AR No. 5

Notched V-belts

Recommended Action

Replace standard V-belts on 20 motors with higher efficiency notched V-belts. The use of notched belts has been demonstrated to yield energy savings between 2% and 4% through reduction of belt losses due to friction, bending, and slippage.

Assessment Recommendation Summary			
Energy (10^6Btu)	Cost Savings	Implementation Cost	Payback (years)
129	$1,746	$0.0	0.0

Background

A notched belt reduces slippage and allows the belt to bend around sheaves with less effort. Loss in motor speed and efficiency occurs when a standard V-belt slips within the groove of the sheave. The friction between the standard V-belt and sheave generates heat within the belt, resulting in an energy loss and a shortening of belt life.

Anticipated Savings

Efficiency losses occur due to bending, friction and slippage between the belt and sheave. Notched V-belts can improve efficiency by approximately 2% to 4% over standard V-belts. For this recommendation, we estimate average efficiency improvement to be 2%. Motors at your facility with belt drives are indicated with a "V" in the Drive (DRV) column in the Motor Applications worksheet (Appendix A.3).

Demand and energy savings resulting from conversion to notched V-belts are summarized in the table at the end of this recommendation. The annual demand savings are based on motor energy calculations shown in Appendix A. Demand savings (DS) for each motor can be calculated as:

$$DS = D_0 \times \eta_I \times DF$$

where,

D_0 = Current power use for motors with standard belt drives: kW
η_I = Notched V-belts efficiency improvement: 2%
DF = Diversity factor: 86%

The diversity factor accounts for the amount that a particular motor will affect the peak demand, and is a function of billed peak, lighting, and calculated motor demand.

Annual energy savings (ES) can be calculated as:

$$ES = E \times \eta_I$$

where,

E = Annual motor energy use: kWh/yr

The demand and energy costs were taken from your current rate schedule. The annual demand cost savings (DC) are given by

$$\begin{aligned} DC &= DS \times \text{Demand cost} \\ &= 11.8 \text{ kW} \times \$3.32/\text{kW-mo} \times 12 \text{ mo/yr} \\ &= \$471/\text{yr} \end{aligned}$$

The energy cost savings (EC) will be

$$\begin{aligned} EC &= ES \times \text{Energy cost} \\ &= 37{,}861 \text{ kWh/yr} \times \$0.03367/\text{kWh} \\ &= \$1{,}275/\text{yr} \end{aligned}$$

Combined energy and cost savings are summarized in the following table.

Savings Summary

Source	Quantity	Units	Energy 10^6Btu	Cost $
Electric Energy	37,861	kWh	129	$1,275
Demand	11.8	kW		$471
Total			129	$1,746

Implementation Cost

In general, we assume that the additional cost of the notched V-belts is offset by a longer lifetime. Thus, no cost is associated with installing notched V-belts and the payback is immediate.

Note: With less belt slippage, motor applications may operate at a slightly higher speed. In some cases this is an advantage. In other cases, you may want to reduce the pulley ratios when new notched V-belts are purchased. You can save additional energy by operating some applications at the same or lower speeds. Greater savings (4% to 8%) are reported by using high torque drive (HTD) belts. However, a greater investment is required to replace belts and pulleys, with individual motor payback ranging between 2 years and 12 years.

Description	Qty	HP	Total HP	Current Total kW Usage	Current Total kWh Usage	Total Savings kW	Total Savings kWh	Total Savings $
Refrig Compressors 3	2	20	40	50	201,982	0.5	2,020	$176
Refrig Compressor 16-40	1	40	40	25	109,062	0.5	2,181	$93
Refrig Compressor 4-5	1	60	60	37	133,161	0.7	2,663	$119
Refrig Compressor 11	2	60	120	149	441,764	1.5	4,418	$416
Refrig Compressor 12	2	60	120	149	605,138	1.5	6,051	$526
Refrig Compressor 13	2	60	120	149	441,030	1.5	4,410	$416
Refrig Compressor 14	1	60	60	37	110,257	0.7	2,205	$104
Refrig Compressor 15	1	60	60	37	152,691	0.7	3,054	$133
Refrig Compressor 17	1	60	60	37	152,691	0.7	3,054	$133
Refrig Compressor 18	1	60	60	37	152,691	0.7	3,054	$133
Refrig Compressor 19	1	60	60	37	74,952	0.7	1,499	$80
Refrig Compressor 20	1	60	60	37	74,952	0.7	1,499	$80
Refrig System	1	100	100	57	87,669	1.1	1,753	$105
Totals	**17**	**-**	**960**	**841**	**2,737,986**	**11.8**	**37,861**	**$2,514**