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Engineering Report

for

Department of Veterans Affairs

Tennessee Valley Healthcare System
Nashville Campus

Short-Circuit and Overcurrent Device Time-Current Coordination Analysis

Submitted
March 11, 2005

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Revisions

This is the second submission of this report. In this submission, the section “Corrective Action” and Appendix B are added to give further information on options to correct a coordination problem discovered in the study.

Introduction

This report is submitted to document the results of a short-circuit and overcurrent coordination analysis for the second phase of the electrical upgrade for the Department of Veterans Affairs Nashville Hospital and to fulfill Nash Lipsey Burch's contract with the Department. The objectives of this study include:

1. Determine the fault currents available in the upgraded parts of the system. And evaluate the adequacy of each overcurrent device and panel to withstand or interrupt the calculated maximum available short-circuit current at its location.

2. Establish the appropriate settings for overcurrent protection devices with adjustable settings that were either added in this phase of the electrical upgrade or affect the overcurrent devices added in this phase of the electrical upgrade. The settings of these devices are determined to provide a coordinated system. In this context, the "coordinated system" indicates that the overcurrent protection device settings provide the best possible combination of equipment protection and selectivity, recognizing that trade-offs must be made between these two system features.

A significant portion of the facility's distribution system is not in the scope of this project. Since this project is the second phase of a facility-wide electrical upgrade, there are many parts of the electrical system which have already been upgraded. Some of these systems include the facility's utility network service, main switchboard, and additional major electrical distribution switchgear. The scope of this phase involves the replacement of a large portion of the existing facility's power distribution and lighting and appliance panelboards. Where existing panelboards are being replaced, fault duties were selected based on known available fault currents as calculated in the first electrical study.

All panelboards for 208Y/120 volt systems have a minimum interrupting capacity of 22,000 amps. Since the service to the hospital is 480 volts, all 208Y/120 volt panelboards are fed by dry-type transformers that do not provide much more than 10,000 amps in a fault. The largest transformer feeding a 208Y/120 volt panelboard replaced in this phase of the electrical upgrade is the 300 kVA transformer in Fan Room 3 which feeds panel "LP4-LV" (which is an existing panel in this phase of the electrical upgrade). Panel "LP4-LV" has a three-phase fault current of 14,400 amps and a line to ground fault current of 16,400 amps. All other transformers of concern to this phase of the upgrade are 225 kVA and smaller and have less than 10,000 amps of fault current available at the secondary terminals. Therefore, all 208Y/120 volt panelboards added in this project are adequately rated for the available fault current. The majority of the panelboards replaced in the main hospital building are for 208Y/120 volt systems. Where panelboards are for 480Y/277 volt systems, the interrupting capacity specified is greater than the available fault current that was calculated in the first phase of the electrical upgrade. The ACRE building, however, has a more extensive upgrade which requires new calculations.

The ACRE building has a complete upgrade of its electrical distribution system in this project. This includes removing the Nashville Electrical Service's transformer and installing a new distribution switchboard fed from the main building's switchboard. The upgrade for the ACRE building replaced all major power distribution panelboards for the normal, emergency, and equipment systems. The available fault current for this new system is included as part of this report to verify the new systems have adequate fault duty for the fault current available on the new system.

Available Fault Current

In order to correctly determine the settings for time-current coordination and determine the adequacy of the device ratings for the new equipment, it is necessary to know the available fault current at each point in the system. These values were calculated on a personal computer using a computer assisted design program to calculate the maximum three-phase RMS symmetrical short circuit amperes at each piece of equipment. The calculation procedures are based upon the recommendations in ANSI/IEEE standards C37.13-1981, C37.010-1973, and C37.5-1979. The values used in the computer model are shown on a simplified one-line drawing included in this report (Figure 1, page 5). The diagram and short-circuit study computer data files are available in electronic format for SKM Power Tools, Version 5.0.2.0.

The model used for the short-circuit study uses the previously calculated short circuit current values for the utility, the four oil-filled transformers, and the short circuit current available in both sections of the Main Switchboard (See *Engineering Report for Department of Veterans Affairs, VA Hospital Nashville, TN, Short-Circuit and Overcurrent Device Time-Current Coordination Analysis, April 24, 2000,* by Nash Lipsey Burch, LLC).

The available fault currents at each bus are listed as the "Fault Duty" for each overcurrent device in the report in Appendix A – Overcurrent Device Settings Report. The available fault current is also listed at each bus on Figure 1 - One Line Diagram of the Modeled System.

Findings

The study confirmed that the short circuit current rating of all of the new devices as they are installed is adequate for the available fault current at each device. However, there are two items that are of concern that are discussed below.

The study revealed one possible weak point in the system at panel "HPBA" in the ACRE building. There are several Square D "FD" frame breakers installed in panel "HPBA" that have 21,200 amps of fault current available at the panel. These breakers series rate to 200 kA with the upstream Square D "LX" frame breaker in the ACRE building main switchboard, but are only fully rated for 18 kA of fault current. A marking must be applied to the panel to indicate the series rating to comply with NFPA 70 Article 110.22. The manufacturer (Square D) can supply the required labels. Additionally, the sum of the full load current of all motors connected to panel "HPBA" and its sub-panels must be verified to be less than 180 amps in order to use the series rating and comply with NFPA 70 article 240.86. While series rating breakers is a safe practice, it is not the best practice for a fully coordinated system. It is desirable to replace the breakers with ones rated at 25 kA to ensure that all devices are fully rated against the available fault current.

Larger frame breakers in the panel are Square D “KA” frame breakers, which are fully rated at 25 kA interrupting capacity.

All other panels in the ACRE building, with the exception of the existing panel “HPBB” and the ACRE Main Switchboard have less than 18 kA of available fault current. All new 480Y/277 volt panels have at a minimum 18 kA fully rated interrupting capacity breakers installed in them. Panel “HPBB” was not replaced as part of this project. The interrupting capacity of the breakers installed in “HPBB” should be verified to determine if they have adequate interrupting capacity against the available fault current of 18,647 amps. Since panel “HPBB” was manufactured by a different manufacturer than the new gear, series rating data is not readily available for its breakers and the new breaker feeding it upstream.

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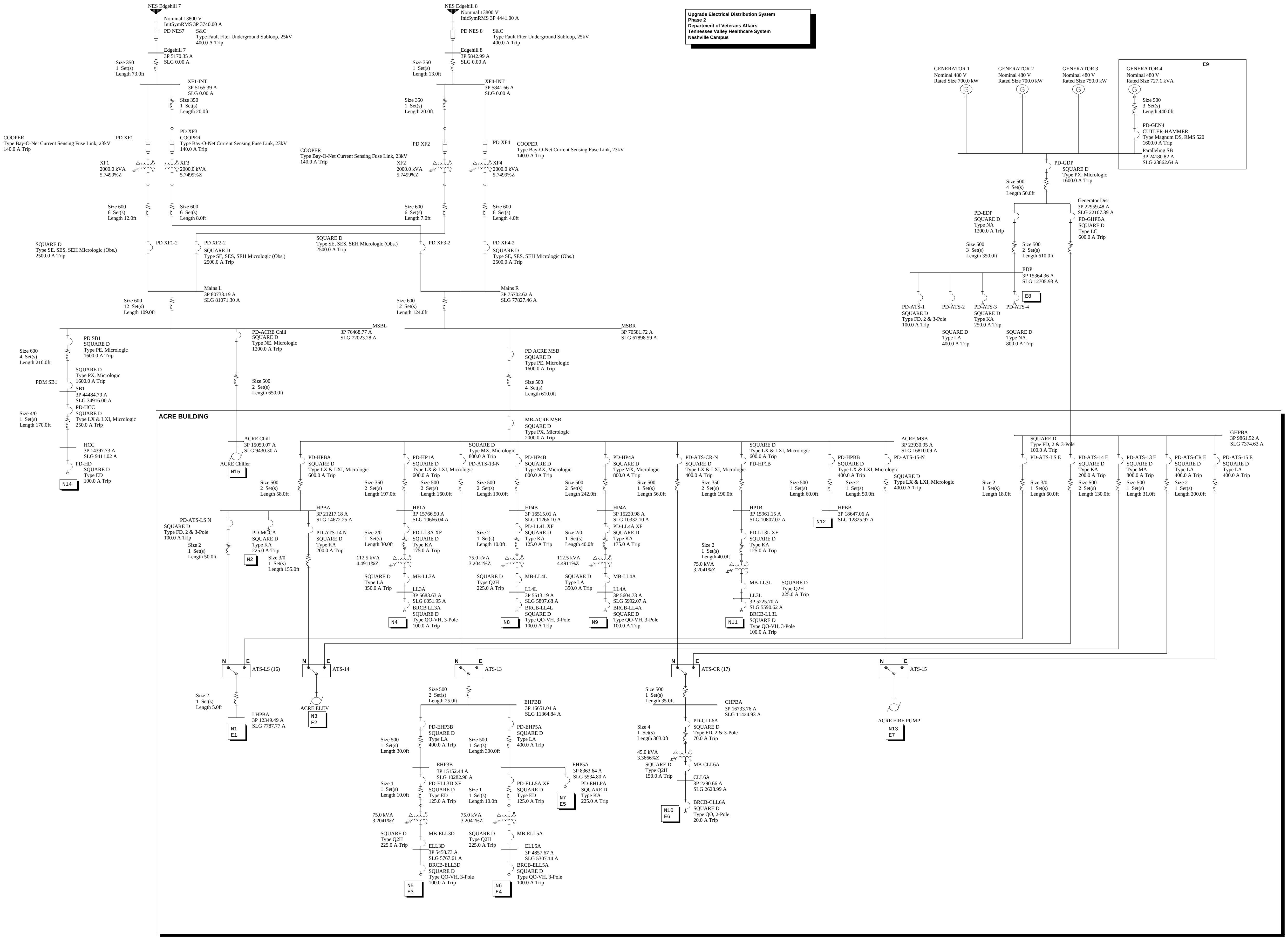

Figure 1 - One Line Diagram of the Modeled System

Selectivity and Coordination

Selectivity is the ability of the system to respond to a short circuit where the nearest upstream device trips in response to a fault and other protective devices closer to the source do not trip. This ensures maximum service continuity while providing protection for equipment and personnel. Selectivity is demonstrated on a time-current curve by showing that each individual breaker (or fuse) curve falls below and to the left of the next upstream breaker in line, from load to source. Ideally, there will be no overlap. In practice, it is rare that a system can be economically arranged to be 100% selective, but in general a high degree of selectivity can be achieved for most fault current levels. The coordination plots are broken down into two different systems, the normal utility power system and the emergency system fed from the emergency generator paralleling gear.

