7.2.2 Low-voltage terminals (Present)

The electrical characteristics of the completely assembled low-voltage terminals shall be as shown in **Error! Reference source not found.**. The low-voltage terminal size shall be cable leads or spade terminal per Table 4. The low-voltage terminal stud shall be per Figure 2.

When low-voltage cable leads are specified, they shall extend 350 mm (14 in) above the top of the cover and shall be arranged for vertical takeoff. Cable insulation shall be in accordance with ANSI/NEMA WC 70/ICEA S-95-658 or functional equivalent for continuous operation at a minimum of 90 °C and 600 V. Cable flexibility shall be such that bending it into an arc having a radius of 300 mm (12 in) can be accomplished without overstressing the low-voltage bushing. The connection between the low-voltage bushings and the cable shall be fully insulated and sealed to prevent the entrance of moisture into the cable.

When spade terminals are specified, (one per terminal) they shall be in accordance with Figure 3.

For transformers with three low-voltage terminals only, the low-voltage neutral (X2) connection of the winding shall be made to the tank or cover but not to the core clamp. When the low-voltage neutral (X2) connection is through a fully insulated bushing, the neutral connection shall be shown on the nameplate as being internally or externally connected to the tank or cover.

7.2.3 Low-voltage terminals (Proposed)

The low-voltage terminal shall consist of an insulated terminal stud welded to the transformer tank or cover as shown in Figure 1. Each terminal stud shall have one cable lead or spade terminal attached to the terminal stud. The electrical characteristics of the completely assembled low-voltage terminals shall be per Table 2. The low-voltage terminal sizes shall be per Table 4.

The low-voltage terminal stud shall be per Figure 2. When spade terminals are specified, they shall be per Figure 3. When low-voltage cable leads are specified, they shall be made from stranded copper cable. The cable insulation shall be in accordance with ANSI/NEMA WC 70/ICEA S-95-658 or functional equivalent for continuous operation at a minimum of 90 °C and 600 V. The cable leads shall extend 350 mm (14 in) above the top of the cover and shall be arranged for vertical takeoff. Cable flexibility shall be such that bending it into an arc having a radius of 300 mm (12 in) can be accomplished without overstressing the low-voltage terminal stud. The connection between the low-voltage terminal stud and the cable shall be fully insulated and sealed to prevent the entrance of moisture into the cable.

For transformers with three low-voltage terminals, the low-voltage neutral (X2) connection of the winding shall be made to the tank or cover but not to the core clamp. When the low-voltage neutral (X2) connection is through a fully insulated bushing, the neutral connection shall be shown on the nameplate as being internally or externally connected to the tank or cover. If the low-voltage neutral terminal is externally connected to ground, a ground pad shall be provided on the tank or cover near the X2 terminal. The ground pad shall consist of a stainless steel or non-corrosive pad with a 1/2-inch-13-NC tapped hole, 11 mm (0.44 in) deep. One or more removeable ground straps suitably sized for the short-circuit rating of the transformer as defined in IEEE Std C57.12.00 shall be provided and connected between the low-voltage neutral terminal and the ground pad.

Table 2 - Transformer and terminal requirements (low-voltage)

Low-voltage ratings (V)	BIL (kV)	Nominal system voltage (kV)	60 Hz, dry, 1 min withstand (kV)	Number of terminals
120/240, 240/480	30	1.2	10	4
240/120, 480/240	30	1.2	10	3
120; 240; 277; 480; 347; 600	30	1.2	10	2

Commented [AT1]: Added requirements for the ground pad and ground straps. Consistent with C57.12.24 and other standards.

