood (CLSI) MH-F (EUCAST)	MHB	0.5 McFarland		35 ± 2°C 20-24 h	5% CO ₂	

Organism	Specific phenotype	Agar media	INOCULUM		Example of MIC panel	INCUBATION		Notes
			Suspension medium	Turbidity		Temperature/ Time	Atmosphere	
Anaerobes		Brucella Blood or FAA	Brucella Broth or MHB	1 McFarland	Metronidazole (MTZ) Clindamycin (CD) Cefoxitin (FOX) Imipenem (IMI) Piperacillin-tazobactam (TZP) Penicillin G (P)	36 ± 1°C 24-72 h	Anaerobic: 80-85% N ₂ 5-10% CO ₂ 10% H ₂	TZP high range. Anaerobiosis must be obtained within 1-2 h for MTS.
<i>Helicobacter pylori</i>		MHA + 5% blood or MH-F	MHB + 5% Bovine Serum	3 McFarland	Amoxicillin (AML) Clarithromycin (CLR) Metronidazole (MTZ) Tetracycline (TE)	35 ± 2°C 72 h or longer	Microaerobic: 85% N ₂ 10% CO ₂ 5% O ₂	First 24 h anaerobic incubation for MTZ
Gonococci		GC Agar Base + defined supplements (CLSI) or MH Chocolate	MHB	0.5 McFarland	Ciprofloxacin (CIP) Penicillin G (P) Tetracycline (TE) Ceftriaxone (CRO) Spectinomycin (SPC)	36 ± 1°C 20-24 h	5% CO ₂	
Meningococci		MHA + 5% blood	MHB	0.5 McFarland	Ciprofloxacin (CIP) Penicillin G (P) Trimethoprim-sulfamethoxazole (SXT) Meropenem (MRP) Ceftriaxone (CRO)	35 ± 2°C 24 h	5% CO ₂	
<i>Campylobacter</i> spp.		MHA + 5% blood (CLSI) MH-F (EUCAST)	MHB	1 McFarland	Ciprofloxacin (CIP) Gentamicin (CN) Erythromycin (E) Doxycycline (DXT)	35 ± 2°C 48-72 h	Microaerobic: 85% N ₂ 10% CO ₂ 5% O ₂	

Organism	Specific phenotype	Agar media	INOCULUM		Example of MIC panel	INCUBATION		Notes
			Suspension medium	Turbidity		Temperature/Time	Atmosphere	
FASTIDIOUS GRAM-POSITIVE ORGANISMS								
<i>Arcanobacterium</i> spp., <i>Bacilli</i> <i>Listeria monocytogenes</i> , <i>Bacillus</i> , <i>Corynebacterium</i> , <i>Erysipelothrix</i> , and <i>Lactobacillus</i> spp. <i>Cocci</i> <i>Rothia</i> , <i>Pediococcus</i> , <i>Leuconostoc</i> and <i>Gemella</i> spp.		MHA + 5% blood (CLSI) MH-F (EUCAST)	MHB	1 McFarland		35 ± 2°C 20-24 h (48 h if required)	5% CO ₂ (if needed)	
FASTIDIOUS GRAM-NEGATIVE ORGANISMS								
<i>Bartonella</i> spp.		MH Chocolate	MHB	1 McFarland		35 ± 2°C 3-5 d	5% CO ₂	
<i>Bordetella pertussis</i>		MHA + 5% blood	MHB	3 McFarland		35 ± 2°C 3-5 d	Ambient air in bags (moist)	
<i>Capnocytophaga</i> spp.		Brucella Blood	MHB	1 McFarland		35 ± 2°C 48 h	5% CO ₂	
<i>Legionella</i> spp.		Legionella BCYE	MHB	0.5-1 McFarland		35 ± 2°C 3-5 d	Ambient air in bags (moist)	
<i>Pasteurella</i> spp.		MHA + 5% blood (CLSI) MH-F (EUCAST)	MHB	1 McFarland		35 ± 2°C 48 h	5% CO ₂	

Organism	Specific phenotype	Agar media	INOCULUM		Example of MIC panel	INCUBATION		Notes
			Suspension medium	Turbidity		Temperature/ Time	Atmosphere	
HACEK group		MHA + 1% Hemoglobin + 1% IsoVitalex or HTM or Brucella Blood or MH-F	MHB	1 McFarland	Levofloxacin (LEV) Imipenem (IMI) Trimethoprim-sulfamethoxazole (SXT) Ceftriaxone (CRO)	35 ± 2°C 24-72 h	5% CO ₂	