Plots showing the time-current curves for selected overcurrent protective devices follow later in this report. Plots that show devices feeding large motors, such as the ACRE chiller, have an additional curve representing the motor's load. The motor's curve demonstrates that the breaker feeding the motor is coordinated with the motor when the motor's curve is below and to the left of the breaker's, indicating the breaker will not trip when the motor is running or starting.

Where there are multiple systems with the same characteristics, then only one of the similar systems is modeled. For example, the critical branch of the emergency system in the ACRE building has ten equal sized transformers and 208Y/120 volt panelboards with essentially the same breakers in each one. For the study, only one panel (CLL6A) was modeled, but the resulting plot is characteristic for the other panels on the critical branch. Where the plot has a branch circuit breaker's curve on it, the largest branch breaker in that panel is selected to show the "worst case" scenario as coordination is concerned.

Analysis of the Plots

Most of the plots demonstrate a high degree of selectivity. There are a few instances where two curves overlap each other without causing a degradation of selectivity. Examples of this are the main breaker in the ACRE switchboard and the breaker upstream of it in the facility's main switchboard. Since the two breakers feed the same load, the consequence of either breaker tripping will be the same. Therefore, the long time settings are the same, leaving the two curves touching at the top of the plot. These two breakers do coordinate for higher fault current values. Another example of where curves touching do not degrade selectivity is breakers on the primary and secondary of the same transformer. Both of the breakers are shown on the time-current plots, which generally will be "on top of" each other, but the consequence of either breaker tripping is the same. Other instances where the protective device curves touch indicate the possible lack of selectivity.

Where devices that do not feed the same equipment overlap there is an effect on overall system reliability. Since the filled area of the curve indicates the range at which the device may trip, a slight overlap represents a small chance of there being a lack of selectivity. The point at where the overlap occurs also indicates the likelihood of the event occurring.

Thermal magnetic circuit breakers take more than one cycle to clear a large fault current caused by a “bolted” short circuit (where metal contact causes the short). This is represented by a horizontal region on the curve, which is in the region of less than 100 milliseconds. Since bolted faults of this magnitude are a rare occurrence, these overlaps are usually acceptable in a coordinated system.

There are several instances where two curves touch in other areas on the plot. For example, in Figure 15, the curve for the breaker feeding panel “HD” overlaps the curve for the breaker feeding panel “HCC”. This means there is a real chance of the breaker feeding panel “HCC” tripping before the smaller breaker for panel “HD”. All of the overlap occurs at 900 milliseconds or less and at currents above 1000 amps. While this is undesirable, the situation is due to limitations of fixed trip thermal-magnetic circuit breakers. This overlap occurs in several other plots, all for this same reason. There is no cost effective remedy to such a problem due to the high cost of electronic, fully adjustable breakers, which are expensive and large in size for a small feeder circuit such as this one.

Normal System

There are fifteen time-current curves representing the equipment added in this phase of the electrical upgrade. These curves represent devices with adjustable settings and downstream breakers fed from them. There are two plots for loads fed from the left section of the main switchboard. One curve represents the re-fed panel HCC (Figure 15, page 23), which was fed from the existing switchboard SB1. The second curve is for the ACRE building chiller (Figure 16, page 24), which was re-fed directly from the main switchboard. Each of these curves start with either the load (chiller) or the largest branch circuit breaker in the panel (HCC) and show all upstream devices to the breaker protecting the utility transformer secondary. The remainder of the normal curves show loads fed from the ACRE building main switchboard.

Since the ACRE building underwent an extensive electrical upgrade, including a new main switchboard, the majority of normal system coordination curves involve gear in the ACRE building. There are thirteen time-current curves for the normal system in the ACRE building, which includes the essential system devices when the transfer switches are connected to the normal system. For these curves, only a few plots show the coordination upstream of the ACRE main switchboard for clarity. The curve for the breaker at the secondary of the oil-filled transformer feeding the right section of the facility’s main switchboard is shown on selected plots (see Figure 2 on page 10) to demonstrate coordination between it and the breaker feeding the ACRE main switchboard. Since this breaker has instantaneous trip disabled and has a 2500 amp trip rating, it fully coordinates with the downstream breakers.

Emergency System

There are nine time-current curves showing devices on the emergency system. The first seven demonstrate coordination between essential system gear in the ACRE building back to the generator paralleling gear. The portion of these curves downstream of the respective automatic transfer switches show the same devices plotted on the corresponding normal system curve. One curve demonstrates coordination between the largest breaker in panel “EDP”, which was re-fed from the paralleling gear. The last curve shows the breaker which connects the feed from generator four to the paralleling gear.

There is one item which is causing a lack of coordination on the emergency system. This occurs with the feeder breaker to generator distribution panel "GHPBA". The panel has a feeder capable of 800 amps; however, the breaker feeding it has a trip rating of 600 amps. The coordination problem occurs with the 800 amp trip breaker in "GHPBA" feeding ATS-13. This situation is discussed in more detail in the chapter named Corrective Action on page 36.

Coordination Curves

Graphs showing the breaker curves for coordination are on the following pages.

Settings

We recommend setting the adjustable breakers to the settings listed in Appendix A – Overcurrent Device Settings Report that correspond to these curves.

