International Journal of Electronic and Electrical Engineering.
ISSN 0974-2174, Volume 7, Number 4 (2014), pp. 347-356

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Modeling and Simulation of Multi-Pulse Method Using Diode and Thyristor Bridge Reactifier in Matlab / Simulink

Gagan Deep[1] and Vijay Kumar Garg[2]

[1]M.tech Student(EE) ,UIET, Kurukshetra University, Kurukshetra, Haryanaz, India
[2]UIET, Kurukshetra University, Kurukshetra, Haryana, India

Abstract

This paper presents the modeling and simulation of multi-pulse method to reduce the harmonic content from the circuit. Mainly harmonics occurs in the Input current. The main focus of this study is to reduce the total harmonic distortion of Input current and improves the power factor. Results of the each configuration 6,12,18,24,30,36,48 are checked to make the particular configuration cost-effective for high power application in power industry. Using MATLAB/SIMULINK these modeling are done.

Keywords: muli-pulse method,Total harmonic reduction (THD), Power factor etc.

1. Introduction

This method is used for the high power application. To improve the performance of the system multi-pulse method is suitable for the improving the performance of the system. The system hp>150 multi-pulse is cost- effective than any other method to reduce harmonics from system. The input current has harmonics presence which is identified by the following equation.

$$A = BC \pm 1 \quad (1)$$

A → Harmonic order
B → integer value
C → no. of reactifier

Reduction of THD is done with Multi-pulse scheme and results are obtained. In this project work total harmonic distortion is achieved in supply current[1]. Simulation is done for same type of load. Harmonic content are reduced by many techniques. Passive filters are used in many research works this technique is suffer from resonance problem and having heavy filter elements and instead of passive filters active filters seems to be a interesting option but it's cost goes high[1],[5]. The hybrid solution of

both passive and active filter used for high power application but the construction of this technique is quite complex[4].

In this paper work , phase shift transformer is employed between the supply side and load side of the circuit. With proper phase shifting angle higher pulse system can be made. Effect of increasing the number of pulse in multi-pulse converter on input supply current is shown in this research work.

2. Multi-pulse Methods

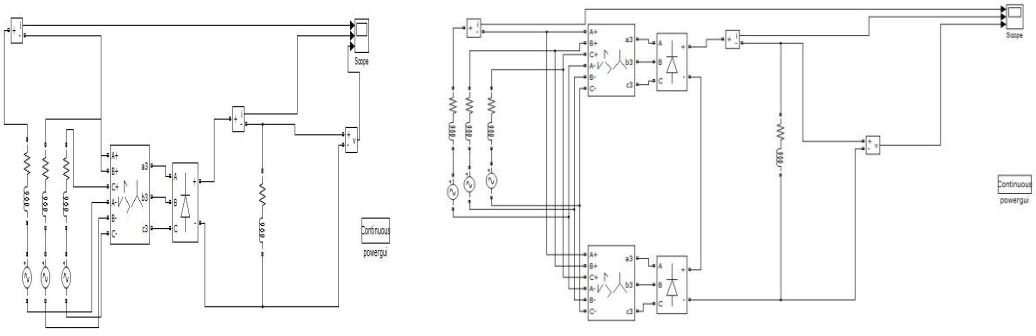
The number pulses in the dc output voltage within one time period of the ac source voltage is called pulse number[3]. For high power applications, AC-DC converter which based on the concept of multi-pulse namely 6,12,18,24,30,36,48 pulses. These pulses are connected to the Zigzag transformer with diode and thyristor bridge[2].

Table 1: Harmonic Order Reduced By Respective Multi-Pulse Converter.

No. of Pulses	**Harmonic Order**
6	5,7,11,13,17,19…….
12	11,13,23,25,35,37……..
18	17,19,35,37,53,57……
24	23,25,47,49,71,73……..
30	29,31,59,61,89,91
-	
48	47,49,96,97,143,147

