APRV – LTV STUDY METARULES

Goal: Maintain a mean airway pressure that recruits and maintains end expiratory lung volume. Also follow release volumes and keep release volumes between 4-8cc/kg with target 6.0cc/kg

- All patients should have an ABG at the time of randomization and generally every 2 hours unless contraindicated
- Protocol will be run within 30 minutes of new ABG's
- Use PaO2 if available, only use SPO2 if PaO2 more than 30 minutes old.

- Paper and computer charting must be done every two hours and whenever a change is made. When the patient is taken off the protocol, the paper charting will be turned in to a member of the research team.
- Treat correctable problems before failing patient or reassessing:
    1. Anxiety, pain, delirium
    2. Acute bronchospasm
    3. Mucus plug
    4. Excessive sedation
    5. Patient position
    6. Ventilator circuit problem
- Contact the attending MD or house officer when the following conditions occur:
    1. P high has been increased 6 cmH2O
    2. P high at 28 cm H2O.
    3. FiO2 increased 30 %.
    4. P Low and P high are closer than 5mmHg apart
- % of peak expiratory flow will be maintained at 50 to 75 %. T low will be adjusted to maintain the % of peak expiratory flow at 50 to 75%.
- Slope is set at "0" to ensure a square waveform.
- ATC will be off until mode is CPAP.
- P low will be titrated to target release volumes
- If P high is being decreased for oxygenation Plow will decrease generally by same amount
- P high will not be increased or decreased by more than 4 cm H2O every two hours
- T high will not be increased or decreased by more than 2 seconds every two hours.
- If the patient is being paralyzed, change the mode to PRVC, use the procedure APRV to Assist Control Transition
- If the pH > 7.25 and < 7.40
    - And PCO2 > 35 follow the protocol
    - And PCO2 is 25 – 35, contact MD
- ABG recommended:
    - When ABG SpO2 and SaO2 differ by more than 5.
    - Significant change in temperature or minute volume shifting the O2 dissociation curve.
- ABG required:

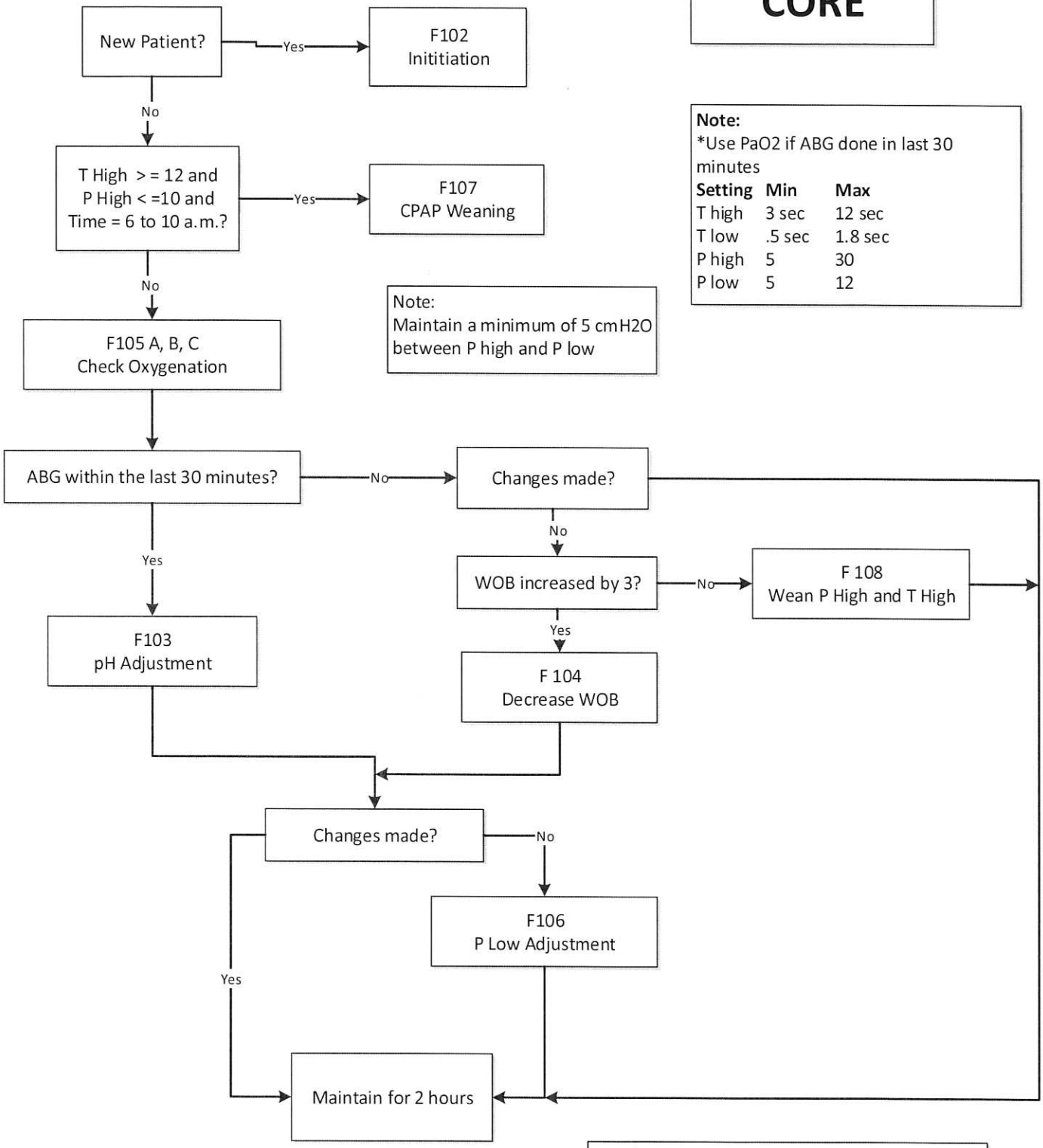
- Increase or decrease T high by a total of 5 seconds.
- 6 hours if ABG SpO2 and SaO2 differ by 6.
- 6 hours when P high $\geq$ 25 and FiO2 >0.6
- 12 hours when FiO2 > .4 and P High $\geq$ 15
- 24 hours when FiO2 = .4 and P High $\leq$ 10.