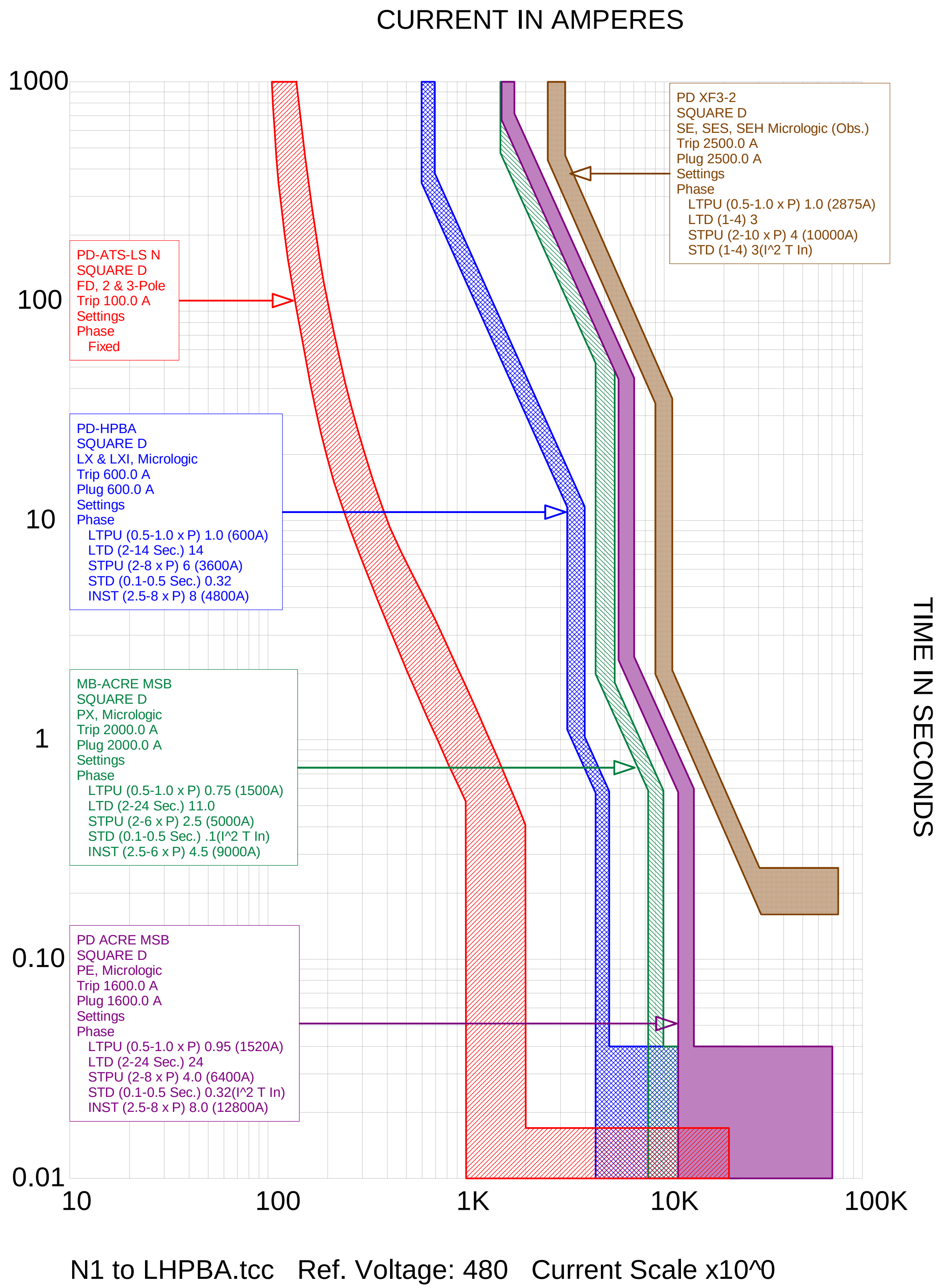

Figure 2 - Normal Power Feed to LHPBA

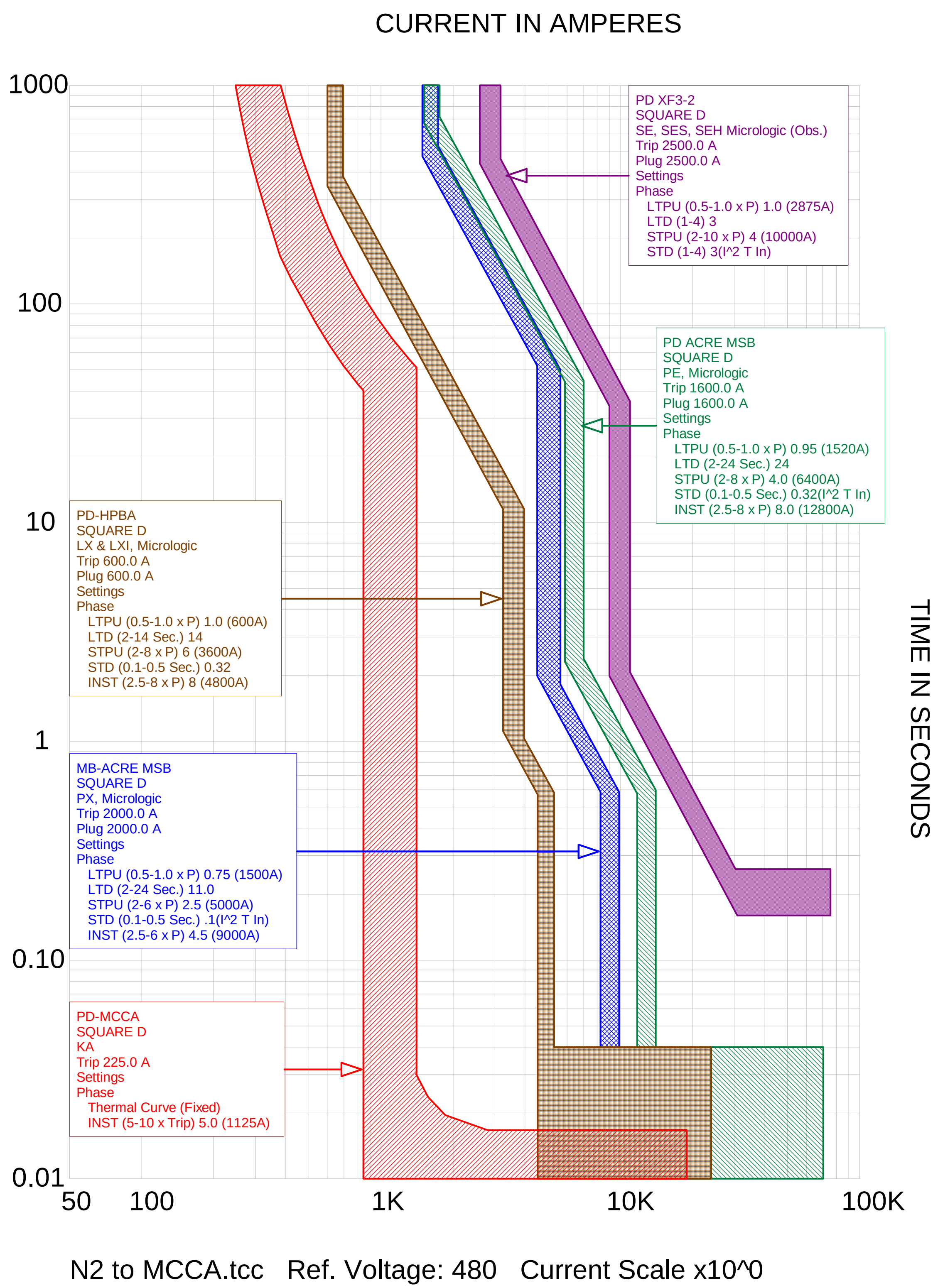

Figure 3 - Normal Power Feed to MCCA

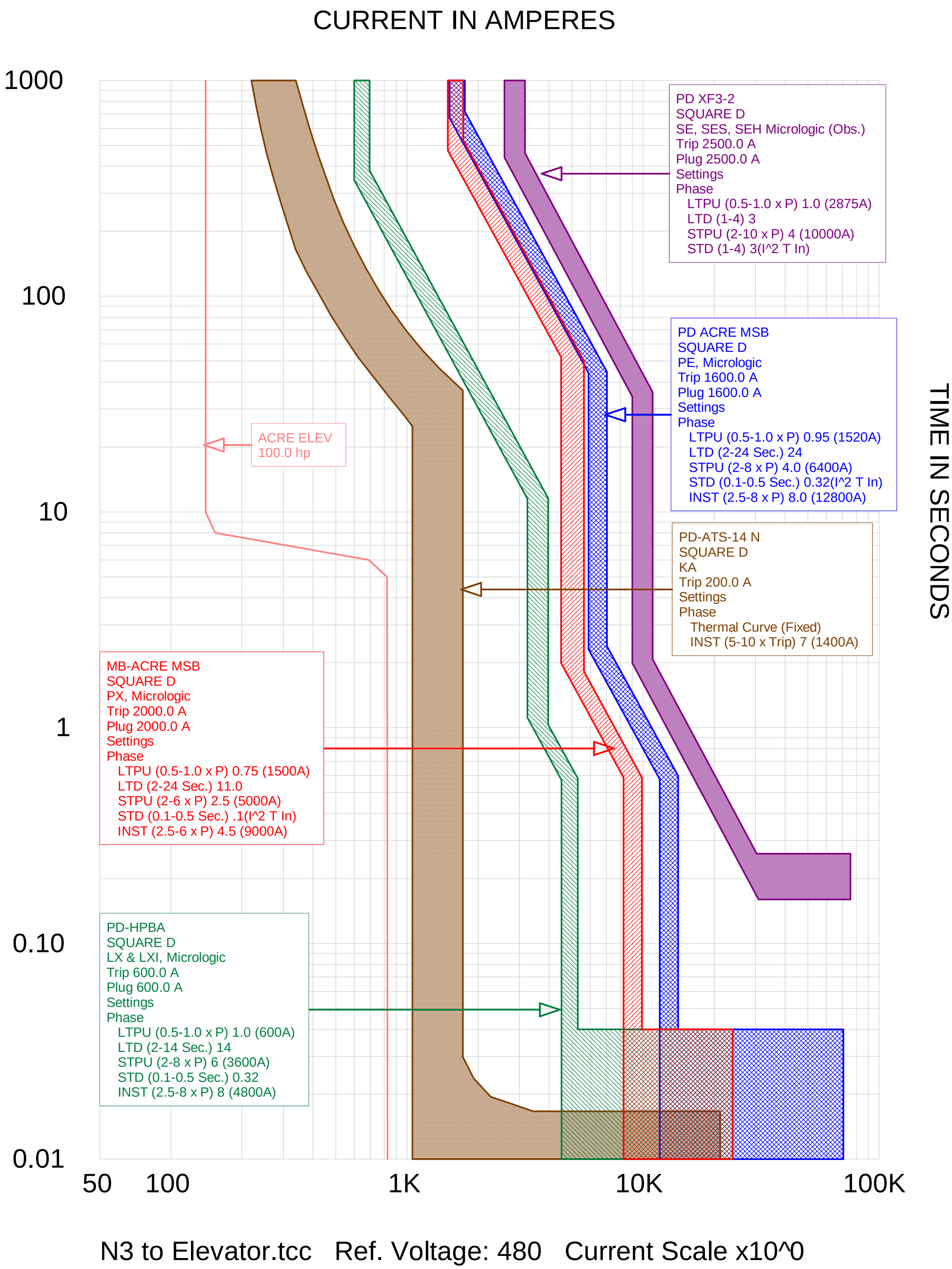

