

# The Minnesota Code Classification System<sup>†</sup> for Electrocardiographic Findings

## **Q and QS Patterns**

(Do not code in the presence of WPW code 6-4-1.) To qualify as a Q- or QS-wave, the deflection should be at least 0.1 mV (1 mm in amplitude).

### **Anterolateral site (leads I, aVL, V<sub>6</sub>)**

- 1-1-1 Q/R amplitude ratio  $\geq 1/3$ , plus Q duration  $\geq 0.03$  sec in lead I or V<sub>6</sub>.
- 1-1-2 Q duration  $\geq 0.04$  sec in lead I or V<sub>6</sub>.
- 1-1-3 Q duration  $\geq 0.04$  sec, plus R amplitude  $\geq 3$  mm in lead aVL.
- 1-2-1 Q/R amplitude ratio  $\geq 1/3$ , plus Q duration  $\geq 0.02$  sec and  $< 0.03$  sec in lead I or V<sub>6</sub>.
- 1-2-2 Q duration  $\geq 0.03$  sec and  $< 0.04$  sec in lead I or V<sub>6</sub>.
- 1-2-3 QS pattern in lead I. Do not code in the presence of 7-1-1.
- 1-2-8 Initial R amplitude decreasing to 2 mm or less in every beat (and absence of codes 3-2, 7-1-1, 7-2-1, or 7-3 between V<sub>5</sub> and V<sub>6</sub>. (All beats in lead V<sub>5</sub> must have an initial R  $> 2$  mm.)
- 1-3-1 Q/R amplitude ratio  $\geq 1/5$  and  $< 1/3$ , plus Q duration  $\geq 0.02$  sec and  $< 0.03$  sec in lead I or V<sub>6</sub>.
- 1-3-3 Q duration  $\geq 0.03$  sec and  $< 0.04$  sec, plus R amplitude  $\geq 3$  mm in lead aVL.

### **Posterior (inferior) site (leads II, III, aVF)**

- 1-1-1 Q/R amplitude ratio  $\geq 1/3$ , plus Q duration  $\geq 0.03$  sec in lead II.
- 1-1-2 Q duration  $\geq 0.04$  sec in lead II.
- 1-1-4 Q duration  $\geq 0.05$  sec in lead III, plus a Q-wave amplitude  $\geq 1.0$  mm in the majority of beats in lead aVF.
- 1-1-5 Q duration  $\geq 0.05$  sec in lead aVF.
- 1-2-1 Q/R amplitude ratio  $\geq 1/3$ , plus Q duration  $\geq 0.02$  sec and  $< 0.03$  sec in lead II.
- 1-2-2 Q duration  $\geq 0.03$  sec and  $< 0.04$  sec in lead II.
- 1-2-3 QS pattern in lead II. Do not code in the presence of 7-1-1.
- 1-2-4 Q duration  $\geq 0.04$  sec and  $< 0.05$  sec in lead III, plus a Q-wave  $\geq 1.0$  mm amplitude in the majority of beats in aVF.
- 1-2-5 Q duration  $\geq 0.04$  sec and  $< 0.05$  sec in lead aVF.
- 1-2-6 Q amplitude  $\geq 5.0$  mm in leads III or aVF.
- 1-3-1 Q/R amplitude ratio  $\geq 1/5$  and  $< 1/3$ , plus Q duration  $\geq 0.02$  sec and  $< 0.03$  sec in lead II.
- 1-3-4 Q duration  $\geq 0.03$  sec and  $< 0.04$  sec in lead III, plus a Q-wave  $\geq 1.0$  mm amplitude in the majority of beats in lead aVF.
- 1-3-5 Q duration  $\geq 0.03$  sec and  $< 0.04$  sec in lead aVF.
- 1-3-6 QS pattern in each of leads III and aVF. (Do not code in the presence of 7-1-1.)

