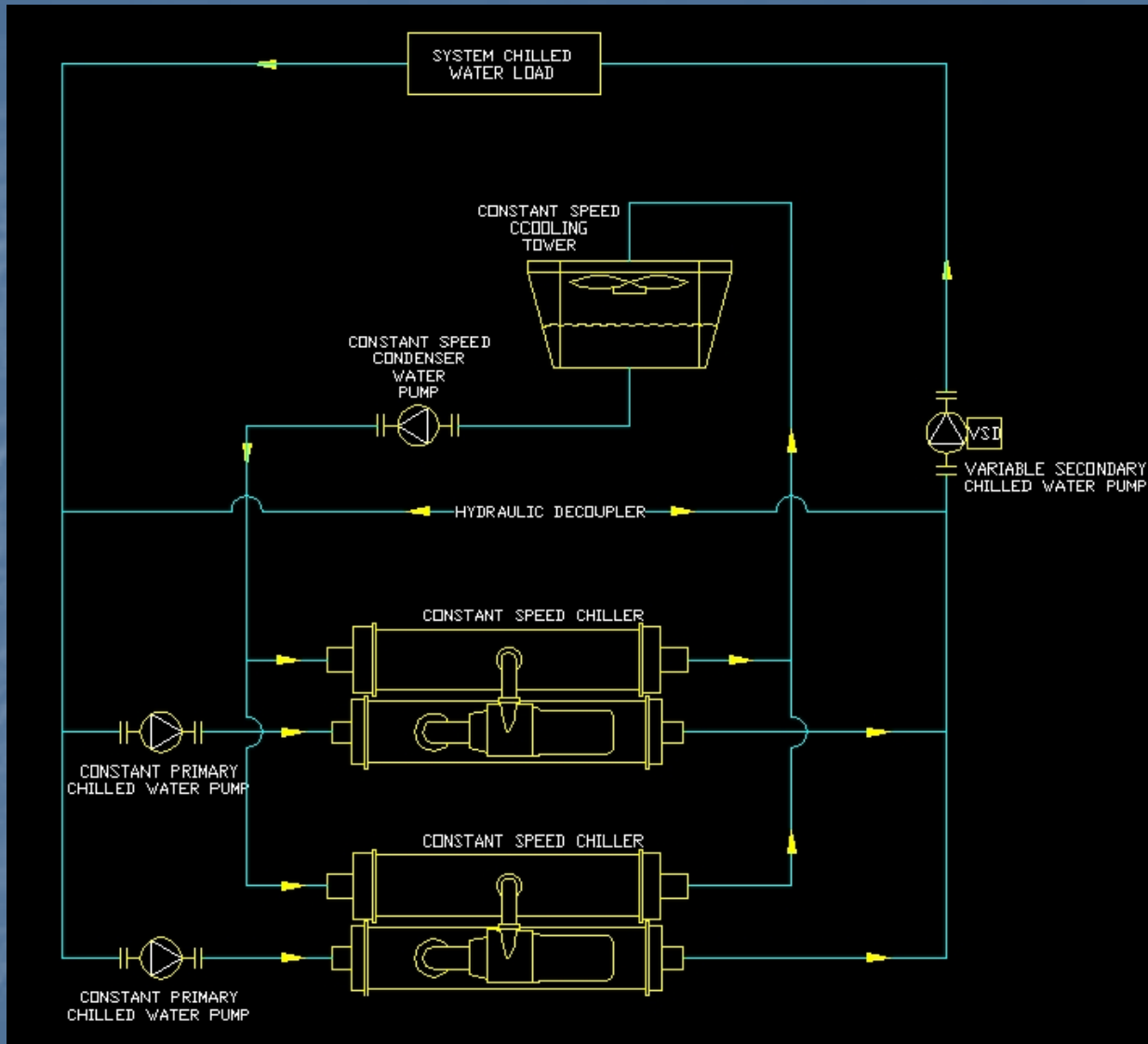


# ULTRA EFFICIENT CHILLED WATER PRODUCTION AND DISTRIBUTION SYSTEMS

# TRADITIONAL CONSTANT SPEED CHILLED WATER PLANT



# ALL VARIABLE