CEE Relays Ltd

87C Whitby Road, Slough, SL1 3DR (Registered Office)

Tel: +44 1753 576477 Fax: +44 1753 825661

Web: www.ceerelays.co.uk

Power*Tools for Windows (PTW)

Enhancement List

V9.0

Please remember to visit our FAQs section (ceerelays.co.uk/ptw_faqs.htm) if you have any questions.

Registered in England No. 1977107

IEEE 1584 2018 Equipment Data Table

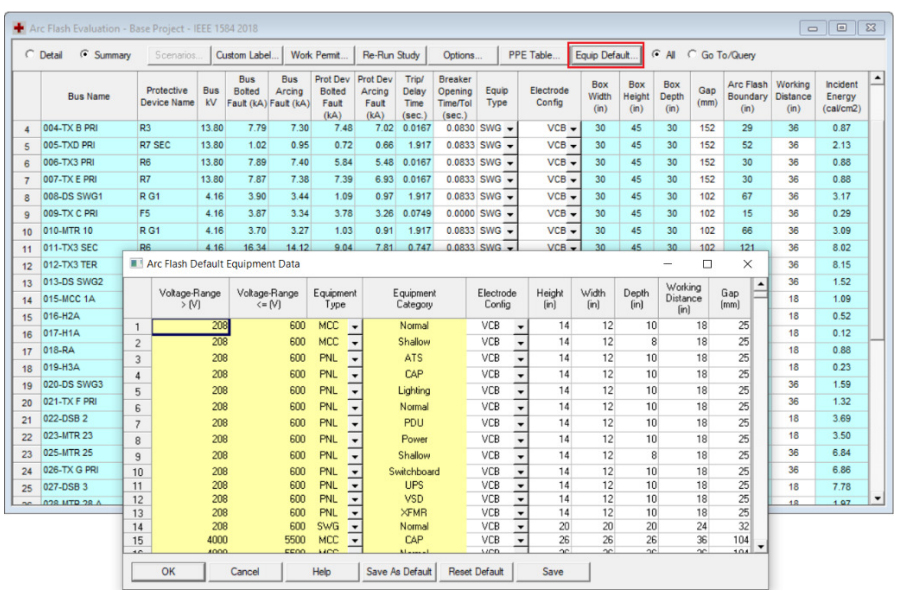
The updated IEEE 1584 2018 “Guide for Performing Arc-Flash Hazard Calculations” provides greater flexibility when analyzing enclosure sizes for various types of equipment. Enclosure sizes can significantly affect the resulting incident energy and arc flash boundary calculations. Smaller enclosures will have more concentrated energy that can be directed towards the worker. Larger enclosures will have less of an effect. IEEE 1584 2018 provides typical enclosure sizes for commonly manufactured enclosures. However, an automatic Correction Factor (as detailed in 1584 section 4.8) can be applied in the software when enclosure sizes differ from the IEEE 1584 2018 typical values.

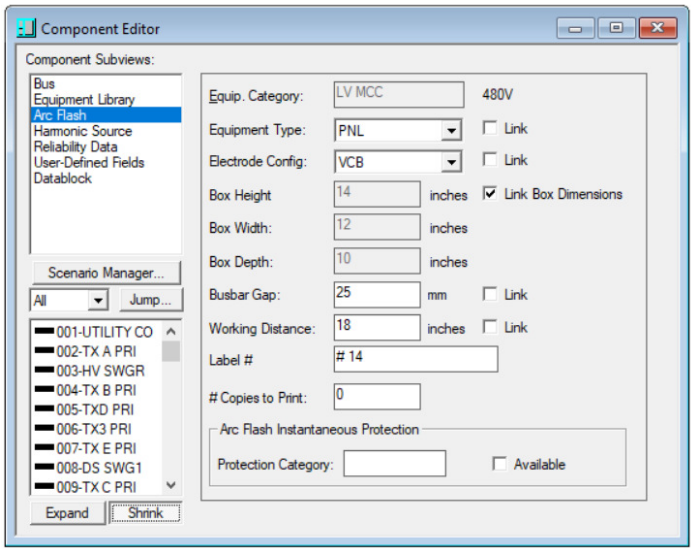
In the SKM Power*Tools software, there is an Equipment Data table within the Arc Flash study module that can be used to specify the enclosure sizes for all buses and protective devices. This Equipment Data table is open for users to define their own custom enclosure sizes and is used for all buses and protective devices in your project (globally). This table is project specific and can also be used in other projects by saving the current project's table as the default table.

The operation of the Equipment Data is simple. As long as the bus contains data, either typed in or linked from the bus library, the software will refer to the Equipment Data table to find a match and automatically populate the enclosure size.

Required Bus data consists of the ***Voltage***, ***Equipment Type*** (PNL, SWG, MCC), and ***Equipment Category*** (Lighting, Power, Switchboard, etc.). When a match is located, the Height, Width, Depth, Working Distance, Gap, and ***Electrode Configuration*** (VCB, VCBB, HCB) values are automatically populated for that bus.

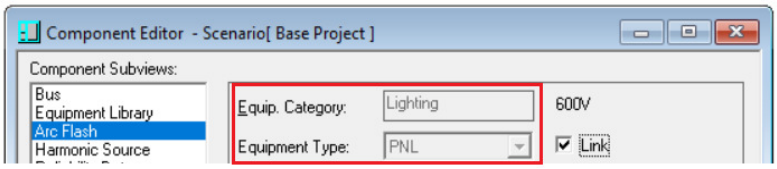
Custom enclosure sizes can also be specified in the Arc Flash spreadsheet where it may be easier to view all buses and enclosure sizes together. The Equipment Category will be read-only in the Arc Flash spreadsheet if the bus is linked to a model in the library.



