

Mike Puckett, PE

From: RobertWBurke@Eaton.com
Sent: Friday, August 05, 2016 1:11 PM
To: Mike Puckett, PE
Cc: mhughes@emrassociates.com
Subject: Voltage regulation
Attachments: PDU Regulation.xlsx; WP202001EN.pdf

I asked our engineering group to comment on the question about voltage regulation. It is a great question and below is the response.

Regulation is the voltage drop across the $\%IR$ and $\%IX$ of the windings. The only things that affect regulation are the per unit load, the load power factor, the $\%IR$ and the $\%IX$. The $\%IR$ and $\%IX$ are fixed ($\%IR$ varies slightly with temperature and thus with load but not enough to matter) so the load and load power-factor are the only things that are varying.

- Higher $\%IX$ gives you higher (worse) regulation;
- A lower lagging power factor gives you higher (worse) regulation;
- A leading power factor (unusual) can give you lower (better) regulation;
- Regulation is linear with load so it is normally only calculated at full load;
- $\%IR$ has minimal effect on regulation, the $\%IX$ is much more important.

Our engineering group provided the attached simple calculator. You can change the values in blue to match your specific application.

I have also attached the white paper on the voltage transient study.

Thank you for having us. It was a great group. We learned a lot from the interaction with the members.

Please let me know if you need anything else.

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