MYCOBACTERIA AND NOCARDIA

Organism	Specific phenotype	Agar media	INOCULUM		Example of MIC panel	INCUBATION		Notes
			Suspension medium	Turbidity		Temperature/ Time	Atmosphere	
<i>Mycobacterium tuberculosis</i>		Middlebrook 7H11 agar + 10% OADC	Middlebrook 7H9 broth + 0.5% Tween or 2% glycerol	3-4 McFarland	Ethambutol (EB) Ethionamide (ET) Isoniazide (IZ) Rifampicin (RD)	35 ± 2°C 5-10 d	5-10% CO ₂	Inoculum preparation: vortex 3-5 min with glass beads, allow to settle for 20 min and adjust supernatant to correct turbidity.
Nontuberculous mycobacteria		MHA + 10% OADC + 5% blood (<i>M. avium</i> , <i>M. marinum</i>) Middlebrook 7H11 agar + 10% OADC (<i>M. kansasii</i>)	Middlebrook 7H9 broth	1 McFarland (3 for <i>M. kansasii</i>)	Amikacin (AK) Ciprofloxacin (CIP) Clarithromycin (CLR) Rifampicin (RD)	35 ± 2°C (<i>M. marinum</i> at 30°C) 5-10 d	5-10% CO ₂	Inoculum preparation: vortex 2-3 min with glass beads, allow to settle for 20 min and adjust supernatant to correct turbidity.
Rapid growing mycobacteria		MHA + 5% blood	0.85% NaCl	1 McFarland	Cefoxitin (FOX) Imipenem (IMI) Ciprofloxacin (CIP) Clarithromycin (CLR)	35 ± 2°C 48-72 h	Ambient air in bags (moist)	

Organism	Specific phenotype	Agar media	INOCULUM		Example of MIC panel	INCUBATION		Notes
			Suspension medium	Turbidity		Temperature/ Time	Atmosphere	
<i>Nocardia</i> spp.		MHA + 5% blood	BHI broth	1 McFarland	Amikacin (AK) Trimethoprim-sulfamethoxazole (SXT) Ciprofloxacin (CIP) Clarithromycin (CLR) Imipenem (IMI)	35 ± 2°C 48-72 h (dependent on spp.)	Ambient air	

FUNGI

Organism	Specific phenotype	Agar media	INOCULUM		Example of MIC panel	INCUBATION		Notes
			Suspension medium	Turbidity		Temperature/ Time	Atmosphere	
Yeast		RPMI agar	0.85% NaCl	0.5 McFarland (1 for <i>Cryptococcus neoformans</i>)	Fluconazole (FLU) Itraconazole (ITC) Amphotericin B (AMB) Flucytosine (FC) Voriconazole (VO) Caspofungin (CAS)	35 ± 2°C 24-48 h (48-72 h for <i>C. neoformans</i>)	Ambient air in bags (moist)	Once plate inoculated, re-dip swab and streak again
Mould		RPMI agar	0.85% NaCl + Tween 20	0.5 McFarland <i>Aspergillus</i> spp. (1 for <i>Fusarium</i> / <i>Rhizopus</i> spp.)	Amphotericin B (AMB) Itraconazole (ITC) Voriconazole (VO) Posaconazole (POS) Caspofungin (CAS)	35 ± 2°C 16-72 h (dependent on genus)	Ambient air in bags (moist)	

References

Clinical and Laboratory Standards Institute. Performance Standards for Antimicrobial Susceptibility Testing; latest edition. CLSI supplement M100.

Clinical and Laboratory Standards Institute. Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically; latest edition. CLSI standard M07.

Clinical and Laboratory Standards Institute. Performance Standards for Antimicrobial Disk Susceptibility Tests; latest edition. CLSI standard M02.

Clinical and Laboratory Standards Institute. Methods for Dilution Antimicrobial Susceptibility Testing of Anaerobic Bacteria; Approved Standard, latest edition. CLSI document M11.