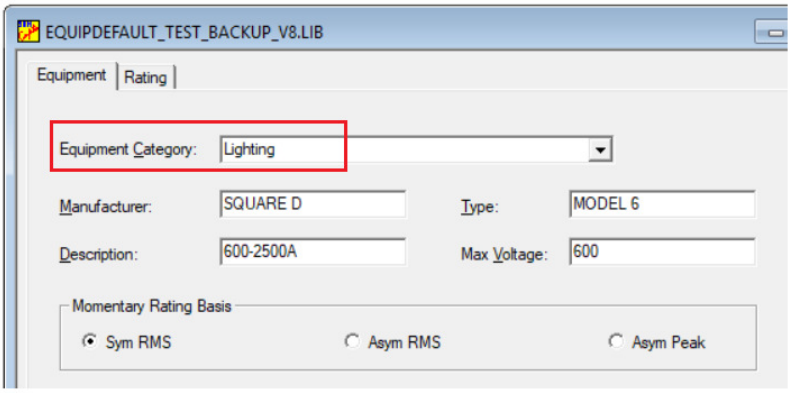


Component Editor now shows Box Dimensions

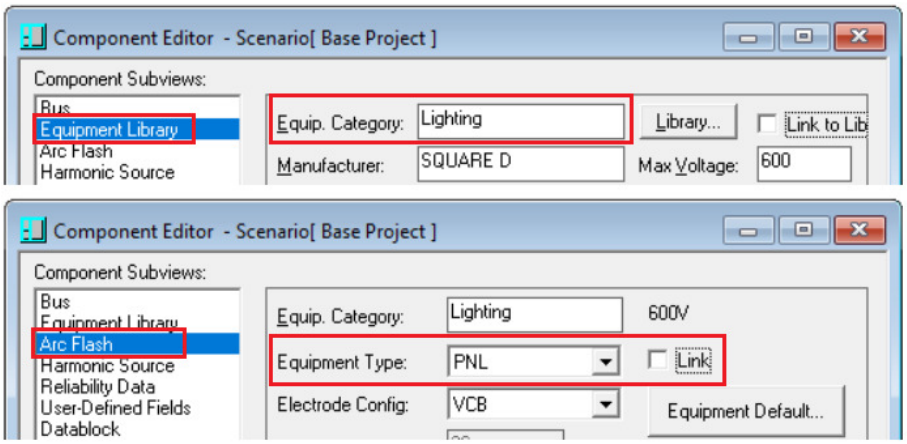
Equipment Type is taken directly from IEEE 1584 2018. Type consists of SWG, PNL, CBL, AIR, and MCC. When linked, the software contains intelligence to correctly select the appropriate Type based on the ***Equipment Category*** and ***Voltage***. For example, if the software sees certain keywords in the Equipment Category such as *Panel* in the word *Panelboard*, PNL will be selected for the Equipment Type. Refer to IEEE 1584 2018 for a list of typical Equipment based on Voltage levels.



The Equipment Category is taken from the Bus library model. Additional entries may also be created by directly typing into this field in the library model.



The Equipment Type and Equipment Category information may also be manually entered directly in the Component Editor in lieu of selecting a Bus library model.

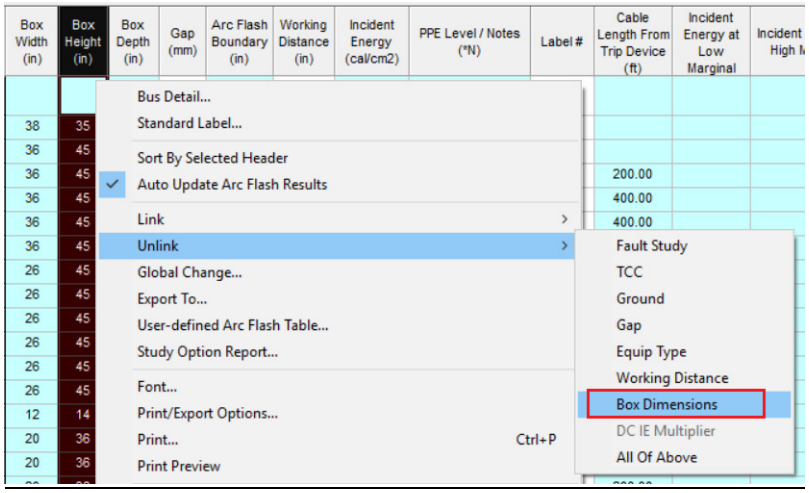


The Equipment Data table is project specific – meaning that each project can have its own Equipment Data table (AF_EquipDefault.ss6 & AF_EquipDefault_Metric.ss6). If these files are missing, it will be copied from the Misc folder (Default C:\PTW32\Lib). Original Equipment Data tables can be found in C:\PTW32\Bin and will be copied to the Misc folder if they are missing.

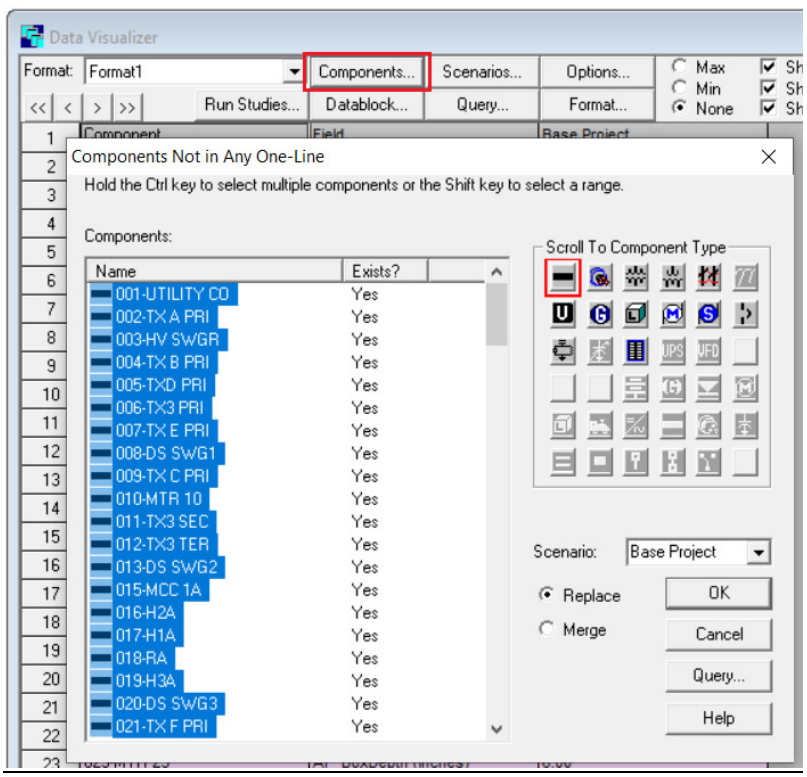
If a match cannot be found in the Equipment Data table, then the default enclosure dimensions from IEEE 1584 2018 will be used instead. Again, the ***Equipment Category*** and ***Voltage*** will be used to correctly select the values from IEEE 1584 2018.

Using Data Visualizer to change enclosure dimensions for multiple equipment simultaneously

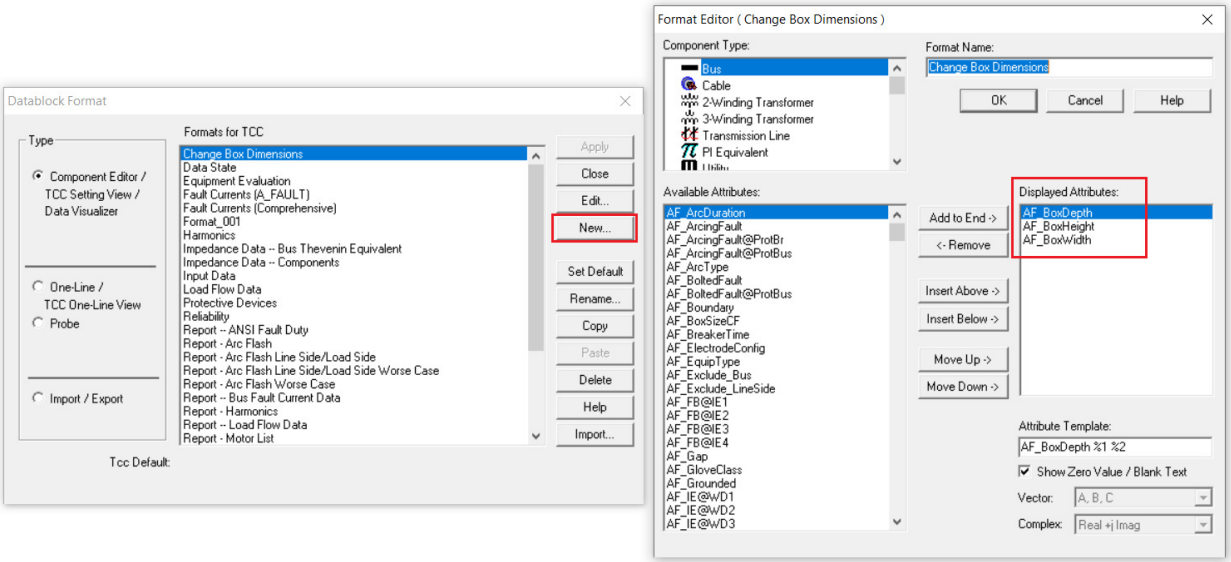
1. Unlink the Box Dimensions. This can easily be done within Arc Flash.

