YAZAKI

THAI – YAZAKI ELECTRIC WIRE CO., LTD.

USER GUIDE

VOlTAGE DROP CALCULATE

For

THAI-YAZAKI
Wire & Cable

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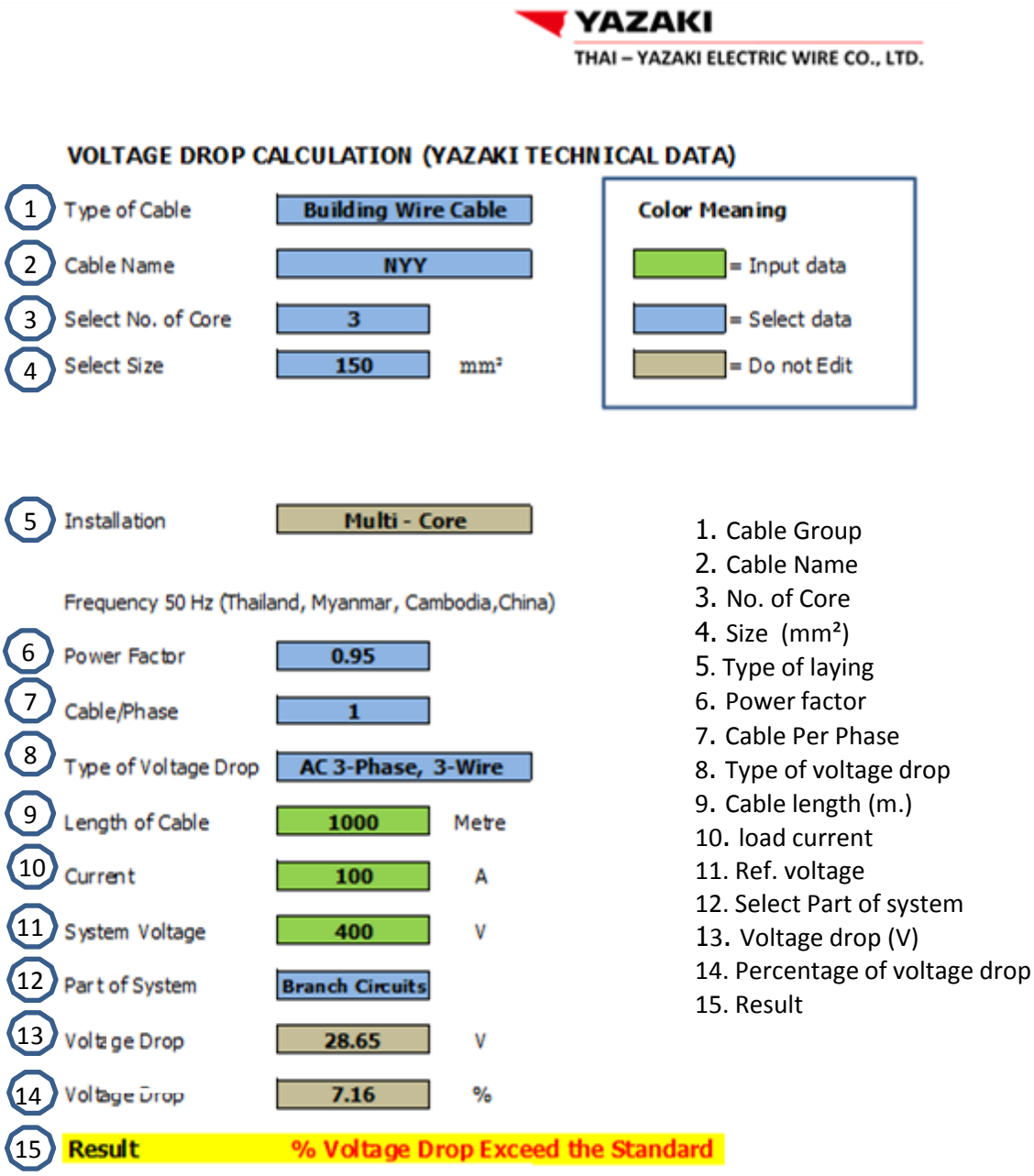
Part 1 : Voltage drop caculate in Yazaki Technical data