3. Simulation Modeling And Results

3.1 6 & 12 pulse converter



(a) **(b)**

Fig. 3.1 (a), (b) 6 ,12 Pulse Converter

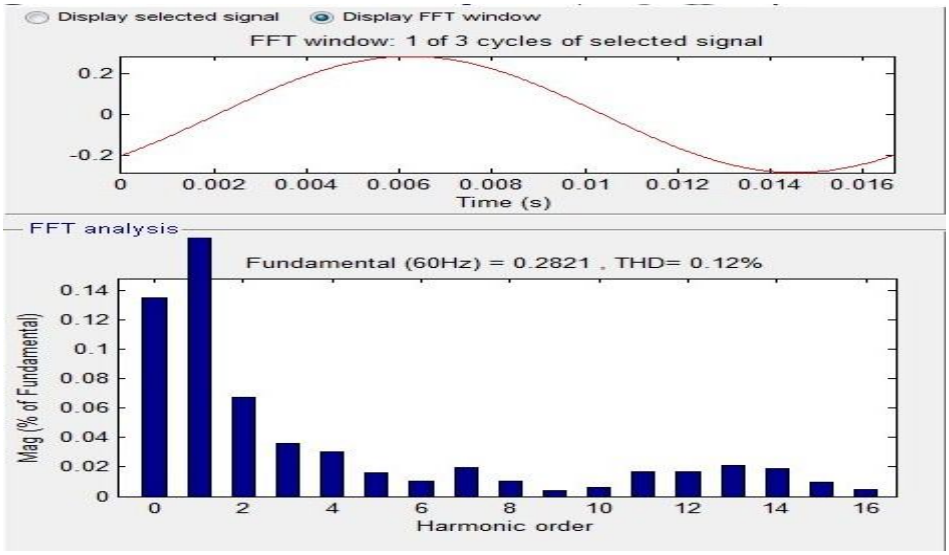
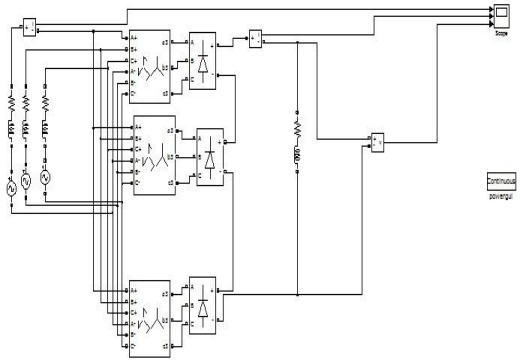
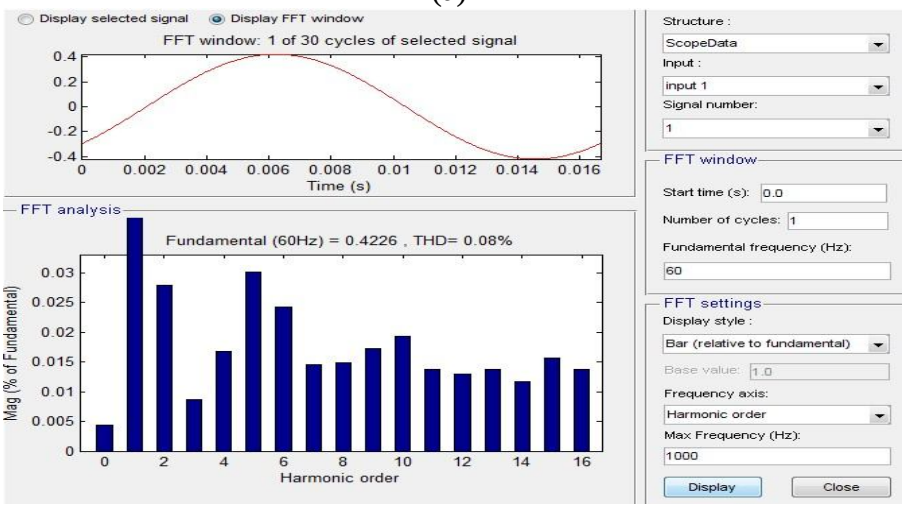


Fig. 3.2: THD for input current of 12 pulse converter

3.2 18 pulse converter

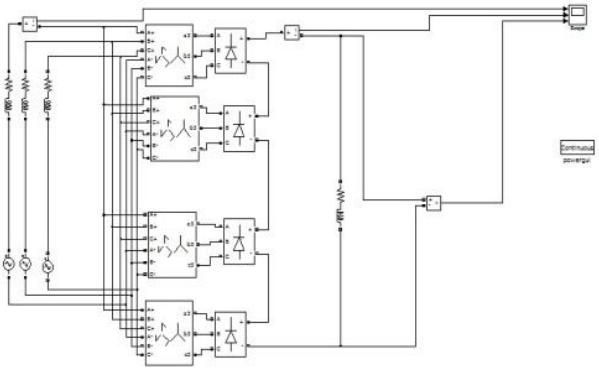


(a)

