PROCEDURE FOR TESTING P643 TRANSFORMER DIFFERENTIAL RELAY
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CHAPTER 1
GETTING STARTED
Establishing Communication With the relay

Click on the Micom S1 studio
Click OK
Create New system Put Any name KFH 8166 & Put the Saving location
Now Click on the Quick connect

After that Select the type of Protection Series (for P643 it is 40)
Select Front port Communication

Select Com Port

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After Click finish

If the data model of P643 is available in your Data Model Manager it will communicate

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Click Finish it will come like this.

Right click on the Setting and extract settings
It will show like this while downloading

In the setting it will show 000
Right Click on the PSL & extract the setting

Select Group 1
Now its downloading the seeing downloading

In the PSL it will show 000

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CHAPTER 2
SETTING VALUES
Double Click on The Settings 000

Click on the system data and change frequency 60 Hz
Click on the CT & VT ratios and change as per your schemes

Put the setting values secondary
Right Click on Device P643 & select Send

Click Yes

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It starts sending the setting to Relay
Click Close
CHAPTER 3
DIFFERENTIAL RELAY SETTINGS
In Configuration, select the Differential protection

Click on Group1
In System configuration put the Winding configuration, MVA rating and Voltage rating

Put the MVA rating & Voltage rating
Select Differential Protection and put the settings

As per the setting of differential $\text{Id} >$ it will gives trip in the range 0.190 A to 0.210 A when the zero sequence filter is On and when the Zero sequence filter is Off it will gives trip 0.130 A to 0.145 A.
Calculation of differential and biased currents is as follows:

\[ I_{\text{diff}, y} = \{ Is_y, CT1 + Is_y, CT2 + Is_y, CT3 + Is_y, CT4 + Is_y, CT5 \} \]

\[ I_{\text{bias}, y} = 0.5\{ Is_y, CT1 + Is_y, CT2 + Is_y, CT3 + Is_y, CT4 + Is_y, CT5 \} \]

The tripping characteristic of the differential protection device P64x has two knees. The first knee is dependent on the settings of \( Is_1 \) and \( K_1 \).

The second knee of the tripping characteristic is defined by the setting \( Is_2 \).

The lower slope provides sensitivity for internal faults. The higher slope provides stability under through fault conditions, since transient differential currents may be present due to current transformer saturation.

The characteristic equations for the three different ranges are given below. Figure 6 shows the tripping characteristic.

Characteristic equation for the range: \( 0 \leq I_{\text{bias}} \leq Is_1/K_1 \):

\[ I_{\text{diff}} = Is_1 \]

Characteristic equation for the range: \( Is_1/K_1 \leq I_{\text{bias}} \leq Is_2 \):

\[ I_{\text{diff}} = K_1 * I_{\text{bias}} \]

Characteristic equation for the range: \( I_{\text{bias}} \geq Is_2 \):

\[ I_{\text{diff}} = K_1 * I_{\text{bias}} + K_2 (I_{\text{bias}} - Is_2) \]

\( K_1 \): gradient of characteristic in range \( Is_1/K_1 \leq I_{\text{bias}} \leq Is_2 \)

\( K_2 \): gradient of characteristic in range \( I_{\text{bias}} \geq Is_2 \)
P64x transformer biased differential characteristic

Tripping characteristic of differential protection
As per the setting of differential $\text{Id} \gg$ it will give trip in the range 2.85 A to 3.15 A.

For Bias Characteristics test put the setting.
In the Fereja ramp Ir from 0.2 to 1 A at 0 degree phase angle & Iy from 0.2 to 0 A at 180 degree phase angle

It will give trip b/w 0.20 A to 0.253 A

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In the Fereja ramp Ir from 1.2 to 2 A at 0 degree phase angle & Iy from 1.2 to 0 A at 180 degree phase angle

It will give trip b/w 0.460 A to 0.530 A
In the Fereja ramp Ir from 2.2 to 3 A at 0 degree phase angle & Iy from 2.2 to 0 A at 180 degree phase angle

It will give trip b/w 0.740 A to 0.950 A
For the Second Harmonic Restraining test put the setting 20%

For the Output take Idiff Trip
In the Fereja select multiple frequency

In Ir put 60 Hz & Iy 120 Hz
When you apply the 2\textsuperscript{nd} harmonic current less than setting 0.19 A, it will trip

When you apply the 2\textsuperscript{nd} harmonic current more than setting 0.21 A, it will not trip

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CHAPTER 4
OVER CURRENT RELAY SETTINGS
Now Enable the Over-current Protection $I>1$

As per setting it will give trip
Now Enable the Over-current Protection \( I>2 \)

As per setting it will trip
For timing

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