SPEED CHILLED WATER PLANT

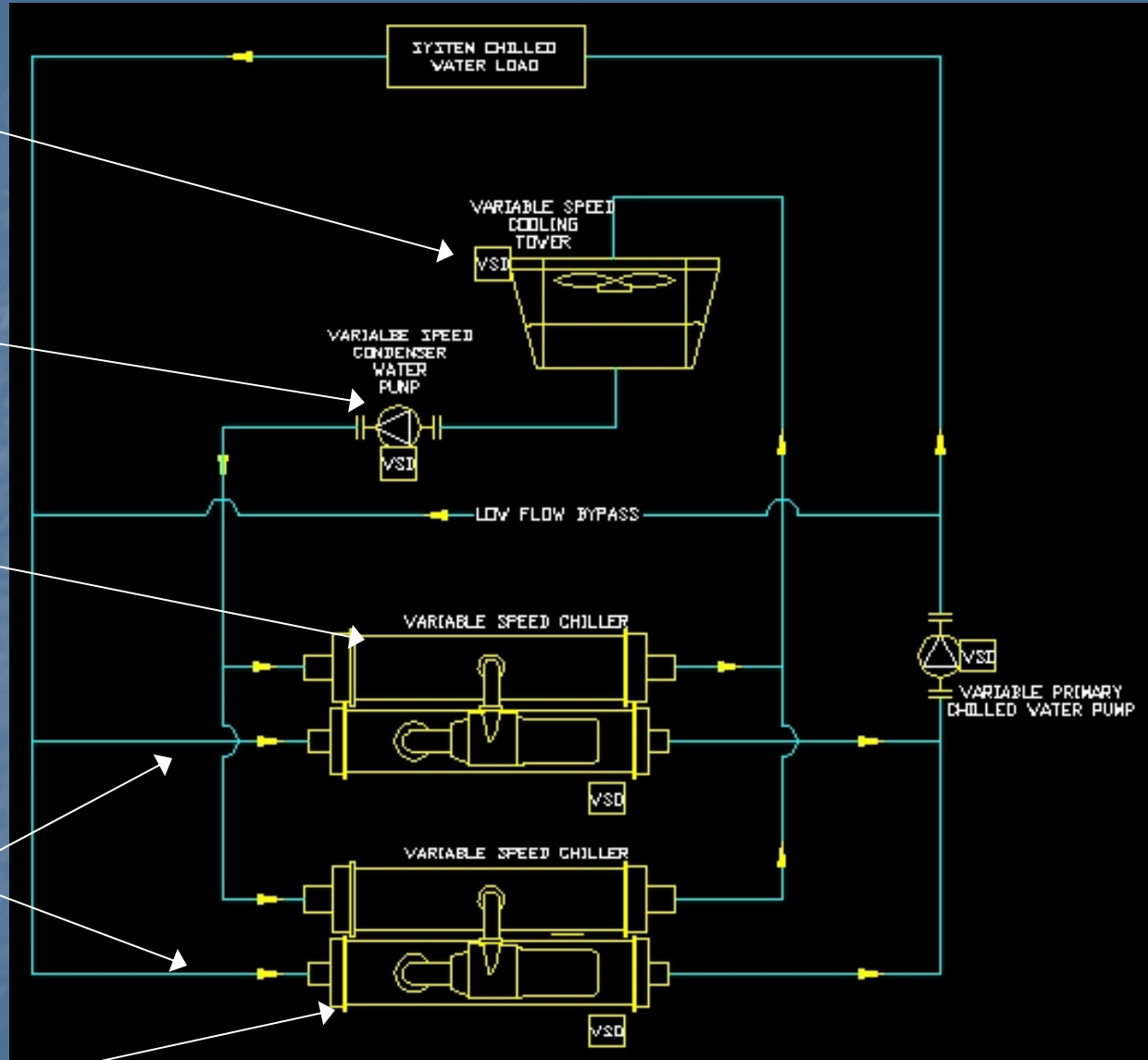
VARIABLE SPEED DRIVE ADDED TO COOLING TOWER FAN MOTOR

VARIABLE SPEED DRIVE ADDED TO CONDENSER WATER PUMP