### **Anterior site (leads V<sub>1</sub>, V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>)**

- 1-1-1 Q/R amplitude ratio  $\geq 1/3$  plus Q duration  $\geq 0.03$  sec in any of leads V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.
- 1-1-2 Q duration  $\geq 0.04$  sec in any of leads V<sub>1</sub>, V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.
- 1-1-6 QS pattern when initial R-wave is present in adjacent lead to the right on the chest, in any of leads V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>, V<sub>6</sub>.
- 1-1-7 QS pattern in all of leads V<sub>1</sub>-V<sub>4</sub> or V<sub>1</sub>-V<sub>5</sub>.
- 1-2-1 Q/R amplitude ratio  $\geq 1/3$ , plus Q duration  $\geq 0.02$  sec and  $< 0.03$  sec, in any of leads V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.
- 1-2-2 Q duration  $\geq 0.03$  sec and  $< 0.04$  sec in any of leads V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.
- 1-2-7 QS pattern in all of leads V<sub>1</sub>, V<sub>2</sub>, and V<sub>3</sub>. (Do not code in the presence of 7-1-1).
- 1-2-8 Initial R amplitude decreasing to 2.0 mm or less in every beat (and absence of codes 3-2, 7-1-1, 7-2-1, or 7-3) between any of leads V<sub>2</sub> and V<sub>3</sub>, V<sub>3</sub> and V<sub>4</sub>, or V<sub>4</sub> and V<sub>5</sub>. (All beats in the lead immediately to the right on the chest must have an initial R  $> 2$  mm.)
- 1-3-1 Q/R amplitude ratio  $\geq 1/5$  and  $< 1/3$  plus Q duration  $\geq 0.02$  and  $< 0.03$  sec in any of leads V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.
- 1-3-2 QS pattern in lead V<sub>1</sub> and V<sub>2</sub>. (Do not code in the presence of 3-1 or 7-1-1.)

## **QRS Axis Deviation**

(Do not code in presence of low-voltage QRS, code 9-1, WPW 6-4-1, ventricular conduction defects, or 7-1-1, 7-2-1, and 7-4.)

- 2-1 Left. QRS axis from  $-30^0$  through  $-90^0$  in leads I, II, III. (The algebraic sum of major positive and major negative QRS waves must be zero or positive in I, negative in III, and zero or negative in II.)
- 2-2 Right. QRS axis from  $+120^0$  through  $-150^0$  in leads I, II, III. (The algebraic sum of major positive and major negative QRS waves must be negative in I, and zero or positive in III, and in I must be one-half or more of that in III.)
- 2-3 Right (optional code when 2-2 is not present). QRS axis from  $+90^0$  through  $+119^0$  in leads I, II, III. (The algebraic sum of major positive and major negative QRS waves must be zero or negative in I and positive in II and III.)
- 2-4 Extreme axis deviation (usually S1, S2, S3 pattern). QRS axis from  $-90^0$  through  $-149^0$  in leads I, II, and III. (The algebraic sum of major positive and major negative QRS waves must be negative in each of leads I, II, and III.)
- 2-5 Indeterminate axis QRS axis approximately  $90^0$  from the frontal plane. (The algebraic sum of major positive and major negative QRS waves is zero in each of leads I, II and III, or the information from these three leads is incongruous.)

## **High Amplitude R Waves**

- 3-1 Left: R amplitude  $> 26$  mm in either  $V_5$  or  $V_6$ , or R amplitude  $> 20.0$  mm in any of leads I, II, III, aVF, or R amplitude  $> 12.0$  mm in lead aVL. (All criteria measured only on second to last complete normal beat.)
- 3-2 Right: R amplitude  $\geq 5.0$  mm and R amplitude  $\geq$  S amplitude in the majority of beats in lead  $V_1$ , when S amplitude is  $>$  R amplitude somewhere to the left on the chest of  $V_1$  (codes 7-3 and 3-2, if criteria for both are present).
- 3-3 Left (optional code when 3-1 is not present): R amplitude  $> 15.0$  mm but  $\leq 20.0$  mm in lead I, or R amplitude in  $V_5$  or  $V_6$ , plus S amplitude in  $V_1 > 35.0$  mm. (Measured only on second to last complete normal beat.)
- 3-4 Criteria for 3-1 and 3-2 both present.

## **ST Junction (J) and Segment Depression**

(Do not code in the presence of codes 6-4-1, 7-1-1, 7-2-1 or 7-4. When 4-1, 4-2, or 4-3 is coded, then a 5-code must also be assigned except in lead  $V_1$ .)

