

USER GUIDE

VOITAGE DROP CALCULATE

For

THAI-YAZAKI
Wire & Cable

Create by

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Part 1 : Voltage drop caculate in Yazaki Technical data

Part 1-1 Components of the Program



VOLTAGE DROP CALCULATION (YAZAKI TECHNICAL DATA)

1	Type of Cable	Building Wire Cable	
2	Cable Name	NYY	
3	Select No. of Core	3	
4	Select Size	150	mm ²
<div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Color Meaning</p> <p> = Input data</p> <p> = Select data</p> <p> = Do not Edit</p> </div>			
5	Installation	Multi - Core	
<p>Frequency 50 Hz (Thailand, Myanmar, Cambodia,China)</p>			
6	Power Factor	0.95	
7	Cable/Phase	1	
8	Type of Voltage Drop	AC 3-Phase, 3-Wire	
9	Length of Cable	1000	Mete
10	Current	100	A
11	System Voltage	400	V
12	Part of System	Branch Circuits	
13	Voltage Drop	28.65	V
14	Voltage Drop	7.16	%
15	Result	% Voltage Drop Exceed the Standard	

1. Cable Group
2. Cable Name
3. No. of Core
4. Size (mm²)
5. Type of laying
6. Power factor
7. Cable Per Phase
8. Type of voltage drop
9. Cable length (m.)
10. load current
11. Ref. voltage
12. Select Part of system
13. Voltage drop (V)
14. Percentage of voltage drop
15. Result

NOTE: NEC RECOMMENDATIONS

1. **Branch Circuits** – maximum voltage drop of 3%. (The maximum total voltage drop for a combination of both branch-circuit and feeder should not exceed 5%)

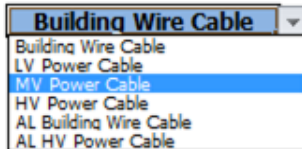
2. **Main Feeder** – maximum voltage drop of 2%. (The maximum total voltage drop for a combination of both branch-circuit and feeder should not exceed 5%)

Part 1-2 Start to use

1. Choose type of Cable

VOLTAGE DROP CALCULATION (YAZAKI TECHNICAL DATA)

Type of Cable



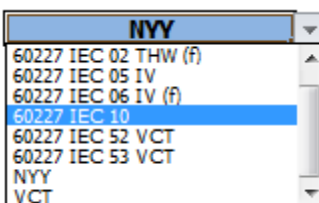
A dropdown menu with 'Building Wire Cable' selected. The list includes: Building Wire Cable, LV Power Cable, MV Power Cable, HV Power Cable, AL Building Wire Cable, and AL HV Power Cable.

Group of Cable:

1. Building Wire Cable
2. LV Power Cable
3. MV Power Cable
4. HV Power Cable
5. AL Building wire Cable
6. Al HV Power Cable

2. Choose - Cable Name

Cable Name

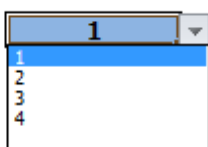


A dropdown menu with 'NYY' selected. The list includes: 60227 IEC 02 THW (f), 60227 IEC 05 IV, 60227 IEC 06 IV (f), 60227 IEC 10, 60227 IEC 52 VCT, 60227 IEC 53 VCT, NYY, and VCT.

Cable name's reference of cable group

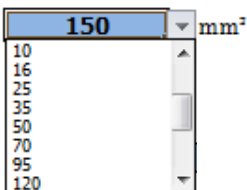
3. Choose - No. of core , Size, Laying type

Select No. of Core



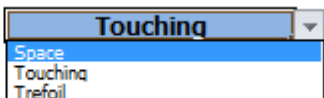
A dropdown menu with '1' selected. The list includes: 1, 2, 3, and 4.

Select Size



A dropdown menu with '150' selected. The list includes: 10, 16, 25, 35, 50, 70, 95, and 120. The unit 'mm²' is shown to the right of the dropdown.

Select Installation



A dropdown menu with 'Touching' selected. The list includes: Space, Touching, and Trefoil.

When selecting No. of core ,the size and laying type are variable by cables name and the number of cores.