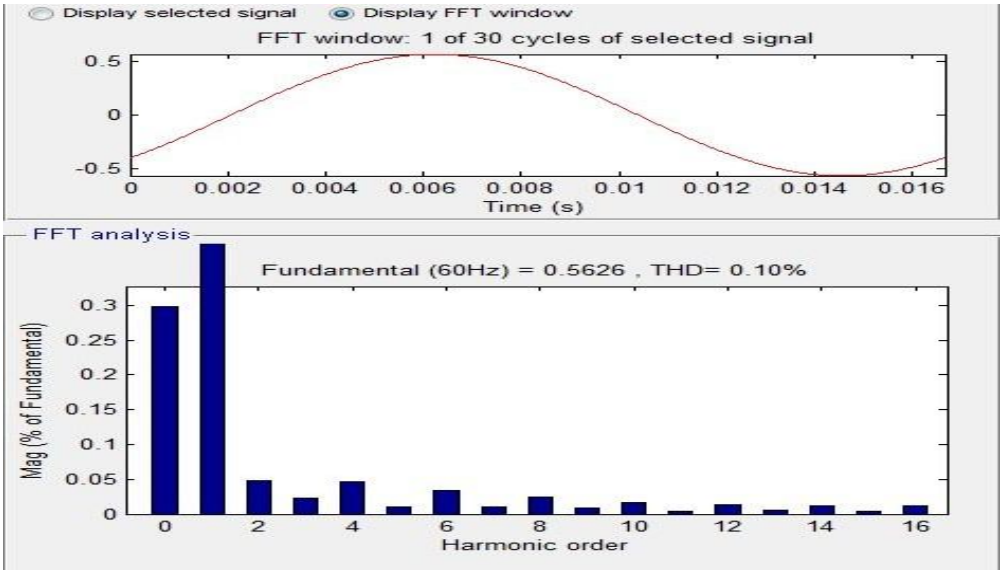


(b)

Fig. 3.3: (a) & (b) 18 pulse converter & THD for input current 24 pulse converter



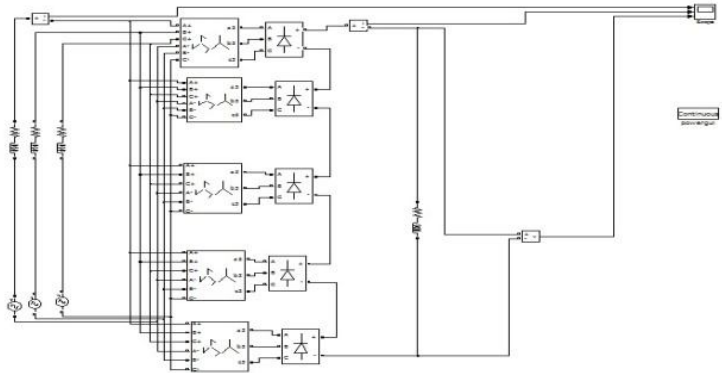
(a)



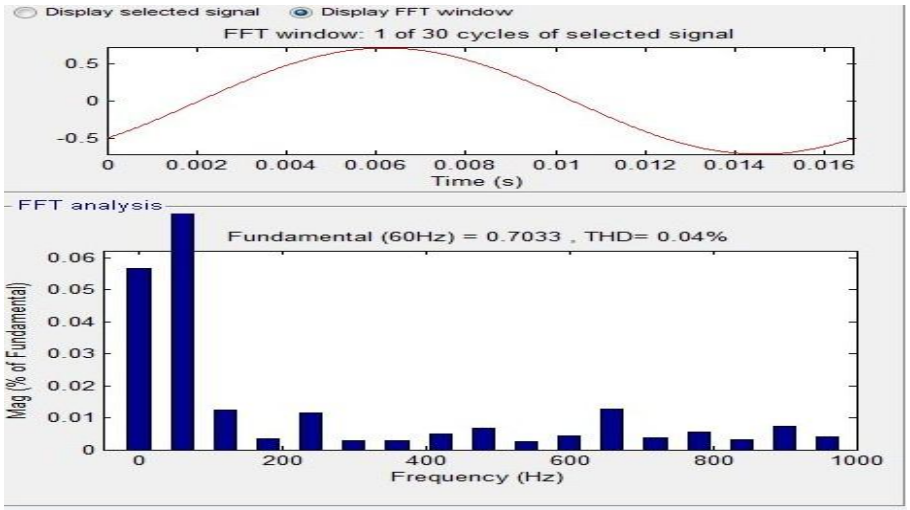
(b)