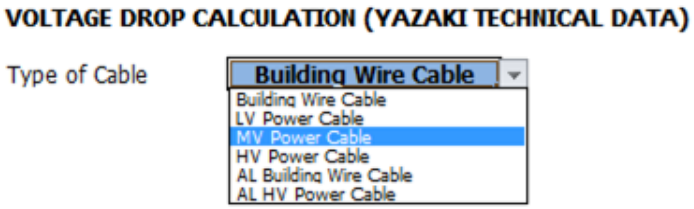
Part 1-1 Components of the Program



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

Part 1-2 Start to use

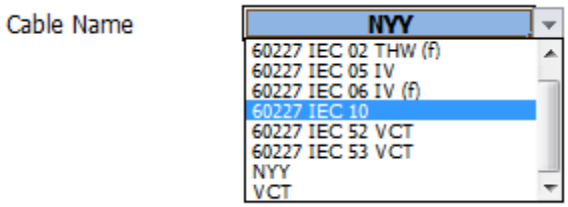
1. Choose type of Cable



Group of Cable:

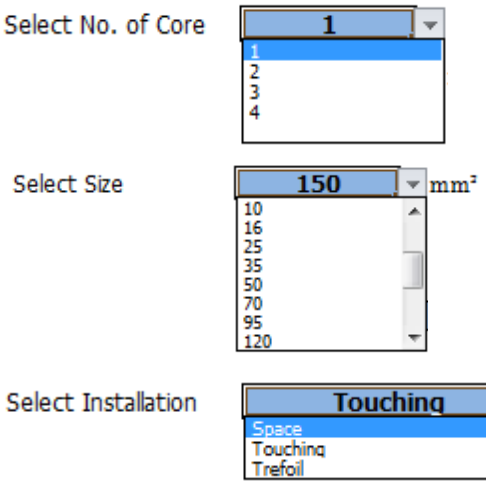
1. Building Wire Cable
2. LV Power Cable
3. MV Power Cable
4. HV Power Cable
5. AL Building wire Cable
6. Al HV Power Cable

2. Choose - Cable Name



Cable name's referance of cable group

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



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	0.95	
2	Cable/Phase	1	
3	Type of Voltage Drop	AC 3-Phase, 3-Wire	
4	Length of Cable	1000	Metre
5	Current	100	A
6	System Voltage	400	V
7	Part of System	Branch Circuits	

1 Power factor (0.7-1)
2 Cable/Phase (Same size)
3 Type of Voltage Drop
4 length of cable (m)
5 Load current A (Not max capacity of cable
6 System Voltage
7 Part of system

5. Output Data

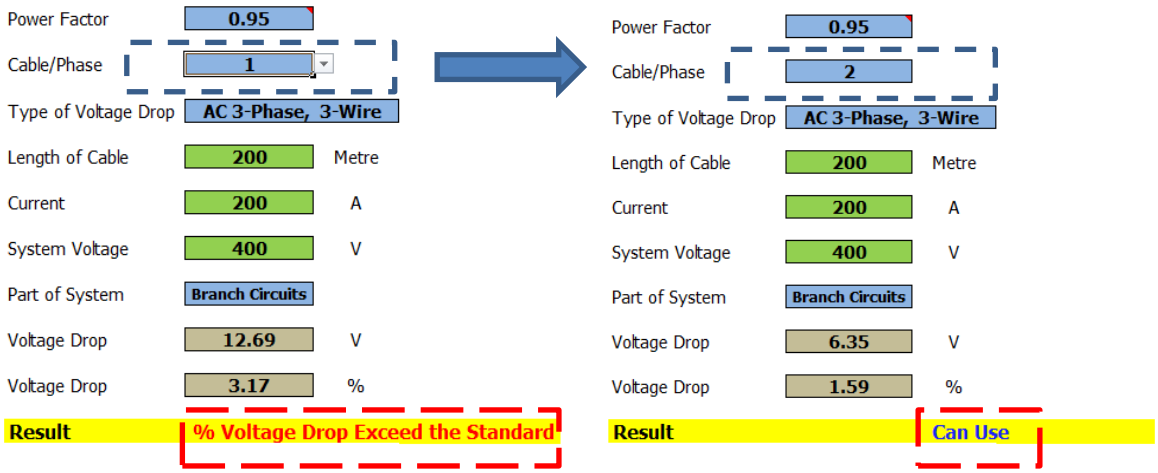
1	Voltage Drop	8.61	V
2	Voltage Drop	2.15	%
3	**Result**	**Can Use**	

