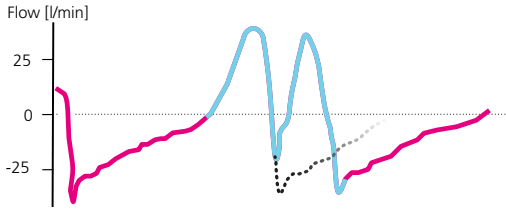






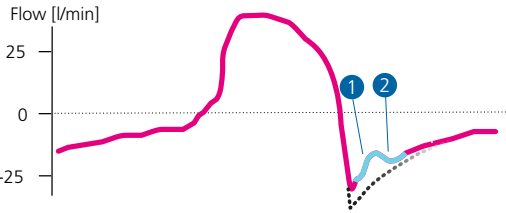




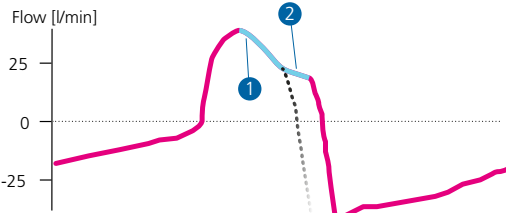










Patient-ventilator asynchrony reference card

Asynchrony	Description	On the waveform	Waveform example	Common possible causes
Trigger asynchronies - during the beginning of inspiration				
Delayed triggering	The time interval between the patient's inspiratory effort and the delivery of a mechanical breath is increased	Flow waveform: Look for a longer-than-normal time interval between the positive deflection in flow ① and the delivery of ventilatory support ②		<ul style="list-style-type: none"> Trigger threshold set too high Ventilator pneumatics Presence of AutoPEEP Low respiratory drive Weak inspiratory effort
Ineffective effort	The patient's inspiratory effort fails to trigger the delivery of a mechanical breath	Flow waveform: Look for an abrupt change in the steepness of the waveform ① (decrease in expiratory flow or increase in inspiratory flow) that is not followed by ventilatory support ②		<ul style="list-style-type: none"> Trigger threshold set too high Pressure support too high Set frequency and/or inspiratory time too high (in controlled modes) Tidal volume set too high Presence of AutoPEEP Low respiratory drive Weak inspiratory effort Sedation
Auto triggering	A mechanical breath delivered without an inspiratory effort	Pressure waveform: Look for a delivered mechanical breath showing no drop in airway pressure ① at the beginning of the inspiratory phase		<ul style="list-style-type: none"> Trigger threshold set too low Air leaks in the endotracheal tube cuff, ventilator circuit, or chest tube Flow oscillations (water or secretion in the circuit, cardiac oscillations)
Flow asynchronies - during the gas delivery				
Flow asynchrony	The delivered flow does not meet the patient's inspiratory flow demands	Pressure waveform: Look for an upward concavity ① preceding the end of the mechanical breath		<ul style="list-style-type: none"> Inappropriate selection of ventilation mode (more frequent in volume-controlled modes) High inspiratory effort <p style="color: #0056b3;">In volume-controlled modes:</p> <ul style="list-style-type: none"> Inappropriate flow settings <p style="color: #0056b3;">In pressure-controlled modes:</p> <ul style="list-style-type: none"> Inappropriate P-ramp settings

Asynchrony	Description	On the waveform	Waveform example	Common possible causes
Termination asynchronies - during the end of inspiration				
Double triggering	Two (or more) mechanical breaths are delivered during one single inspiratory effort	Flow waveform: Look for two assisted breaths without expiration between them or with an expiration interval of less than half of the mean inspiratory time (often visually displayed as a waveform with two inspiratory peaks)		<ul style="list-style-type: none">  Cycling criteria (ETS) set too high  Pressure support too low  P-ramp too short  Flow starvation  High respiratory drive  Time constant too short <p>Double triggering can be an effect of and/or promoted by reverse triggering or early cycling</p>
Early cycling	The duration of the mechanical breath is shorter than the duration of the patient's inspiratory effort	Flow waveform: Look for a small bump ① at the beginning of expiration (after peak expiratory flow) followed by an abrupt initial reversal in the expiratory flow ②		<p>In pressure support ventilation:</p> <ul style="list-style-type: none">  Cycling criteria (ETS) set too high  Low levels of ventilator pressure support  Time constant too short <p>In time-cycled ventilation:</p> <ul style="list-style-type: none">  Short inspiratory time
Delayed cycling	The duration of the mechanical breath is longer than the duration of the patient's inspiratory effort	Flow waveform: Look for a change in the slope of the inspiratory flow: a fast decrease ① followed by an exponential (less steep) decline ②		<p>In pressure support ventilation:</p> <ul style="list-style-type: none">  Cycling criteria (ETS) set too low  Pressure support too high  P-ramp too long <p>In pressure control ventilation:</p> <ul style="list-style-type: none">  Cycling criteria (ETS) set too low  Inspiratory time too long <p>In volume control ventilation:</p> <ul style="list-style-type: none">  Low flow  Long inspiratory time  High tidal volume

References