Flow Waveform Interpretation Guide

Waveform	Interpretation / Definition
0. Sinusoidal 	Normal flow waveform where the inspiratory flow is semi - elliptical, or a half-moon shape. Generally, the base of the waveform is wider than the amplitude. Peak flows usually remain < 40 Lpm. Sinusoidal waveforms indicate **good recruitment with minimal elastic WOB.**
1. Whale's Tooth 	Round at the top and the amplitude is usually greater than the width of the base. Minimal tapering is observed from the bottom to the top of the inspiratory waveform. Peak flow usually remains < 50 – 60 LPM. Suggests **mild to moderate elastic WOB.**
2. Shark's Tooth 	Triangular in shape where the amplitude of the waveform somewhat exceeds the width of the base. Peak flows usually < 70 LPM. Suggests **moderate to substantial elastic WOB.**
3. Canine Spiked 	Tall narrow waveforms with significant tapering from bottom to top. Peak Flows usually > 70 LPM. Suggests **severe elastic WOB**.

APRV LTV Protocol

F101. CORE



Note:
*Use PaO2 if ABG done in last 30 minutes

Setting	Min	Max
T high	3 sec	12 sec
T low	.5 sec	1.8 sec
P high	5	30
P low	5	12

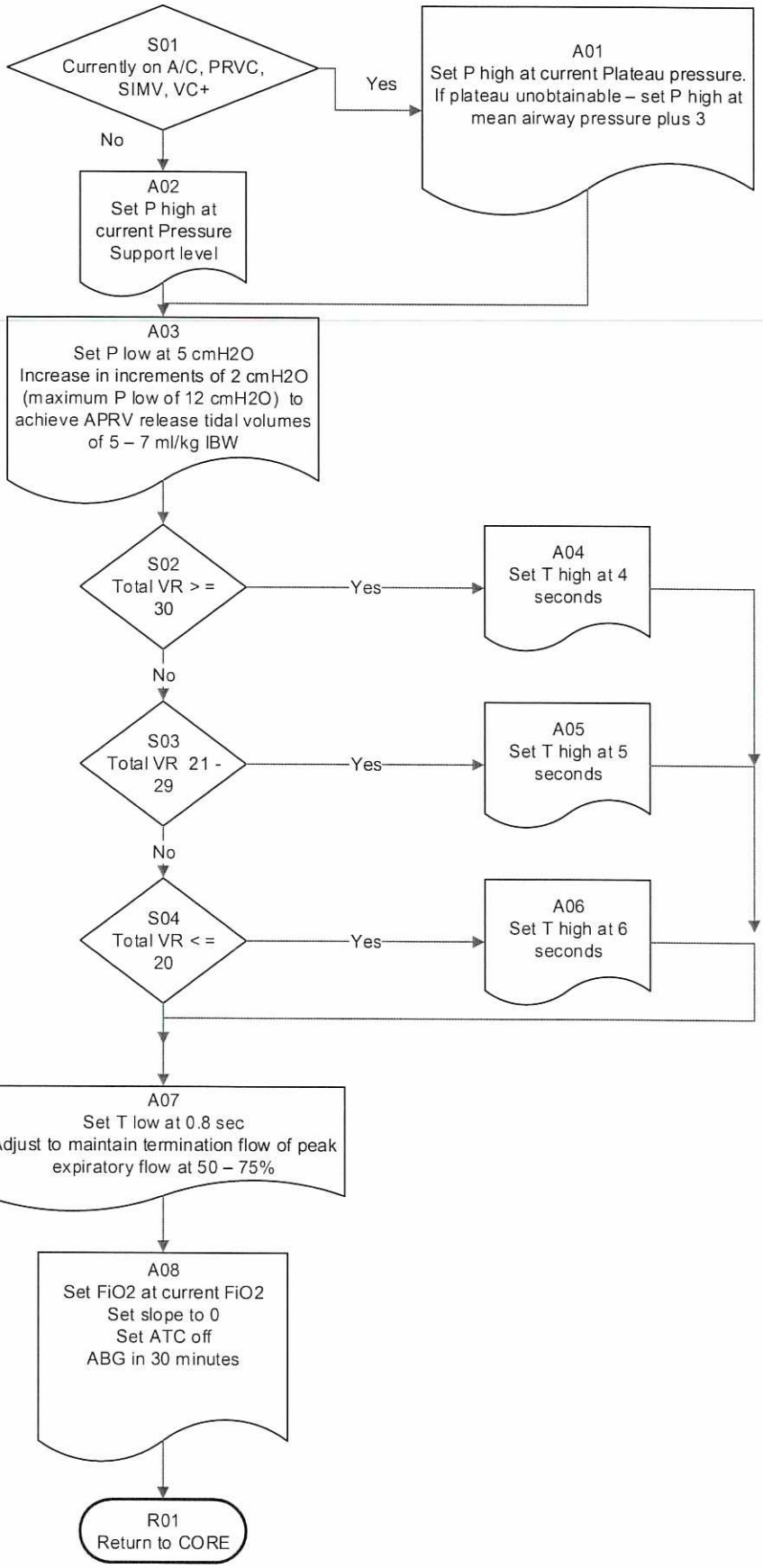
Note:
Maintain a minimum of 5 cmH2O between P high and P low

Legend
CORE: Map to titration of protocol, guide to individual flows
F followed by a number: Flows
S followed by a number: States, decisions
A followed by a number: conditions
Above used to enhance communication/ prepare for computerization
LTV: Low Tidal Volume