1. Voltage Drop (V)
2. Voltage Drop (%)
3. Result

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**



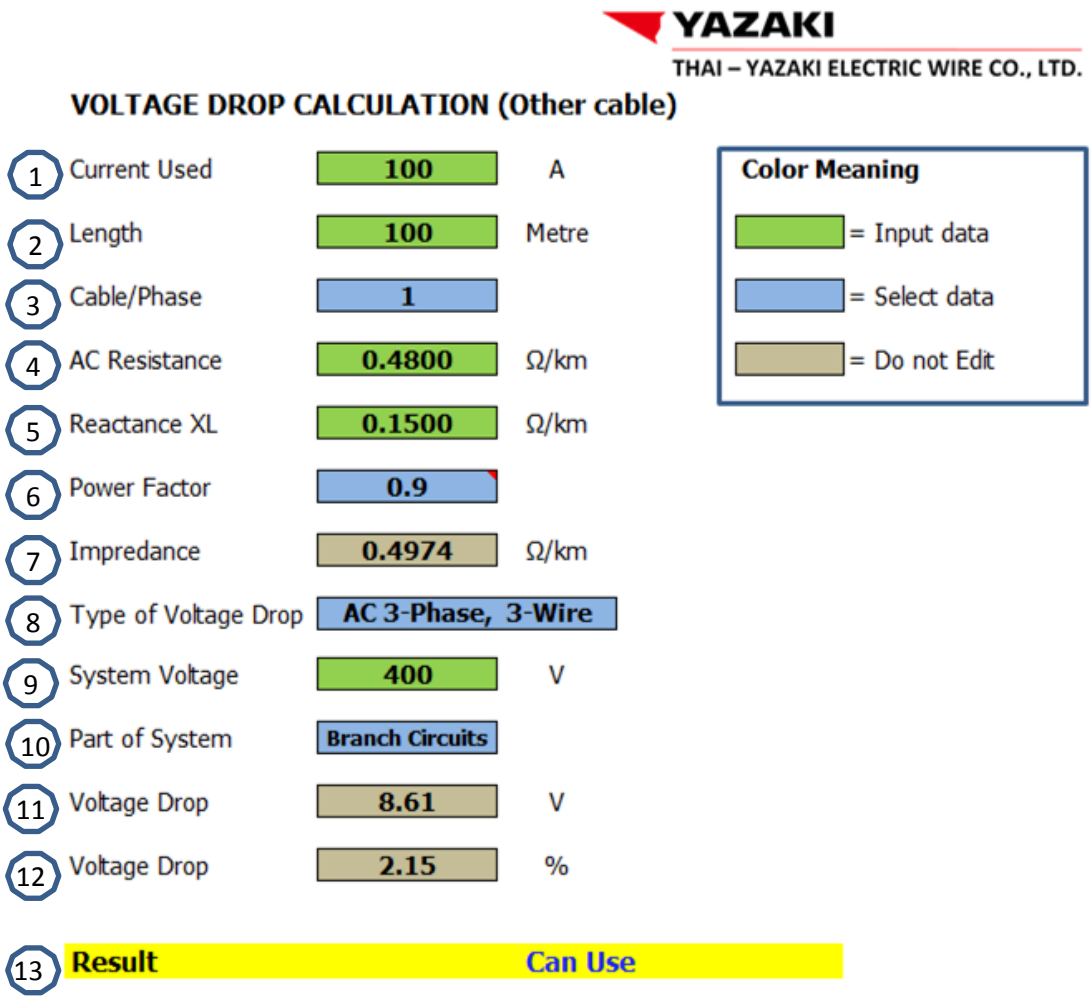
NOTE: NEC RECOMMENDATIONS*

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



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

$XL = 2\pi\ x\ f\ x\ L\ x10^{-3}$

XL= Reactance

f = Frequency

L=Inductance

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

GMD = Geometric Mean Distance

K = constance rating to the conductor formation

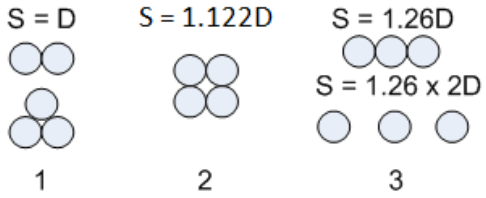
Number of wires in conductor	k
3	0.0778
7	0.0642
19	0.0554
37	0.0528
≥61	0.0514
1 (solid)	0.0500