Clinical and Laboratory Standards Institute. Methods for Antimicrobial Dilution and Disk Susceptibility Testing of Infrequently Isolated or Fastidious Bacteria, latest edition. CLSI guideline M45.

Clinical and Laboratory Standards Institute. Performance Standards for Antifungal Susceptibility Testing of Yeasts, latest edition. CLSI supplement M60.

Clinical and Laboratory Standards Institute. Reference Method for Broth Dilution Antifungal Susceptibility Testing of Yeasts; latest edition. CLSI standard M27.

Clinical and Laboratory Standards Institute. Performance Standards for Antifungal Susceptibility Testing of Filamentous Fungi; latest edition. CLSI supplement M61.

Clinical and Laboratory Standards Institute. Reference Method for Broth Dilution Antifungal Susceptibility Testing of Filamentous Fungi; latest edition. CLSI standard M38.

The European Committee on Antimicrobial Susceptibility Testing. Breakpoint Tables for Interpretation of MICs and Zone Diameters; latest version.

The European Committee on Antimicrobial Susceptibility Testing. Antifungal Agents. Breakpoint Tables for Interpretation of MICs; latest version.

EUCAST Guidance Documents https://eucast.org/ast_of_bacteria/guidance_documents/

Ordering information

Ready to use culture media for AST with MTS method

Agar media

Description	Packaging	REF	Abbreviation
Mueller Hinton II Agar (cation-adjusted), for non-fastidious bacteria	20 plates 90 mm	10031	MHA
	10 plates 140 mm	10231	
Mueller Hinton II Agar with 2% NaCl, for staphylococci with Oxacillin	20 plates 90 mm	11206	MHA + 2% NaCl
Brain Heart Infusion Agar, for staphylococci and enterococci with Vancomycin and Teicoplanin	20 plates 90 mm	10060	BHI agar
Mueller Hinton II Agar with 5% Sheep Blood, for fastidious organisms (CLSI recommended)	20 plates 90 mm	10131	MHA + 5% blood
	10 plates 140 mm	11231	
Mueller Hinton Fastidious Agar: MHA with 20 mg/l β -NAD and 5% Horse Blood for <i>Streptococcus</i> spp., <i>Haemophilus</i> spp., and other fastidious organisms (EUCAST recommended)	20 plates 90 mm	10132	MH-F
	10 plates 140 mm	11132	
Haemophilus Test Agar, for <i>Haemophilus</i> spp. (CLSI recommended)	20 plates 90 mm	10080	HTM
Brucella Blood Agar with Hemin and Vitamin K, for anaerobic bacteria (CLSI recommended)	20 plates 90 mm	10245	Brucella Blood
Fastidious Anaerobe Agar, for anaerobic bacteria (EUCAST recommended)	20 plates 90 mm	10062	FAA
Mueller Hinton Chocolate Agar, for gonococci	20 plates 90 mm	10335	MH Chocolate
Legionella BCYE Agar	20 plates 90 mm	10051	Legionella BCYE
Middlebrook 7H11 Agar, for mycobacteria	20 plates 90 mm	10416	—
RPMI Agar (2% glucose with MOPS), for yeasts and moulds	20 plates 90 mm	11509	—
	10 plates 140 mm	10233	
Chromatic MH, chromogenic medium for the preliminary identification and AST of bacteria directly from clinical and environmental specimens	20 plates 90 mm	11618	—
	10 plates 140 mm	10246	

NOTE: MHA, MH-F and FAA into Petri dishes should have a level depth of 4 ± 0.5 mm.

Ordering information (continued)

Suspension media and supplements

Description	Packaging	REF	Abbreviation
Physiological Solution	20 vials x 7 ml	20095	85% NaCl
Mueller Hinton Broth	20 tubes x 10 ml	24107	MHB
Brucella Broth	20 tubes x 10 ml	24418	—
Bovine Serum	1 bottle x 50 ml	83830	—
Brain Heart Infusion Broth	20 tubes x 10 ml	24104	BHI broth
Tween 20	2 bottles x 50 ml	80032	—

MIC Test Strip European Patent

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LIOFILCHEM® s.r.l.

Via Scozia zona ind.le, 64026 Roseto degli Abruzzi (TE) Italy
Tel. +39 0858930745 Fax +39 0858930330 www.liofilchem.com liofilchem@liofilchem.com

