US Drives Inc.
2221 Niagara Falls Boulevard
P.O. Box 281
Niagara Falls, NY 14304-0281
Tel: (716) 731-1606 Fax: (716) 731-1524
Visit us at www.usdrivesinc.com

APPLICATION NOTES

- Cooling Tower Fans - *Energy Savings / VFD Payback Analysis*

The cooling tower is a simple device. It moves air through falling water to cool the water. The air absorbs heat by carrying away hot water vapor and thus cools the remaining water.

What makes cooling tower analysis and design seemingly difficult is the thermodynamic characteristics of air and water. As air moves through water, it absorbs heat depending upon the difference between the "wet bulb" temperature of the air and the inlet water temperature. This difference dictates how much heat is eliminated per unit of air and water. To increase heat removal at steady state temperatures, the flow of air through the water must be increased. To decrease heat removal, the flow of air through the water must be decreased. The amount of heat removal is directly proportional to the flow of air through the water.

The function of the cooling tower is to deliver outlet water at a specific temperature to permit optimum heat removal at the chiller or other heat source. As the "wet bulb" temperature varies, the heat removal capacity of cooling tower varies. The colder the "wet bulb" temperature of the air is, the less the flow of air required to remove a given amount of heat.

A cooling tower fan is designed to supply adequate air to cool the water to a specific temperature when the air is very hot and humid (design "wet bulb" temperature). The atmosphere, however, is at this design point condition only 2 to 5% of the operational time. Consequently, reductions in air flow can be achieved 95 to 98% of the time.

Remembering fan fundamentals, if one reduces the flow of air by use of motor speed control, one can save energy by the cube of the speed reduction ratio. Thus, a 10% flow decrease can produce a 27% reduction in power use.

Table 1 shows typical savings realized by applying **US DRIVES VFD's** to cooling tower fans. Although each system has its own characteristics, (length of cooling season, fan curve, fan efficiency, design point, etc.) typical operating costs and savings on different motors can be estimated.

Table 1
Typical Savings Per Year For Cooling Tower Fans*

Single Cell HP	VFD applied to On/Off Control	VFD applied to Two/Speed Motor Control
25 HP	$2,425	$1,020
50 HP	$4,850	$2,045
100 HP	$9,700	$4,090
150 HP	$14,550	$6,130
200 HP	$19,400	$8,170

*Based on a conservative $.05 per kilowatt hour and cooling season of 3000 hours.

The information necessary to run a VFD Payback Analysis for your cooling tower fan system is indicated on the "Cooling Tower Fans Energy Savings Program Data" sheet (Doc. # 3012).

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CUSTOMER DATA:

DATE: _____

CUSTOMER NAME_____

PROJECT NAME_____

CITY_____ STATE/PROV. _____ ZIP/POSTAL CODE_____

CONTACT _____PHONE # _____ FAX_____

APPLICATION PARAMETERS: DATA

NUMBER OF CELLS …..……..…	_____	(8,6,4,2,1)
CELL FAN EFFICIENCY ……..……	_____	%
SINGLE CELL DESIGN FLOW ….……..……	_____	CFM
SINGLE CELL DESIGN PRESSURE …….	_____	PSI
	_____	IN. OF WATER
MOTOR HP ……..……..……	_____	HP
MOTOR VOLTAGE ……..	_____	VOLTS
MOTOR EFFICIENCY …….	_____	%
COST OF ELECTRICITY ……...	_____	/KWH
METHOD OF CONTROL (SPECIFY 1 or 2) ……	_____	SELECTION

1: ON/OFF CONTROL
2: TWO SPEED MOTOR

TOTAL HOURS OF OPERATION ……	_____	HOURS