Power Matters

IEE802.3 4P Task Force

Derivation of ILIM-2P and TLIM for Type 3 and Type 4 PSEs.

June 2015

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Contents

Notes:

1. Calculations are based on changes proposed in other comment to Equation 33-12 and 33-12a that defines the Pclass_peak/Pclass_average ratio to 1.05 for type 3 and 4 instead of what we have in Draft D1.0 (1.11 for Type 3 and 1.07 for Type 4).

---------- Base Line starts here ----------

Updated Table 33-11 Item 9, I LIM-2P

Item	Parameter	Symbol	Unit	Min	Max	PSE Type	Additional Information	
9	Output current per pair set – at short circuit condition	I LIM-2P	A	0.400	See info	1	For Class 0-3	See 33.2.7.7. Maximum value defined by Figure 33-14.
				1.14xIcable		2, ~~3~~	For class 4	
				TBD		~~4~~ 3	For Class 5	
				0.817		3	For Class 6	
				TBD		4	For Class 7	
				1.162		4	For Class 8	

Editor Note (to remove prior to publication) : To add information to Table 33-11 item 9 for Type 3 and 4 that ILIM_2P min value is including E2EP2P_Iunb/Runb effect.

Editor Note (to remove prior to publication) : To address the issue that we don't see in Figure 33-14 a TLIM_MAX.

Editor Note: In table 33-11 item 9, ILIM-2P_min was specified per each class power. Rationale: It is not cost effective for transformers to be forced to be designed to at least ILIM_2P of Type 3 or 4 maximum power (>0.817A for Type 3 and >1.162A for Type 4) while the PSE e.g. will support only class 4 power (25.5W) which requires much lower ILIM-2P with PSE Type 3.

The same concept of specifying ILIM-2P per class is relevant for Icont-2P and Icont-2P_unb. For Icut, it is already done in the standard. Comments are planned to be submitted for next draft if we will not have time to address Icont-2P and Icont-2P_unb per class in Draft 1.0 comment cycle.

Editor Note: E2EP2P_Iunb is the highest (~30%) on the pairs were we don't sense the current and lower on the pair we sense current (~15%). While specifying the PSE port current capacity per the highest P2P_Iunb is the correct approach which we already did, it is worth to consider if ILIM and ICUT need to be calculated per the pairs with highest unbalance or per the pairs with lower unbalance. The reason for this question is: Icut and ILIM values are set to much higher values than the actual current measure due to much better P2P_UNB. As a result the actual ILIM protection will be activated ~11.1% above Type 4 maximum power. The solution is: Icut, Ipeak, ILIM will be allowed to be decreased if PSE Rmax and Rmin are increased by a small constant resistance per equation TBD which is actually what happened in the negative pairs. To be discussed in the group.

See annex A for derivation of the numbers

Note: In older revision of this document when ILIM_2P_min was calculated per Pclass_peak/Pclass_average=1.11 for Type 3 and 1.07 for Type 4 per equations 33-12, 33-12a we got the following results: ILIM-2P_MIN for Type 3=0.875, ILIM-2P_MIN for Type 4=1.2A

Derivation of TLIM-2P for Type 4:

We can replace the TBD with a shorter number than 10sec in order to keep the same energy content used in Type 3 in order to keep the same stress over the current limiter.

Type 3 worst case energy on current limiter over a pair set: 30W*10msec=0.3Joule

Type 4 worst case energy on current limiter over a pair set: 50W*TLIM-2P=0.3Joule.

TLIM-2P=0.3/50=6msec.

Design margin=2msec.

TLIM-2P_MIN=4msec.

Summary:

1. Replace TLIM-2P=TBD for Type 4 with 0.004.

Annex A: Derivation of ILIM_2P_MIN, Table 33-11 Item 9, I LIM-2P

The following calculations are based on using Peak_PD=1.05*Pclass_PD for Type 3 and Type 4 for power levels above class 4 and not using Peak_PD=1.07*Pclass_PD as required in IEEE802.3bt D1.0 in order to reduce Type 3 and Type 4 currents Ipeak-2P that its maximum value is further increased due to E2EP2P_Iunb effect.

Separate comment was submitted to make this change.

Background

ILIM-2P_MIN≥ Ipeak-2P_max per figure 33-14.

ILIM-2P_MIN for Type 2 is: 1.14*Icable=Ipeak-2P_max[1]

ILIM-2P_MIN for type 2 is 0.684A and Ipeak is 0.682A which is 2mA difference hence ILIM_2P>Ipeak-2P as required.

We will use same concept for Type 3 and 4 with the additional effect of P2P_Iunb.

Ipeak_max for Type 3 and 4 can be found by equation 33-4 when Kmax, maximum and minimum channel resistance (Rch=12.5Ω and Rch =0.1 Ω) and maximum Ppeak_PD-2P per Table 33-18 item 7 are used.

Per the new proposal for equation 33-12a for Type 3 and 4:

Ppeak_pd-2P=1.05*Pclass_PD=1.05*51W=53.55W for Type 3

Ppeak_pd-2P=1.05*Pclass_PD =1.05*71.3W=74.86W for Type 4.

Ipeak-2P=1.28*0.637A=0.815A for Type 3.

Ipeak-2P=1.26*0.926A=1.167A for Type 4.

(Ipeak-2P=1.26*0.921A=1.160A (If Pclass_PD is rounded down from 71.28W to 71W) for Type 4.)

Adding 2mA margin to keep ILIM-2P_MIN≥ Ipeak-2P_max.

- ⇨ **ILIM_2P_MIN =0.817A for Type 3**
- ⇨ **ILIM_2P_MIN =1.162 for Type 4**

Notes:

1. (Ipeak/Icont_max)=1.14 is the ratio used in 802.3af and 802.3at.

Results if we use current IEEE802.3bt D1.0 data Ppeak_pd-2P=1.11*Pclass_PD for Type 3 and Ppeak_pd-2P=1.07* Pclass_PD for Type 4.

Background

ILIM-2P_MIN≥ Ipeak-2P_max per figure 33-14.

ILIM-2P_MIN for Type 2 is: 1.14*Icable=Ipeak-2P_max[1]

ILIM-2P_MIN for type 2 is 0.684A and Ipeak is 0.682A which is 2mA difference hence ILIM_2P>Ipeak-2P as required.

We will use same concept for Type 3 and 4 with the additional effect of P2P_Iunb.

ILIM-2P_MIN for Type 3 should be the same concept as Type 2 with the addition of the E2EP2P_Iunb effect.

Ipeak_max for Type 3 and 4 can be found by equation 33-4 when Kmax, maximum and minimum channel resistance (Rch=12.5Ω and Rch =0.1 Ω) and maximum Ppeak_PD-2P per Table 33-18 item 7 are used.

Ppeak_pd-2P=1.11*Pclass_PD=1.11*51W=1.11*56.61W for Type 3

Ppeak_pd-2P=1.07* Pclass_PD =1.07*71.28W=76.27W for Type 4.

Ipeak-2P=1.28*0.682A=0.873A for Type 3.

Ipeak-2P=1.26*0.95A=1.198A for Type 4.

(Ipeak-2P=1.26*0.945A=1.191A (If Pclass_PD is rounded down from 71.28W to 71W) for Type 4.)

Adding 2mA margin to keep ILIM-2P_MIN≥ Ipeak-2P_max.

- ⇨ **ILIM_2P_MIN =0.875A for Type 3**
- ⇨ **ILIM_2P_MIN =1.2 for Type 4**

Notes:

2. (Ipeak/Icont_max)=1.14 is the ratio used in 802.3af and 802.3at.