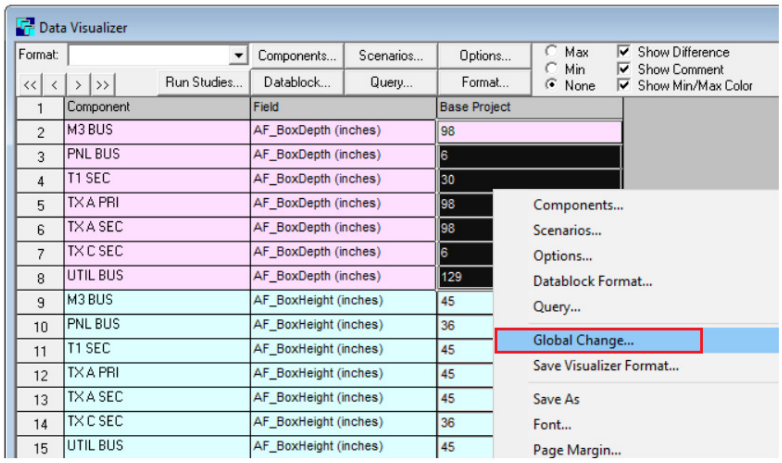


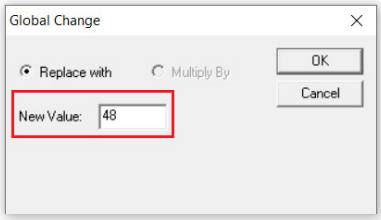
2. Open Data Visualizer and click on Components. Select the buses (or protective devices) that you want to change the box dimensions for.



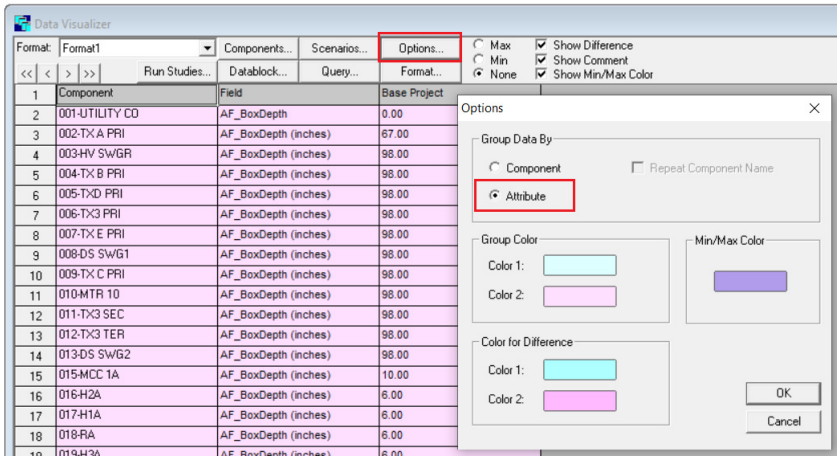
3. Click on Datablock and create a new Format. Enter a format name of “Change Box Dimensions”. Add the attributes shown below.



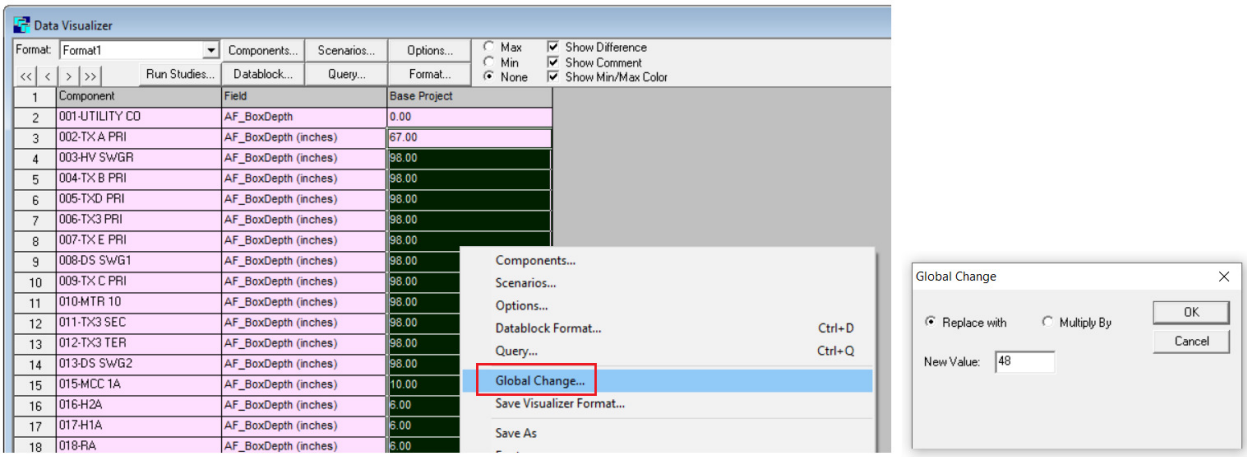




4. Click on Options. Under Group Data By, select Attribute.



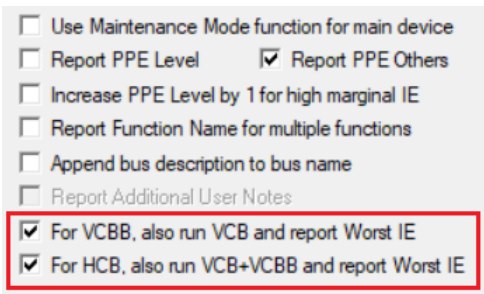
5. Now that all the dimensions are sorted together, select multiple rows, right-click and select Global Change. You can now enter the new desired value.



ANALYZE MULTIPLE ELECTRODE CONFIGURATIONS

Electrode configuration plays a crucial factor in the determination of the incident energy. What happens when a VCBB configuration becomes VCB during an arc flash incident? The PTW software can now automatically analyze other possible electrode configurations and report the higher incident energy result. This is available for equipment configured as VCBB or HCB. Note that HCB is almost always result in a higher incident energy compared to VCB or VCBB. The option is made available for peace of mind and should not be needed on a regular basis.

When another electrode configuration is found to produce a higher incident energy, a (*N25a), (*N25b), or (*N25c) indication will be displayed for that bus.



	Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time/Tol (sec.)	Equip Type	Electrode Config	Box Width (in)	Box Height (in)	Box Depth (in)	Arc Flash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	PPE Level / Notes (*N)
22	023-MTR 23	R TX F	0.48	19.87	15.23	15.28	11.71	0.0167	0.0833	PNL	VCB	12	14	10	35	18	3.50	
23	025-MTR 25	R7 SEC	4.16	6.73	5.77	4.79	4.10	1.35	0.0833	SWG	VCB	30	45	30	109	36	6.84	(*N3)
24	026-TX G PRI	R7 SEC	4.16	6.69	5.74	4.77	4.09	1.356	0.0833	SWG	VCB	30	45	30	110	36	6.86	(*N3)
25	027-DSB 3	F TX G SEC	0.48	31.89	20.30	24.01	15.28	0.1917	0.0000	PNL	VCBB	12	14	10	58	18	7.78	(*N3) (*N25a)
26	028-MTR 28 A	LVP4	0.48	21.89	16.69	18.20	13.87	0.05	0.0000	PNL	VCB	12	14	10	25	18	1.97	
27	028-MTR 28 B	LVP5	0.48	21.89	16.69	18.20	13.87	0.05	0.0000	PNL	VCB	12	14	10	25	18	1.97	
28	029-TX D SEC	R7 SEC	4.16	6.70	5.75	4.82	4.13	1.337	0.0833	SWG	VCB	30	45	30	109	36	6.84	(*N3)
29	BLDG 115 SERV	R7 SEC	4.16	7.01	6.01	5.03	4.31	1.246	0.0833	SWG	VCB	30	45	30	107	36	6.61	(*N3)
30	LV DISTRIB	B-SWBD1	0.48	10.01	7.65	9.23	7.06	0.175	0.0000	PNL	VCB	12	14	10	31	18	2.81	
31	For additional information refer to NFPA 70 E, Standard for Electrical Safety in the Workplace.																	(*N25a) - IE VCB > VCBB

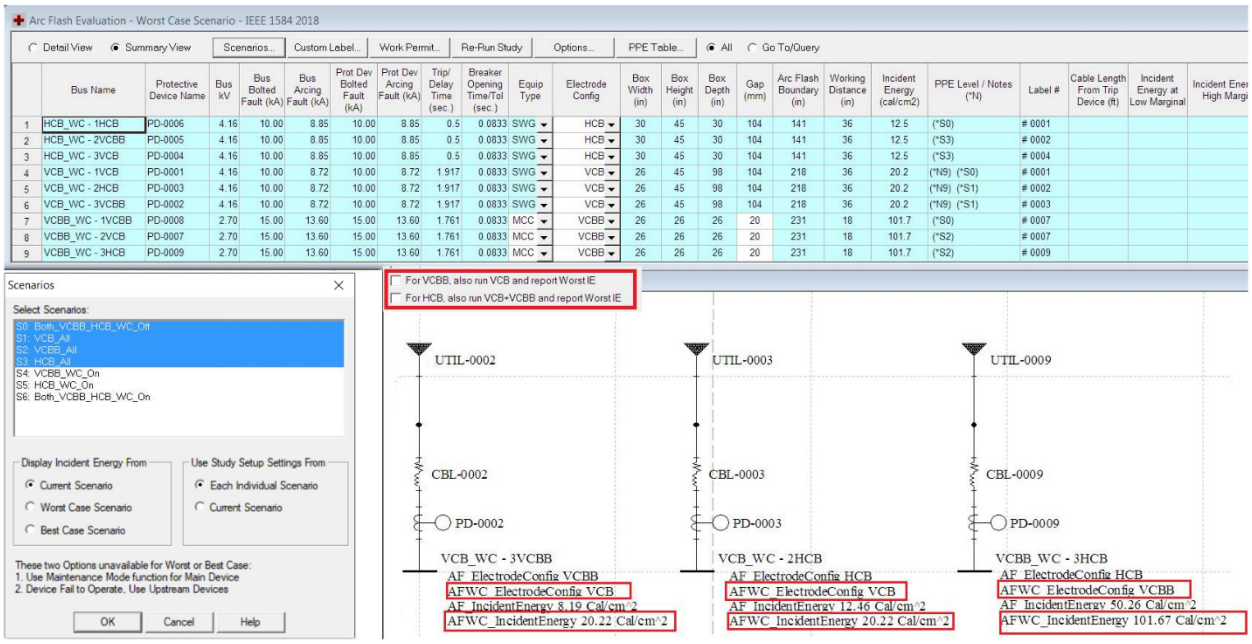
Alternative approach to analyzing different Electrode Configurations:

Scenarios can be created of the Base project where each scenario has all equipment set to a particular electrode configuration. In the example below:

- Scenario S1 has VCB set as the electrode configuration for all equipment.
- Scenario S2 has VCBB set as the electrode configuration for all equipment.
- Scenario S3 has HCB set as the electrode configuration for all equipment.

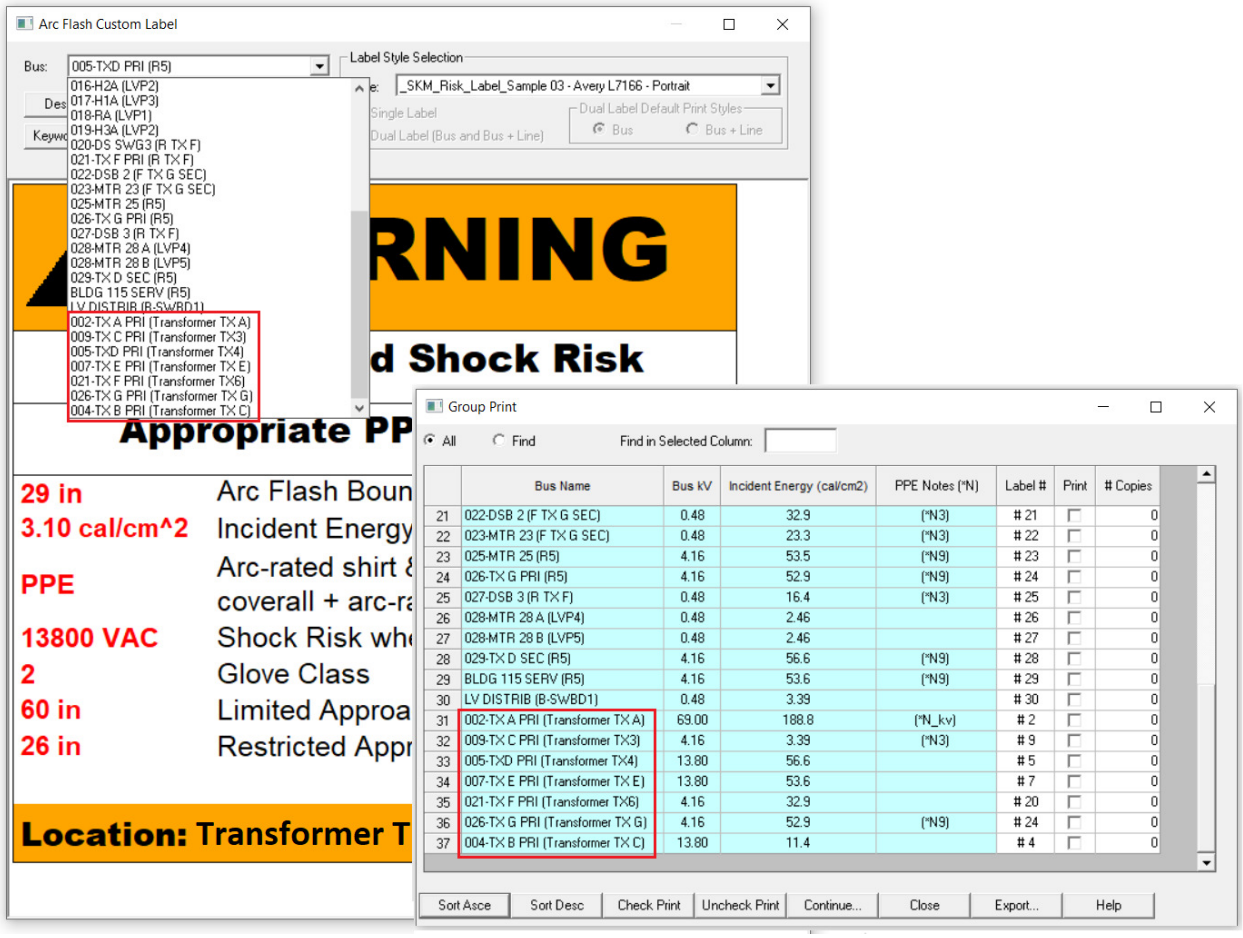
In the Arc Flash Scenario options, select "Display Incident Energy From – Worst Case Scenario". The Arc Flash spreadsheet will compare all scenarios and report the highest incident energy from all selected scenarios. Graphically, the results can also be viewed by applying new Datablock attributes introduced in Version 9.0. AFWC_ElectrodeConfig will show the electrode configuration used to determine the

highest incident energy. AFWC_IncidentEnergy will show the actual highest incident energy across all scenarios.