Figure 4 - Normal Power Feed to ACRE Elevators

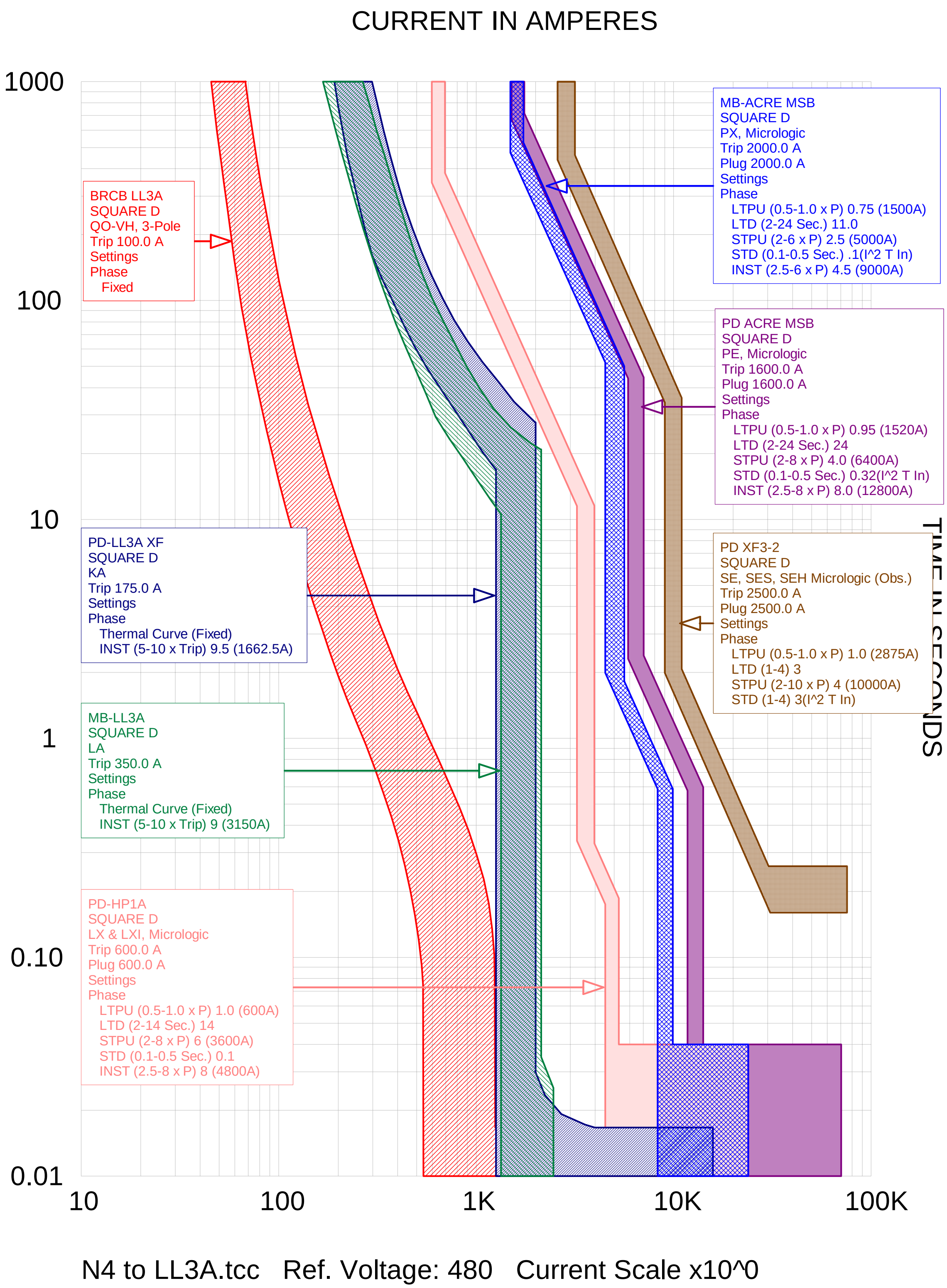

Figure 5 - Normal Power Feed to LL3A

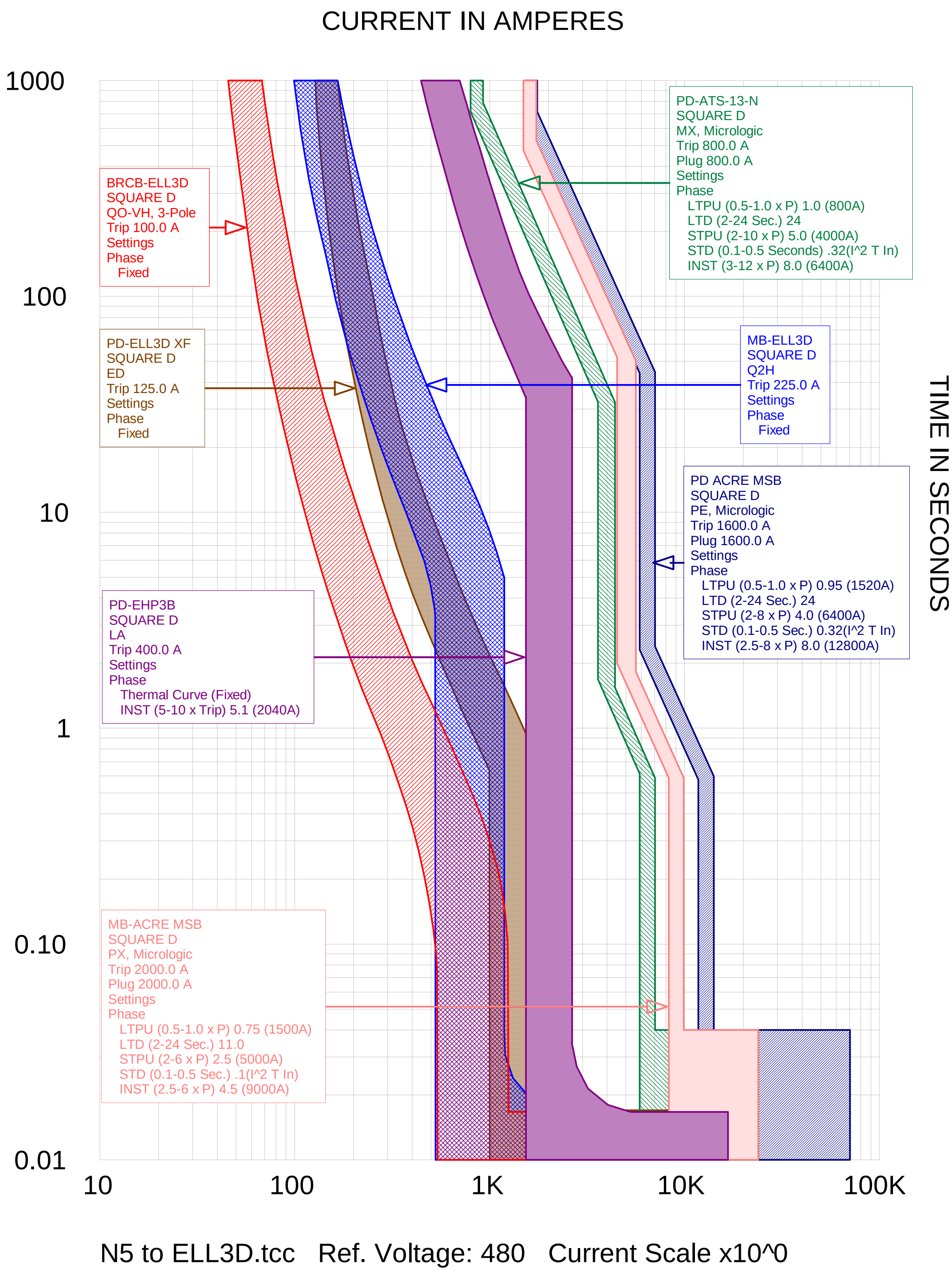

Figure 6 - Normal Power Feed to ELL3D

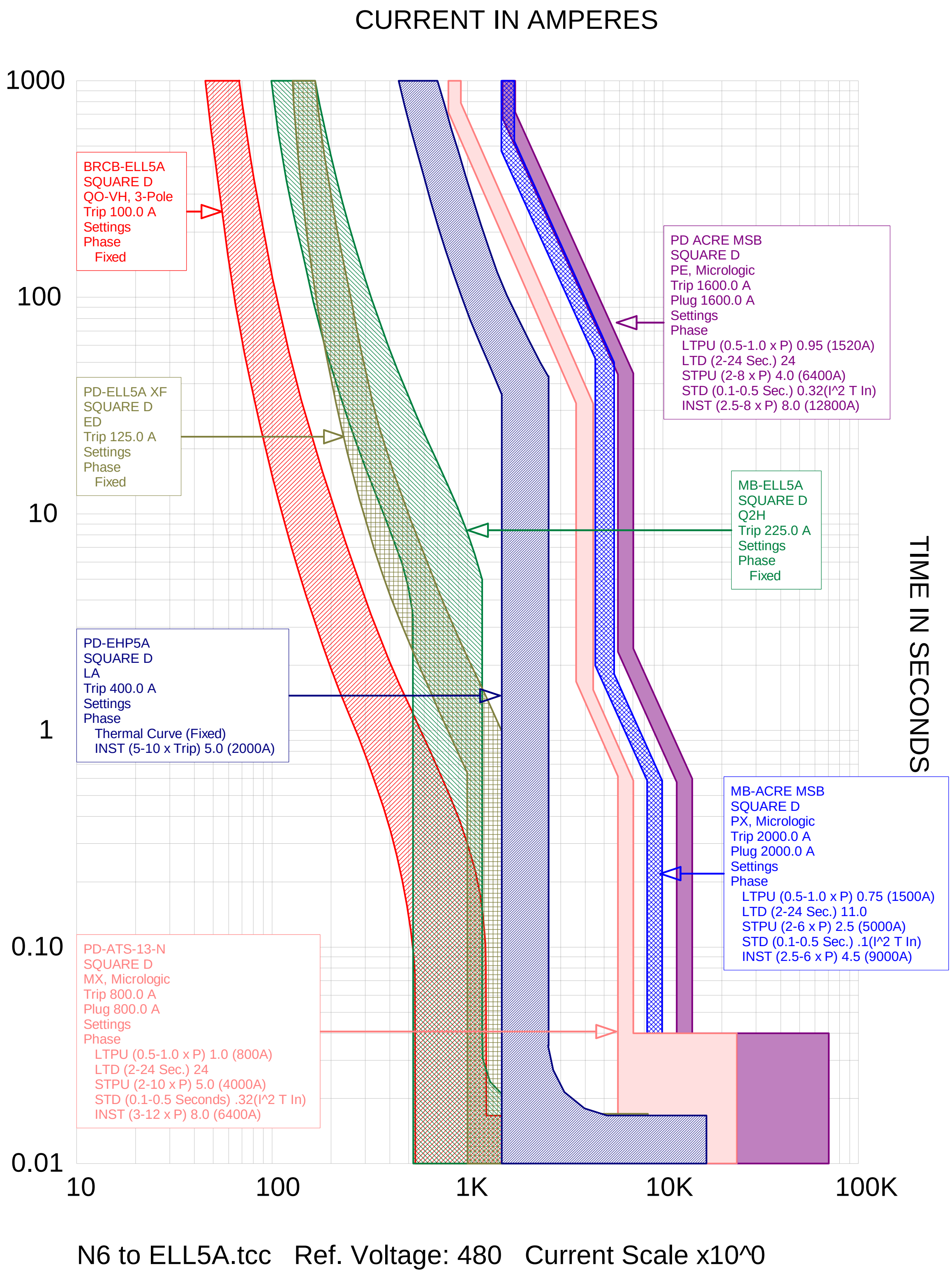

