

Transformer Tap Specification

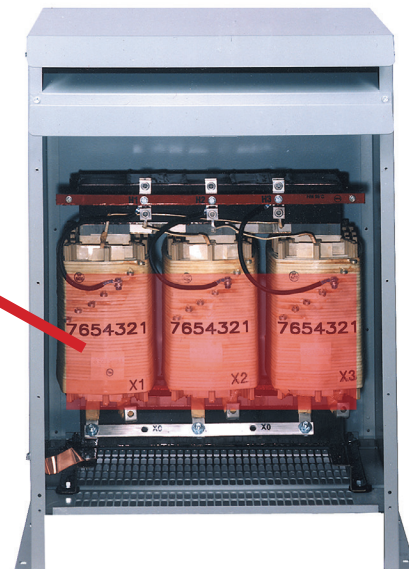
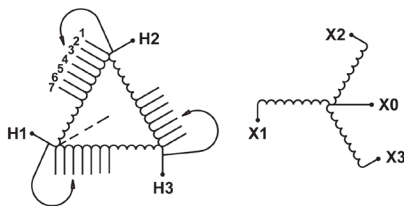
Transformer taps allow the coil ratio and therefore voltage ratio to be changed. This is useful to adjust the output voltage if the input voltage differs from the nominal voltage.

In the example below, a transformer has a nominal input voltage of 480 Volts and is provided with 2.5% taps; 2 above and 4 below.

This is often referenced as Taps: 2 x +2.5%, 4 x -2.5% (2FCAN, 4FCBN) or similar.

FCAN = Full Capacity Above Normal, **FCBN** = Full Capacity Below Normal. FCAN and FCBN signify that the transformer is still rated for its full kVA rating when the taps are utilized.

VOLT	CURRENT COURANT	% RATED VOLTAGE %TENSION NOMINALE	CONNECTION EACH PHASE CONNEXION PAR PHASE
504	85.9	105	1
492	88.0	102.5	2
480	90.2	100	3
468	92.5	97.5	4
456	95.0	95	5
444	97.5	92.5	6
432	100.2	90	7



NEMA ST 20 defines the allowable tap ranges for 600 volt class transformers in tables 2-1 and 2-2 by phase and kVA. As the charts below shows, a wide range of taps are offered at each kVA except for the lower kVA's.

A common questions is: Should a specification require a standard tap range, say 2x + 2.5%, 4 x -2.5% (2FCAN, 4FCBN), for all kVA's and voltages? In reality, transformers have differing number of coil turns to utilize taps. A 480 VAC primary essentially has twice as many turns as a 240 VAC primary.

- Taps need to b on the front face of the primary coil
- The primary coil is always the outer coil
- In a 240 VAC to 480 VAC step-up transformer, the primary coil is the 240 VAC coil

For example, offering six sets of taps on a 240 VAC primary step up to 480 VAC secondary would most likely result in taps on the sides or back of the coil. Some users may try to back-feed a 480 VAC primary coil by using the inner lower voltage to achieve a "step-up" design, but this is discourage for a number of reasons covered in other HP's technical bulletins. As a result, it is common that transformers designed to "Step-Up" voltages will offer fewer taps as an engineering necessity.

**Table 2-1
KILOVOLTAMPERE AND VOLTAGE RATINGS AND PRIMARY TAPS FOR SINGLE PHASE TRANSFORMERS HAVING
PRIMARY VOLTAGES UP THROUGH 600 VOLTS***