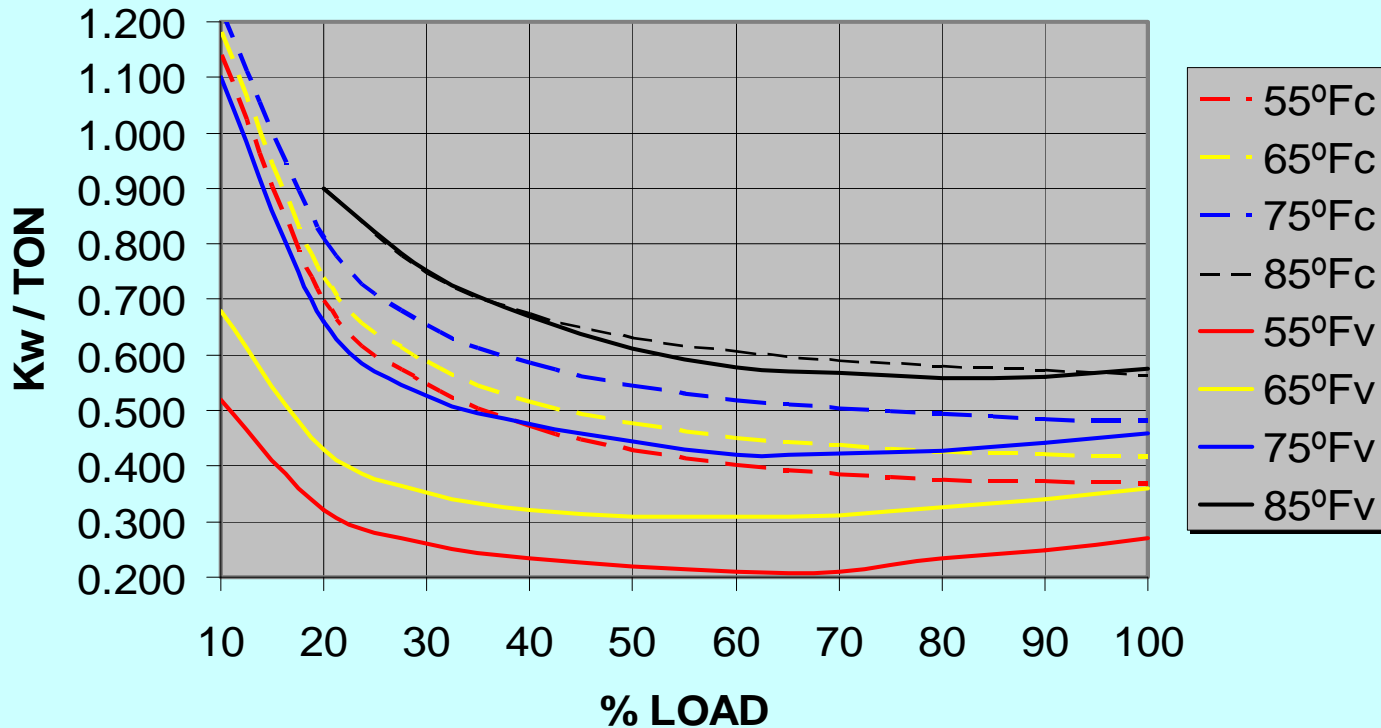
VARIABLE SPEED CHILLER REPLACES CONSTANT SPEED MODEL

PRIMARY CHILLED WATER PUMPS REMOVED

VARIABLE SPEED CHILLER REPLACES CONSTANT SPEED MODEL

