

Analysis of Power Consumption Saving of A Compressor Motor Using With & Without Variable Frequency Drive

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Abstract- Rotary screw compressors are widely used for refrigeration applications to compress ammonia & other refrigerating gases. Capacity control is used in screw compressor to vary the amount of gas drawn into the compressor. This is necessary to provide accurate suction pressure control as the evaporator load varies. One of the commonly used methods used is slide valve control of discharge port. It enables capacity control from 10-100%. VFDs are increasingly used for capacity control for screw compressor as they are more energy efficient and can be used in a closed loop control system for precise control of suction pressure as evaporator load varies.

Indexed Terms- Rotary screw compressor, Load operation with and without VFD.

I. INTRODUCTION

The Variable Frequency Drive (VFD) industry is growing rapidly and it is now more important than ever for technicians and maintenance personnel to keep VFD installations running smoothly. Variable Frequency Drives (VFD) change the speed of motor by changing voltage and frequency of the power supplied to the motor. In order to maintain proper power factor and reduce excessive heating of the motor, the name plate volts/hertz ratio must be maintained. This is the main task of Variable Frequency Drive.

- a) Variable Frequency Drive (AC drives) are used to stepless speed control of squirrel cage induction motors mostly used in process plants due to its ruggedness and maintenance free long life.
- b) VFD control speed of motor by varying output voltage and frequency through sophisticated microprocessor controlled electronics device.
- c) VFD consists of Rectifier and inverter units.

Rectifier converts AC in DC voltage and inverter converts DC voltage back in AC voltage.

II. ADVANTAGES OF VFD

- 1. Large energy savings at lower speed.
- 2. Increased life of rotating components due to lower operating speed.
- 3. Reduced noise and vibration level.

III. USE OF VFD FOR SCREW COMPRESSOR MOTOR IN BREWERY PLANT

The screw compressor is part of the refrigeration system which uses ammonia gas as a refrigerant for producing chilled water. The drive motor for compressor has the following nameplate data:

- 1. Capacity -315 KW
- 2. Supply voltage -415V,3Φ, 50Hz
- 3. Design speed -3000rpm
- 4. Full Load Current - 620A

Trials were conducted with a VFD suitable for the above mentioned motor. For the purpose of comparison, readings were taken compressor control with VFD.

Power consumption for partial load operation (with &without VFD)

Power consumed without VFD (KW)	Power consumed with VFD (KW)	Measured Power consumed per ton of refrigeration load without VFD(KW/TR)	Measured Power consumed per ton of refrigeration load with VFD (KW/TR)	Hourly saving due to VFD operation (KW)

173.10	127.05	0.945	0.715	46.05
203.90	149.80	0.945	0.715	54.10
210.01	154.51	0.945	0.715	55.50
225.35	165.15	0.945	0.715	60.20
254.70	187.55	0.945	0.715	67.15
160.71	118.31	0.945	0.715	42.40
176	129.74	0.945	0.715	45.24
193.61	142.30	0.945	0.715	51.31
221.23	162.21	0.945	0.715	59.02
239.87	176.35	0.945	0.715	63.52

IV. RESULT

- A. This table show the comparison of with and without VFD power consumption in the compressor and practical data show that without VFD more power consumed then with VFD.
- B. Power consumed per ton of refrigeration load without VFD more than power consumption per ton of refrigeration with VFD these are show in the table.

V. CONCLUSION

Average hourly power saving = 54.449 KW
 Average yearly energy saving (300 days x 11 hours) = 179681.7 KW hr

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