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Analysis of Single Phase To Three Phase Converter Alongwith improved Power Factor And Energy Saving

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Abstract—*Static phase converters, as the name implies, have no moving parts other than switching relays which operate during the starting of the three-phase motor. This is also called a capacitor-only phase converter. It is the least expensive and simplest kind of converter. Two of the three phases motor leads are connected directly to the single-phase line. The third lead of the motor is connected to one of the single-phase through a bank of oil capacitors. The capacitors shift the phase of the voltage to the third winding. The phase-shifted voltage in combination with the physical position of the motor windings produces the rotating magnetic field to start and run the motor*

Keywords- *capacitor bank, DOL starter, induction motor, MCB, fuses, voltmeter, ammeter*

I. INTRODUCTION

Static phase converters, as the name implies, have no moving parts other than switching relays which operate during the starting of the three-phase motor. Capacitor type this is also called a capacitor-only phase converter. It is the least expensive and simplest kind of converter. Two of the three-phase motor leads are connected directly to the single-phase line. The third lead of the motor is connected to one of the single-phase through a bank of oil capacitors. The capacitors shift the phase of the voltage to the third winding. The phase-shifted voltage in combination with the physical position of the motor windings produces the rotating magnetic field to start and run the motor [1], [2], [3], [4]

II. PROPOSED SYSTEM AND BLOCK DIAGRAM

The block diagram showing schematic arrangement of single phase to three phase converter using capacitor bank to drive induction motor

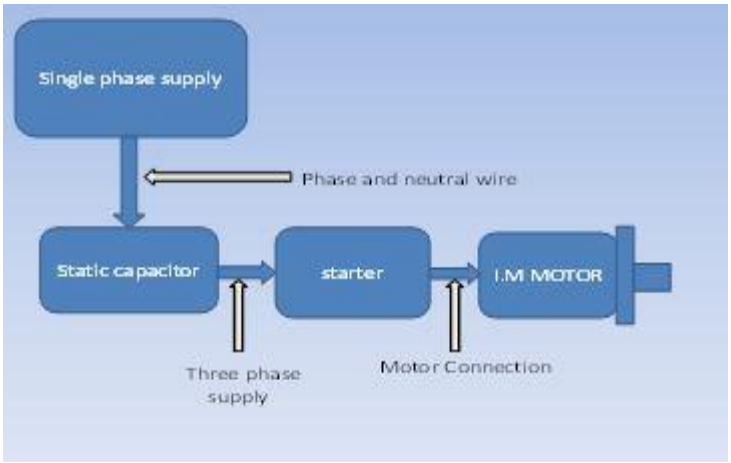

Fig. 1 block diagram of implemented scheme

A three phase device can be run with a single phase converter by means of a static capacitor phase converter. The phase converter converts the single phase into three phase voltage which can be connected to the three phase of the motor
The single phase supply is connected two of the motor phase terminals. The other phase terminal is connected to one of the single phase terminal through a capacitor. The capacitor introduce a phase shift which cause the phase third to be out of phase by 120 degrees that produces the rotating magnetic field required for starting and running three phase motor [1], [4]

III. DEVELOPMENT OF PROPOSED SYSTEM

3.1. HISTORY OF PROJECT

Phase converters have been in use for several decades. According to Robert Cotanch, The first phase converter was invented more than 60 years ago. Much of the improvement and development was accomplished in the 1960's. Im-proved performance of phase converters has resulted in steadily increasing applications**.**

3.2. Principle of operation

A three phase device can be run with a single phase converter by means of a static capacitor phase converter. The phase converter converts the single phase into three phase voltage which can be connected to the three phase of the motor**.** The single phase supply is connected two of the motor phase terminals. The other phase terminal is connected to one of the single phase terminal through a capacitor. The capacitor introducesa phase shift which causes the phase third to be out of phase by 120 degrees. The produces the rotating magnetic field required for starting and running three phase motor [2], [4]