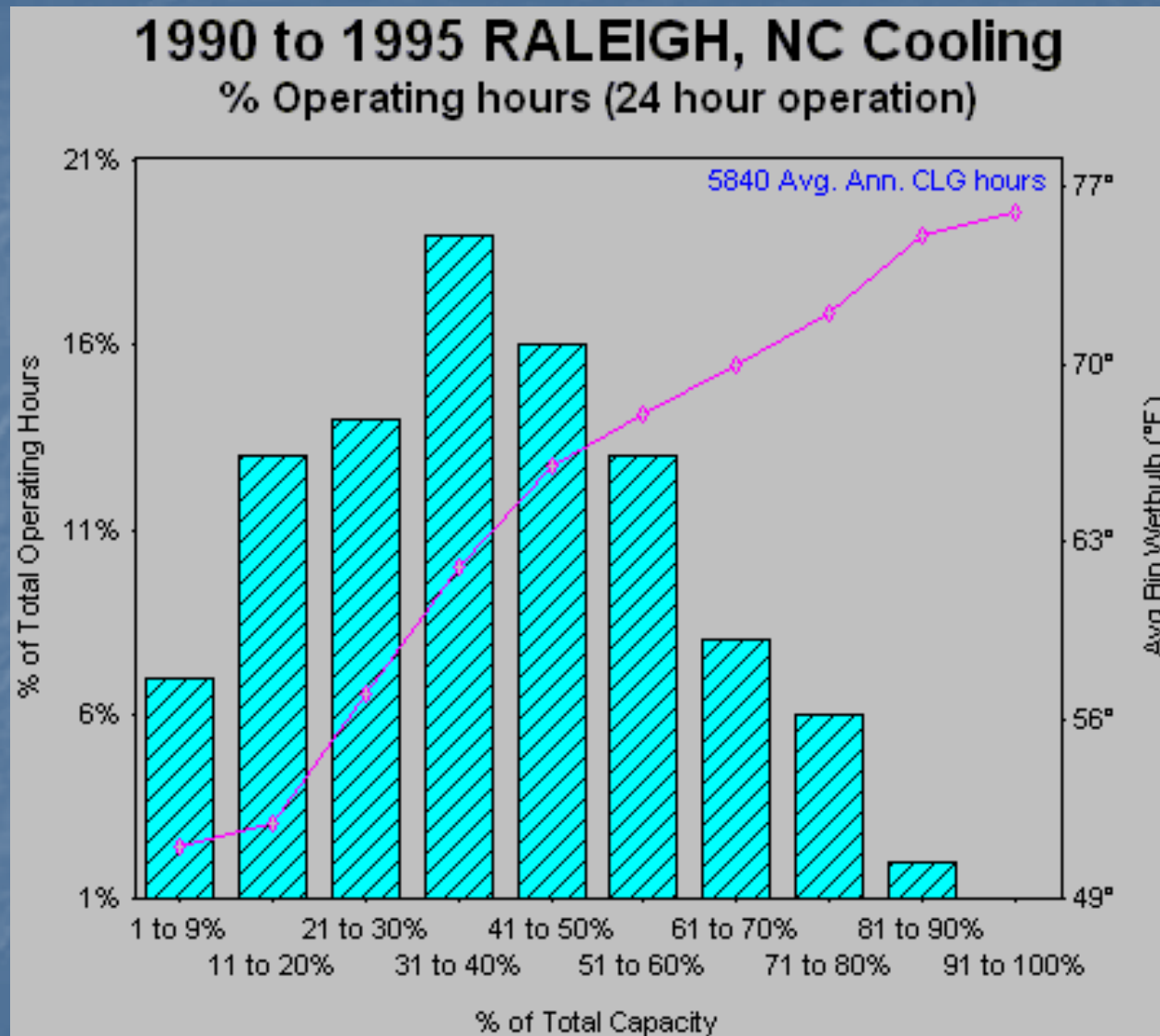


# CONSTANT AND VARIABLE SPEED CHILLER EFFICIENCIES AT VARYING LOADS AND CONDENSER WATER TEMPERATURES

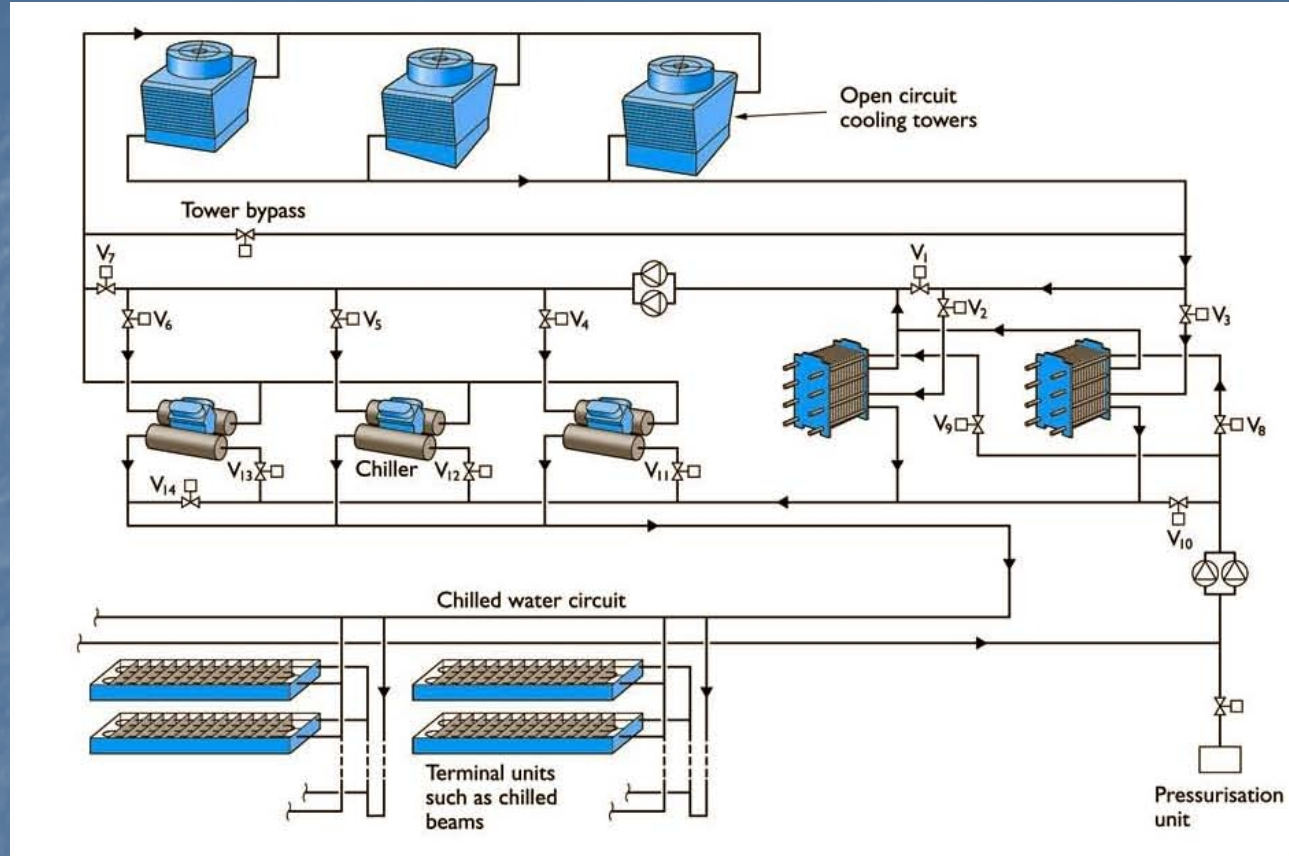


	EXCELLENT		GOOD	FAIR	NEEDS IMPROVEMENT			
kW/ton	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2
C.O.P.	(7.0)	(5.9)	(5.0)	(4.4)	(3.9)	(3.5)	(3.2)	(2.9)