4. Input Data

①	Power Factor	<input type="text" value="0.95"/>		1 Power factor (0.7-1)
②	Cable/Phase	<input type="text" value="1"/>		2 Cable/Phase (Same size)
③	Type of Voltage Drop	<input type="text" value="AC 3-Phase, 3-Wire"/>		3 Type of Voltage Drop
④	Length of Cable	<input type="text" value="1000"/>	Metre	4 length of cable (m)
⑤	Current	<input type="text" value="100"/>	A	5 Load current A (Not max capacity of cable)
⑥	System Voltage	<input type="text" value="400"/>	V	6 System Voltage
⑦	Part of System	<input type="text" value="Branch Circuits"/>		7 Part of system

5. Output Data

①	Voltage Drop	<input type="text" value="8.61"/>	V	1. Voltage Drop (V)
②	Voltage Drop	<input type="text" value="2.15"/>	%	2. Voltage Drop (%)
③	Result	Can Use		

Remark : Incase Result = "% Voltage Drop Exceed the Standard"*

Can fix % of voltage drop by

1. select upper size of cable
2. Bundle cable **

Bundle Cable**

Power Factor	<input type="text" value="0.95"/>		Power Factor	<input type="text" value="0.95"/>	
Cable/Phase	<input type="text" value="1"/>		Cable/Phase	<input type="text" value="2"/>	
Type of Voltage Drop	<input type="text" value="AC 3-Phase, 3-Wire"/>		Type of Voltage Drop	<input type="text" value="AC 3-Phase, 3-Wire"/>	
Length of Cable	<input type="text" value="200"/>	Metre	Length of Cable	<input type="text" value="200"/>	Metre
Current	<input type="text" value="200"/>	A	Current	<input type="text" value="200"/>	A
System Voltage	<input type="text" value="400"/>	V	System Voltage	<input type="text" value="400"/>	V
Part of System	<input type="text" value="Branch Circuits"/>		Part of System	<input type="text" value="Branch Circuits"/>	
Voltage Drop	<input type="text" value="12.69"/>	V	Voltage Drop	<input type="text" value="6.35"/>	V
Voltage Drop	<input type="text" value="3.17"/>	%	Voltage Drop	<input type="text" value="1.59"/>	%
Result	% Voltage Drop Exceed the Standard		Result	Can Use	

NOTE: NEC RECOMMENDATIONS*

- 1. Branch Circuits** – maximum voltage drop of 3%. (The maximum total voltage drop for a combination of both branch-circuit and feeder should not exceed 5%)
- 2. Main Feeder** – maximum voltage drop of 2%. (The maximum total voltage drop for a combination of both branch-circuit and feeder should not exceed 5%)

Part 2 : Voltage drop caculate of Other cable

Part 2-1 Components of the Program



VOLTAGE DROP CALCULATION (Other cable)

①	Current Used	<input type="text" value="100"/>	A	Color Meaning <input type="text" value=""/> = Input data <input type="text" value=""/> = Select data <input type="text" value=""/> = Do not Edit
②	Length	<input type="text" value="100"/>	Metre	
③	Cable/Phase	<input type="text" value="1"/>		
④	AC Resistance	<input type="text" value="0.4800"/>	Ω/km	
⑤	Reactance XL	<input type="text" value="0.1500"/>	Ω/km	
⑥	Power Factor	<input type="text" value="0.9"/>		
⑦	Impredance	<input type="text" value="0.4974"/>	Ω/km	
⑧	Type of Voltage Drop	<input type="text" value="AC 3-Phase, 3-Wire"/>		
⑨	System Voltage	<input type="text" value="400"/>	V	
⑩	Part of System	<input type="text" value="Branch Circuits"/>		
⑪	Voltage Drop	<input type="text" value="8.61"/>	V	
⑫	Voltage Drop	<input type="text" value="2.15"/>	%	
⑬	Result	Can Use		

1. Current
2. Cable length (m.)
3. Cable Per Phase
4. AC Resistance (calculation) (See in part 3)
5. Reactance XL (calculation) (See in part 3)
6. Power factor
7. Impredance (Z)
8. Type of voltage drop
9. Ref. voltage
10. Select Part of system
11. Voltage drop (V)
12. Percentage of voltage drop
13. Result

Part 3 : Formular

$$XL = 2\pi \times f \times L \times 10^{-3}$$

XL= Reactance

f = Frequency

L=Inductance

$$L = K + 0.2 \ln\left(2 \frac{GMD}{Dia.Cond}\right)$$

GMD = Geometric Mean Distance

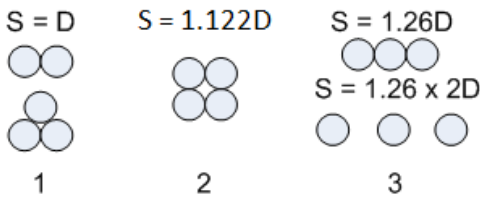
K = constance rating to the conductor formation