6/24/2013

APRV LTV Protocol

102. Initial APRV Settings

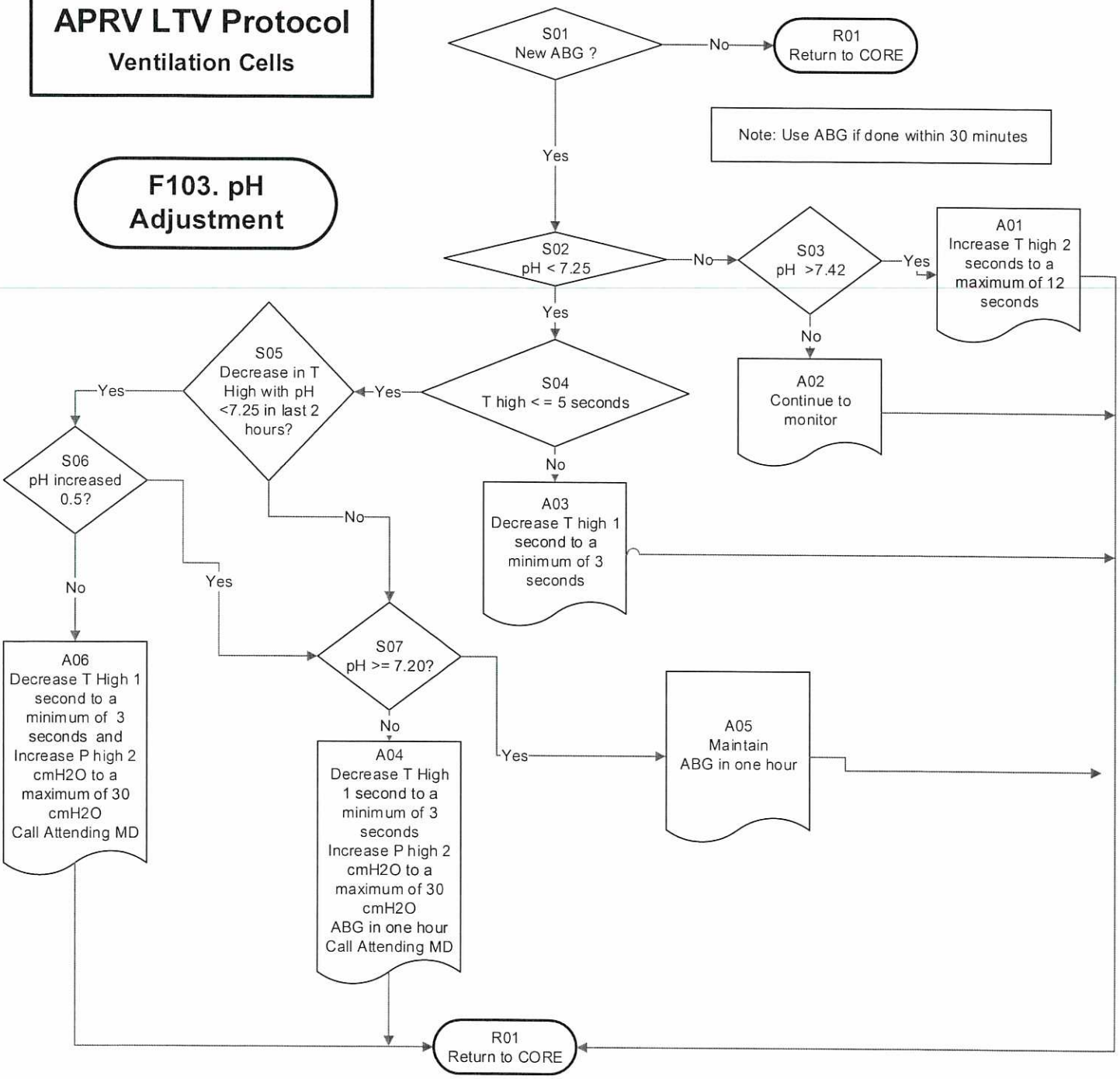


Note:
Maintain a minimum of 5 cmH2O between P high and P low.

Setting	Min	Max
T high	3 sec	12 sec
T low	.5 sec	1.8 sec
P high	5	30
P low	5	12