New Transformer Arc Flash Labels

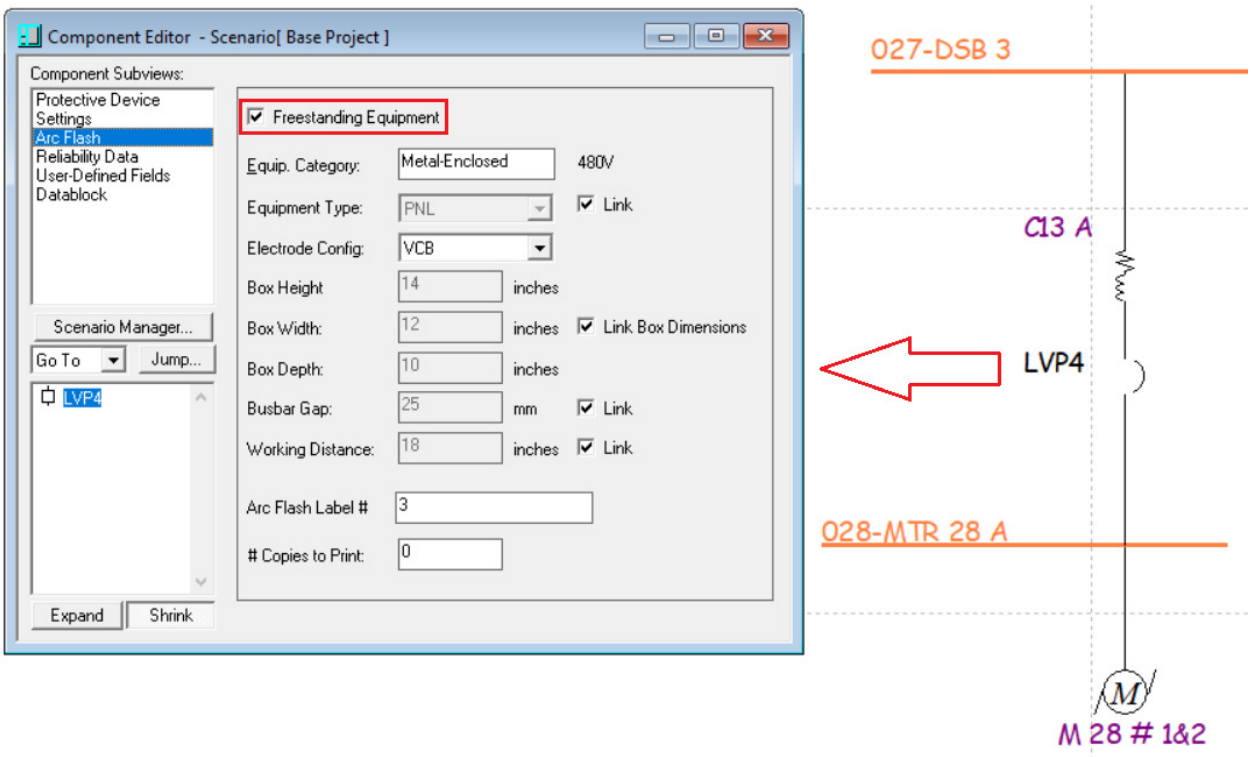
For some transformers, such as dry type, the incident energy will likely be higher on the secondary bus, but the worst-case shock protection is on the primary bus. A new single transformer arc flash label is now available to display the higher incident energy and shock protection from both the secondary and primary bus. The new transformer label can be found at the bottom of the list within the Custom Label, Standard Label, and Group Print interface. It is also available in the Bus Detailed report.



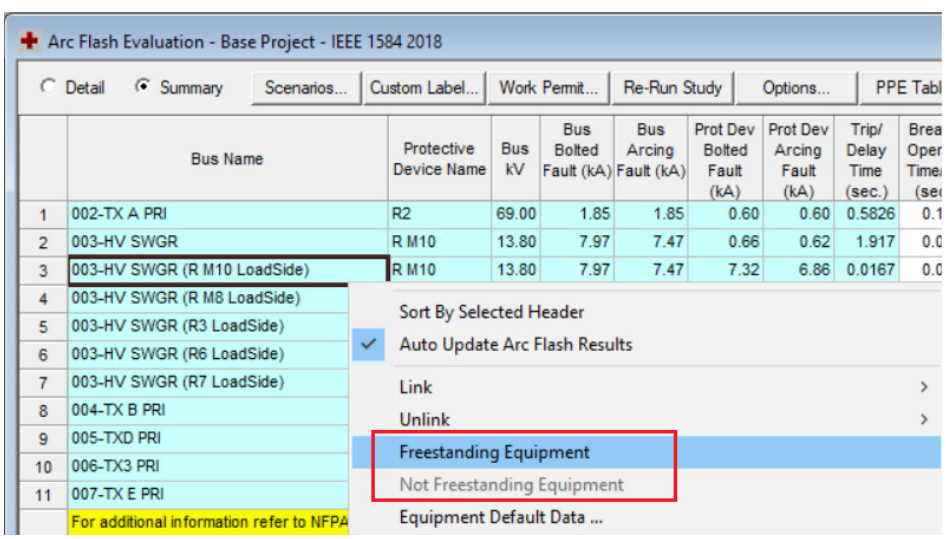
	Bus Name	Bus kV	Incident Energy (cal/cm2)	PPE Notes (*N)	Label #	Print	# Copies
21	022-DSB 2 (F TX G SEC)	0.48	32.9	(*N3)	# 21		0
22	023-MTR 23 (F TX G SEC)	0.48	23.3	(*N3)	# 22		0
23	025-MTR 25 (R5)	4.16	53.5	(*N9)	# 23		0
24	026-TX G PRI (R5)	4.16	52.9	(*N9)	# 24		0
25	027-DSB 3 (R TX F)	0.48	16.4	(*N3)	# 25		0
26	028-MTR 28 A (LVP4)	0.48	2.46		# 26		0
27	028-MTR 28 B (LVP5)	0.48	2.46		# 27		0
28	029-TX D SEC (R5)	4.16	56.6	(*N9)	# 28		0
29	BLDG 115 SERV (R5)	4.16	53.6	(*N9)	# 29		0
30	LV DISTRIB (B-SWBD1)	0.48	3.39		# 30		0
31	002-TX A PRI (Transformer TX A)	69.00	188.8	(*N_kv)	# 2		0
32	009-TX C PRI (Transformer TX3)	4.16	3.39	(*N3)	# 9		0
33	005-TXD PRI (Transformer TX4)	13.80	56.6		# 5		0
34	007-TX E PRI (Transformer TX E)	13.80	53.6		# 7		0
35	021-TX F PRI (Transformer TX6)	4.16	32.9		# 20		0
36	026-TX G PRI (Transformer TX G)	4.16	52.9	(*N9)	# 24		0
37	004-TX B PRI (Transformer TX C)	13.80	11.4		# 4		0