Number of wires in conductor	k
3	0.0778
7	0.0642
19	0.0554
37	0.0528
≥61	0.0514
1 (solid)	0.0500

GMD

1. Individual shield = OD shield x Distance factor
2. Insulation conductor = OD insulation x Distance factor

Distance factor



$$Z = \sqrt{Rac^2 + XL^2}$$

$$Rac = Rdc(max) \times (1 + \lambda_s + \lambda_p)$$

$$Rdc(max) = R20(1 + \alpha(\theta - 20))$$

R20 = Rdc at 20 °C

α = constant mass temperature coefficient at 20 °C

= 0.00393 for copper

= 0.00403 for Aluminium

θ = Temp. Conductor Ref. Type Insulation

λ_s = The skin effect factor

λ_p = The proximity effect factor

$$\lambda_s = \frac{X_s^4}{192 + 0.8X_s^4}$$

$$X_s = \sqrt{\frac{8\pi f}{Rdc(max)} 10^{-7} k_s}$$

f = supply frequency in Hertz

k_s = skin effect coefficient from the table below

Type of Conductor	Dried and Impregnated?	k _s	k _p
Copper			
Round, stranded	Yes	1	0.8
Round, stranded	No	1	1
Round, segmental	-	0.435	0.37
Sector-shaped	Yes	1	0.8
Sector-shaped	No	1	1
Aluminum			
Round, stranded	Either	1	1
Round, 4 segment	Either	0.28	0.37
Round, 5 segment	Either	0.19	0.37
Round, 6 segment	Either	0.12	0.37

Proximity effect factor

Three core cables or three single core cables

$$\lambda_p = \frac{X'^4}{192 + 0.8X'^4} \cdot \left[\frac{d_c}{GMD} \right]^2 \cdot \left[0.312 \left[\left[\frac{d_c}{GMD} \right]^2 \right] + \frac{1.18}{\frac{X'^4}{192 + 0.8X'^4} + 0.27} \right]$$

Two core cables or Two single core cables

$$\lambda_p = \frac{X'^4}{192 + 0.8X'^4} \cdot \left[\frac{d_c}{GMD} \right]^2 \cdot 2.9$$

Where :

$$X' = \sqrt{0.8} \cdot X_s$$

dc = diameter of conductor

Part 4 : EXAMPLE

EXAMPLE

System Voltage 400/230 V ,Used 60227 IEC 01 THW cable (In YAZAKI technical data), Trefoil laying , Size 50 mm², Load 150 A Length of cable 100 m, PF. =0.85 , Sub-Circuit, Find VD?

VOLTAGE DROP CALCULATION (YAZAKI TECHNICAL DATA)

Type of Cable	<input type="text" value="Building Wire Cable"/>
	<ul style="list-style-type: none">Building Wire CableLV Power CableMV Power CableHV Power CableAL Building Wire CableAL HV Power Cable
Cable Name	<input type="text" value="60227 IEC 01 THW"/>
	<ul style="list-style-type: none">60227 IEC 01 THW60227 IEC 02 THW (f)60227 IEC 05 IV60227 IEC 06 IV (f)60227 IEC 1060227 IEC 52 VCT60227 IEC 53 VCTNYF
Select No. of Core	<input type="text" value="1"/>
Select Size	<input type="text" value="50"/>
	<ul style="list-style-type: none">507095120150185240300
Select Installation	<input type="text" value="Trefoil"/>
	<ul style="list-style-type: none">SpaceTouchingTrefoil
Power Factor	<input type="text" value="0.85"/>
	<ul style="list-style-type: none">0.70.750.80.850.90.951
Cable/Phase	<input type="text" value="1"/>
Type of Voltage Drop	<input type="text" value="AC 3-Phase, 3-Wire"/>
Length of Cable	<input type="text" value="100"/> Metre
Current	<input type="text" value="150"/> A
System Voltage	<input type="text" value="400"/> V
Part of System	<input type="text" value="Branch Circuits"/>
Voltage Drop	<input type="text" value="11.33"/> V
Voltage Drop	<input type="text" value="2.83"/> %

Result Can Use

VOLTAGE DROP = 2.83 % < 3 % " CAN USE"

EXAMPLE

System Voltage 400/230 V ,Used THW cable , Trefoil laying ,Size 50 mm², Load 150 A
 Length of cable 100 m PF. =0.85 , Sub-Circuit, Find VD?