Commented [AT2]: No change to table 2

Table 4- Low-voltage terminal sizes

kVA	Low-voltage rating (V)					
	120	**240 240/120 120/240**	**277**	**347**	**480 480/240 240/480**	**600**
25	0.625–11 stud 4/0 AWG cable	0.625–11 stud 2/0 AWG cable	0.625–11 stud 2/0 AWG cable	0.625–11 stud 2/0 AWG cable	0.625–11 stud 2/0 AWG cable	0.625–11 stud 2/0 AWG cable
37.5	0.625–11 stud 500 kcmil cable	0.625–11 stud 2/0 AWG cable	0.625–11 stud 2/0 AWG cable	0.625–11 stud 2/0 AWG cable	0.625–11 stud 2/0 AWG cable	0.625–11 stud 2/0 AWG cable
50	1.000–14 stud 500 kcmil cable	0.625–11 stud 4/0 AWG cable	0.625–11 stud 2/0 AWG cable	0.625–11 stud 2/0 AWG cable	0.625–11 stud 2/0 AWG cable	0.625–11 stud 2/0 AWG cable
75	1.000–14 stud H spade	0.625–11 stud 500 kcmil cable	0.625–11 stud 500 kcmil cable	0.625–11 stud 4/0 AWG cable	0.625–11 stud 2/0 AWG cable	0.625–11 stud 2/0 AWG cable
100	1.000–14 stud H spade	1.000–14 stud 500 kcmil cable	0.625–11 stud 500 kcmil cable	0.625–11 stud 500 kcmil cable	0.625–11 stud 4/0 AWG cable	0.625–11 stud 2/0 AWG cable
167	1.250–12 stud H spade	1.000–14 stud H spade	1.000–14 stud H spade	0.625–11 stud H spade	0.625–11 stud 500 kcmil cable	0.625–11 stud 500 kcmil cable
250	1.250-12 stud H spade	1.000–14 stud H spade	1.000–14 stud H spade	1.000–14 stud H spade	1.000–14 stud H spade	1.000–14 stud 500 kcmil cable

Transformer kVA size	Required stud size for low-voltage rating of:			
	120	**240 240/120 120/240**	**277**	**347 480 480/240 240/480 600**
25	0.625–11	0.625–11	0.625–11	0.625–11
37.5	0.625–11	0.625–11	0.625–11	0.625–11
50	1.000–14	0.625–11	0.625–11	0.625–11
75	1.000–14	0.625–11	0.625–11	0.625–11
100	1.000–14	1.000–14	0.625–11	0.625–11
167	1.250–12	1.000–14	1.000–14	0.625–11
250	1.250-12	1.000–14	1.000–14	1.000–14

Low-voltage terminals	Low-voltage ratings (V)	kVA ratings
2/0 AWG copper cable	120/240, 240/120, 240	25–37.5
	240/480, 480/240, 480	25–75
	120	—
	277, 347	25–50
	600	25–100
4/0 AWG copper cable	120/240, 240/120, 240	50
	240/480, 480/240, 480	100
	120	25
	277	—
	347	75
	600	—
500 kcmil copper cable	120/240, 240/120, 240, 277	75–100
	240/480, 480/240 ,480	167
	120	37.5–50
	347	100
	600	167–250
H spade	120/240, 240/120, 240, 277, 347	167–250
	240/480, 480/240, 480	250
	120	75–250
	600	—

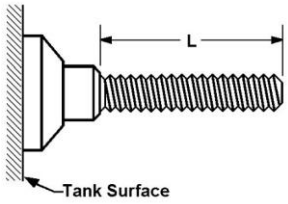
Commented [AT3]: Propose Combine Stud size into Table 4. Similar to C57.12.24

Commented [AT4]: Should this be J spade?
C57,12,20 is J spade for 120V 167-250kVA
4" X 0.375"min
C57.12.38 is H spade for 120V 167-250kVA
3.5" X 0.250"min
C57.12.34 120V 167 is 6-hole spade 4" X 0.250"min
C57.12.34 120V 250 is 10-hole spade 4" X 0.250"min
C57.12.24 120V 167 is 6-hole spade 4" X 0.250"min
C57.12.24 120V 250 is 10-hole spade 4" X 0.625"min

Commented [AT5]: 250kVA 120V was "n/a"
C57.12.38 specifies 1.25-12 stud

Commented [AT6]: Stud size in existing Fig 2

Commented [AT7]: Terminal size in existing Table 4



Low-voltage terminal stud size[a]		Showing for reference only			
Thread size	**Minimum L**	**C57.19.02**	**C57.12.38**	**C57.12.24**	**C57.12.34**
0.625–11 UNC–2A	31.75 (1.25)	32 (1.25)	31.75 (1.25)	32 (1.25)	32 (1.25)
1.000–14 UNS–2A	44.45 (1.75)	44 (1.75)	44.45 (1.75)	44 (1.75)	44 (1.75)
1.250–12 UNF–2A	63.5 (2.5)	67 (2.625)	63.5 (2.5)	67 (2.62)	67 (2.625)

[a] Dimension “L” is shown in millimeters (inches) and shall be the minimum useable thread length prior to any jam nuts, ground straps, or secondary connectors. Longer stud lengths may be required for user-supplied secondary connectors. Larger thread size or length, or both, may be required if materials other than copper are used. Stud thread sizes are standard trade sizes [B2] and are shown in inches only.