GMD

1.Individual shield = OD shield x Distance factor

2.Insulation conductor = OD insulation x Distance factor

Distance factor



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

$Rac = Rdc(max)x(1 + \lambda s + \lambda p)$

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

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

λs= The skin effect factor

λp = The proximity effect factor

$$\lambda s = \frac{Xs^4}{192 + 0.8Xs^4}$$

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

f = supply frequency in Hertz

ks = 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 :

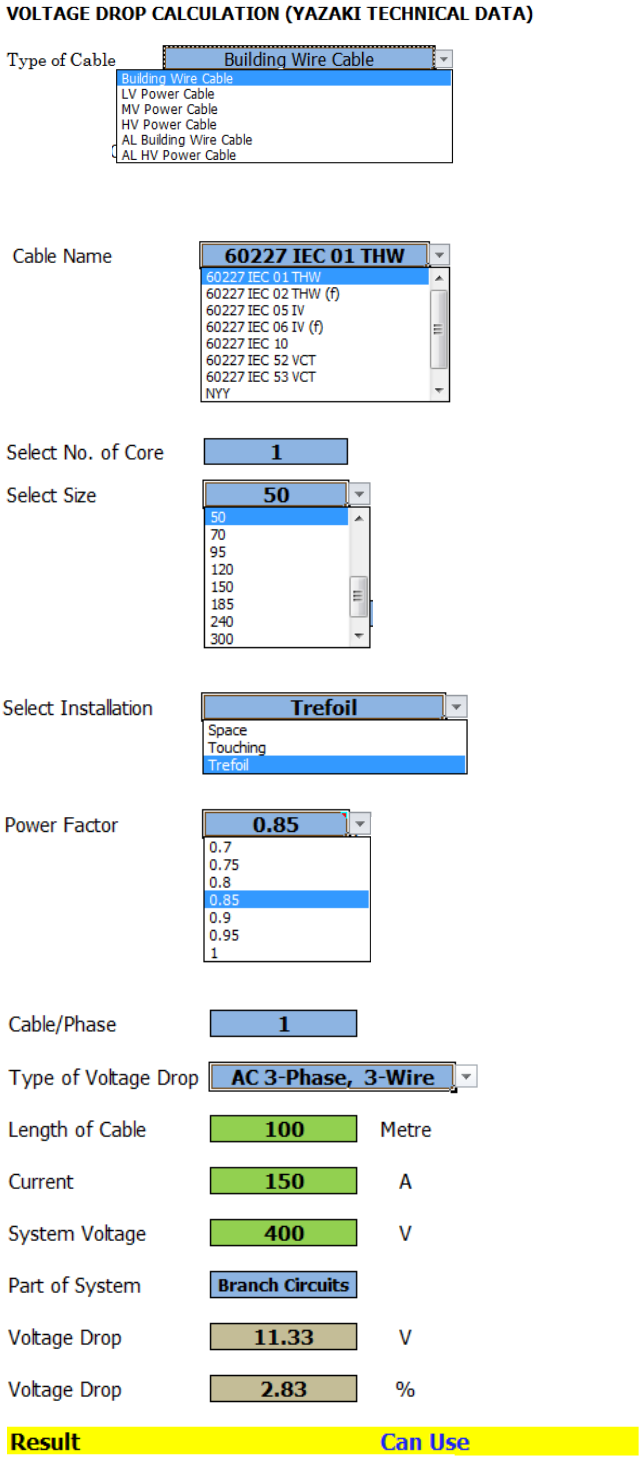
$X' = \sqrt{0.8}\ .Xs$

$dc = diameter\ of\ conductor$

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 = 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

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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