Rac = 0.464 ohm/km, XL = 0.079 Ohm/Km



VOLTAGE DROP CALCULATION (Other cable)

Current Used	150	A
Length	100	Metre
Cable/Phase	1	
AC Resistance	0.4640	Ω/km
Reactance XL	0.0790	Ω/km
Power Factor	0.85	(Recommandation by MEA, EIT)
Impredance	0.4360	Ω/km
Type of Voltage Drop	AC 3-Phase, 3-Wire	
System Voltage	400	V
Part of System	Branch Circuits	
Voltage Drop	11.33	V
Voltage Drop	2.83	%

Color Meaning

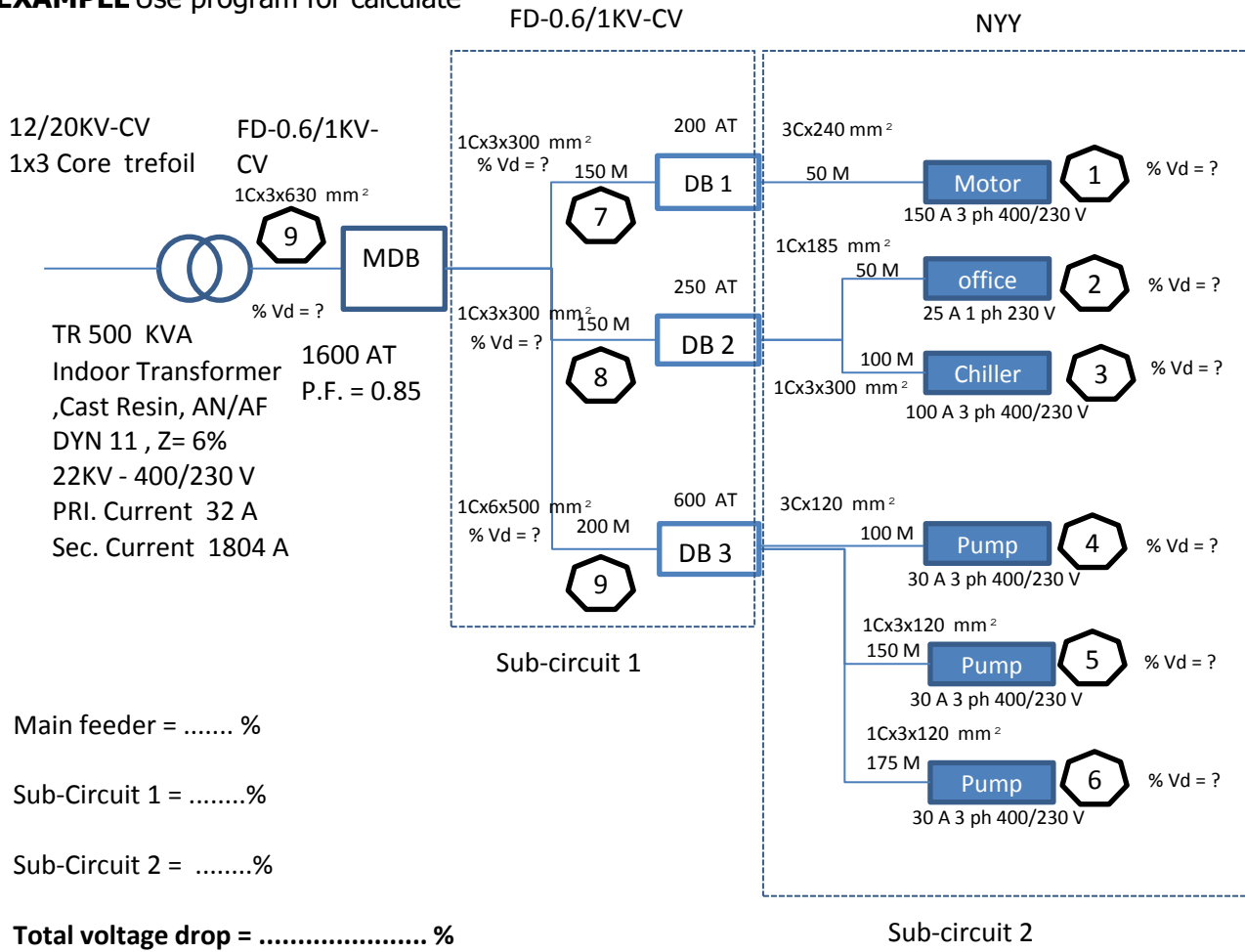
- = Input data
- = Select data
- = Do not Edit