FREESTANDING EQUIPMENT

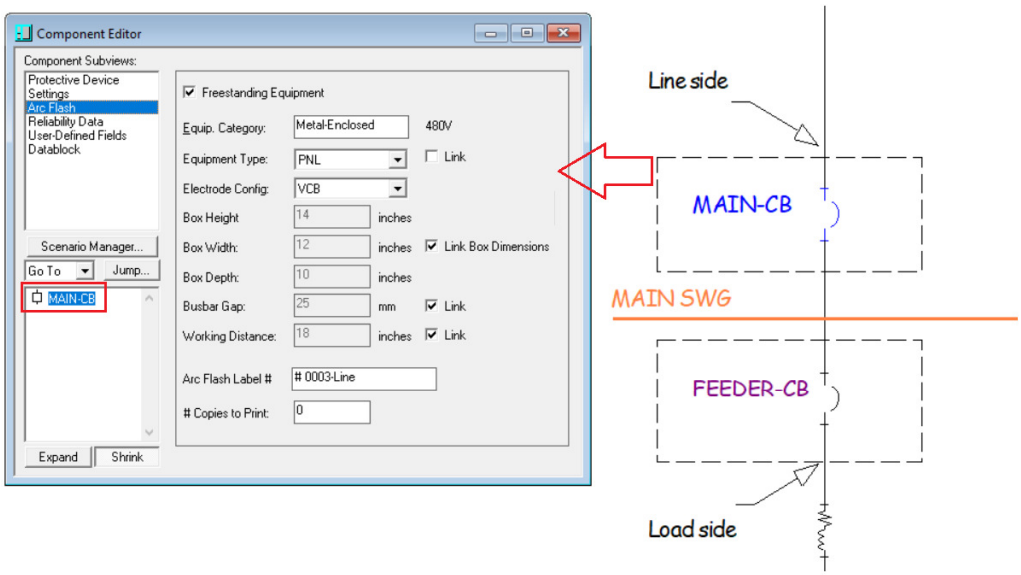
When protective devices are located in separate enclosures within switchgears or MCCs, it is now possible to enter another set of data for electrode configuration, enclosure size, gap, and working distance. This allows arc flash evaluation at this separate location within the same equipment and printing of its own arc flash label.



Setting a protective device to be a Freestanding Equipment can also be done within Arc Flash Evaluation.



The Bus, Line Side, and Load Side Calculations will have its own equipment parameters that are independent of each other providing flexibility to simulate actual conditions. The Equipment Category is always enabled in the Component Editor and within the Arc Flash spreadsheet. Box dimensions, Gap, and Working Distance will automatically be populated based on the Equipment Default Table.



Arc Flash Evaluation - Base Project - IEEE 1584 2018

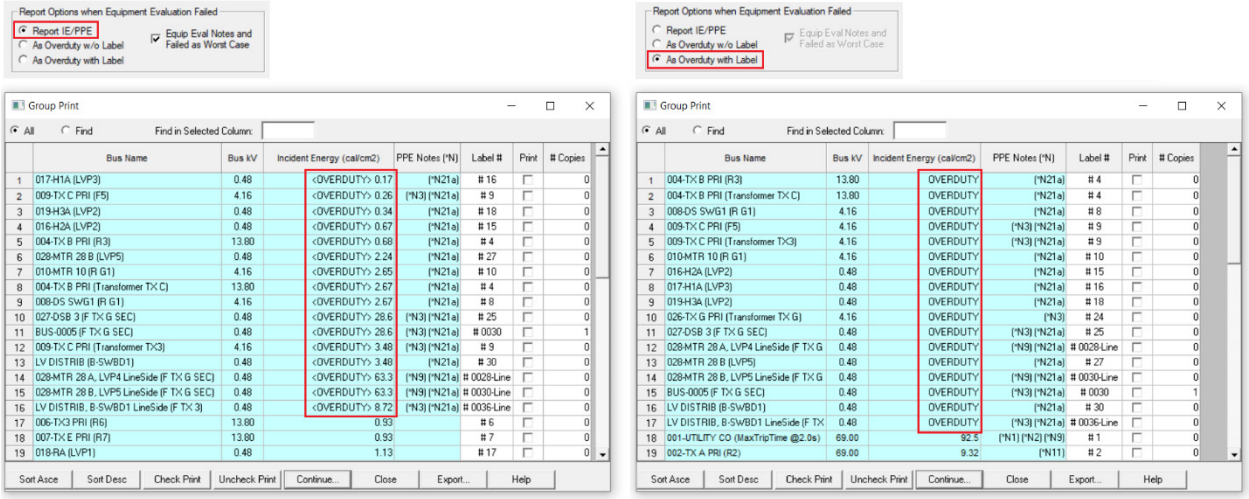
Detail | Summary | Scenarios... | Custom Label... | Work Permit... | Re-Run Study | Options... | PPE Table... | Equip Default... | All | Go To/Query

	Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time/Tol (sec.)	Equip Type	Equip Category	Electrode Config	Box Height (in)	Box Width (in)	Box Depth (in)	Gap (mm)	Arc Flash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)
3	MAIN SWG	MAIN-CB	0.48	10.01	7.65	9.23	7.06	0.175	0.0000	PNL	Switchgear	VCB	49	24	36	25	26	18	2.18
4	MAIN SWG (FEEDER-CB LoadSide)	FEEDER-CB	0.48	10.01	7.44	9.23	6.87	0.066	0.0000	SWG	LV Switchgear	VCB	20	20	36	32	18	24	0.75
5	MAIN SWG (MAIN-CB LineSide)	F5	0.48	10.01	6.70	9.23	6.19	1.006	0.0000	PNL	Metal-Enclosed	VCB	14	12	10	25	82	18	13.5

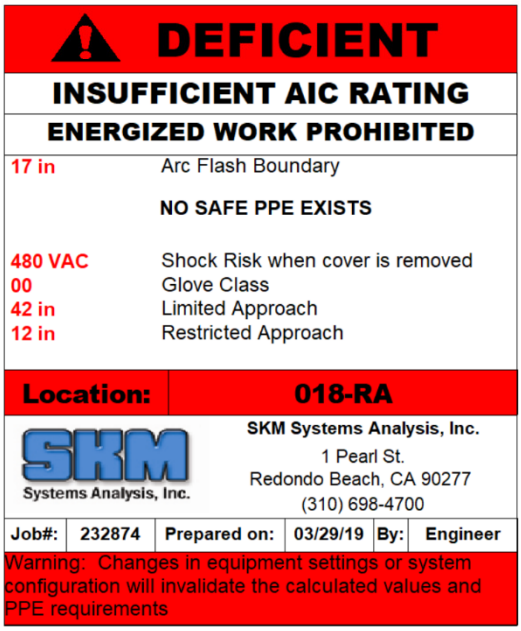
Enhance Arc Flash Label Printing of Overdutied Equipment

To help sort and print custom Deficient arc flash labels for Overdutied equipment, the text "OVERDUTY" is now shown for equipment that have a Failed status in Equipment Evaluation. First select a Deficient label and go to the Group Print interface. Sorting by OVERDUTY allows easy selection and printing of a custom label.