### **Anterolateral site (leads I, aVL, $V_6$ )**

- 4-1-1 STJ depression  $\geq 2.0$  mm and ST segment horizontal or downward sloping in any of leads I, aVL, or  $V_6$ .
- 4-1-2 STJ depression  $\geq 1.0$  mm but  $< 2.0$  mm, and ST segment horizontal or downward sloping in any of leads I, aVL, or  $V_6$ .
- 4-2 STJ depression  $\geq 0.5$  mm and  $< 1.0$  mm and ST segment horizontal or downward sloping in any of leads I, aVL, or  $V_6$ .
- 4-3 No STJ depression as much as 0.5 mm but ST segment downward sloping and segment or T-wave nadir  $\geq 0.5$  mm below P-R baseline, in any of leads I, aVL, or  $V_6$ .
- 4-4 STJ depression  $\geq 1.0$  mm and ST segment upward sloping or U-shaped, in any of leads I, aVL, or  $V_6$ .

### **Posterior (inferior) site (leads II, III, aVF)**

- 4-1-1 STJ depression  $\geq 2.0$  mm and ST segment horizontal or downward sloping in lead II or aVF.
- 4-1-2 STJ depression  $\geq 1.0$  mm but  $< 2.0$  mm and ST segment horizontal or downward sloping in lead II or aVF.
- 4-2 STJ depression  $\geq 0.5$  mm and  $< 1.0$  mm and ST segment horizontal or downward sloping in lead II or aVF.
- 4-3 No STJ depression as much as 0.5 mm, but ST segment downward sloping and segment or T-wave nadir  $\geq 0.5$  mm below P-R baseline in lead II.
- 4-4 STJ depression  $\geq 1.0$  mm and ST segment upward sloping, or U-shaped, in lead II.

## **ST Junction (J) and Segment Depression (continued)**

### **Anterior site (leads V<sub>1</sub>, V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>)**

- 4-1-1 STJ depression  $\geq 2.0$  and ST segment horizontal or downward sloping in any of leads V<sub>1</sub>, V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.
- 4-1-2 STJ depression  $\geq 1.0$  mm but  $< 2.0$  mm and ST segment horizontal or downward sloping in any of leads V<sub>1</sub>, V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.
- 4-2 STJ depression  $\geq 0.5$  mm and  $< 1.0$  mm and ST segment horizontal or downward sloping in any of leads V<sub>1</sub>, V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.
- 4-2 No STJ depression as much as 0.5 mm, but ST segment downward sloping and segment or T-wave nadir  $\geq 0.5$  mm below P-R baseline in any of leads V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.
- 4-4 STJ depression  $\geq 1.0$  mm and ST segment upward sloping or U-shaped in any of leads V<sub>1</sub>, V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.

## **T-Wave Items**

(Do not code in the presence of code 6-4-1, 7-1-1, 7-2-1 or 7-4.)

### **Anterolateral site (leads I, aVL, V<sub>6</sub>)**

- 5-1 T amplitude negative 5.0 mm or more in either of leads I, V<sub>6</sub>, or in lead aVL when R amplitude is  $\geq 5.0$  mm.
- 5-2 T amplitude negative or diphasic (positive-negative or negative-positive type) with negative phase at least 1.0 mm but not as deep as 5.0 mm in lead I or V<sub>6</sub>, or in lead aVL when R amplitude is  $\geq 5.0$  mm.
- 5-3 T amplitude zero (flat), or negative, or diphasic (negative-positive type only) with less than 1.0 mm negative phase in lead I or V<sub>6</sub>, or in lead aVL when R amplitude is  $\geq 5.0$  mm.
- 5-4 T amplitude positive and T/R amplitude ratio  $< 1/20$  in any of leads I, aVL, V<sub>6</sub>; R wave amplitude must be  $\geq 10.0$  mm.

### **Posterior (inferior) site (leads II, III, aVF)**

- 5-1 T amplitude negative 5.0 mm or more in lead II, or in lead aVF when QRS is mainly upright.
- 5-2 T amplitude negative or diphasic with negative phase (negative-positive or positive-negative type) at least 1.0 mm but not as deep as 5.0 mm in lead II, or in lead aVF when QRS is mainly upright.
- 5-3 T amplitude zero (flat), or negative, or diphasic (negative-positive type only) with less than 1.0 mm negative phase in lead II; not coded in lead aVF.
- 5-4 T amplitude positive and T/R amplitude ratio  $< 1/20$  in lead II; R wave amplitude must be  $\geq 10.0$  mm.