APRV LTV Protocol
Ventilation Cells

F103. pH Adjustment



Setting	Min	Max
T high	3 sec	12 sec
T low	.5 sec	1.8 sec
P high	5	30
P low	5	12

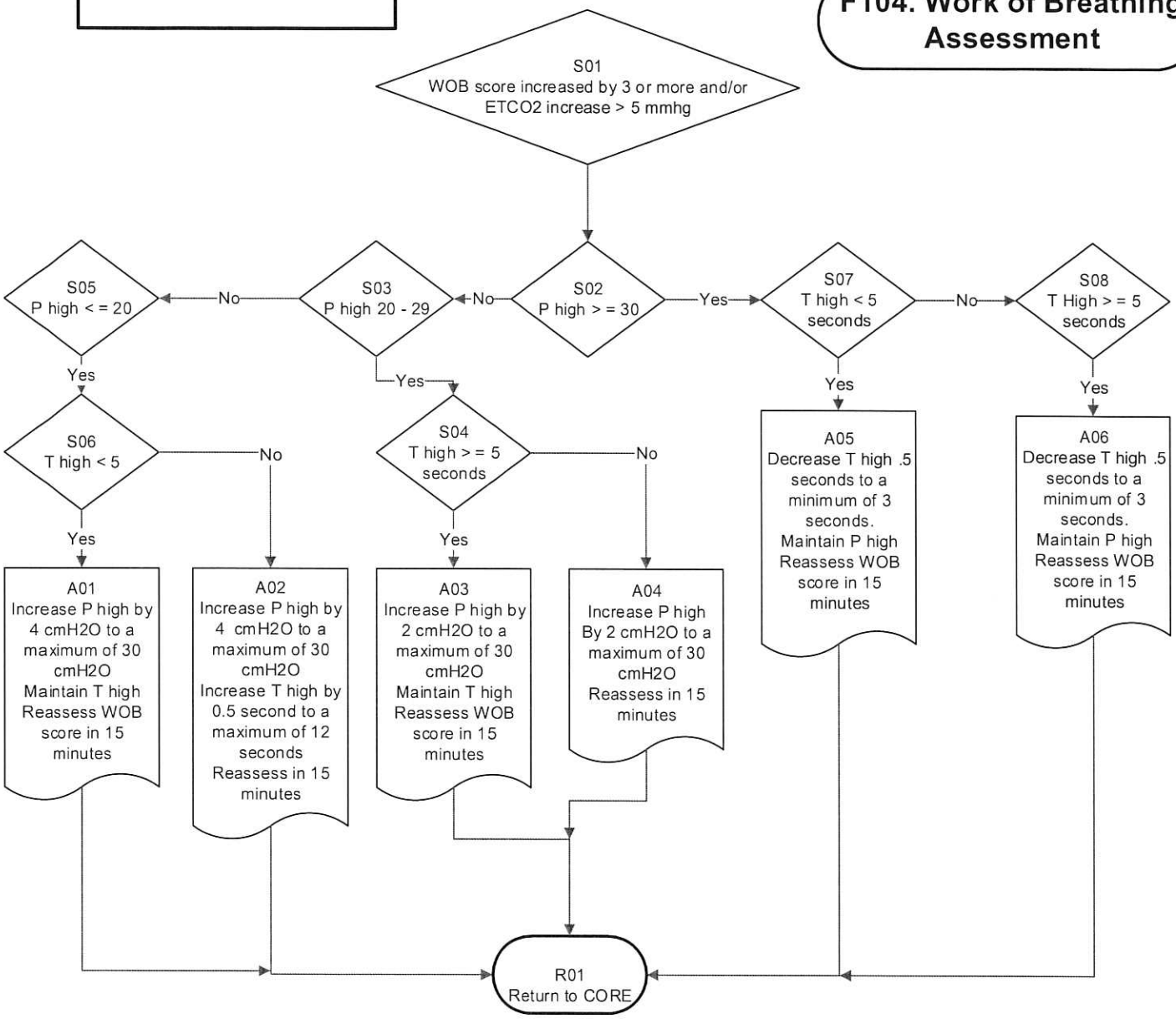
Note:
*Maintain a minimum of 5 cmH2O between P high and P low.