Figure 7 - Normal Power Feed to ELL5A

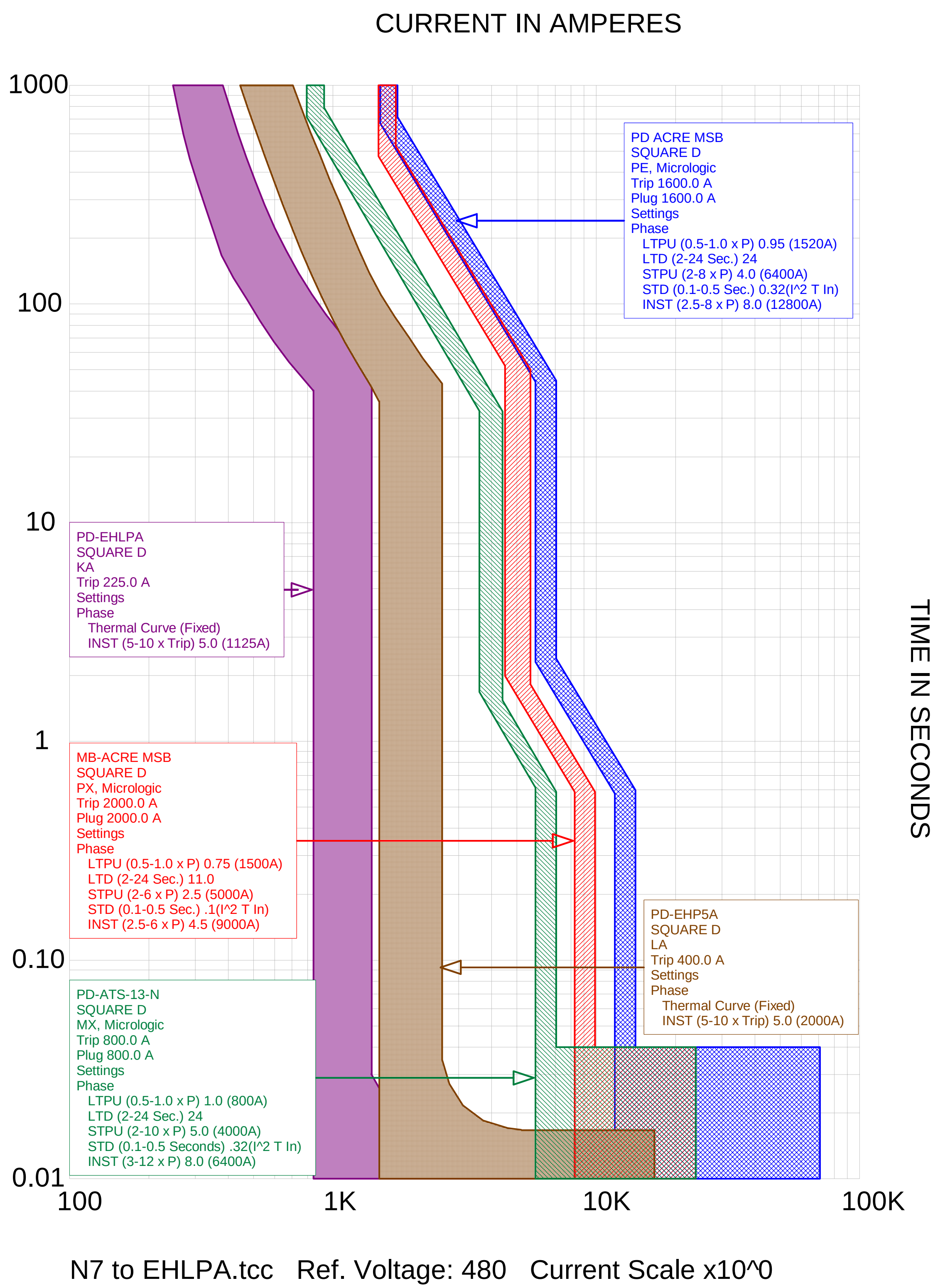

Figure 8 - Normal Power Feed to EHLPA

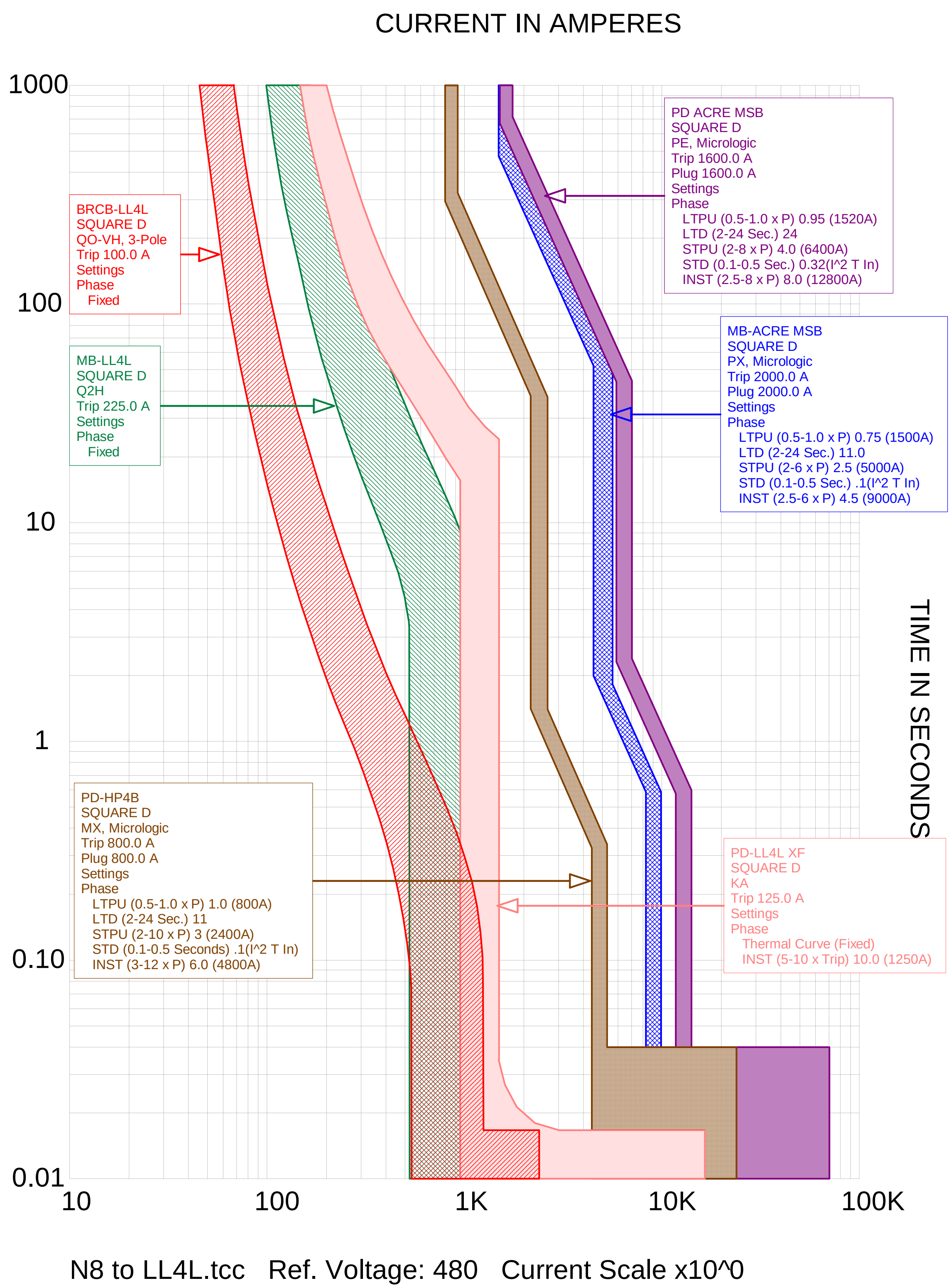

Figure 9 - Normal Power Feed to LL4L