### **Anterior site (leads V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>)**

- 5-1 T amplitude negative 5.0 mm or more in any of leads V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.
- 5-2 T amplitude negative (flat), or diphasic (negative-positive or positive-negative type) with negative phase at least 1.0 mm but not as deep as 5.0 mm, in any of leads V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.
- 5-3 T amplitude zero (flat), or negative, or diphasic (negative-positive type only) with less than 1.0 mm negative phase, in any of leads V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>.
- 5-4 T amplitude positive and T/R amplitude ratio  $< 1/20$  in any of leads V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>; R wave amplitude must be  $\geq 10.0$  mm.

## **A-V Conduction Defect**

- 6-1 Complete (third degree) A-V block (permanent or intermittent) in any lead. Atrial and ventricular complexes independent, and atrial rate faster than ventricular rate, with ventricular rate < 60.
- 6-2-1 Mobitz Type II (occurrence of P-wave on time with dropped QRS and T).
- 6-2-2 Partial (second degree) A-V block in any lead (2:1 or 3:1 block).
- 6-2-3 Wenckebach's Phenomenon (P-R interval increasing from beat to beat until QRS and T dropped).
- 6-3 P-R (P-Q) interval  $\geq 0.22$  sec in the majority of beats in any of leads I, II, III, aVL, aVF.
- 6-4-1 Wolff-Parkinson-White Pattern (WPW), persistent. Sinus P-wave. P-R interval < 0.12 sec, plus QRS duration  $\geq 0.12$  sec, plus R peak duration  $\geq 0.06$  sec, coexisting in the same beat and present in the majority of beats in any of leads I, II, aVL, V<sub>4</sub>, V<sub>5</sub>, V<sub>6</sub>. (6-4-1 suppresses 1-2-3, 1-2-7, 1-2-8, 1-3-2, 1-3-6, all 3, 4, 5, 9-2, 9-4, 9-5 codes.)
- 6-4-2 WPW Pattern, intermittent. WPW pattern in  $\leq 50\%$  of beats in appropriate leads.
- 6-5 Short P-R interval. P-R interval < 0.12 sec in all beats of any two of leads I, II, III, aVL, aVF.
- 6-6 Intermittent aberrant atrioventricular conduction. P-R > 0.12 sec (except in presence of 6-5 or heart rate greater than 100); wide QRS complex > 0.12 sec; normal P-wave when most beats are sinus rhythm. (Do not code in the presence of 6-4-2.)
- 6-8 Artificial pacemaker.

## **Ventricular Conduction Defect**

- 7-1-1 Complete left bundle branch block (LBBB). (Do not code in presence of 6-1, 6-4-1, 6-8, 8-2-1 or 8-2-2.) QRS duration  $\geq 0.12$  sec in a majority of beats in any of leads I, II, III, aVL, aVF, *plus* R peak duration  $\geq 0.06$  sec in a majority of beats (of the same QRS pattern) in any of leads I, II, aVL, V<sub>5</sub>, V<sub>6</sub>. (7-1-1 suppresses 1-2-3, 1-2-7, 1-2-8, 1-3-2, 1-3-6, all 2, 3, 4, 5, 9-2, 9-4, 9-5 codes. If any other codable Q-wave coexists with the LBBB pattern, code the Q and diminish the 7-1-1 code to a 7-4 code.)
- 7-1-2 Intermittent left bundle branch block. Same as 7-1-1 but with presence of normally conducted QRS complexes of different shape than the LBBB pattern.
- 7-2-1 Complete right bundle branch block (RBBB). (Do not code in the presence of 6-1, 6-4-1, 6-8, 8-2-1 or 8-2-2.) QRS duration  $\geq 0.12$  sec in a majority of beats in any of leads I, II, III, aVL, aVF, *plus*: R' > R in V<sub>1</sub> or V<sub>2</sub>; or QRS mainly upright, with R peak duration  $\geq 0.06$  sec in V<sub>1</sub> or V<sub>2</sub>; or S duration > R duration in all beats in lead I or II. (7-1 suppresses 1-2-3, 1-2-7, 1-2-8, 1-3-2, 1-3-6, all 2, 3, 4, 5, 9-2, 9-4, 9-5 codes.)
- 7-2-2 Intermittent right bundle branch block. Same as 7-2-1 but with presence of normally conducted QRS complexes of different shape than the RBBB pattern.
- 7-3 Incomplete right bundle branch block. QRS duration < 0.12 sec in each of leads I, II, III, aVL, aVF, and R' > R in either of leads V<sub>1</sub>, V<sub>2</sub>. (Code as 3-2 in addition if those criteria are met. 7-3 suppresses code 1-2-8.)
- 7-4 Intraventricular block. QRS duration  $\geq 0.12$  sec in a majority of beats in any of leads I, II, III, aVL, aVF. (7-4 suppresses all 2, 3, 4, 5, 9-2, 9-4, 9-5 codes.)
- 7-5 R-R' pattern in either of leads V<sub>1</sub>, V<sub>2</sub> with R' amplitude  $\geq R$ .
- 7-6 Incomplete left bundle branch block. (Do not code in the presence of any codable Q- or QS-wave.) QRS duration  $\geq 0.10$  sec and < 0.12 in the majority of beats of each of leads I, aVL, and V<sub>5</sub> or V<sub>6</sub>.
- 7-7 Left anterior hemiblock (LAH). QRS duration < 0.12 sec in the majority of beats in leads I, II, III, aVL, aVF, plus Q-wave amplitude  $\geq 0.25$  mm and < 0.03 sec duration in lead I, plus left axis deviation of  $-45^{\circ}$  or more negative. (In presence of 7-2, code 7-8 if axis is <  $-45^{\circ}$  and the Q-wave in lead I meets the above criteria.)
- 7-8 Combination of 7-7 and 7-2.