NOTE
If the pH is between 7.25 and 7.40:
* PCO2 > 35 follow the protocol
*PCO2 25 – 35, contact MD

06/24/2013

APRV LTV

F104. Work of Breathing Assessment



Note:

*Do not increase or decrease P high by more than 4 cm H2O every 2 hours.
*Do not increase or decrease T high by more than 2 seconds every 2 hours.
*Maintain a minimum of 5 cmH2O between P high and P low.

Setting	Min	Max
T high	3 sec	12 sec
T low	.5 sec	1.8 sec
P high	10	30
P low	5	12

06/24/2013

F105a. Improve Oxygenation

APRV LTV

Do not wean P High if VT is less than 6 ml/kg

After intervention based on the cell Return to CORE

SpO2 < 87 or paO2 < 55

P High	FiO2 = .40	FiO2 = .50	FiO2 =.60	FiO2 = .70	FiO2 = .80	FiO2 = .90	FiO2 = 1.0
8	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
9	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
10	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
11	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
12	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
13	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
14	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
15	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
16	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
17	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
18	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
19	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
20	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
21	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
22	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
23	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
24	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
25	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
26	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
27	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
28	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2, FiO2 .1	↑ P high 2, P low 2
29	↑ FiO2 0.1	↑ FiO2 0.1	↑ P high 1, P low 1, FiO2 0.1	↑ P high 1, P low 1, FiO2 0.1	↑ P high 1, P low 1, FiO2 0.1	↑ P high 1, P low 1, FiO2 0.1	↑ P high 1, P low 1
30	↑ FiO2 0.1	↑ FiO2 0.1	↑ FiO2 0.1	↑ FiO2 0.1	↑ FiO2 0.1	↑ FiO2 0.1	Call MD

F105b. Optimize Oxygenation

APRV LTV

Do not wean P High if VT is less than 6 ml/kg

After intervention based on cell Return to Core

SpO2 > 93 or paO2 > 68

P High	FiO2 = .40	FiO2 =.50	FiO2 = .60	FiO2 = .70	FiO2 = .80	FiO2 = .90	FiO2 = 1.0
8	Go to CPAP weaning	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
9	↓ P high 1 & P low 1	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
10	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
11	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
12	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
13	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
14	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
15	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
16	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
17	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
18	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
19	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
20	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
21	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
22	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
23	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
24	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ FiO2 0.1	↓ FiO2 0.1	↓ FiO2 0.1
25	↓ P high 1 & P low 1	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2
26	↓ P high 1 & P low 1	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2
27	↓ P high 1 & P low 1	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2
28	↓ P high 1 & P low 1	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2
29	↓ P high 1 & P low 1	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2
30	↓ P high 1 & P low 1	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2	↓ P high 2 & P low 2