	Bus Name	Bus kV	Incident Energy (cal/cm2)	PPE Notes (*N)	Label #	Print	# Copies
1	017-H1A (LVP3)	0.48	<OVERDUTY> 0.17	(*N21a)	# 16		0
2	009-TX C PRI (F5)	4.16	<OVERDUTY> 0.26	(*N3) (*N21a)	# 9		0
3	019-H3A (LVP2)	0.48	<OVERDUTY> 0.34	(*N21a)	# 18		0
4	016-H2A (LVP2)	0.48	<OVERDUTY> 0.67	(*N21a)	# 15		0
5	004-TX B PRI (R3)	13.80	<OVERDUTY> 0.68	(*N21a)	# 4		0
6	028-MTR 28 B (LVP5)	0.48	<OVERDUTY> 2.24	(*N21a)	# 27		0
7	010-MTR 10 (R G1)	4.16	<OVERDUTY> 2.65	(*N21a)	# 10		0
8	004-TX B PRI (Transformer TX C)	13.80	<OVERDUTY> 2.67	(*N21a)	# 4		0
9	008-DS SWG1 (R G1)	4.16	<OVERDUTY> 2.67	(*N21a)	# 8		0
10	027-DSB 3 (F TX G SEC)	0.48	<OVERDUTY> 28.6	(*N3) (*N21a)	# 25		0
11	BUS-0005 (F TX G SEC)	0.48	<OVERDUTY> 28.6	(*N3) (*N21a)	# 0030		1
12	009-TX C PRI (Transformer TX3)	4.16	<OVERDUTY> 3.48	(*N3) (*N21a)	# 9		0
13	LV DISTRIB (B-SWBD1)	0.48	<OVERDUTY> 3.48	(*N21a)	# 30		0
14	028-MTR 28 A, LVP4 LineSide (F TX G SEC)	0.48	<OVERDUTY> 63.3	(*N9) (*N21a)	# 0028-Line		0
15	028-MTR 28 B, LVP5 LineSide (F TX G SEC)	0.48	<OVERDUTY> 63.3	(*N9) (*N21a)	# 0030-Line		0
16	LV DISTRIB, B-SWBD1 LineSide (F TX 3)	0.48	<OVERDUTY> 8.72	(*N3) (*N21a)	# 0036-Line		0
17	006-TX3 PRI (R6)	13.80	0.93		# 6		0
18	007-TX E PRI (R7)	13.80	0.93		# 7		0
19	018-RA (LVP1)	0.48	1.13		# 17		0



	Bus Name	Bus kV	Incident Energy (cal/cm2)	PPE Notes (*N)	Label #	Print	# Copies
1	004-TX B PRI (R3)	13.80	OVERDUTY	(*N21a)	# 4		0
2	004-TX B PRI (Transformer TX C)	13.80	OVERDUTY	(*N21a)	# 4		0
3	008-DS SWG1 (R G1)	4.16	OVERDUTY	(*N21a)	# 8		0
4	009-TX C PRI (F5)	4.16	OVERDUTY	(*N3) (*N21a)	# 9		0
5	009-TX C PRI (Transformer TX3)	4.16	OVERDUTY	(*N3) (*N21a)	# 9		0
6	010-MTR 10 (R G1)	4.16	OVERDUTY	(*N21a)	# 10		0
7	016-H2A (LVP2)	0.48	OVERDUTY	(*N21a)	# 15		0
8	017-H1A (LVP3)	0.48	OVERDUTY	(*N21a)	# 16		0
9	019-H3A (LVP2)	0.48	OVERDUTY	(*N21a)	# 18		0
10	026-TX G PRI (Transformer TX G)	4.16	OVERDUTY	(*N3)	# 24		0
11	027-DSB 3 (F TX G SEC)	0.48	OVERDUTY	(*N3) (*N21a)	# 25		0
12	028-MTR 28 A, LVP4 LineSide (F TX G	0.48	OVERDUTY	(*N9) (*N21a)	# 0028-Line		0
13	028-MTR 28 B (LVP5)	0.48	OVERDUTY	(*N21a)	# 27		0
14	028-MTR 28 B, LVP5 LineSide (F TX G	0.48	OVERDUTY	(*N9) (*N21a)	# 0030-Line		0
15	BUS-0005 (F TX G SEC)	0.48	OVERDUTY	(*N3) (*N21a)	# 0030		1
16	LV DISTRIB (B-SWBD1)	0.48	OVERDUTY	(*N21a)	# 30		0
17	LV DISTRIB, B-SWBD1 LineSide (F TX	0.48	OVERDUTY	(*N3) (*N21a)	# 0036-Line		0
18	001-UTILITY CO (MaxTripTime @2.0s)	69.00	92.5	(*N1) (*N2) (*N9)	# 1		0
19	002-TX A PRI (R2)	69.00	9.32	(*N11)	# 2		0



NEW DATABLOCK ATTRIBUTES

AF_BoxDepth- The depth of an enclosed equipment such as Panelboards, Switchgears, and MCCs. Used as a parameter in Incident Energy and Flash Boundary calculations for types VCB, VCBB, and HCB.

AF_BoxHeight - The height of an enclosed equipment such as Panelboards, Switchgears, and MCCs. Used as a parameter in Incident Energy and Flash Boundary calculations for types VCB, VCBB, and HCB.

AF_BoxWidth - The width of an enclosed equipment such as Panelboards, Switchgears, and MCCs. Used as a parameter in Incident Energy and Flash Boundary calculations for types VCB, VCBB, and HCB.

AF_BoxSizeCF – Shows the enclosure correction factor used for calculating the incident energy and flash boundary using the IEEE 1584-2018 method.

AF_ElectrodeConfig - Bus electrode configuration of the equipment with 5 choices: VCB - Vertical Electrodes in Cubic Box, VCBB - Vertical Electrodes in Cubic Box with Barrier, HCB - Horizontal Electrodes in Cubic Box, VOA - Vertical Electrodes in Open Air, and HOA - Horizontal Electrodes in Open Air.

AF_UnLinkedBoxDimensions - indicate if the bus box dimensions are linked.

AFWC_ElectrodeConfig – The bus electrode configuration of the equipment used for the worst case scenario incident energy.

AF_MinArcingFault - Shows the arcing current variation correction factor used for calculating the incident energy and flash boundary using the IEEE 1584-2018 method.

AF_MaxFaultInScenarios – Shows the highest Short Circuit Fault current (Bolted Fault) among all the scenarios regardless of the incident energy value.