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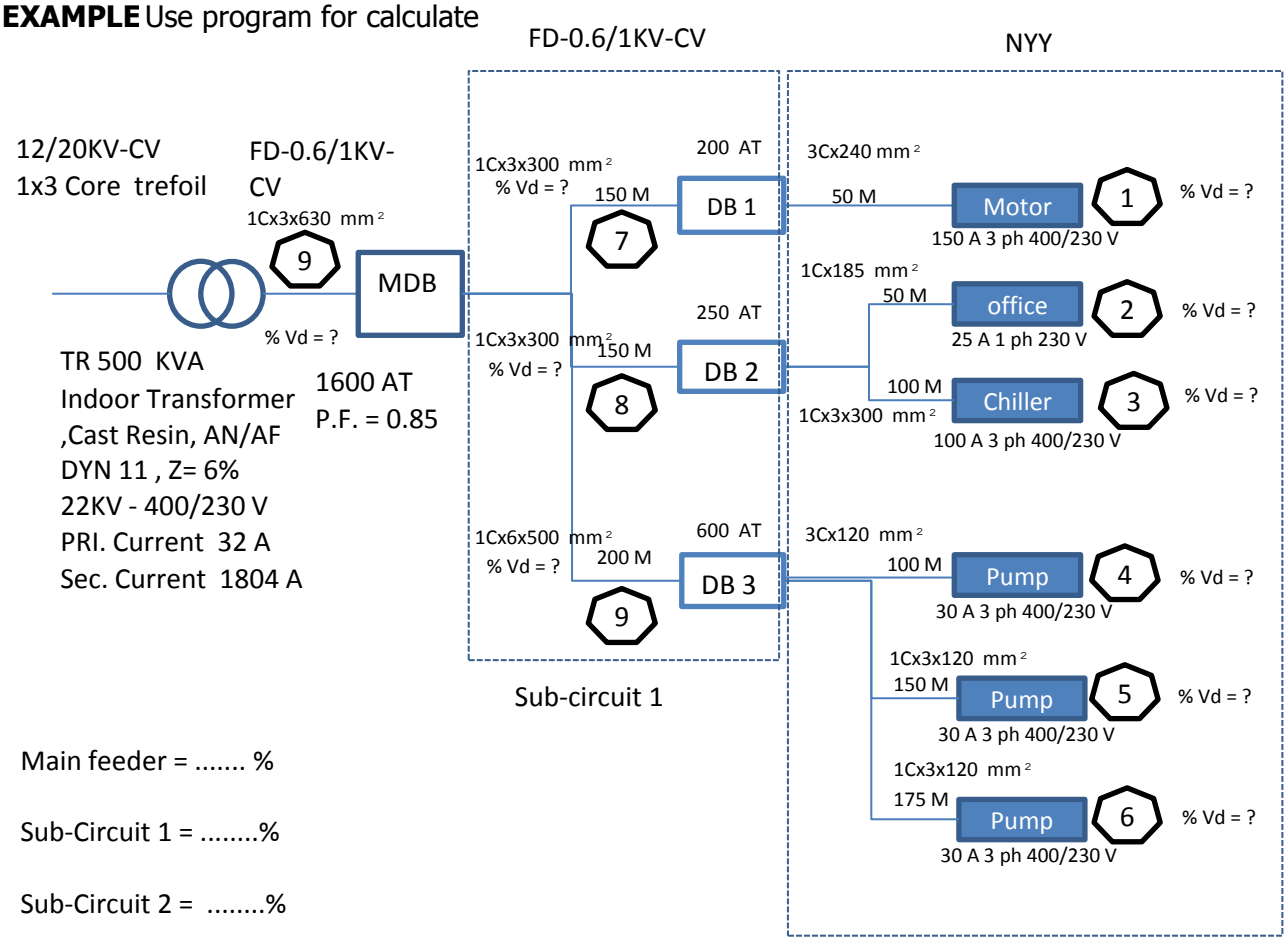
2. Main Feeder – maximum voltage drop of 2%. (The maximum total voltage drop for a combination of both branch-circuit and feeder should not exceed 5%)