F105c. Maintain Oxygenation

APRV LTV

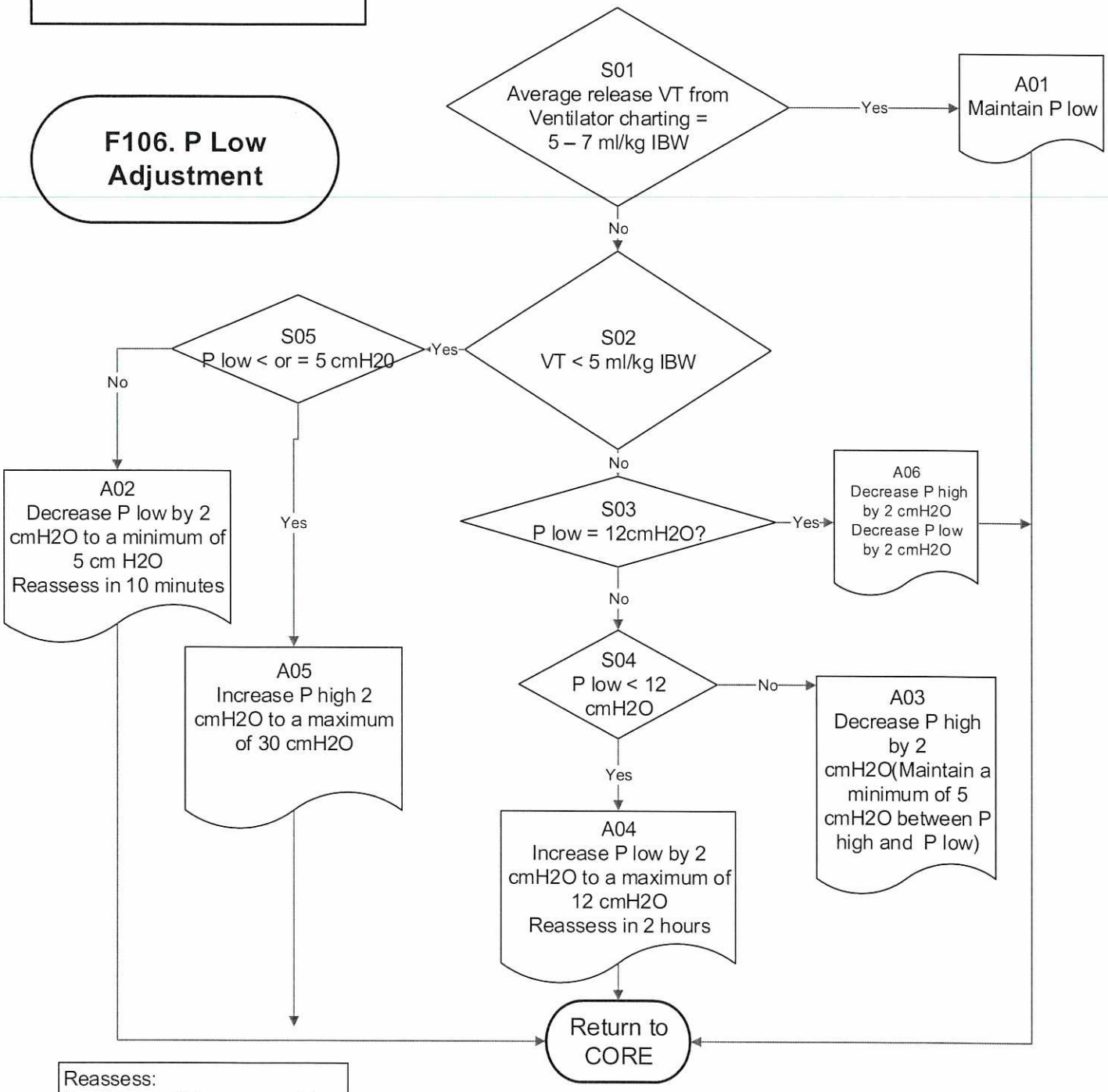
After intervention based on cell, Return to Core

SpO2 88 to 93 or paO2 55 to 68

P High	FiO2 = 0.4	FiO2 = 0.5	FiO2 = 0.6	FiO2 = .7	FiO2 = .8	FiO2 = .9	FiO2 = 1.0
8	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
9	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
10	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
11	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
12	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
13	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
14	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
15	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
16	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
17	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
18	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
19	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
20	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
21	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
22	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
23	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
24	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
25	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
26	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
27	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
28	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
29	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain
30	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain

