

Droop

Optimization of Governor's Droop for Emergency diesel generator in NPPs

103-16

(EDG: Emergency Diesel Generator)

-
 . EDG
 가
 Droop - 가 EDG Load Swing
 Load Swing
 Droop EDG Droop 가
 - 가 가
 . EDG Droop 3%~5% 가 가

Abstract

The governor type installed in emergency diesel generators(EDG) in the most part of nuclear power plants in Korea is a back-up type which is composed of an electric governor and an auxiliary mechanical-hydraulic governor. The periodic test of the EDG is conducted through the paralleling operation to main grid. If the electric governor is failed during the paralleling operation to main grid test, the EDG shall be controlled by the mechanical-hydraulic one. If the mechanical-hydraulic governor doesn't have a Droop establishment for this case, the EDG will show a Load Swing phenomenon and the operation will be unstable. In order to solve these situations, the Droop should be established appropriately. In this research the characteristics of normal and periodic test during the paralleling and the isolated operations were considered to establish a optimum Droop value. The results show that the proper value of Droop is 3-5%.

1.0

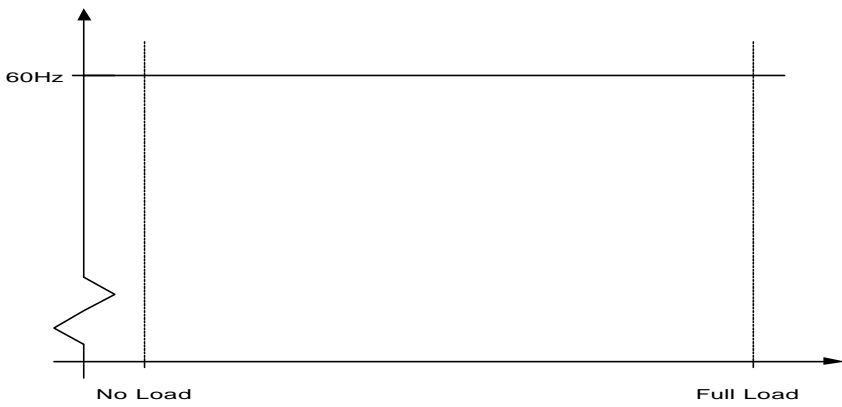
(EDG: Emergency Diesel Generator)

EDG (Back-Up) 가
EDG 가
EDG 가
EDG Droop 가
EDG Droop

2.0

2.1 (Isochronous)

()가 가 가



1. Isochronous Curve

Isochronous 가
Infinity Grid 가

2.2 Speed Droop

Droop () 가 가 가

1800rpm

가

가 1800rpm

Droop

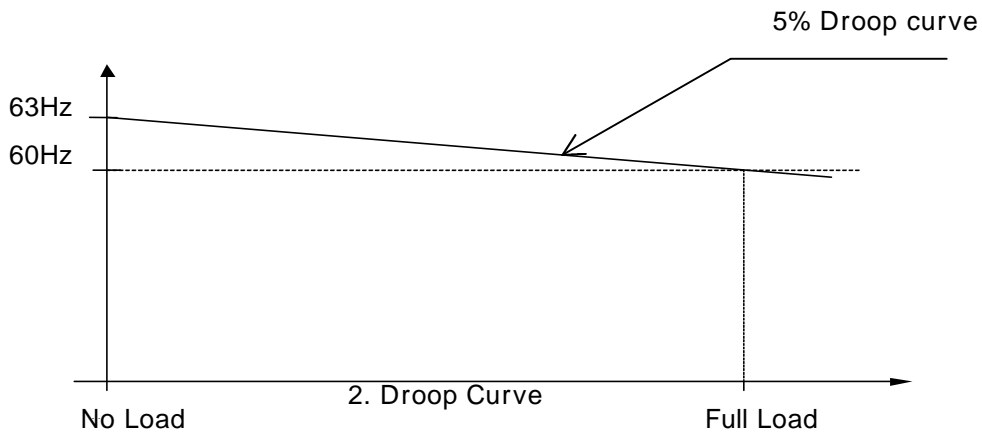
가

Droop Curve % Droop

. %Droop

$$\% Droop = \frac{(NoLoadRatedSpeed - FullLoadSpeed)}{RatedSpeed} \times 100\%$$

