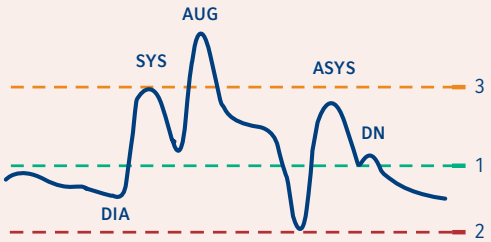
TIMING GUIDELINES



INFLATION

Goal: To produce a rapid rise in aortic pressure (optimize AUG), thereby increasing O_2 supply to coronary circulation.

1. Inflate just prior to DN which should result in AUG > SYS

DEFLATION

Goal: To reduce aortic end diastolic pressure (afterload), thereby decreasing MVO_2 while improving the CO (cardiac output).

2. ADIA ≤ DIA

3. ASYS < SYS

Abbreviation	Definition
DIA	Unassisted End Diastolic Pressure
SYS	Unassisted Peak Systolic Pressure
AUG	Diastolic Augmentation/Peak Diastolic Pressure
ADIA	Assisted End Diastolic Pressure
ASYS	Assisted Peak Systolic Pressure (Systole after IAB deflation)
DN	Dicrotic Notch

24-Hour Intra-Aortic Balloon Product Hotline: **800-447-IABP** Worldwide: **617-389-8628**

AUTOPILOT™ MODE

AUTOPILOT MODE

In AutoPilot mode, the console selects the ECG and AP source, trigger mode, timing method and optimizes timing.

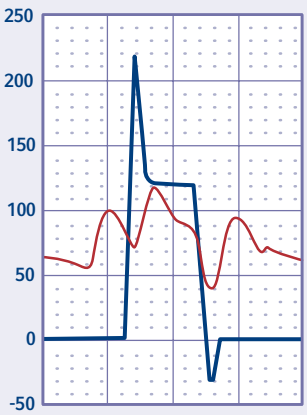
1. Console scans all available ECG leads continuously. If the current lead selected is lost or noisy, the console will select the best available lead. If the clinician prefers, the ECG lead, source and gain can be manually selected.
2. AP source is selected by the console but can be changed by the clinician. If the Fiber Optic sensor is connected, it will always be selected.
3. Console continuously monitors the patient condition and selects the trigger mode best suited for the clinical situation. Selects between different ECG trigger modes, AP or Pacer trigger modes.
4. All timing settings are under control of the console and are continuously assessed and adjusted as required. Deflation can be managed by the pump or selected by the user when an arrhythmia is detected.

OPERATOR MODE

The clinician makes all choices regarding ECG source, AP source, trigger, and timing.

1. Once the timing has been set, the console will automatically adjust for changes in heart rate.

BALLOON PRESSURE WAVEFORM



DESCRIPTION

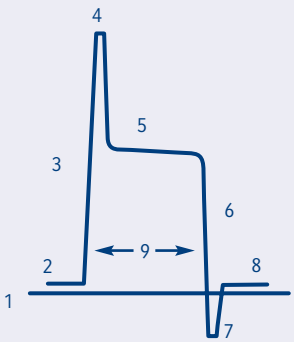
The Balloon Pressure Waveform (BPW) represents helium movement between the console and the IAB catheter. It is shown as a calibrated, continuous waveform allowing objective assessment of the safety and effectiveness of counterpulsation.

BPW HEIGHT

Reflects the pressure in the aorta, therefore the plateau pressure on the BPW should be within 25 mmHg (+/-) of the AUG.

BPW WIDTH

Is approximately the duration in which the balloon is inflated.

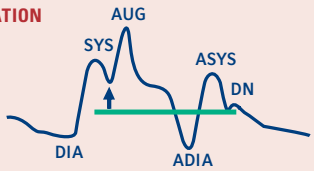


1. Zero Baseline
2. Balloon Pressure Baseline
3. Rapid Inflation
4. Peak Inflation Artifact
5. Plateau Pressure
6. Rapid Deflation
7. Deflation Artifact
8. Return to Baseline
9. Duration of Balloon Cycle

COMMON TIMING ERRORS

EARLY INFLATION

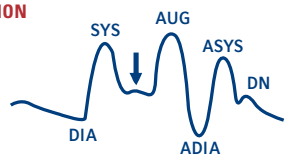
IAB is inflated well before actual DN. (aortic valve closure.) Violates **Rule 1** for inflation.



Result:
- Premature closure of aortic valve
- Reduces stroke volume/CO
- Increase in LVED volume
- Increase in LV wall tension

LATE INFLATION

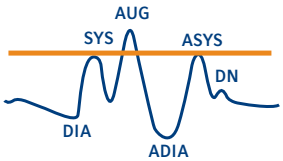
DN is visible between points SYS/AUG. Violates **Rule 1** for inflation



Result:
- AUG less than optimum
- Decreased perfusion pressure and volume to coronary arteries

EARLY DEFLATION

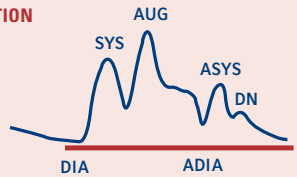
ASYS = SYS Violates **Rule 3** for deflation. May see "U" shape at ADIA.