--- original below ---

[a] Dimension “L” is in millimeters (inches). Dimensions in parentheses are in inches. The tolerance is ±2 mm (0.079 in).

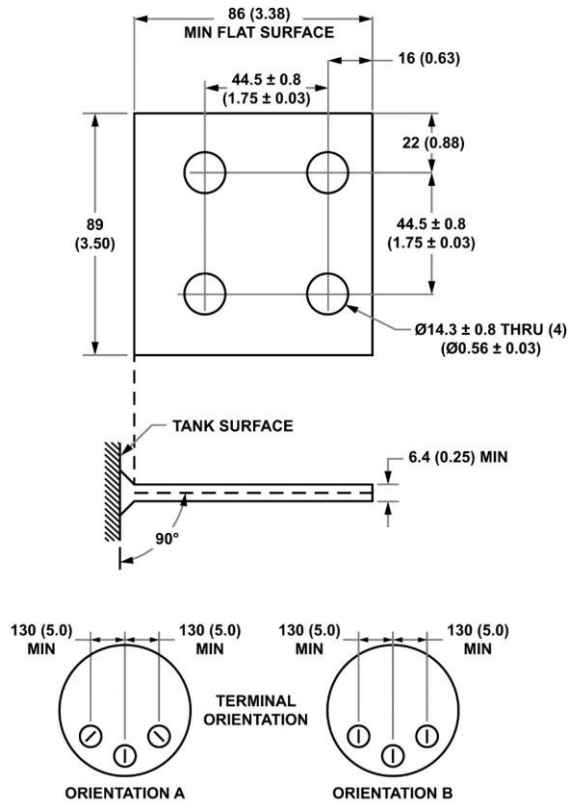
[b] Dimension “L” shall be the length prior to any jam nuts, ground straps, or secondary connectors. Longer stud lengths may be required for user-supplied secondary connectors. Larger thread size or length, or both, may be required if materials other than copper are used. Stud thread sizes are in inches only.

Figure 2—Low-voltage terminal stud details

Commented [AT8]: Combined footnotes a and b. Added minimum useable thread

Commented [AT9]: Added bibliography reference.

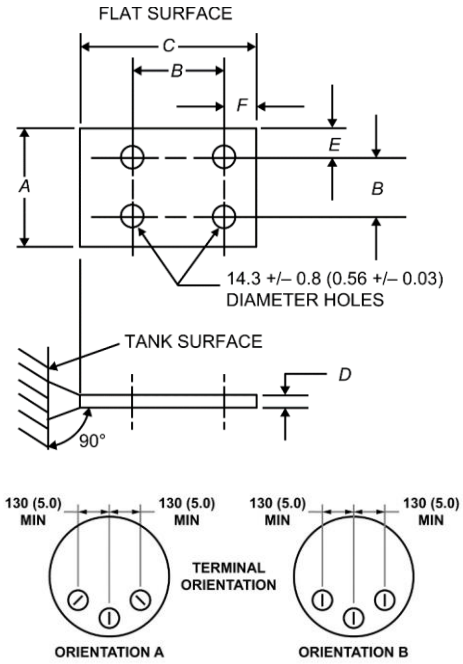
Commented [AT10]: Tolerance is not need when dimension is specified as a minimum



[a] Dimensions are minimums unless a tolerance is specified
NOTE 1 – Dimensions are in millimeters (inches)
NOTE 2 – Spade thickness may need to be larger to provided adequate ampacity.
NOTE 3 – Corners and edges may be rounded.

Figure 3—Spade terminals

Commented [AT11]: H-spade same as other stds.
Change figure title to H-spade terminal?
Add J spade? 4” wide X 0.25” thick



Spade Size	A	B	C	D	E	F
H-Spade	89 (3.50)	44.5 ± 0.8 (1.75 ± 0.03)	86 (3.375)	6.4 (0.25)	22 (0.875)	16 (0.625)
J-Spade	102 (4.00)	44.5 ± 0.8 (1.75 ± 0.03)	114.3 (4.50)	6.4 (0.25)	29 (1.125)	22.4 (0.875)

[a] Dimensions are minimums unless a tolerance is specified
NOTE 1 – Dimensions are shown in millimeters (inches)
NOTE 2 – Spade thickness "D" may need to be larger to provided adequate ampacity.
NOTE 3 – Corners and edges may be rounded.

Figure 3—Spade terminals

Commented [AT12]: Spade dimensions match existing 12.23, 12,24 and 19.02

Commented [AT13]: H-spade same as other stds. Add J spade? 4" wide X 0.25" thick? 0.375" thick?