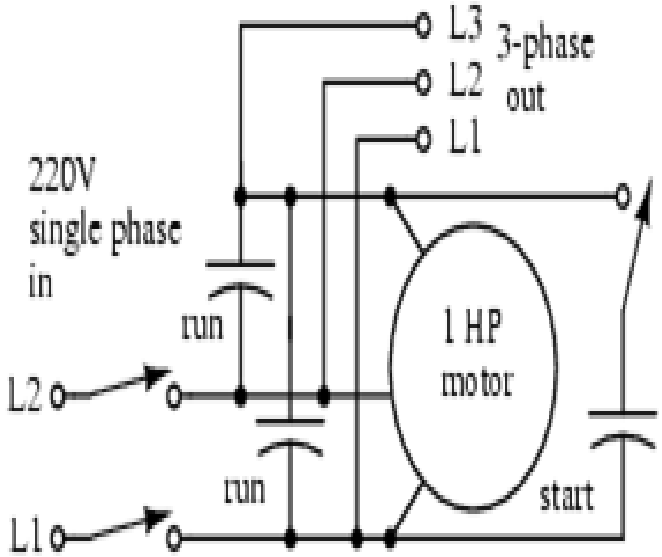

Fig. 2 circuit diagram of operation of converter

3.2.1. Induction Motor drive

Induction motor is an electrical to mechanical conservation device and it is an asynchronous AC machine because the rotor speed is always less than stator magnetic speed. The construction of IM is rugged. Hence, Induction motors are the most commonly used due to their reliability, low cost and robustness. However, induction motors do not integrally have the ability of variable speed operation. Due to this reason, earlier dc motors were applied in most of the electrical drive system, But the recent developments in speed control methods of the induction motor have led to the place where in large scale use in almost all electrical drives application. . Out of the several methods of speed control of an induction such as frequency variation, variable rotor resistance pole changing, variable stator voltage, slip recovery method, constant V/f control, etc. the closed loop constant V/f control speed techniques most commonly used. In this method, By applying V/f ratio constant which in turn maintaining the maximum torque remains unchanged by taking the magnetizing flux constant. Thus, the motor is completely utilized in this method. Hence it is widely used in much application like in elevator, water pumping system and in industry [2], [4]

3.2.2 Capacitor bank

A **Capacitor Bank** is a group of several **capacitors** of the same rating that are connected in series or parallel with each other to store electrical energy. The resulting**bank** is then used to counteract or correct a power factor lag or phase shift in an alternative current (AC) power supply.The capacitor bank supply voltage is work as $1/3^{rd}$ phase supply voltage of out of three phases. In three phases supply there is a 120 phase difference between three phases.In our project, capacitor bank makes a third phase difference and act as a three phase supply and due to this three phase induction motor can work

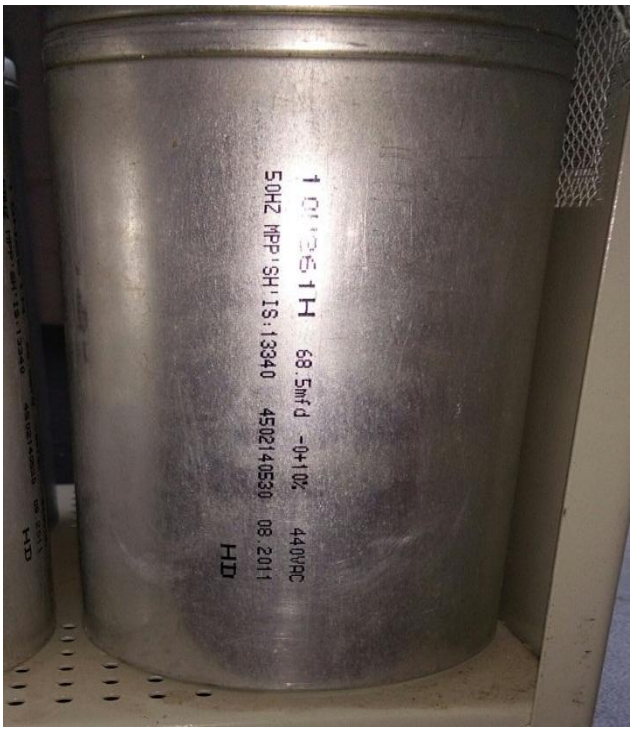

Fig. 3 capacitor used in proposed technique

3.2.4 DIRECT ONLINE STARTER (DOL)

To start, the contactor is closed, applying full line voltage to the motor windings. The motor will draw a very high inrush current for a very short time, the magnetic field in the iron, and then the current will be limited to the Locked Rotor Current of the motor. The motor will develop Locked Rotor Torque and begin to accelerate towards full speed. As the motor accelerates, the current will begin to drop, but will not drop significantly until the motor is at a high speed, typically about 85% of synchronous speed. The actual starting current curve is a function of the motor design, and the terminal voltage, and is totally independent of the motor load [2].

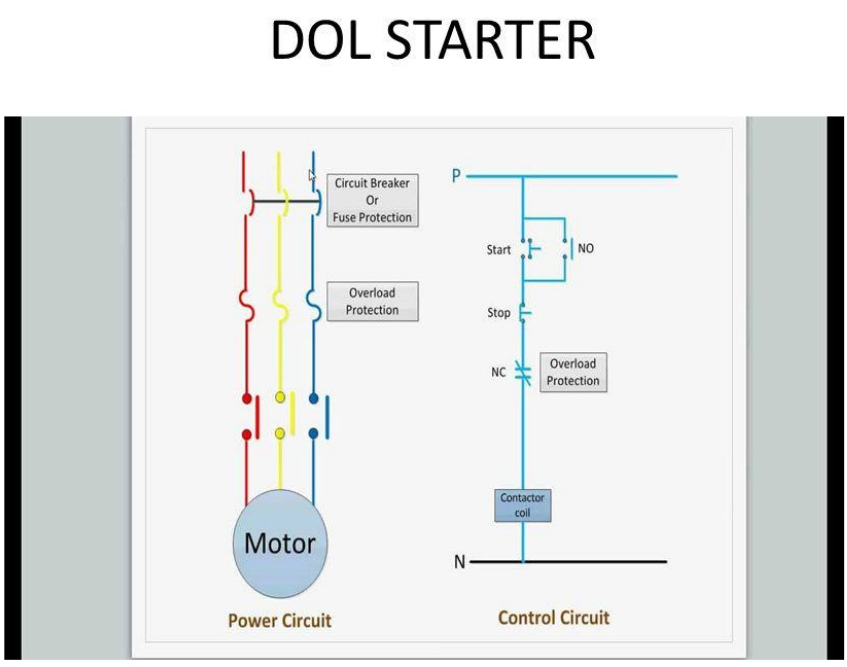

Fig4D.O.L starter

IV. RESULT AND DISCUSSION

This paper involves operation and analysis of Single Phase To Three Phase System Using capacitor bank topology with improved Active Power Factor Correction and analysis of load of motor with reference to power factor of the conversion system