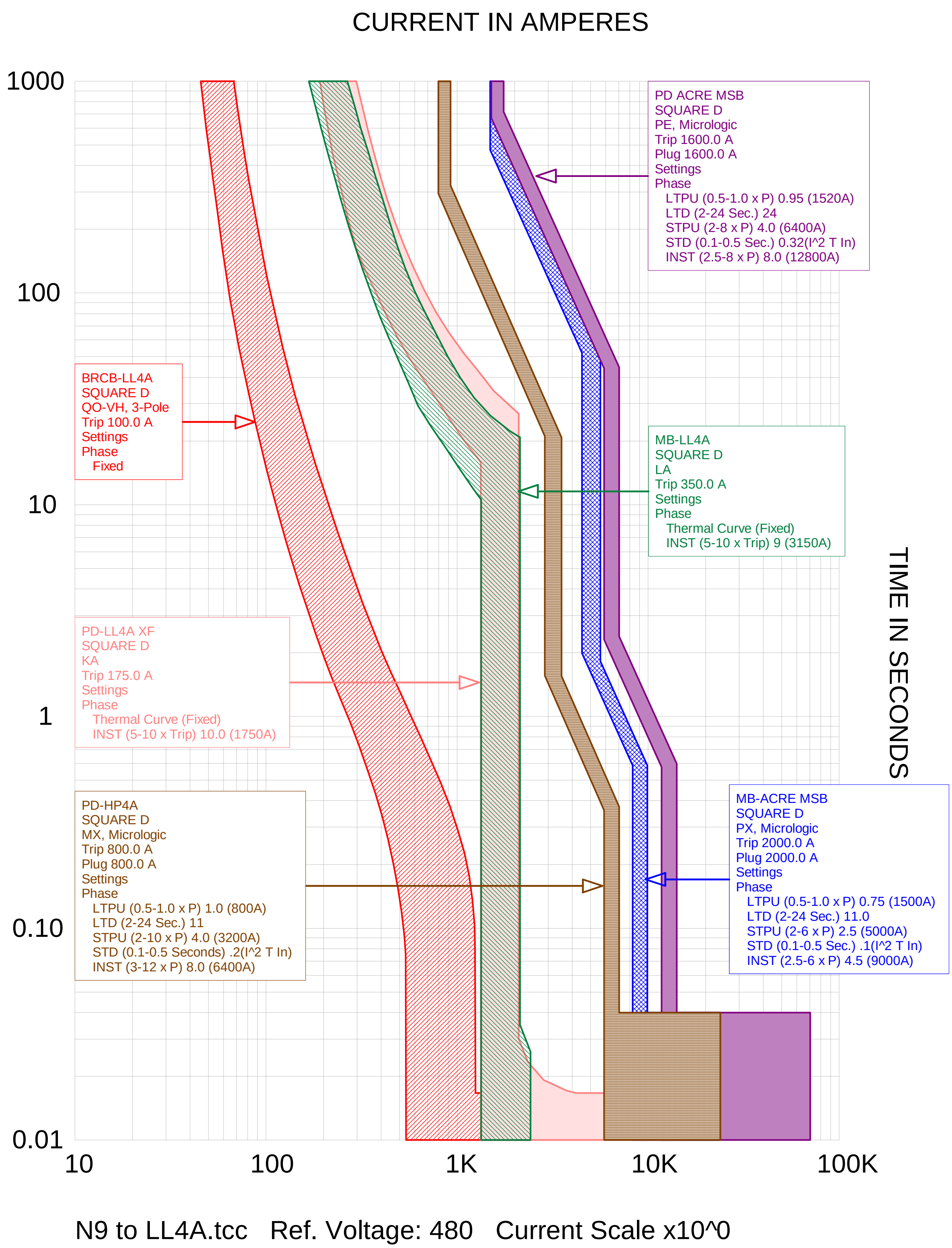

Figure 10 - Normal Power Feed to LL4A

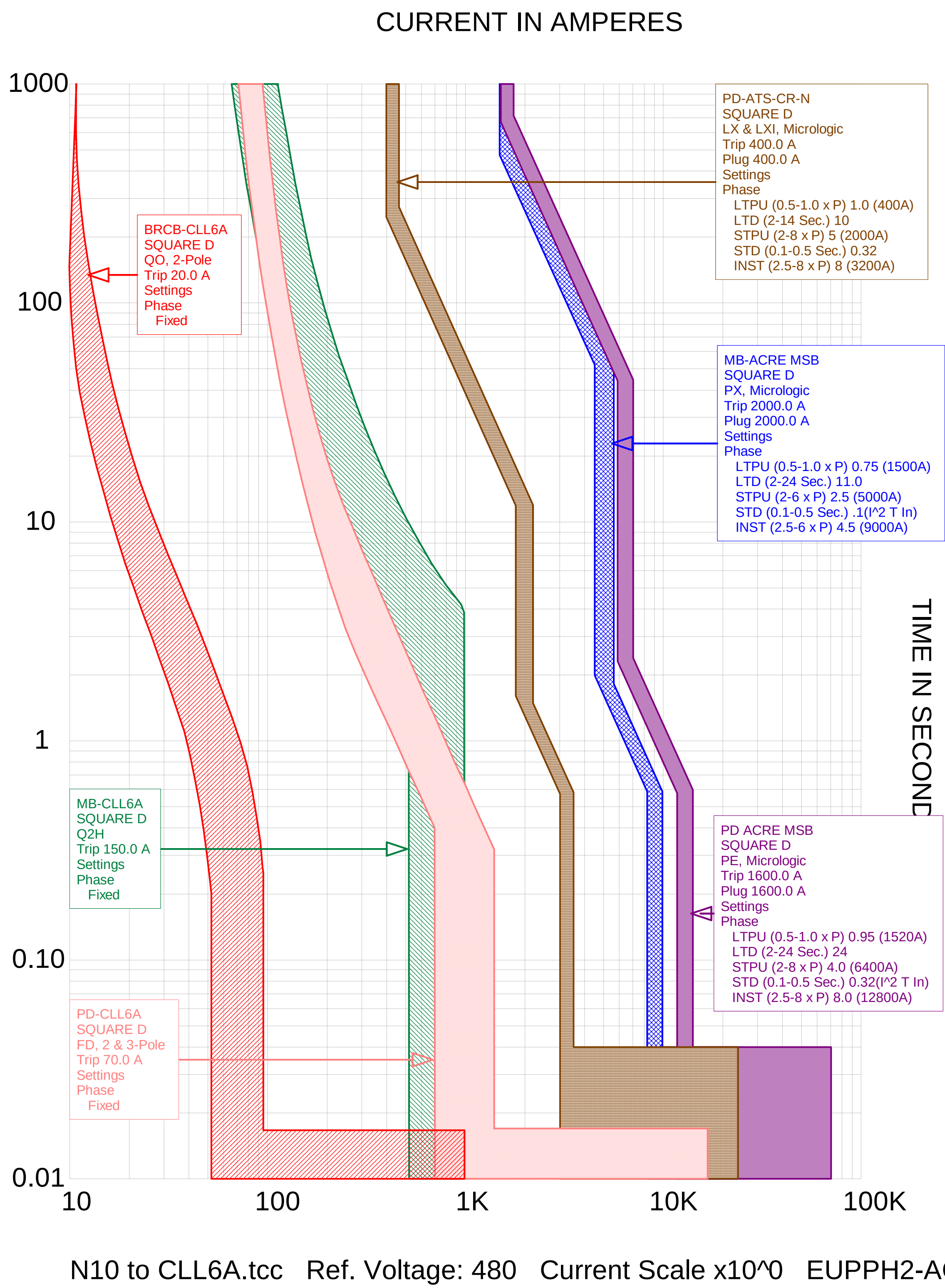

Figure 11 - Normal Power Feed to CLL6A

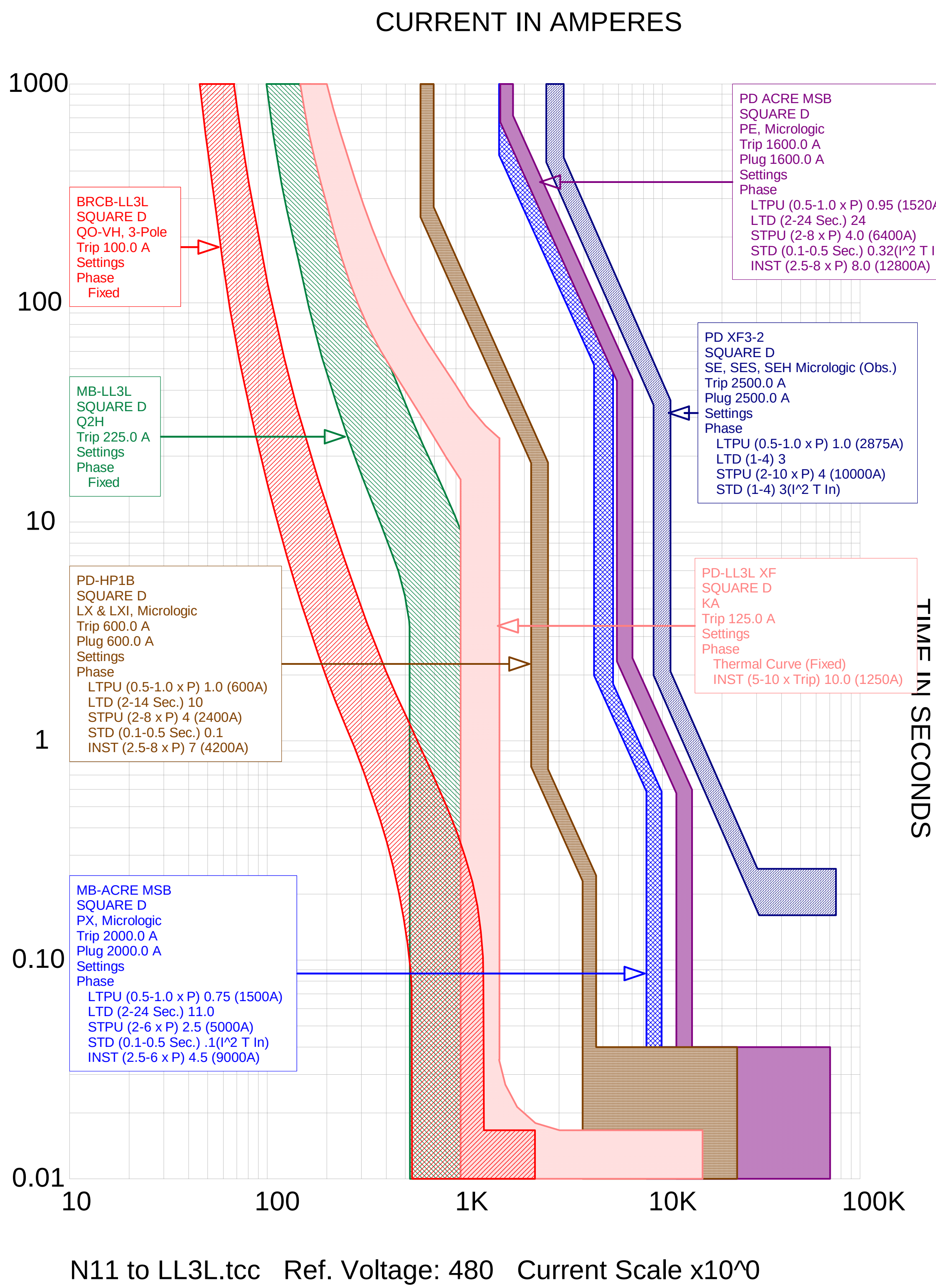

Figure 12 - Normal Power Feed to LL3L

