

# Ageing effect on Stator winding of a Hydro Power Plant and its Upgrading

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*Abstract— Age has an effect on the working and efficiency of generators in a Hydro Power plant. While we discuss about refurbishment of a Hydro Power Plant, we can plan to refurbish, uprate and modernization of generators. Stator and rotor are the main component which can be refurbished and upgraded in order to increase efficiency. In the case of “Bassi” Hydro Power Plant, we planned to refurbish the all four generators. In this paper we are focusing on rewinding of stator and results thereof.*

*Keywords—component, formatting, style, styling, insert (key words)*

## I. Introduction

While planning of refurbishment of a Hydro Power Plant, it can be discussed that generators can be refurbished completely or partly depending upon the condition of the generators. Among these two options time constraint and loss in power production are also taken into consideration. In the case of “Bassi Power Plant” there are four generators. Power plant can not be stopped for refurbishment so it is decided to refurbish these generators one by one. Again a major issue to decide is whether go for complete replacement of Generators or refurbish them partially. In the case of complete refurbishment of generators a cost worth Rs 420 Crore was required and time taken was estimated to be 36 months. Whereas partial refurbishment by replacing all those parts which had deteriorated badly needs less amount of finance required that is Rs 300 crore and time taken is 24 months. Complete refurbishment was planned since Power Plant is 37 years old. The Power Plant was commissioned in the year of 1970 and it needs to be refurbished for increased installed capacity and to achieve more efficiency. After considering all parameters it was decided that rewinding of stator is more beneficiary.

## II. Rewinding of Stator

Site Responsibility: Work on the site was undertaken by M/S Andritz Hydro Private Ltd. With the help of Power Plant staff the erection of the stator was completed.

## Description of the Generators

THREE PHASE SYNCHRONOUS GENERATOR

NO. OF UNITS INSTALLED IN PLANT OF SAME RATING	4
TYPE	Ssv 298 /12 - 120
SERIAL NO	C260/191/R
YEAR OF MANUFACTURER	2011
TYPE OF CONSTRUCTION	IM 8510
TYPE OF PROTECTION	IP 44
CONNECTION	STAR. 6 - PARALLEL
MAX. COOLING AIR TEMPERATURE	40 DEGREE CELSIUS
MAX. COOLING WATER TEMPERATURE	30 DEGREE CELSIUS
RATED OUTPUT S1 KVA	183333
TEMP RISE STATOR / ROTOR	85/90 K
RATED POWER FACTOR	0.9
RATED VOLTAGE	11000 V
RATED CURRENT	962.2 A
RATED FREQUENCY	50 Hz
RATED SPEED	500 RPM
DIERCTION OF ROTATION	CLOCKWISE
RATED FIELD CURRENT	1172 A
RATED FIELD VOLTAGE	80
MANUFACTURER	ANDRITZ HYDRO PRIVATE Ltd. D - 17 MPAKVN INDUSTRIAL AREA MANDIDEEP

The stator frame of the stator was used as it is. Rewinding was done with the replacement of Insulation too. Earlier Class B insulation was used, now it has been changed by Class F insulation for more reliability. Stator core is also changed and it is housed in the same fabricated steel frame made into two sections. It is built of segmental laminations punched from high grade cold reduced electrical steel sheet and is in the frame by dovetailed key bars welded to the frame. The core is dividing into the packets by narrow radial steel spacers, thus framing ventilating ducts leading from inside bore to the

outside periphery. The spacers which are non-magnetic steel along with core teeth are located by spot welding to adjust laminations. The stator winding is of Double Layer Lap type, comprising of turns, coil laid in open slots. Each is made up of 16 insulated copper strands. Stator winding of all the four generators was replaced one by one. Power plant was in function with other generators while rewinding of one was undergoing. Time given to Andritz for complete refurbishment of plant was 36 months, but it took 48 months practically. Refurbishment was started In year 2007 and it was completed in 2011.

## Result achieved By Stator winding replacement

Power production with old winding	15x4= 60MW
Power production after winding replacement	16.5x4=66MW
Increase in Power generation	6MW

### **Conclusion**

Complete replacement of winding in stator and rotor gave a high efficiency and increased power generation. Complete refurbishment of all the generators was done in time. With Rewinding of stator and other refurbished component an increase of 16 MW is achieved.

### **References**

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