APRV LTV

F106. P Low Adjustment



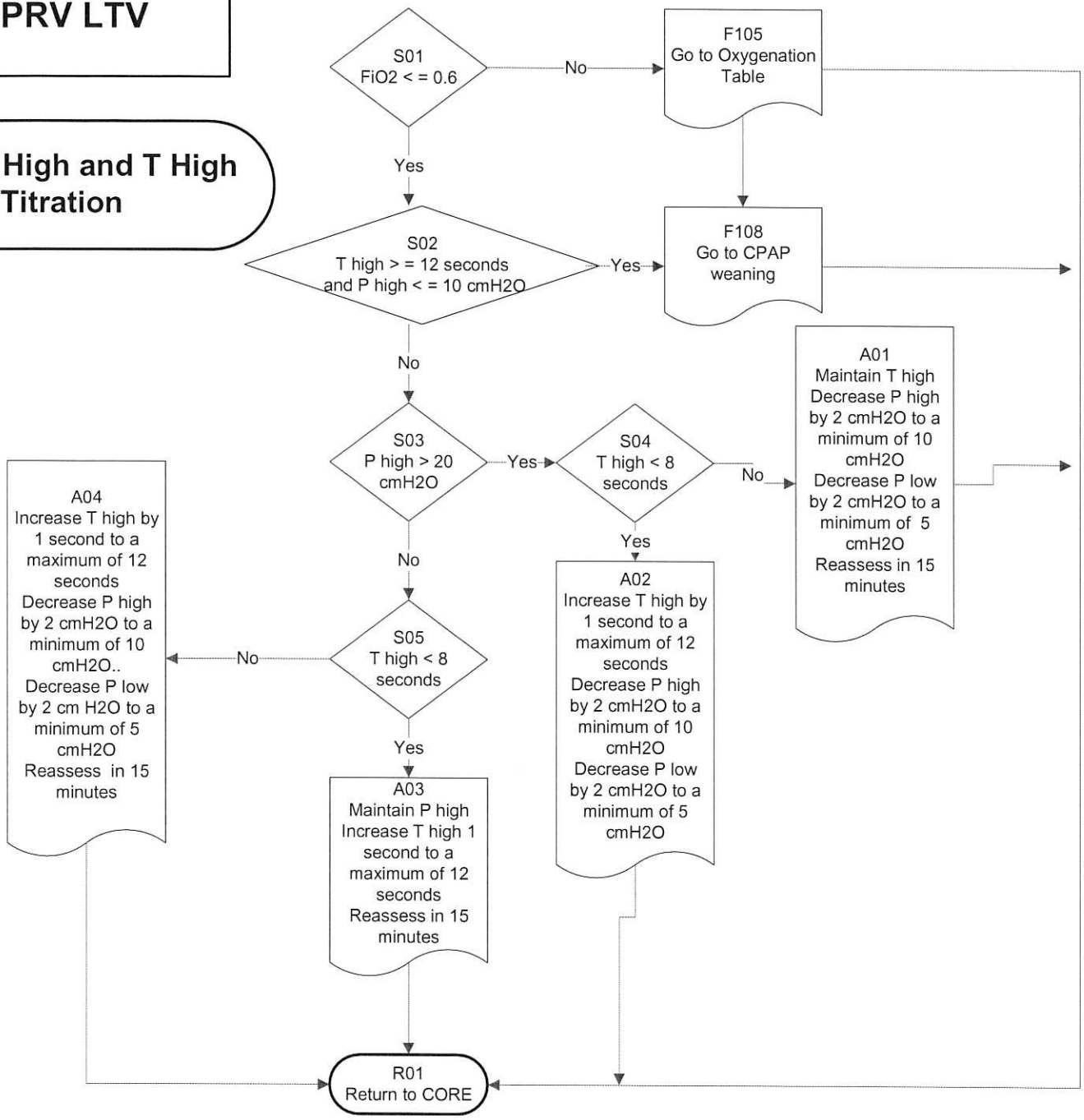
Reassess:
Complete a ventilator assessment in the computer. If the release tidal volume is > 7 ml/kg IBW or less than 5 ml/kg IBW. Adjust P low according to above flow diagham.
Note:
*Maintain a minimum of 5 cmH2O between P high and P low