Single-Phase kVA Rating												
Primary Voltage	0.05	0.1	0.25	0.5	0.75	1	1.5	2	3	5	7.5	10
120	X	X	X	X	X	X	X	X	X	X	X	X
240	X	X	X	X	X	X	X	X	X, A	X, A	X, A	X, A
277	X	X	X	X	X	X	X	X	X, A	X, A	X, A	X, A
480	X	X	X	X	X	X	X	X	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E
600	X	X	X	X	X	X	X	X	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E
Single Voltages less than 300 not listed above	X	X	X	X	X	X	X	X	X, A	X, A	X, A	X, A
Single Voltage Greater than or equal to 300 not listed above	X	X	X	X	X	X	X	X	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E
120x240	X	X	X	X	X	X	X	X	X	X	X	X
240x480	X	X	X	X	X	X	X	X	X, C	X, C	X, C	X, C
Other Dual Voltages not listed above	X	X	X	X	X	X	X	X	X, C	X, C	X, C	X, C
Primary Voltage	15	25	37.5	50	75	100	167	250	333	500		
120	X, A, F	X, A, F	X, A, F	X, A, F	X, A, F	X, A, F	X, A, F	X, A, F	X, A, F	X, A, F		
240	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, F, H	X, A, F, H	X, A, F, H		
277	X, A	X, A	X, A	X, A	X, A	X, A	X, A	X, A	X, A	X, A		
480	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, F, H	X, A, F, H		
600	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, F, H	X, A, F, H		
Single Voltages less than 300 not listed above	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, F, H	X, A, F, H	X, A, F, H		
Single Voltage Greater than or equal to 300 not listed above	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, D, E	X, A, F, H	X, A, F, H	X, A, F, H		
120x240	X, C	X, C	X, C	X, C	X, C	X, C	X, C	X, C	X, C	X, C		
240x480	X, C, J	X, C, J	X, C, J	X, C, J	X, C, J	X, C, J	X, C, J	X, C	X, C	X, C		
Other Dual Voltages not listed above	X, C, J	X, C, J	X, C, J	X, C, J	X, C, J	X, C, J	X, C, J	X, C	X, C	X, C		

- X NO TAPS
- A 2 - 5% FCBN
- C 4 - 2/5% FCBN (Series Connected) 2-5 % FCBN (Parallel Connected)
- D 6 - 2.5% 2 FCAN, 4 FCBN
- E 4 - 2.5% 2 FCAN, 2 FCBN
- F 2 - 5% 1 FCAN, 1 FCBN
- H 3 - 5% 1 FCAN, 2FCBN
- J 6 - 2.5% 4-FCBN, 2-FCAN, (Series Connected) 3 - 2-5% FCBN 1-5% FCAN (Parallel Connected)

**Table 2-2
KILOVOLTAMPERE AND VOLTAGE RATINGS AND PRIMARY TAPS FOR THREE PHASE TRANSFORMERS HAVING PRIMARY VOLTAGES UP THROUGH 600 VOLTS'**

Primary Voltage	Three-Phase kVA Rating														
	3	6	9	15	30	45	75	112.5	150	225	300	500	750	1000	1500
120	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
240	X, A	X, A	X, A	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, E, H	X, A, E, H	X, A, E, H	X, A, E, H
400	X, A	X, A	X, A	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, E, H	X, A, E, H	X, A, E, H	X, A, E, H
480	X, A	X, A	X, A	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, E, H	X, A, E, H	X, A, E, H	X, A, E, H
600	X, A	X, A	X, A	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, E, H	X, A, E, H	X, A, E, H	X, A, E, H
All other voltages	X, A	X, A	X, A	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, D, E, H	X, A, E, H	X, A, E, H	X, A, E, H	X, A, E, H

- X NO TAPS
- A 2 - 5% FCBN
- C 4 - 2/5% FCBN (Series Connected) 2-5 % FCBN (Parallel Connected)
- D 6 - 2.5% 2 FCAN, 4 FCBN
- E 4 - 2.5% 2 FCAN, 2 FCBN
- F 2 - 5% 1 FCAN, 1 FCBN
- H 3 - 5% 1 FCAN, 2FCBN
- J 6 - 2.5% 4-FCBN, 2-FCAN, (Series Connected) 3 - 2-5% FCBN 1-5% FCAN (Parallel Connected)

If an application requires greater tap range than what the common taps allow, there are options including:

- Custom transformers with a greater tap range
- Custom transformers with a nominal voltage closer to the actual voltage
- Buck-Boost transformers used separately or in tandem with isolation transformers