Fig. 3.4: (a) & (b) 24 pulse converter & THD for current input current

4.4 30 pulse converter



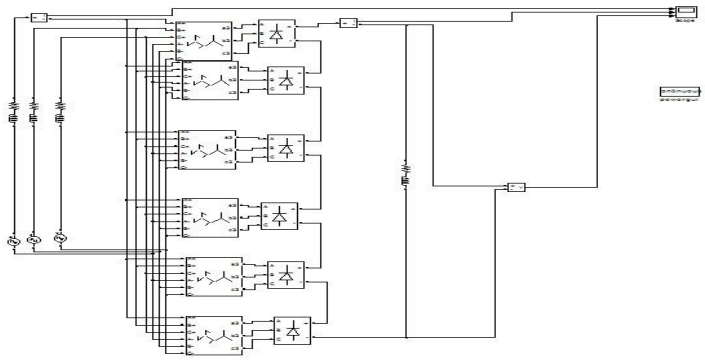
(a)



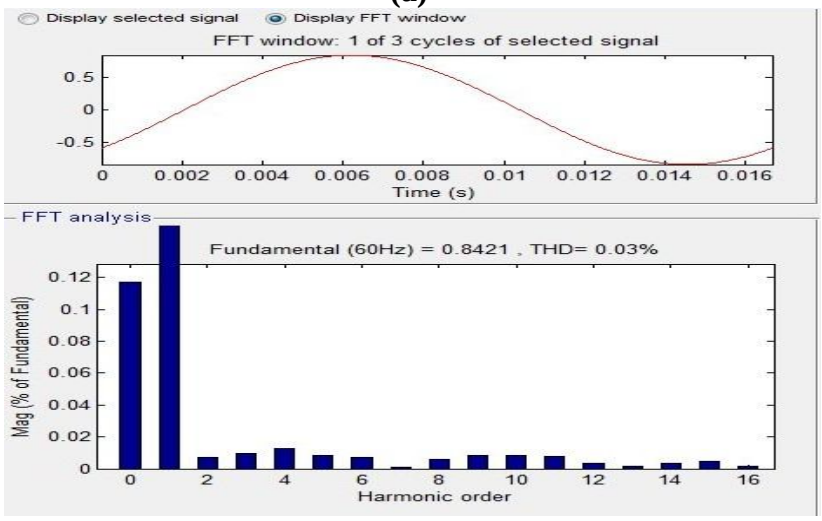
(b)

Fig. 3.5: (a) & (b) 30 pulse converter & THD for input current

4.5 36 pulse converter



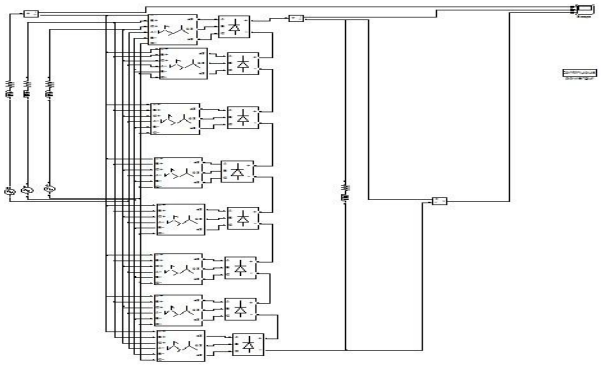
(a)



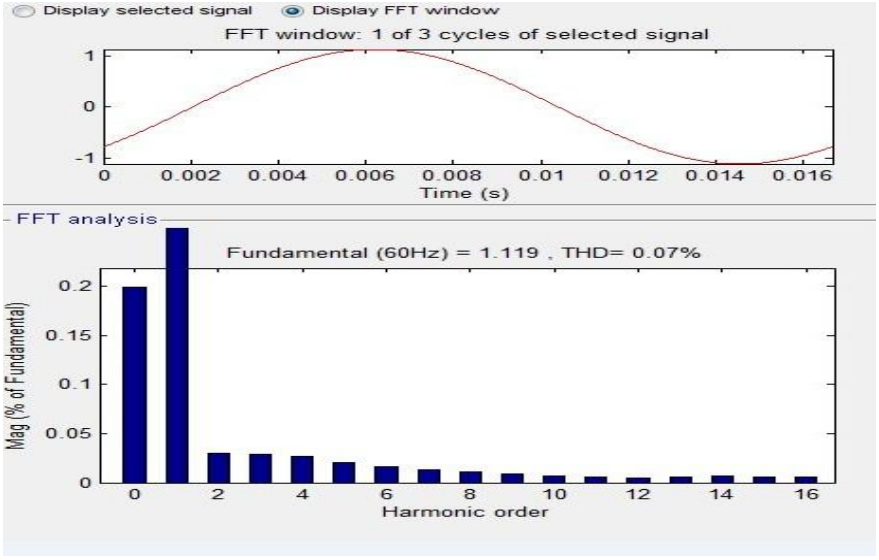
(b)