Power (HP)	Speed (RPM)	Power Factor		
		½ Load	¾ Load	Full Load
0-5	1450	0.72	0.82	0.84
5-20	1450	0.74	0.84	0.86
20-100	1450	0.79	0.86	0.89
100-300	1450	0.81	0.88	0.91

Table 1- The power factor of induction motor with reference to load

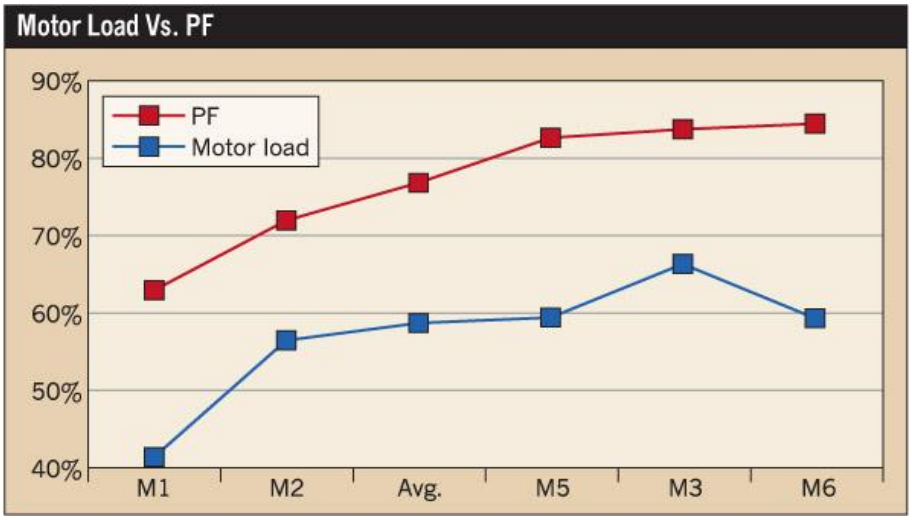

Fig. 4 – graph showing Motor load Vs. Power factor

4.1 selection of rating of capacitor along with motor capacitor in H.P

Sr. No.	MOTOR RATING (H.P)	CAPACITOR RATING (µf)
1	1hp	32uf
2	3hp	68uf
3	5hp	130uf

Table 2- rating of capacitor along with motor capacitor in H.P

4.2Analysis of power factor and output Voltage

Sr. No.	Converter Type	Power factor	Output voltage
1)	1ph to 3ph converter	0.992	415v

Table 3- power factor and output voltage

4.1.4 APPENDIX

Capacitor bank specification	• TEM CO ID: RC0049- MOTOR RUN CAPACITOR • 370-440V AC 68.5 MICRO FARAD -0 TO +10% • AMB.TEMP.—40-85 *C, 50/60 HZ
Three phase induction motor specification	• 3 H.P , 415V , 50Hz , 4 pole , 1440 rpm • Stator and rotor resistance =2Ω & 1.9 Ω • Stator and rotor inductance =0.0230 h • Mutual inductance=movement of inertia=0.02kg. m^2

Table 4- Specification of proposed scheme

V. RESULT AND CONCLUSION

This paper shown experimental analysis of single phase to three phase conversion along with Power Factor Correction and discussed on result of motor load with capacitor tapping using capacitor bank, it is noticed that the Power Factor is better for conversion using capacitor bank topology. Further output of conversion unit is given to D. O. L starter thatutilized to drive Induction motor. Hence due to economy of operation, the motor with difference capacity of power isworked smoothly with different rating of capacitor with saving energy taken into account.

REFERENCES

1) Mohammad H Rashid, "power electronics Handbook" (Academic press, 2001).

2) Bimal K. Bose, "Modern power electronics and AC drives", ISBN-978-81-203-2749-8

3) P. VijayaPrasuna, J.V.G. Rama Rao, Ch. M. Lakshmi, "Improvement in Power Factor & THD Using Dual Boost Converter," IJERA journal, Vol. 2, Issue4, July-August 2012, pp.2368-2376

4) Y. U.Rathod, M.R.Bachwad, " Single Phase to Three Phase System Using Dual Boost Converter to DriveInduction Motor Along With Active Power Factor Correction Technique,"*International Journal of Advance Engineering and Research Development (IJAERD) Volume 3, Issue 10, October -2016, e-ISSN: 2348 - 4470, print-ISSN: 2348-6406*