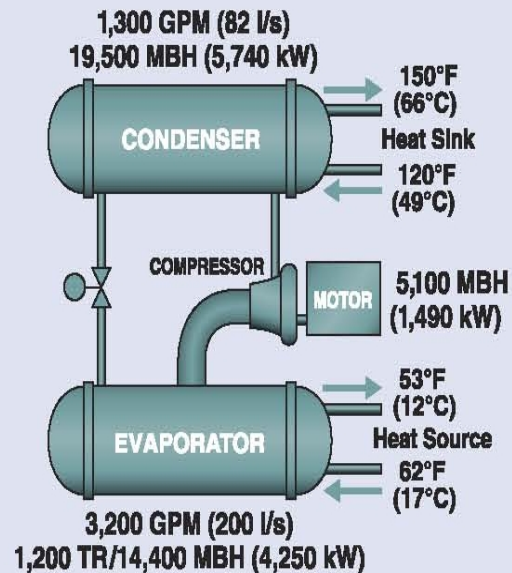
# VARIABLE SPEED CHILLER - LOAD MATCHING CAPABILITIES



# WATER SIDE ECONOMIZER

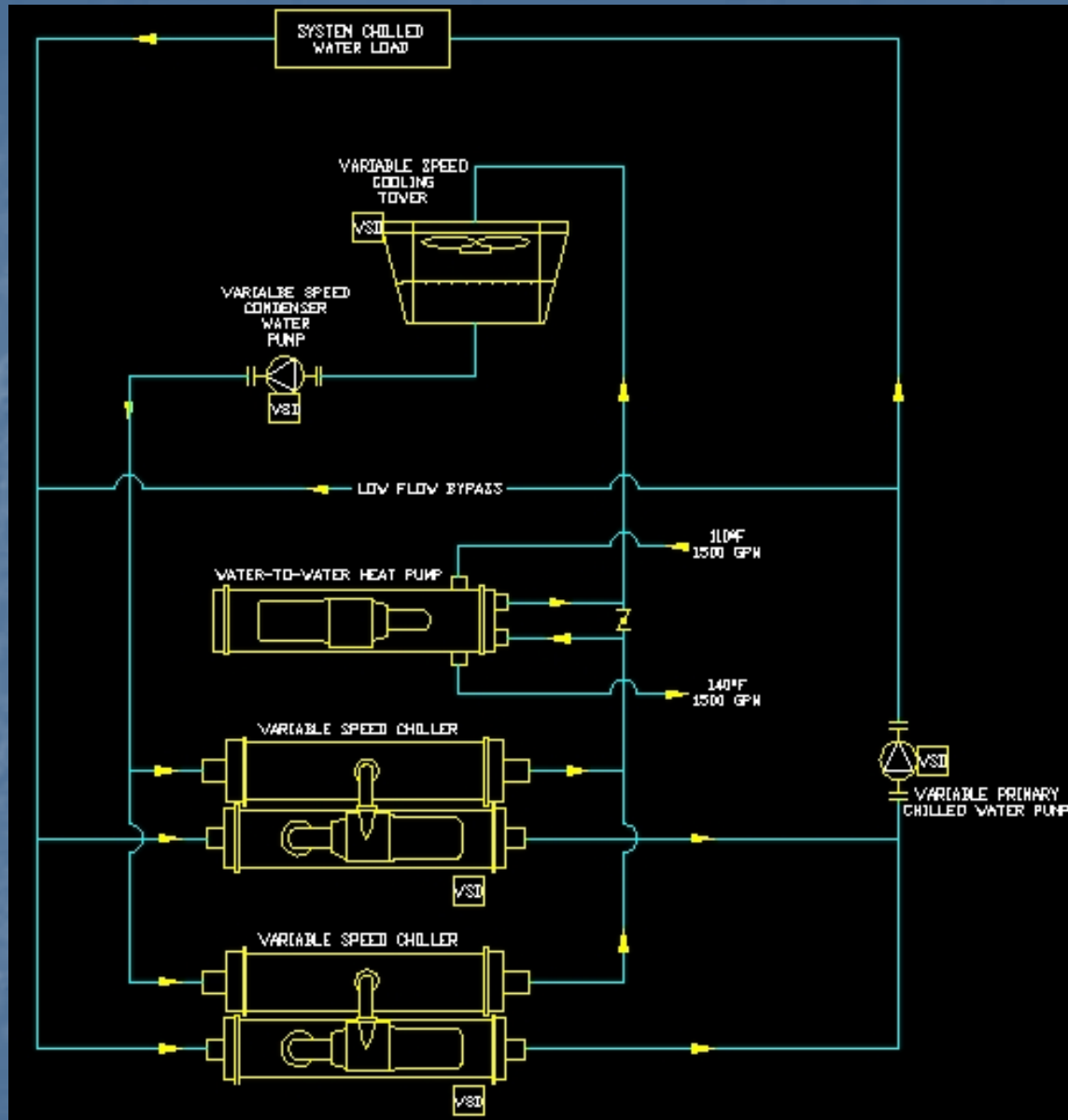


# WATER-TO-WATER HEAT PUMP (WWHP)



$$\begin{aligned} \text{Heat produced in condenser} &= 0.5 \text{ MBH/GPM-}^\circ\text{F} \times 1,300 \text{ GPM} (150-120^\circ\text{F}) \\ &= 19,500 \text{ MBH} \\ &= \frac{19,500 \text{ MBH}}{5,100 \text{ MBH}} = 3.83 \text{ COP} \end{aligned}$$

# VARIABLE SPEED CHILLER PLANT WITH WATER-TO-WATER HEAT PUMP SCHEMATIC



THANK YOU