Fig. 3.6: (a) & (b) 36 pulse converter & THD for input current

3.6 48 pulse converter



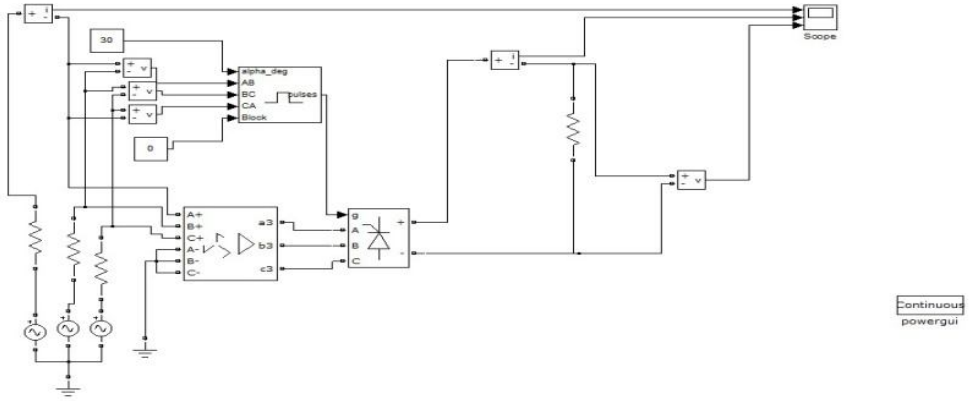
(a)



(b)

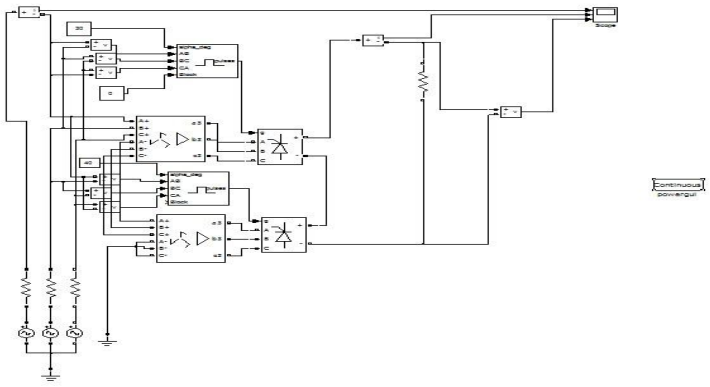
Fig. 3.7: (a) & (b) 48 pulse converter & THD for input current