$$\frac{(63Hz - 60Hz)}{60Hz} \times 100\% = 5\%$$



Speed Droop

Speed Droop

%Droop

가

가

%Droop

가

Speed Droop

2.3 Kw Load Sharing

Kw Load Sharing Speed Droop

Isochronous

Kw Droop

. Speed Droop

가

. Kw

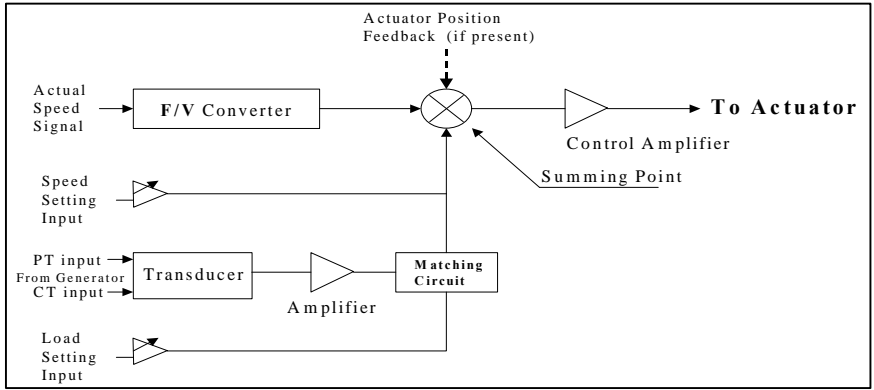
Load Sharing

가

가

PT 2

CT 2



3. Kw Load Sharing Circuit

Kw Load Sharing

Isynchronous

가 Load Setting Signal
Load Sharing 가 가

3.0 EDG

EDG 가
(Back-up) . EDG 가 가
- 가 EDG
- Droop 가

1. EDG

				- Droop %
2	2301 LSSC Tandem	EGB-13P	Kw Load Sharing	0%
3,4	EGA	EGB-50C	Kw Load Sharing	0%
1,2	EGA	EGB-50C	Kw Load Sharing	0%
3,4	2301A LSSC Tandem	EGB-35P	Kw Load Sharing	3%
1	2301A LSSC	EGB-50P	Kw Load Sharing	1.5%
2,3,4	DD1000	EGB-50P	Speed Droop	0%
3,4	DD1000	EGB-50P	Speed Droop	0%

3,4 , 2,3,4 5,6 - Speed Droop

Load Sensing

4.0 Droop

EDG 가 EDG (Standby Condition) 가 EDG 가 EDG가 EDG가 EDG 가 Droop / Droop

4.1

가.

