The following is a sample of the hand calculations that were performed for each motor model.

Hand Calc's

Single2 Model:

$MotorkV = 4$

$MotorMVA = 0.4408$

$Z_B = \frac{MotorkV^2}{MotorMVA}$ $\quad Z_B = 36.29764$

$R_1 = 0.0383\, Z_B$

$X_1 = 0.1029\, Z_B$

$Xm = 3.652\, Z_B$

$R_{2LR} = 0.0123\, Z_B$ $\quad R_{2LR} = 0.44646$

$R_{2FL} = 0.0152\, Z_B$ $\quad R_{2FL} = 0.55172$

$X_{2LR} = 0.093\, Z_B$ $\quad X_{2LR} = 3.37568$

$X_{2FL} = 0.1167\, Z_B$ $\quad X_{2FL} = 4.23593$

Find rated slip using trial and error until current (I1) is satisfied:

$s_{rated} = 0.0155022$

$R_2 = \left(R_{2FL} - R_{2LR}\right)\left(1 - s_{rated}\right) + R_{2LR}$ $\quad R_2 = 0.55009$

$X_2 = \left(X_{2FL} - X_{2LR}\right)\left(1 - s_{rated}\right) + X_{2LR}$ $\quad X_2 = 4.2226$

$$Zeq = R_1 + X_1 i + \left(\frac{1}{Xmi} + \frac{1}{\frac{R_2}{s_{rated}} + X_2\, i}\right)^{-1}$$ $\quad Zeq = 32.61631 + 15.92816i$

$$I_1 = \frac{\frac{MotorkV\,1000}{\sqrt{3}}}{|Zeq|}$$ $\quad I_1 = 63.62373$

Calculate the relationship (K) between Pout and Pag to compensate for rotational losse

$PF = \cos(\arg(Zeq))$ $\quad PF = 0.89858$

$P_{ag} = \sqrt{3}\, MotorkV\, I_1\, PF - \frac{3 I_1^{\,2} R_1}{1000}$ $\quad P_{ag} = 379.20791$

$Pconv = \left(1 - s_{rated}\right) P_{ag}$ $\quad Pconv = 373.32935$

$Pout_{rated} = 500\ 0.7457$ $\quad Pout_{rated} = 372.85$

$K_{ga} = \frac{P_{ag}}{Pout_{rated}}$ $\quad \boxed{K_{ga} = 1.01705}$

Single1 Model:

s (pu)	t (s)	Benchmark		ETAP		% Diff	
		P (kW)	Q (kvar)	P (kW)	Q (kvar)	P (%)	Q (%)
0.900008	0.835	7.4564	1473.97	7.45092	1473.94	**0.074**	**0.002**
0.699987	2.252	32.1621					