## **Arrhythmias**

- 8-1-1 Presence of frequent atrial or junctional premature beats (10% or more of recorded complexes).
- 8-1-2 Presence of frequent ventricular premature beats (10% or more of record complexes).
- 8-1-3 Presence of both atrial and/or junctional premature beats and ventricular premature beats (so that individual frequencies are < 10% but *combined* premature beats are  $\geq$  10% of complexes).
- 8-1-4 Wandering atrial pacemaker.
- 8-1-5 Presence of 8-1-2 and 8-1-4.
- 8-2-1 Ventricular fibrillation or ventricular asystole.
- 8-2-2 Persistent ventricular (idioventricular) rhythm.
- 8-2-3 Intermittent ventricular tachycardia. Three or more consecutive ventricular premature beats occurring at a rate  $\geq$ 100. This includes more persistent ventricular tachycardia.
- 8-2-4 Ventricular parasystole (should not be coded in presence of 8-3-1).
- 8-3-1 Atrial fibrillation (persistent).
- 8-3-2 Atrial flutter (persistent).
- 8-3-3 Intermittent atrial fibrillation (code if 3 or more clear-cut, consecutive sinus beats are present in any lead).
- 8-3-4 Intermittent atrial flutter (code if 3 or more clear-cut, consecutive sinus beats are present in any lead).
- 8-4-1 Supraventricular rhythm persistent. QRS duration < 0.12 sec; and absent P-waves or presence of abnormal P-waves (inverted or flat in aVF); and regular rhythm.
- 8-4-2 Supraventricular tachycardia intermittent. Three consecutive atrial or junctional premature beats occurring at a rate  $\geq$  100.
- 8-5-1 Sinoatrial arrest. Unexpected absence of P, QRS and T, plus a R-R interval at a fixed multiple of the normal interval,  $\pm$  10%.
- 8-5-2 Sinoatrial block. Unexpected absence of P, QRS and T, preceded by progressive shortening of P-P intervals. (R-R interval at a fixed multiple of the normal interval,  $\pm$  10%.
- 8-6-1 A-V dissociation with ventricular pacemaker (without capture). Requires: P-P and R-R occur at variable rates with ventricular rate as fast as or faster than the atrial rate, plus variable P-R intervals, plus no capture beats.
- 8-6-2 A-V dissociation with ventricular pacemaker (with capture).
- 8-6-3 A-V dissociation with atrial pacemaker (without capture).
- 8-6-4 A-V dissociation with atrial pacemaker (with capture).
- 8-7 Sinus tachycardia (over 100/min).
- 8-8 Sinus bradycardia (under 50/min).
- 8-9 Other arrhythmias. Heart rate may be recorded as a continuous variable.

## **ST Segment Elevation**

### **Anterolateral site (leads I, aVL, V<sub>6</sub>)**

- 9-2 ST segment elevation  $\geq$  1.0 mm in any of leads I, aVL, V<sub>6</sub>.

### **Posterior (inferior) site (leads II, III, aVF)**

- 9-2 ST segment elevation  $\geq$  1.0 mm in any of leads II, III, aVF.

### **Anterior site (leads V<sub>1</sub>, V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>)**

- 9-2 ST segment elevation  $\geq$  1.0 mm in lead V<sub>5</sub> or ST segment elevation  $\geq$  2.0 mm in any of leads V<sub>1</sub>, V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>.