Result **Can Use**

NOTE: NEC RECOMMENDATIONS

- 1. Branch Circuits** – maximum voltage drop of 3%. (The maximum total voltage drop for a combination of both branch circuit and feeder should not exceed 5%)
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EXAMPLE Use program for calculate



Main feeder = %

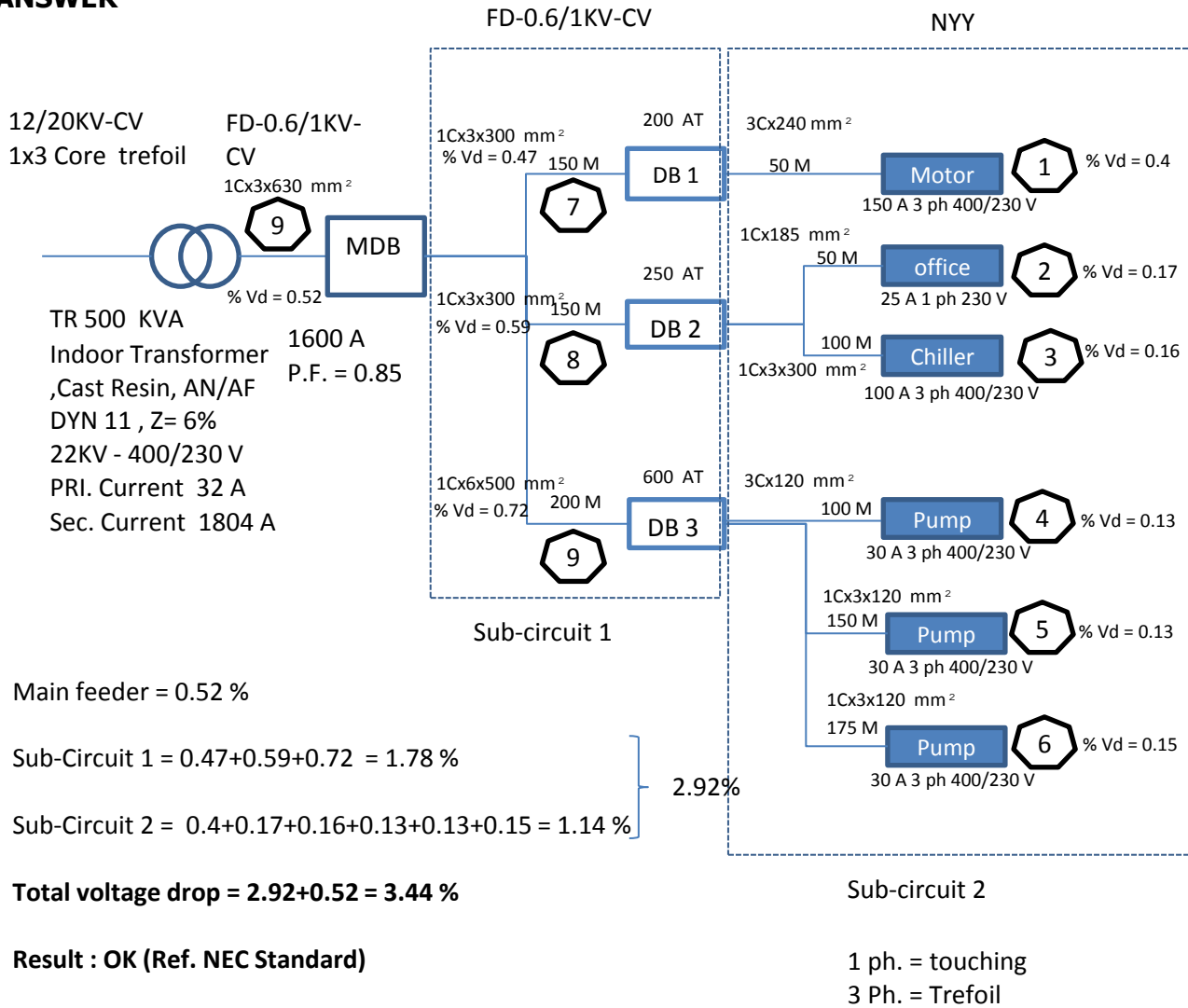
Sub-Circuit 1 =%

Sub-Circuit 2 =%

Total voltage drop = %

1 ph. = touching
3 Ph. = Trefoil

ANSWER



Remark : The difference values was due to used actual structure for calculation.(REF. EIT)

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