3.7 6 ,12,18 pulse converter with thyristor reactifier

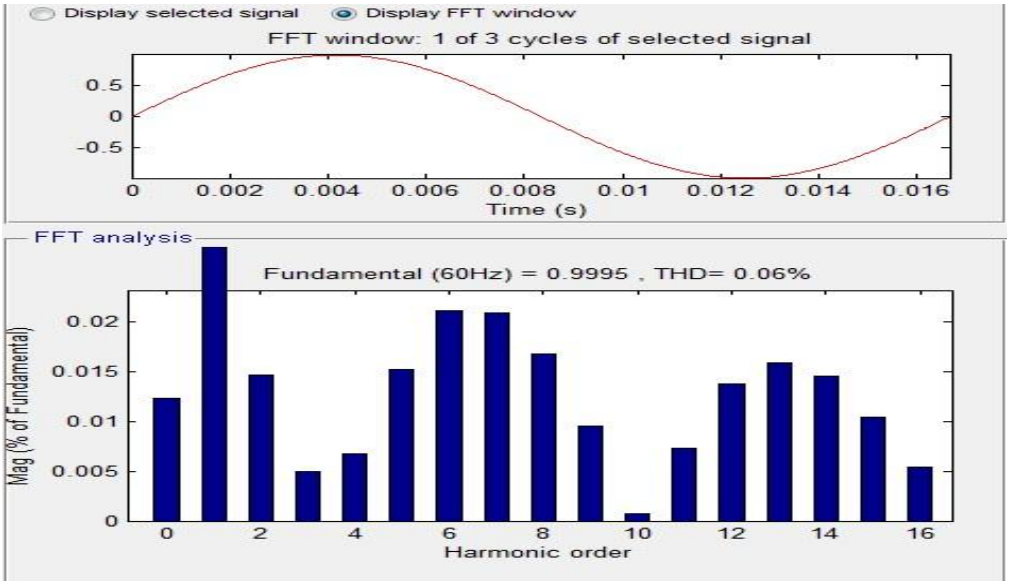


(b)

Fig. 3.8: 6 pulse thyristor converter

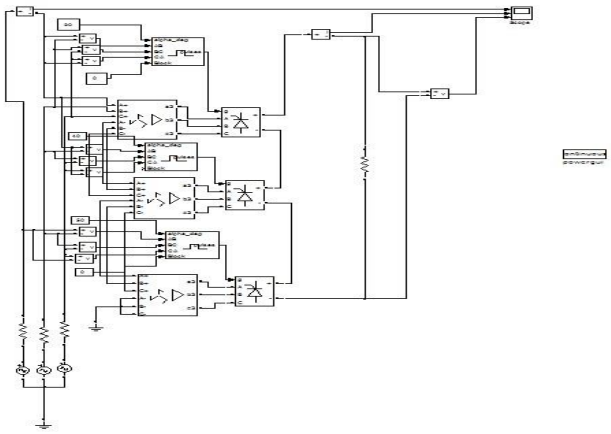


(a)

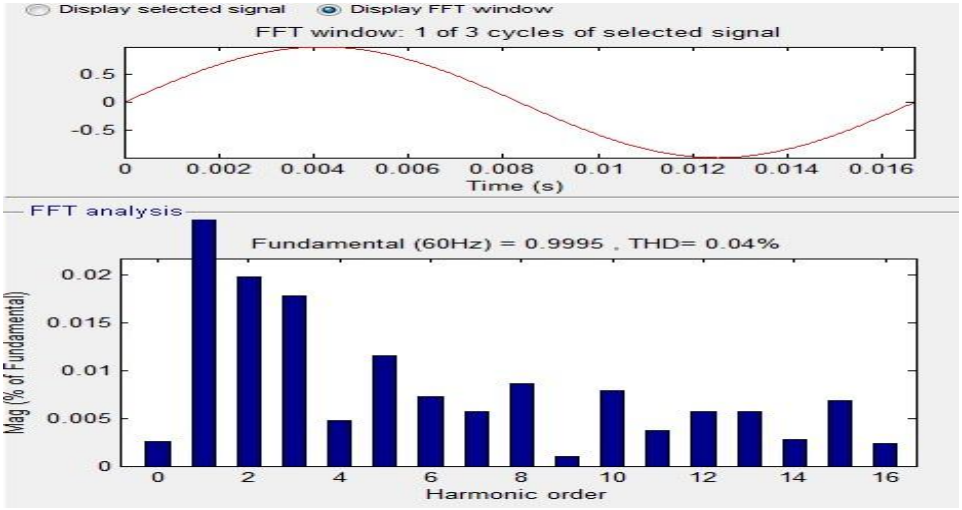


(b)

Fig. 3.9 12 pulse converter & THD for input current.



(a)



(b)

Fig. 3.10 18 pulse converter & THD for input current

Table 1: THD & Power Factor for Diode And Thyristor Converter

(A)

Multi-pulse converter (Diode)	**Total Harmonic Distortion (THD)**	**Power Factor**
12 pulse converter	0.12	0.990
18 pulse converter	0.08	0.996
24 pulse converter	0.10	0.990
30 pulse converter	0.04	0.999
36 pulse converter	0.03	0.999
48 pulse converter	0.07	0.995

(B)

Multi-pulse converter (Thyristor)	**Total Harmonic Distortion (THD)**	**Power Factor**
12 pulse converter	0.06	0.93
18 pulse converter	0.04	0.96

4. Conclusion

Multi-pulse reactifier provides effective solution for harmonic reduction. This provides the 12-pulse, 18-pulse and various topologies provides the effective solution for Total Harmonic Distortion(THD) for input current and power factor which is concluded in table no. 1 (A) ,(B). These configurations provides the cost effective solution for high power configuration in power industry.

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