Setting	Min	Max
T high	3 sec	12 sec
T low	.5 sec	1.8 sec
P high	5	30
P low	5	12

06/24/2013

APRV LTV

F107. P High and T High Titration



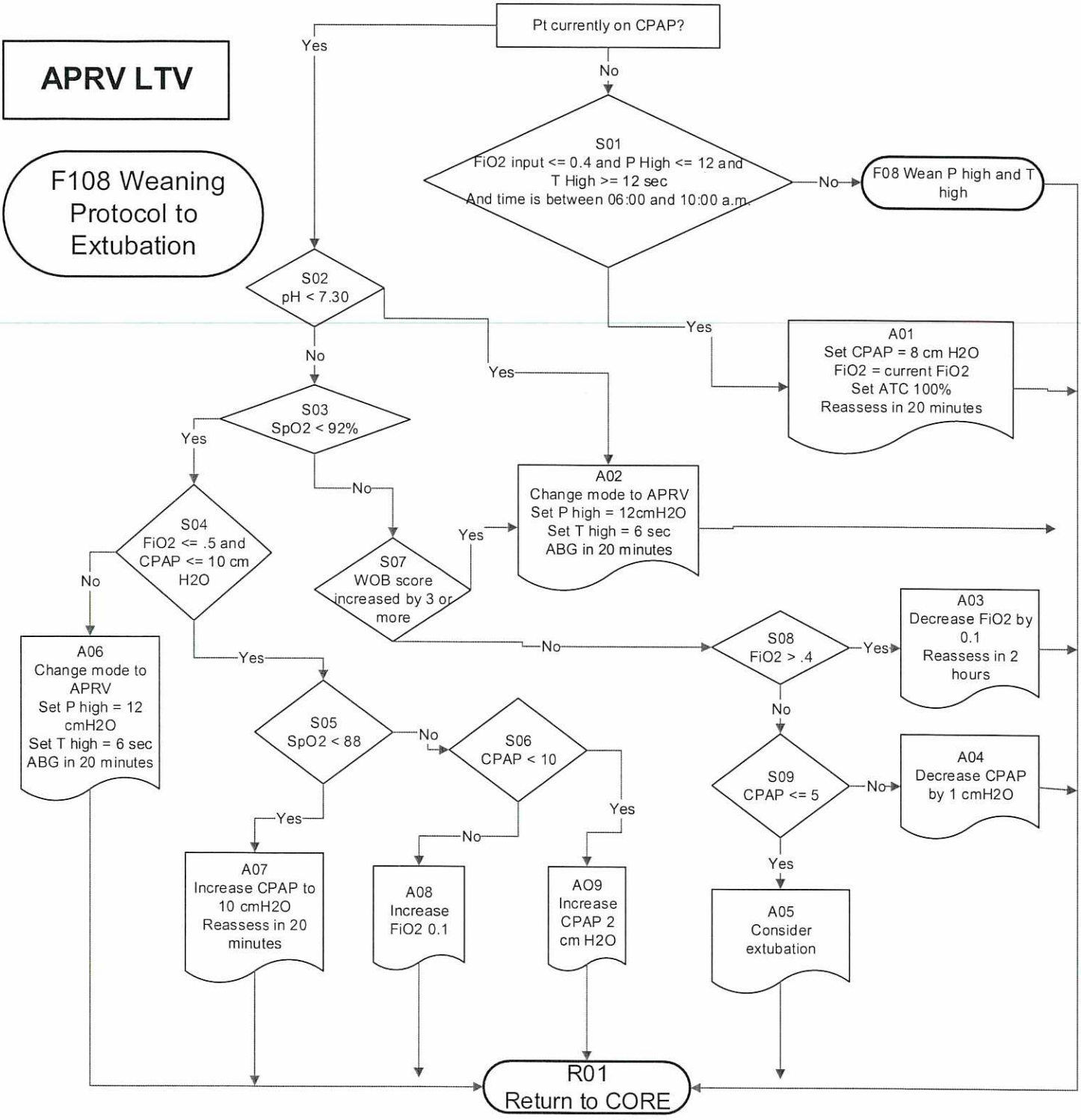
Note:
* Do not increase or decrease P high by more than 4 cm H2O every 2 hours.
*Do not increase or decrease T high by more than 2 seconds every 2 hours.
*Maintain a minimum of 5 cmH2O between P high and P low.

Setting	Min	Max
T high	3 sec	12 sec
T low	.5 sec	1.8 sec
P high	10	30
P low	5	12

Note:
If instruction from F106 P Low adjustment is to increase P low 2 cmH2O and instruction from above is to decrease P High and P low, Only decrease the P High.

APRV LTV

F108 Weaning Protocol to Extubation



Spontaneous Breathing Goals:
1. SpO2 > 90% or PaO2 >55
2. Average spontaneous tidal volume > 4 ml/kg IBW
3. Spontaneous VR < = 35 bpm
4. pH > = 7.30 if measured

Reassess
1. WOB – work of breathing score
2. ETCO2
3. SpO2
4. ABG if done

Treat correctable problems before failing patient back to APRV or reassessing
1. Anxiety, pain, delirium
2. Acute brochospasm
3. Mucus plug
4. Excessive sedation
5. Patient position
6. Ventilator circuit problem

06/24/2013