## **Miscellaneous Items**

- 9-1 Low QRS amplitude. QRS peak-to-peak amplitude < 5 mm in all beats in each of leads I, II, III, or < 10 mm in all beats in each of leads V<sub>1</sub>, V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>, V<sub>6</sub>. (Check calibration before coding.)
- 9-3 P-wave amplitude ≥ 2.5 mm in any of leads II, III, aVF, in a majority of beats.
- 9-4-1 QRS transition zone at V<sub>3</sub> or to the right of V<sub>3</sub> on the chest. (Do not code in the presence of 6-4-1, 7-1-1, 7-2-1 or 7-4.)
- 9-4-2 QRS transition zone at V<sub>4</sub> or to the left of V<sub>4</sub> on the chest. (Do not code in the presence of 6-4-1, 7-1-1, 7-2-1 or 7-4.)
- 9-5 T-wave amplitude > 12 mm in any of leads I, II, III, aVL, aVF, V<sub>1</sub>, V<sub>2</sub>, V<sub>3</sub>, V<sub>4</sub>, V<sub>5</sub>, V<sub>6</sub>. (Do not code in the presence of 6-4-1, 7-1-1, 7-2-1 or 7-4.)
- 9-8-1 Technical problems which interfere with coding.
- 9-8-2 Technical problems which do not interfere with coding.

## **Incompatible Codes**

The codes in the left column suppress codes in the right column.

<b><u>Code</u></b>	<b><u>Suppress this code(s)</u></b>
All Q-, QS-codes	7-6
Q > 0.03 in lead I	7-7
3-1	1-3-2
3-2	1-2-8, 7-3
6-1	All other codes except 8-2
6-4-1	All other codes
6-8	All other codes
7-1-1	1-2-3, 1-2-7, 1-2-8, 1-3-2, 1-3-6, all 2-, 3-, 4-, and 5- codes, 7-7, 9-2, 9-4, 9-5
7-2-1	1-2-8, all 2-, 3-, 4-, and 5-codes, 9-2, 9-4, 9-5
7-3	1-2-8
7-4	All 2-, 3-, 4-, and 5-codes, 9-2, 9-4, 9-5
8-1-2	8-2-4
8-1-4	8-1-1, 9-3
8-2-1	All other codes
8-2-2	All other codes
8-2-3	8-1-2
8-3-1	8-1-1, 8-1-2
8-3-2	6-2-2, 8-1-1, 8-1-2
8-3-3	8-1-1, 8-1-2
8-3-4	6-2-2
8-4-1	6-5
8-4-1 + heart rate ≥ 140	All other codes except 7-4 or 6-2
Heart rate > 100	6-5
8-4-2	8-1-1
9-1 All 2-codes	

## **Categories of Minnesota ECG Abnormalities**

### Diagnostic ECG:

(any ECG may be used for this classification)

- D1. An ECG record with any Diagnostic Q-code (Minn. code 1-1-1 through 1-2-5 plus 1-2-7).
- D2. An ECG record with ST-segment elevation code 9-2 PLUS (T-wave inversion code 5-1 or 5-2 in the absence of 7-2-1 or 7-4).

### Equivocal ECG:

(any ECG may be used for this classification)

- E1. An ECG record with an Equivocal Q-code [(Minn. code 1-2-8 in the absence of a 7-1-1 or 7-3 or (any 1-3-code)].
- E2. An ECG record with ST-segment depression (code 4-1-x or 4-2 or 4-3 in the absence of 7-2-1 or 7-4), or 1-3-x.
- E3. An ECG record with T-wave inversion (code 5-1 or 5-2 or 5-3 in the absence of 7-2-1 or 7-4).
- E4. An ECG record with ST-segment elevation code 9-2.

### Other ECG:

- 01. Reference ECG coded 7-1-1.
- 02. Any ECG coded 7-1-1.
- 03. Normal ECG(s), defined as 1 in “clear” field of all ECGs.
- 04. Other findings including 1-2-6.

### Uncodable ECG:

- U1. Technical errors coded 9-8-1 by Minnesota Code.

### Absent ECG:

- A1. No ECG available for coding.

† Prineas R, Crow R, Blackburn H. The Minnesota Code Manual of Electrocardiographic Findings. John Wright-PSG, Inc. Littleton, MA, June 1982.