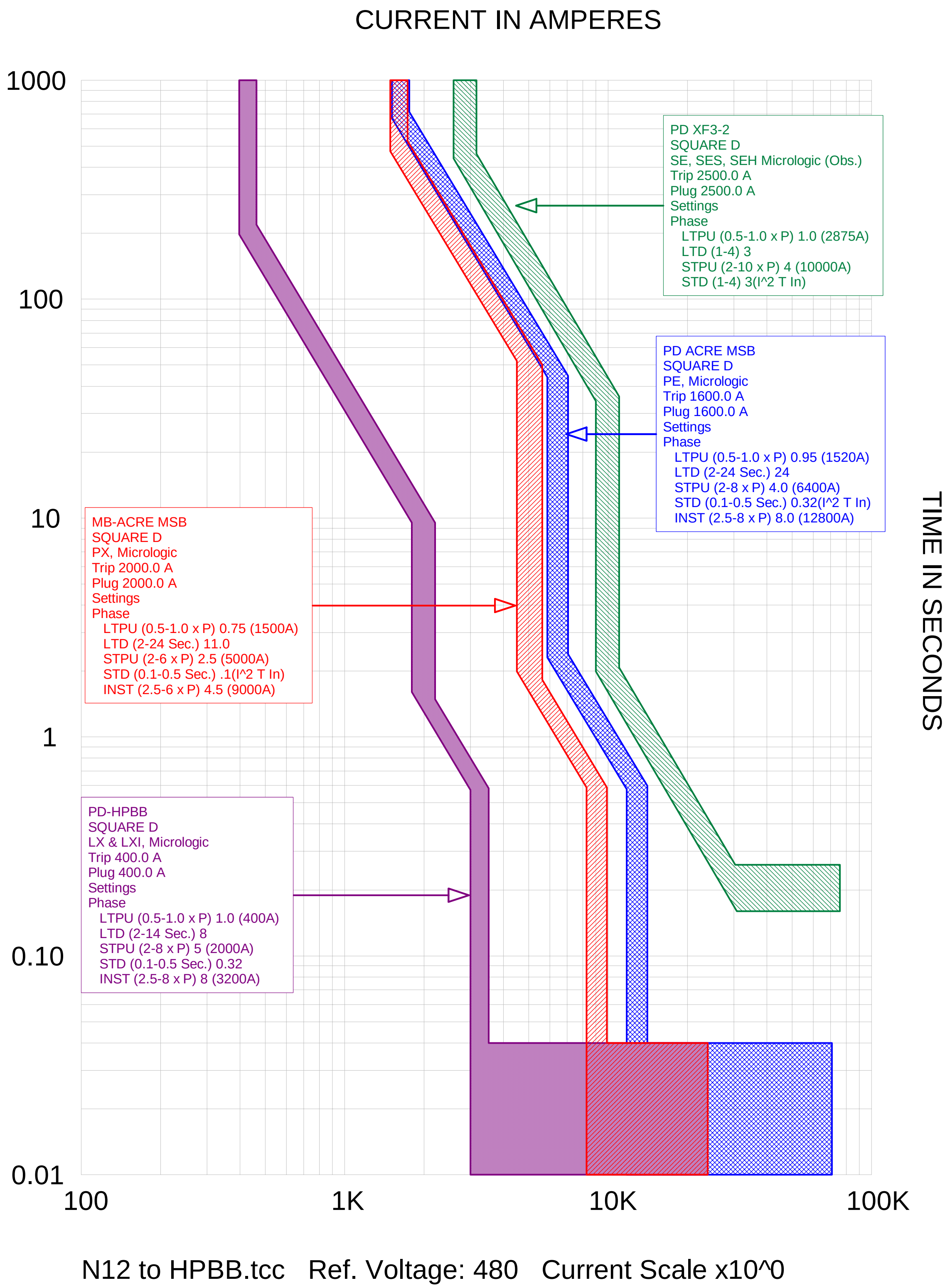

Figure 13 - Normal Power feed to HPBB

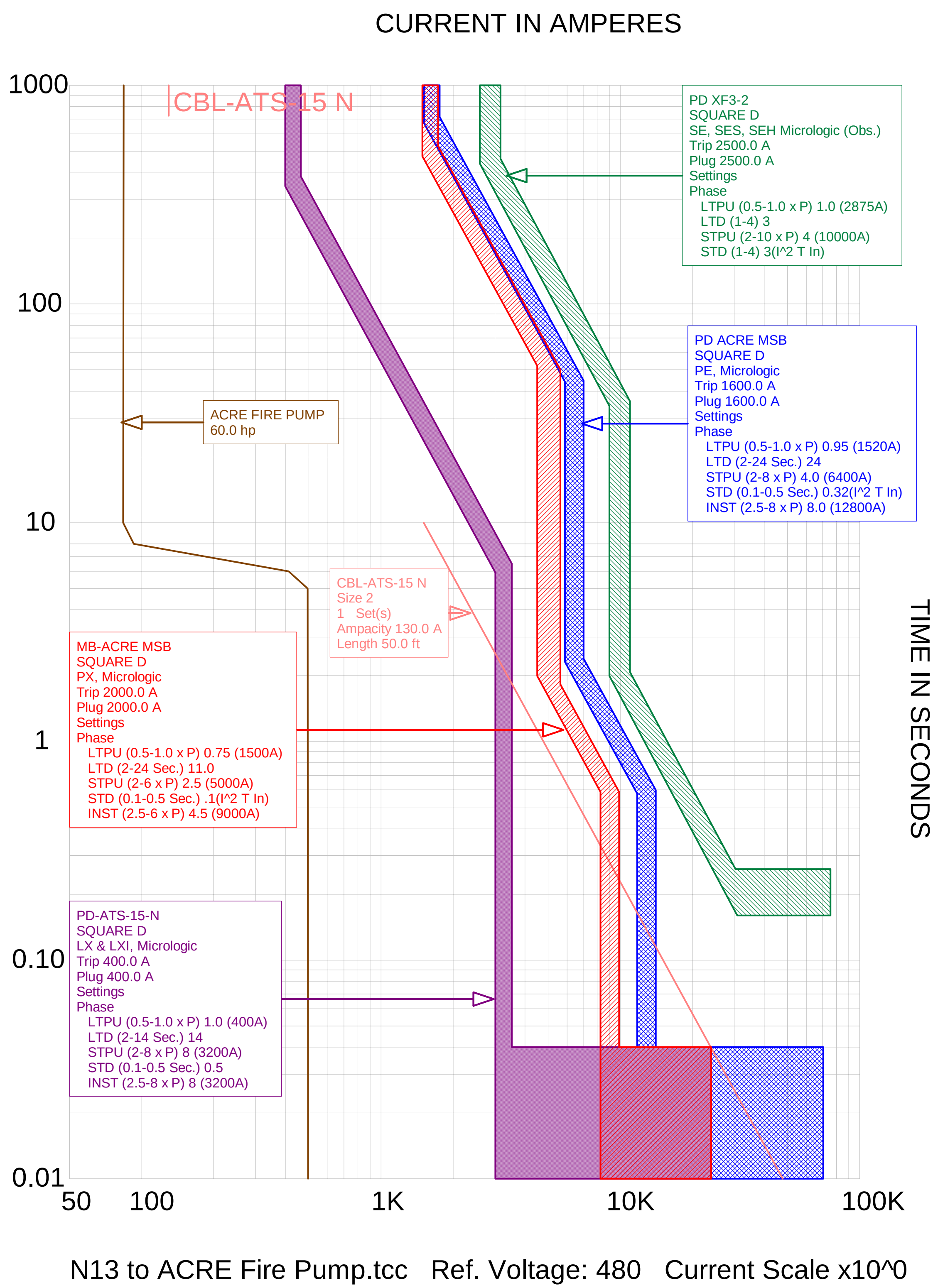

Figure 14 - Normal Power Feed to ACRE Fire Pump

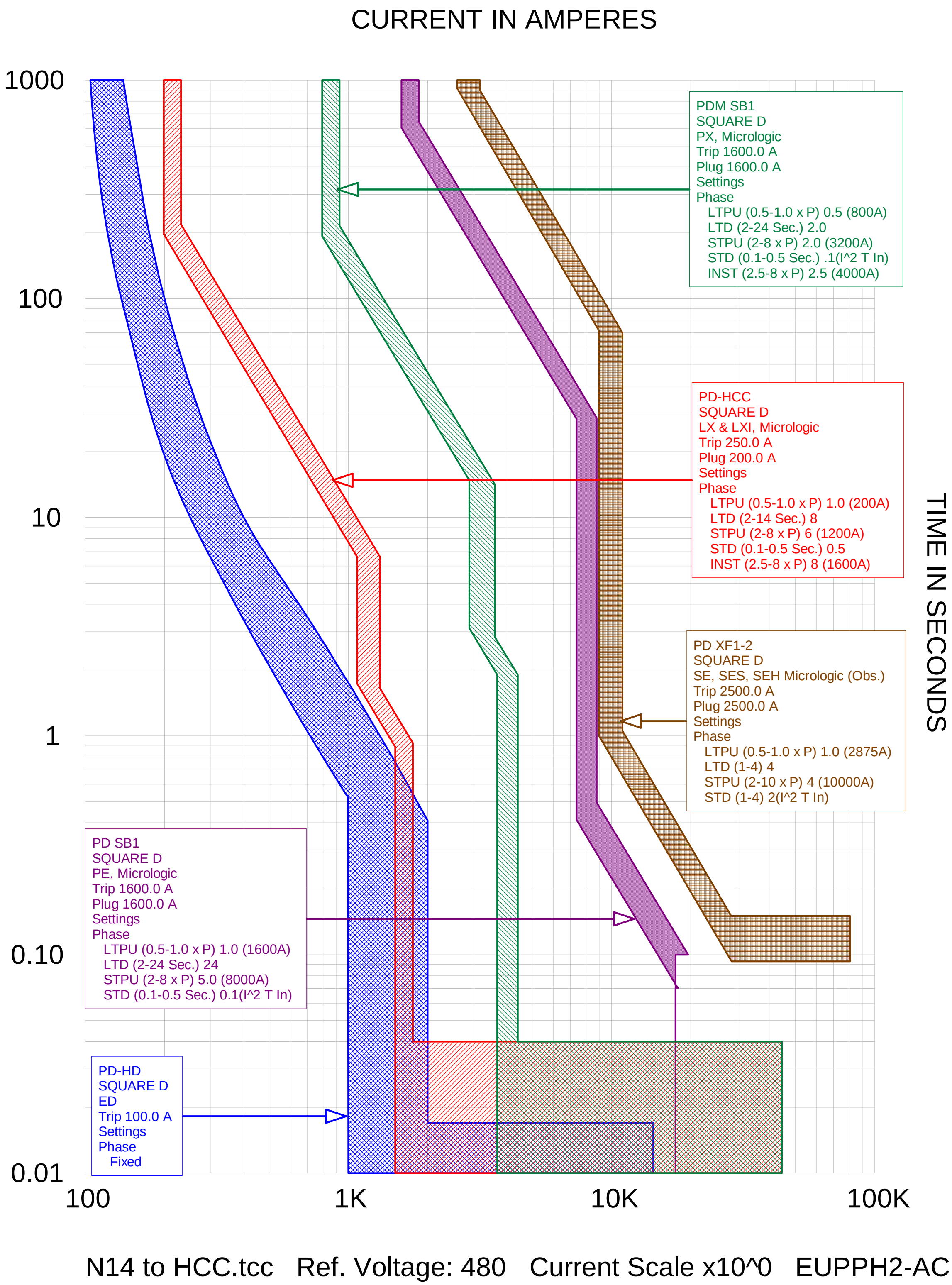