Result:
- No afterload reduction

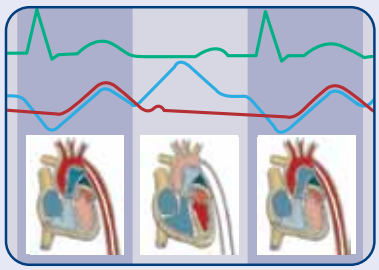
LATE DEFLATION

ADIA > DIA Violates **Rule 2** for deflation.



Result:
- Increased workload of left ventricle
- Increased MVO_2

Electrical and Mechanical Relationship of the ECG, Arterial Pressure and IAB Inflation/Deflation Cycle



RECOMMENDED IABP TRIGGERS

GOOD ECG LEADS FOR TRIGGERING

Whenever possible, it is preferable to trigger on the R wave of the ECG signal. In addition to providing the console with a clean, artifact-free ECG tracing, always select the lead with the most unidirectional R wave (either positive or negative) and with the smallest P and T waves.

POOR ECG LEADS FOR TRIGGERING

This lead has the potential to cause "double triggering" or "wandering timing" (if the R wave is not consistently identified as the trigger event).

A noisy ECG signal could result in triggering on artifact which would result in improper timing.

Biphasic QRS could cause gaining issues and missed triggers or wandering triggering (therefore wandering timing).

If the mA is too high on a temporary pacer, a "pacer tail" can be created increasing the potential for double triggering.

A wandering baseline can cause missed triggers.

ECG Pattern
The preset trigger mode. The computer analyzes the height, width, and slope of a positively or negatively deflected QRS complex. The width of the R wave must be between 25-135 msec.

ECG Peak
The computer analyzes the height and slope of a positively or negatively deflected QRS complex. The trigger mode of choice for wide complex rhythms. Preferred trigger for HR >130.

A Fib
The computer analyzes the QRS complex in the same manner as in the peak mode. The balloon will automatically be deflated whenever an R-wave is sensed. The trigger mode of choice for rhythms with varying R to R intervals.

Arterial Pressure
The computer uses the systolic upstroke of an arterial pressure waveform as the trigger signal. An option for clinical situations where an ECG is unavailable or distorted

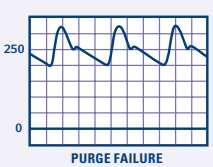
A Pace
The computer uses the atrial pacing spike as the trigger signal. This mode can only be used with 100% atrial paced rhythms.

V Pace
The computer uses the ventricular spike as the trigger signal. Used with ventricular or AV paced rhythms. It is ESSENTIAL that the patient's rhythm is 100% paced.

Internal
The balloon inflates and deflates at a preset rate regardless of the patient's cardiac activity. Used in situations where there is no cardiac output and no ECG. Must be confirmed by an additional keystroke.

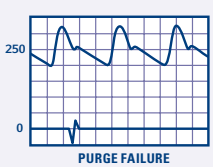
During Cardiac Resuscitation
If counterpulsation is to be continued and synchronized to the CPR effort, then Arterial Pressure should be selected. In the event that the CPR cannot generate a consistent and reliable trigger, Internal may be utilized.

TROUBLESHOOTING



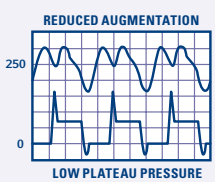
PURGE FAILURE

Check for:
- Loss of trigger
- IAB not connected



PURGE FAILURE

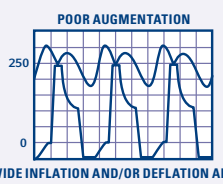
Check for:
- Leaks
- Low helium



REDUCED AUGMENTATION

LOW PLATEAU PRESSURE

Check for:
- Volume setting too low
- Balloon too small for patient
- Balloon too low in aorta
- Low systemic vascular resistance

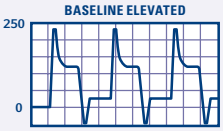


POOR AUGMENTATION

WIDE INFLATION AND/OR DEFLATION ARTIFACT

Check for:
- Proximal portion of IAB in sheath
- Suture too tight around catheter
- Partial obstruction
- Partial kink
- "Slow catheter" or HE^+ shuttle speed
- Very tortuous vessels

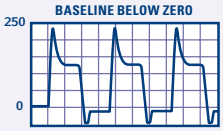
Widened deflation artifact may cause a potential Helium Loss alarm in 1:1 assist.



BASELINE ELEVATED

HIGH BASELINE

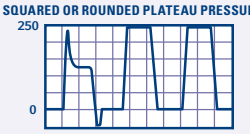
Check for:
- Kinked catheter
- Partially wrapped balloon
- IAB in sheath
- IAB too low in aorta
- IAB too large
- Overfill



BASELINE BELOW ZERO

POSSIBLE HELIUM LOSS

Check for:
- Blood in catheter tubing
- Possible leak in connections or tubing
- Kinked catheter
- Ectopic beats



SQUARED OR ROUNDED PLATEAU PRESSURE

HIGH PRESSURE

Check for:
- Kink in catheter or tubing
- Balloon too large for aorta
- Balloon position too high or too low

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