

Rev	Date	By	Ck	Title
A	3/18/08	HA/JF	HA	Power Factor Correction

Objective

Determine the amount of KVAR to correct the facility power factor to .95 PF so not be penalized by the TVA utility company.

Assumptions:

- TVA Utility company requires RTI to keep the PF above .95 power factor or there will be a financial penalty
- The rectifier will correct their PF to .95 or above per specification
- The demand load for the facility excluding the Rectifier is 26,692KVA and the demand KW is 21,354 and the the demand KVAR is 16,014KVAR
- The overall power factor of the RTI Titanium Plant excluding the rectifier is .8 PF. The small motors have a PF of .77 and over 100 HP motors have PF of .86 PF. UPS and VSD correct to .95PF. Motors are spec to NEMA MG-1 and EPA energy saving type.
- KW is constant

Calculations:

$$P = 21,354 \text{ KW}$$

- Initial $\Phi 1 = \arccos .8 = 36.86^\circ \text{deg}$; $\tan \Phi 1 = \tan 36.86^\circ \text{deg} = 0.75$
- Final $\Phi 2 = \arccos 0.95 = 18.19^\circ \text{deg}$; $\tan \Phi 2 = \tan 18.19^\circ \text{deg} = 0.328$

$$Q_c = P (\tan \Phi 1 - \tan \Phi 2) = 21,354 \text{ KW} (.75 - .328) = \underline{\underline{9,011 \text{ KVAR}}}$$

Results: Parsons will use two Reactive Var capacitor banks 5000 KVAR each at 13.8KV at Swgr 201 and 202.

Second backup Calculation: On line website: calculation from Northeast Power system Inc. website
http://www.nepsi.com/kvars_required_calculation.htm



Calculation of Required Kvar to Raise Power Factor

This web page can be used to calculate the kvar required to raise the power factor of a constant kw (real power) load. The initial power factor, desired power factor, and load kw are required for the calculation.

A negative power factor is interpreted as a leading power factor. A positive power factor is considered a lagging power factor. A negative kvar value should be interpreted as capacitive kvar that shall be removed. A positive kvar value should be interpreted as capacitive kvar that shall be added.

Table 1 - Calculation of Required Kvar

Known Variables: Initial or Present Power Factor, Desired Power Factor, and Real Power of Load

$$\text{kvar} = \text{KW}(\tan \theta_i - \tan \theta_d) \quad \text{where:}$$

$$\theta_i = \cos^{-1} \text{Pf}_i = \text{Initial Power Factor Angle}$$

$$\theta_d = \cos^{-1} \text{Pf}_d = \text{Final Power Factor Angle}$$

Input Initial Power Factor	<input type="text" value=".8"/>
Input Desired Power Factor	<input type="text" value=".95"/>
Input Load KW (KW)	<input type="text" value="21354"/>

Calculated Results are below:

Required Kvar	<input type="text" value="8996.78"/>
Initial KVA	<input type="text" value="26692.5"/>
Final KVA after addition/removal of capacitors.	<input type="text" value="22477.895"/>
	<input type="button" value="Compute"/>

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