EXAMPLE Use program for calculate



Main feeder = ... %

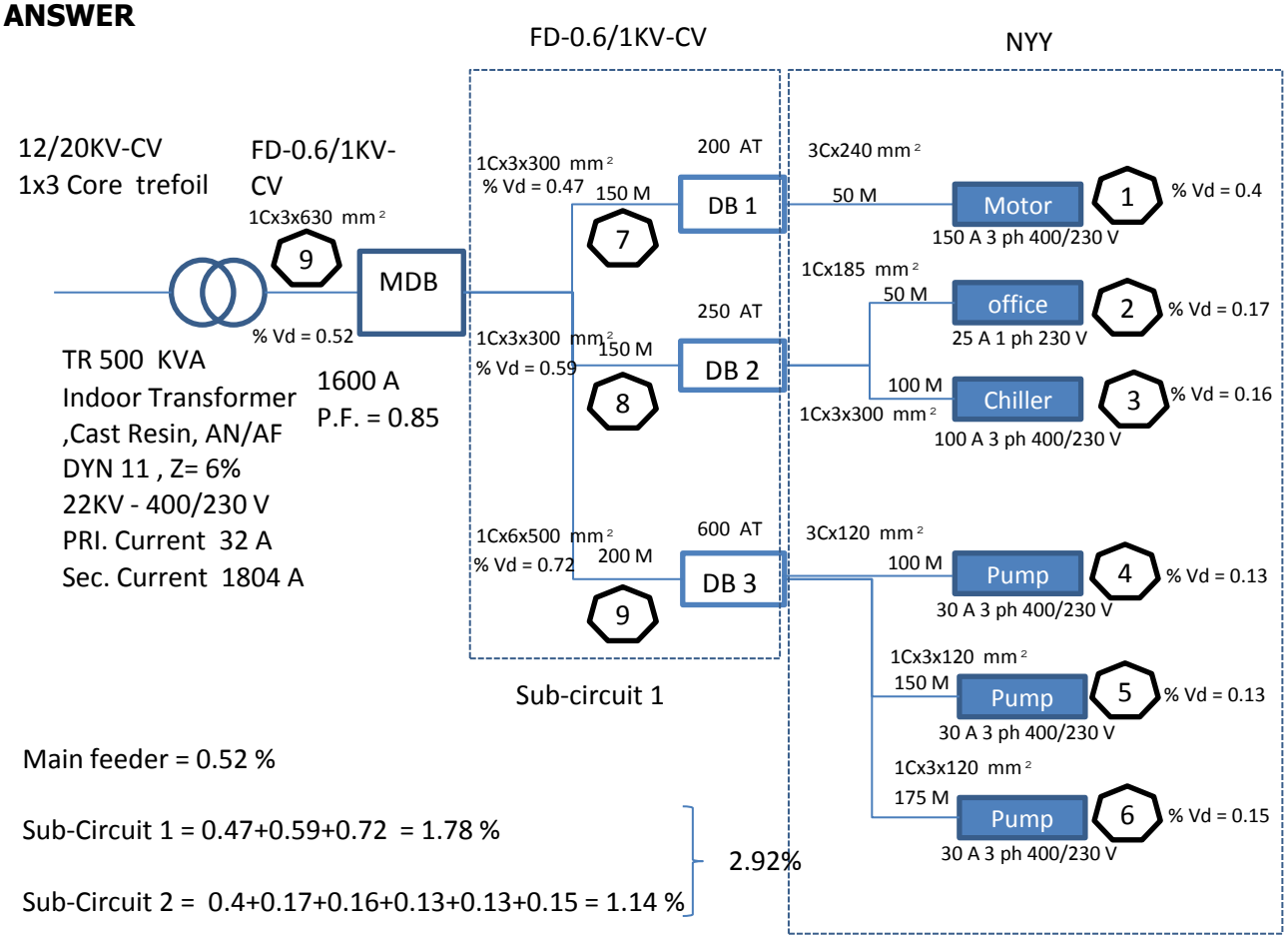
Sub-Circuit 1 = ...%

Sub-Circuit 2 = ...%

Total voltage drop = ... %

1 ph. = touching
3 Ph. = Trefoil

ANSWER



Main feeder = 0.52 %

Sub-Circuit 1 = 0.47+0.59+0.72 = 1.78 %

Sub-Circuit 2 = 0.4+0.17+0.16+0.13+0.13+0.15 = 1.14 %

2.92%

Total voltage drop = 2.92+0.52 = 3.44 %

Result : OK (Ref. NEC Standard)

1 ph. = touching
3 Ph. = Trefoil

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

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