Equipment, Gas Supply and Patient Data

Cylinders, meters, blenders, analyzers, reprocessing and blood gas QC; chest films, bedside findings, oximetry limits, MIP and stress index

CYLINDERS AND CONNECTIONS

POINT	RULE
What is in it	The label decides. US shoulders: O_2 green, air yellow, He brown, N_2O blue, CO_2 gray, N_2 black
Label unreadable	Do not use, whatever the color or fit
Small cylinder valve	Pin Index (PISS) yoke; oxygen pins 2 and 5; one seal only
Wall outlets	DISS: thread diameter differs by gas
Pressure	Full cylinder about 2,000 psi; the regulator drops it to about 50 to 55 psi
Duration	Minutes = psi × cylinder factor ÷ L/min (E factor 0.28; others on PFTs and Oxygen Delivery)

SAFETY Regulator fires: crack the valve first, new crush gasket (or reusable metal-bound washer), no oil or grease, hand-tighten, open slowly. Hissing at the yoke: close the valve, then reseat or replace the seal.

- A connector that will not fit is a warning: check the label, never swap or adapt the fitting.
- MRI: a steel cylinder becomes a projectile. Use MRI-labeled (aluminum) cylinders and ventilators.

FLOWMETERS AND BLENDERS

DEVICE	HOW IT READS	TRAP
Thorpe tube, compensated	Float in a tapered tube; must be upright	Accurate despite a kinked line
Thorpe tube, uncompensated	Calibrated with outlet open	Back pressure: reads low
Bourdon gauge	Pressure gauge read as flow; any position (transport)	Kink: reads high while flow falls
Air-O_2 blender	Mixes 50-psi air and O_2	Alarm when the two supplies differ (one design: 20 psi) or one fails

A blender may not alarm if both supplies fall together, or at 21% when O_2 fails: analyze FiO_2.

OXYGEN SOURCES AND ANALYZERS

SOURCE	FACTS	FAILURE
Bulk liquid O_2	1 L liquid gives about 861 L gas	Pipeline fails: ventilated patients to cylinders or bag, verify FiO_2
Concentrator	Zeolite sieve removes N_2; about 92–96% O_2 when working	Purity alarm (one spec: under 82%) or power cut: backup cylinder, call provider
Galvanic analyzer	Self-powered; anode is used up; about 20 s response	Calibrate at 21% and 100%; replace a cell that fails
Polarographic analyzer	Clark electrode; needs the battery	Same two-point calibration

REPROCESSING AND SHARPS

SPAULDING CLASS	EXAMPLES	MINIMUM
Critical: sterile tissue or blood	Biopsy forceps, vascular catheters	Sterilization
Semicritical: mucous membranes	Bronchoscopes, laryngoscope blades, respiratory and anesthesia equipment	High-level disinfection
Noncritical: intact skin	Blood pressure cuffs	Low-level disinfection

- After high-level disinfection rinse with sterile water; if not feasible, tap or filtered water, then an alcohol rinse and forced-air drying.
- Leak-test a flexible scope before immersion; one that fails goes for repair, not into the soak.
- Needles: no bending or two-handed recapping; use a safety device and drop it in a sharps container at the point of use.

BLOOD GAS ANALYZER QC

RULE	MEANING	POINTS TO
1-2s	One control beyond 2 SD	Warning: check the other rules
1-3s, R-4s	One beyond 3 SD; or in one run, one above +2 SD and one below −2 SD	Reject; random error
2-2s, 4-1s, 10x	Two in a row beyond the same 2 SD; four beyond the same 1 SD; ten on one side of the mean	Reject; systematic error

- CLIA: a control every 8 h of testing, low and high each day, plus one per patient run unless the analyzer self-verifies at least every 30 min.
- Failed QC: fix, rerun, then review patient results since the last good run. Proficiency samples run like patient samples.

CHEST RADIOGRAPH IN WORDS

LOOK AT	EXPECT OR SUSPECT
Quality	Clavicle heads equidistant from spinous processes (else rotated); about 10 posterior ribs; AP film enlarges the heart
ETT	3–5 cm above the carina; neck flexion pushes it toward the carina
Central line	Tip at the cavoatrial junction
PA catheter	Tip not beyond the hilum
Pneumothorax	Pleural line with no markings beyond; supine: deep sulcus sign
Effusion	Upright: blunted angle and meniscus; massive: shift away
Collapse	Opacity with volume loss pulling the trachea toward it (plug, right-mainstem tube)

BEDSIDE FINDINGS

FINDING	CONSOLIDATION	EFFUSION	PNEUMOTHORAX
Percussion	Dull	Dull	Hyperresonant
Tactile fremitus	Increased	Decreased	Decreased
Breath sounds	Bronchial	Decreased	Decreased
Egophony	Present	At the upper edge	Not a feature

- Modified Allen test: color back in 5–15 s is normal; slower, use the other radial.
- Sputum: over 25 neutrophils and under 10 squamous cells per ×100 field, or recollect.
- Clubbing: nail profile angle over 180°; new clubbing in a smoker suggests lung cancer.
- Cyanosis needs about 5 g/dL unsaturated hemoglobin, so severe anemia hides it; blue fingers with a pink tongue = low flow.

PULSE OXIMETRY AND CAPNOGRAPHY LIMITS

- Close to SaO_2 (bias under 2%) at 90% and above; less reliable below.
- Dark skin: readings run high. Occult hypoxemia (SaO_2 under 88% with SpO_2 92–96%) was about 3 times as common in Black patients.
- Low perfusion, cold, pressors, motion: poor pleth. Try a forehead sensor; draw a gas.
- CO: SpO_2 reads falsely normal and SpCO cannot rule poisoning out; send blood CO-oximetry.
- Also nail polish, light, dyes. Capnography limits: see Capnography.

EXAM TIP Number and patient disagree: assess the patient, check waveform and site, confirm with arterial CO-oximetry.

MUSCLE STRENGTH AND STRESS INDEX

TEST	HOW	READ
MIP	Exhale to RV, pull 1–2 s; repeat until efforts agree; record the best	Lower limit about −60 (women), −80 (men) cm H_2O
MEP	From TLC, push 1–2 s	Lower limit about 120 (women), 150 (men)
MIP, cannot cooperate	One-way valve: exhale only; about 25 s; best value near 15–20 s	A short occlusion underreads
Stress index	Volume control, constant flow, passive patient	Under 1: tidal recruitment; over 1: overdistension, lower PEEP or VT

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