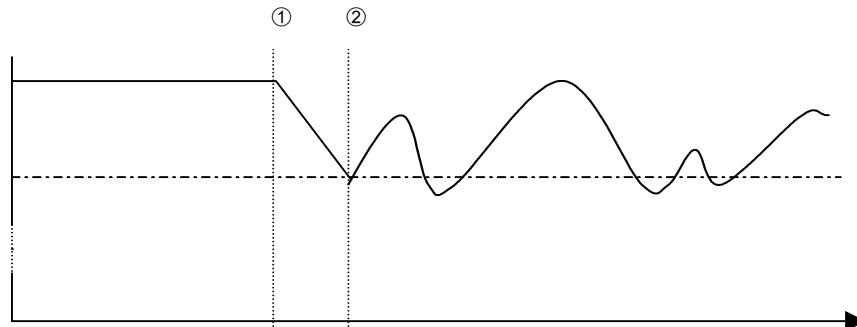
Droop , Isochronous , 2.1 가

(Mechanical Fuel Rack Limit)가

110%

가 가 가 가 가

Load Swing



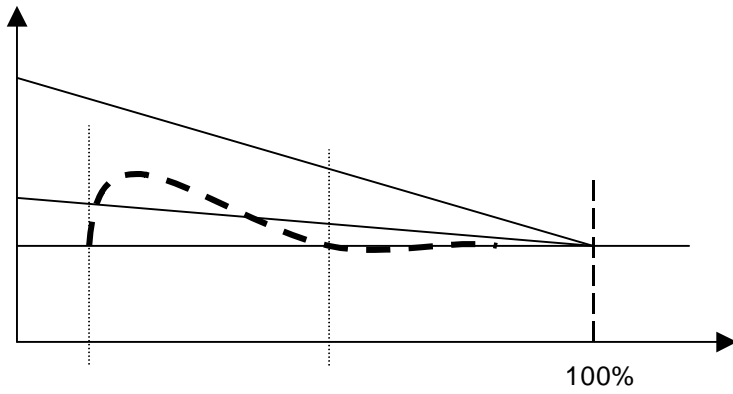
4. Load Swing

① : 가

100%

② : Load Swing

Droop ,
Droop
Droop
5 , Droop
가 Droop
Droop



5. Droop

Droop 가

Droop

Droop

Droop

가 (2.)

Speed Droop

Speed

4.2 Speed Droop

EDG가

EDG

EDG

EDG가

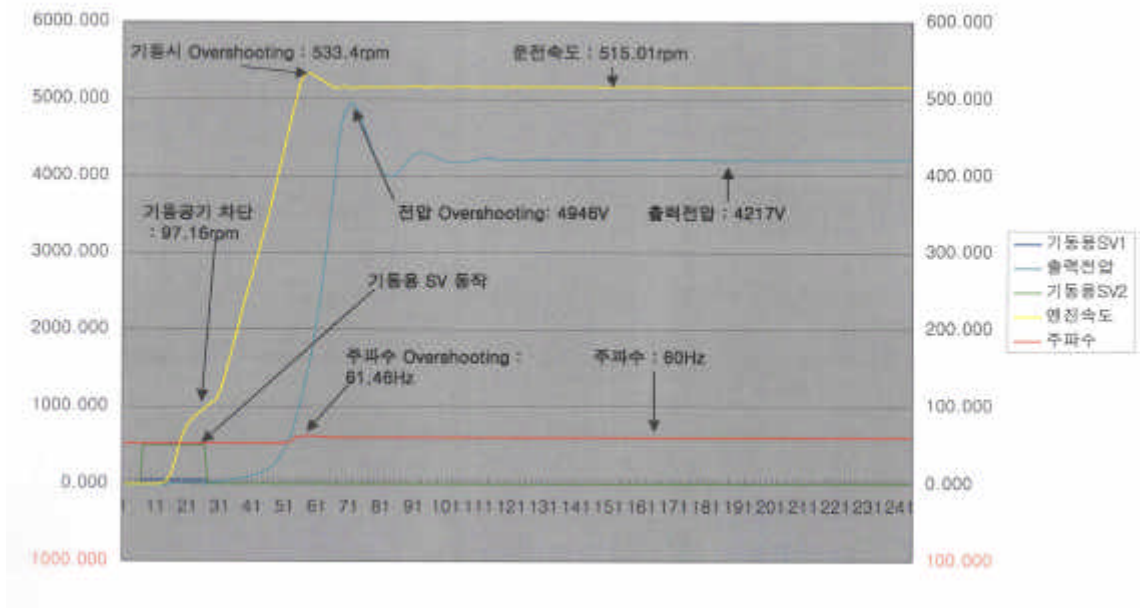
Droop 가

Swing Droop 가

Droop 6% Droop

가. EDG Droop 110%~115% Droop 10% Overshoot 10% Droop overshoot

514rpm 450rpm 가 514 rpm 1 533.4 rpm 104%가 (6.) Droop 6% 5% 가



Droop
 3%
 가
 3% 가
 가
 Droop
 EDG
 EDG
 Droop 3%
 Droop
 Droop EDG
 3~5%가 가
 Droop EDG
 Droop (Overshoot)
 5.
 EDG
 -
 EDG Speed Droop
 EDG Load Swing
 Droop EDG
 EDG 3%~5% Droop
 가

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