UPDATED CRYSTAL REPORTS

Project: PLANT
Base Project

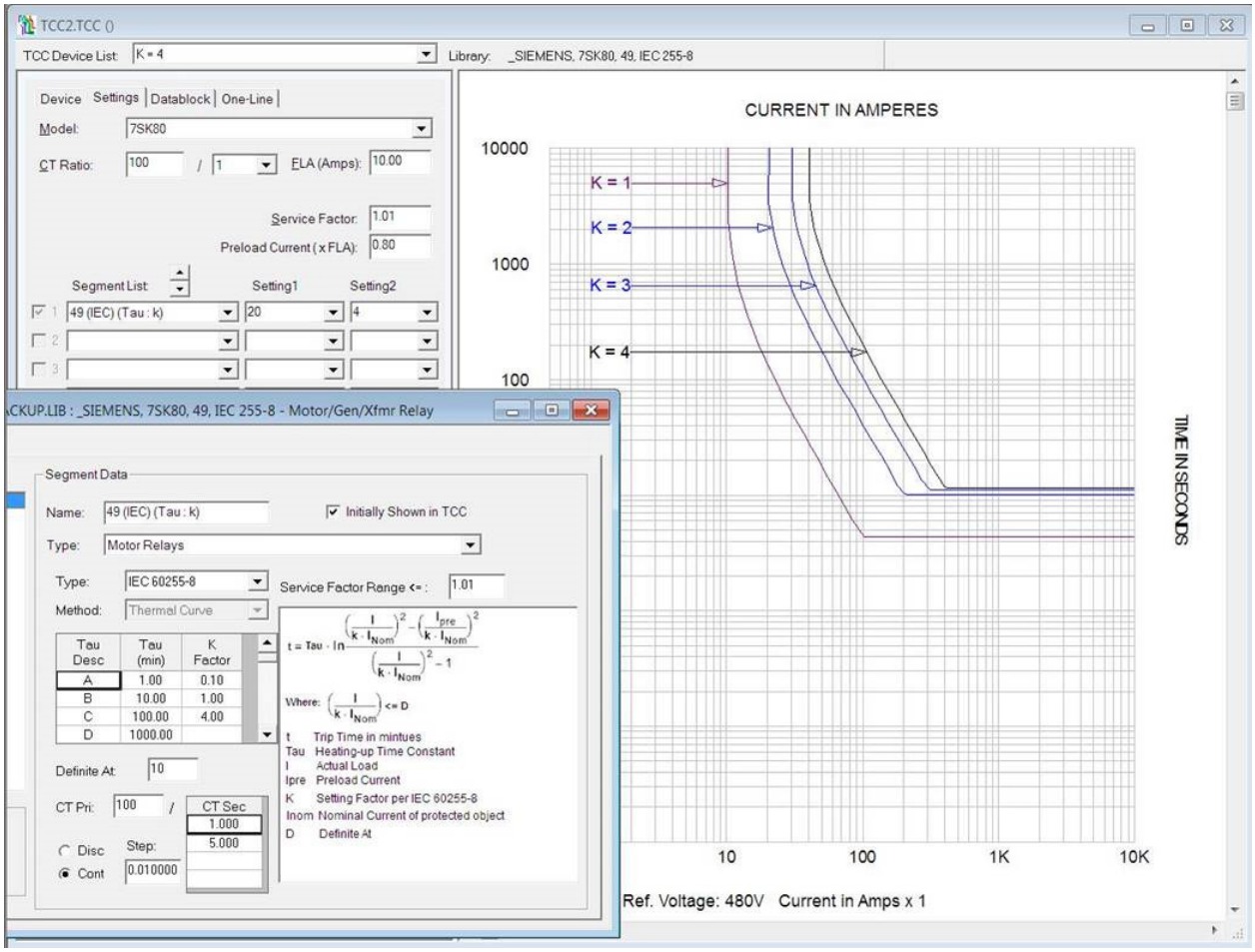
Arc Flash Evaluation Report

Bus Name	Bus kV	Protective Device Name	Bus Bolted/ Arcing (kA)	Prot Bolted/ Arcing (kA)	Trip/ Breaker Time (sec.)	Equip Type/ Gap (mm)	Electrode Config / WC Config	Box Height/ Width (in)	Box Depth (in)	ArcFlash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	PPE
001-UTILITY CO	69.000	Max TripTime @2.0s	4.63	4.18	2.000	AIR	VOA			633.53	72.00	92.52	Arc-rated shirt & pants + arc-rated coverall + arc-rated arc flash suit
			4.63	4.18	0.000	152	VOA						
002-TX A PRI	69.000	R2	1.85	0.60	0.583	SWG	VCB	35	67	201.32	72.00	9.34	Arc-rated shirt & pants + arc-rated coverall + arc-rated arc flash suit
			1.85	0.60	0.133	152	VCB	38					
003-HV SWGR	13.800	R M10	7.97	0.66	1.917	SWG	VCB	45	98	116.19	36.00	7.50	Arc-rated shirt & pants + arc-rated coverall + arc-rated arc flash suit
			7.47	0.62	0.083	152	VCB	36					
004-TX B PRI	13.800	R3	7.79	7.48	0.017	SWG	VCB	45	98	28.95	36.00	0.85	No Arc-rated PPE Required
			7.30	7.02	0.083	152	VCB	36					
005-TXD PRI	13.800	R7 SEC	1.02	0.72	1.917	SWG	VCB	45	98	51.40	36.00	2.09	Arc-rated shirt & pants + arc-rated coverall + arc-rated arc flash suit
			0.95	0.66	0.083	152	VCB	36					
006-TX3 PRI	13.800	R6	7.89	5.84	0.017	SWG	VCB	45	98	29.22	36.00	0.86	No Arc-rated PPE Required
			7.40	5.48	0.083	152	VCB	36					
007-TX E PRI	13.800	R7	7.87	7.39	0.017	SWG	VCB	45	98	29.18	36.00	0.86	No Arc-rated PPE Required
			7.38	6.93	0.083	152	VCB	36					
008-DS SWG1	4.160	R G1	3.90	1.09	1.917	SWG	VCB	45	98	67.55	36.00	3.21	Arc-rated shirt & pants + arc-rated coverall + arc-rated arc flash suit
			3.44	0.97	0.083	102	VCB	26					
009-TX C PRI	4.160	F5	3.87	3.78	0.075	SWG	VCB	45	98	14.78	36.00	0.30	No Arc-rated PPE Required
			3.34	3.26	0.000	102	VCB	26					

Arc Flash_2018_IEEE1584 (Load Side)	2/28/2019 6:53 PM	Crystal Report
Arc Flash_2018_IEEE1584 (Line Side)	2/28/2019 6:46 PM	Crystal Report
30char - Arc Flash_2018_IEEE1584_Metric	2/28/2019 6:24 PM	Crystal Report
14char - Arc Flash_2018_IEEE1584	2/28/2019 6:23 PM	Crystal Report
14char - Arc Flash_2018_IEEE1584_Metric_Calcm2	2/28/2019 6:22 PM	Crystal Report
30char - Arc Flash_2018_IEEE1584	2/28/2019 6:21 PM	Crystal Report
14char - Arc Flash_2018_IEEE1584_Metric	2/28/2019 6:20 PM	Crystal Report
30char - Arc Flash_2018_IEEE1584_Metric_Calcm2	2/28/2019 6:20 PM	Crystal Report

NEW RELAY SEGMENT

IEC 60255-8 Thermal Overload Protection (49) - New relay modeling segment for creating libraries that are based on the IEC 60255-8 thermal overload protection. Added for Siemens 7SK80, GE 869, and SEL 700G in the library.



Other Miscellaneous Enhancements

Speed improvements in conducting Arc Flash studies

Improved Arc Flash miscoordination reporting when an ATS is involved.

Improved input data formatting for the new Arc Flash IEEE 1584 2018 standard.

Improved Arc Flash worst case result Datablock reporting.

Enhanced Arc Flash Evaluation to better handle 3-winding transformers where loops are involved.

Improved Arc Flash Incident Energy Lines in TCC drawings.

Improved the Arc Flash Line and Load Side minimal arcing fault calculations using IEEE 1584 2018.

Added ANSI LLG to Equipment Evaluation.

Updated the protective device library. Refer to "Readme V9.0 Lib Changes.pdf" for more information.