Figure 15 - Normal Power Feed to HCC

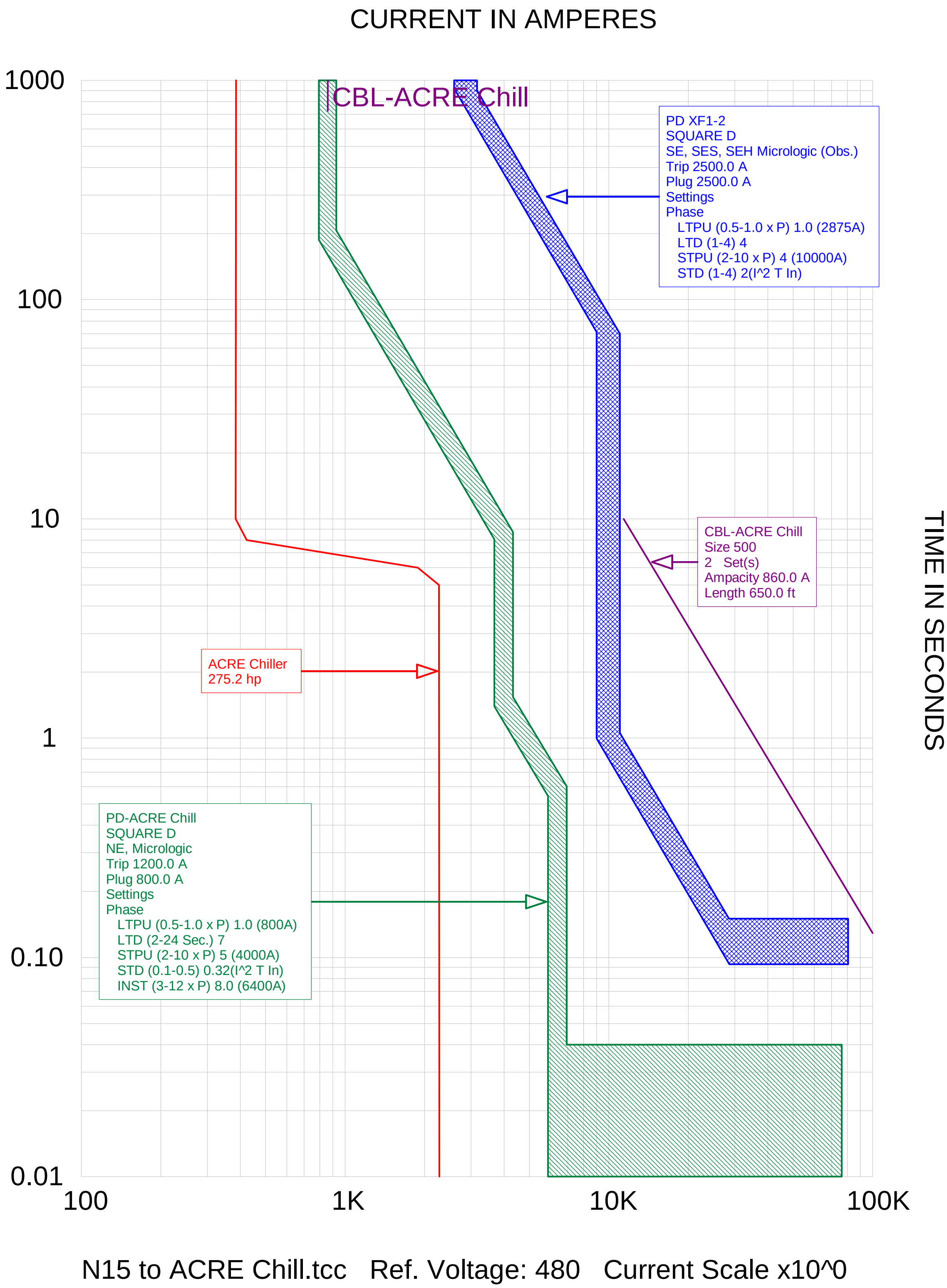

Figure 16 - Normal Power Feed to ACRE Chiller

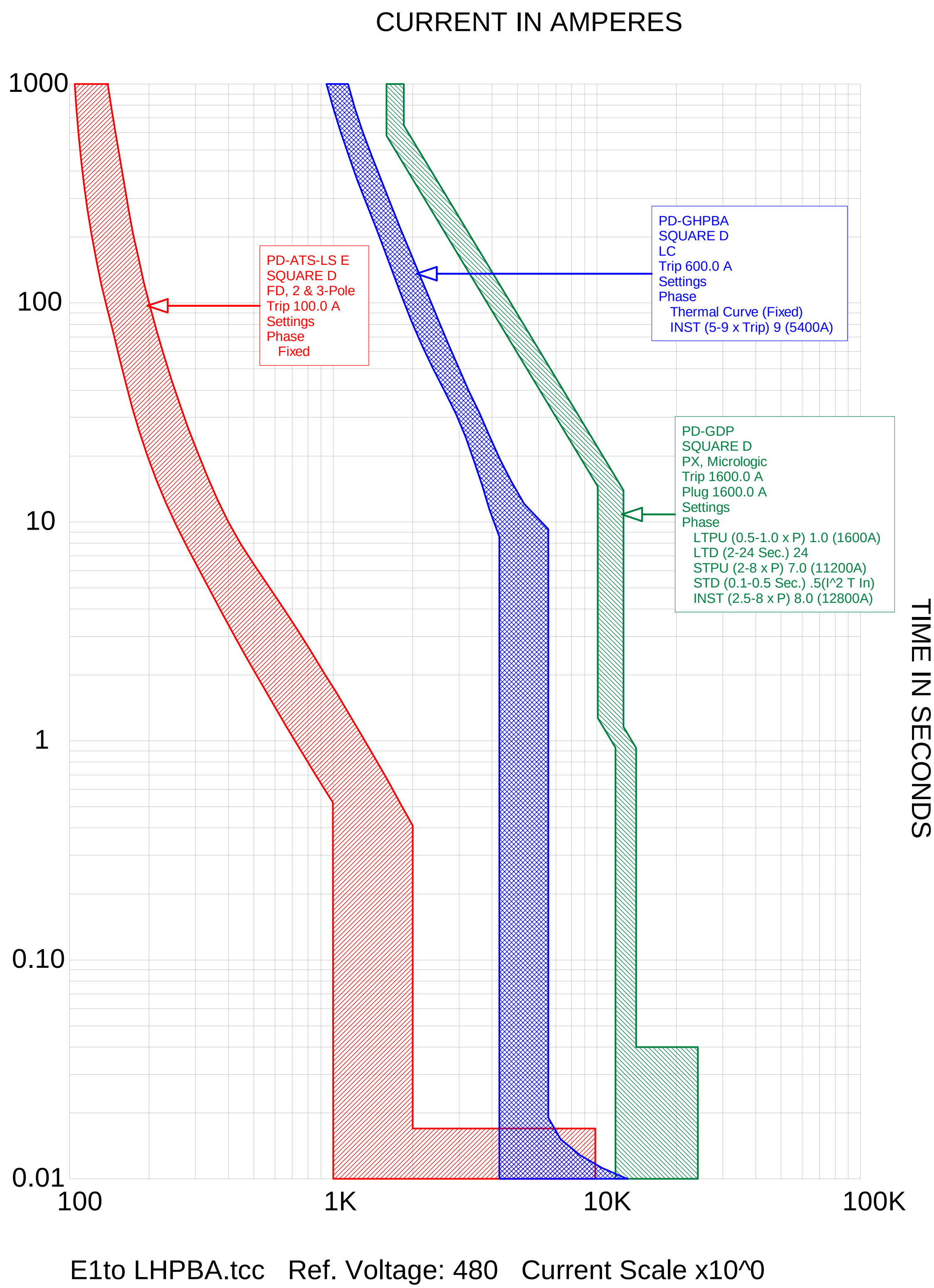

Figure 17 - Emergency Power Feed to LHPBA

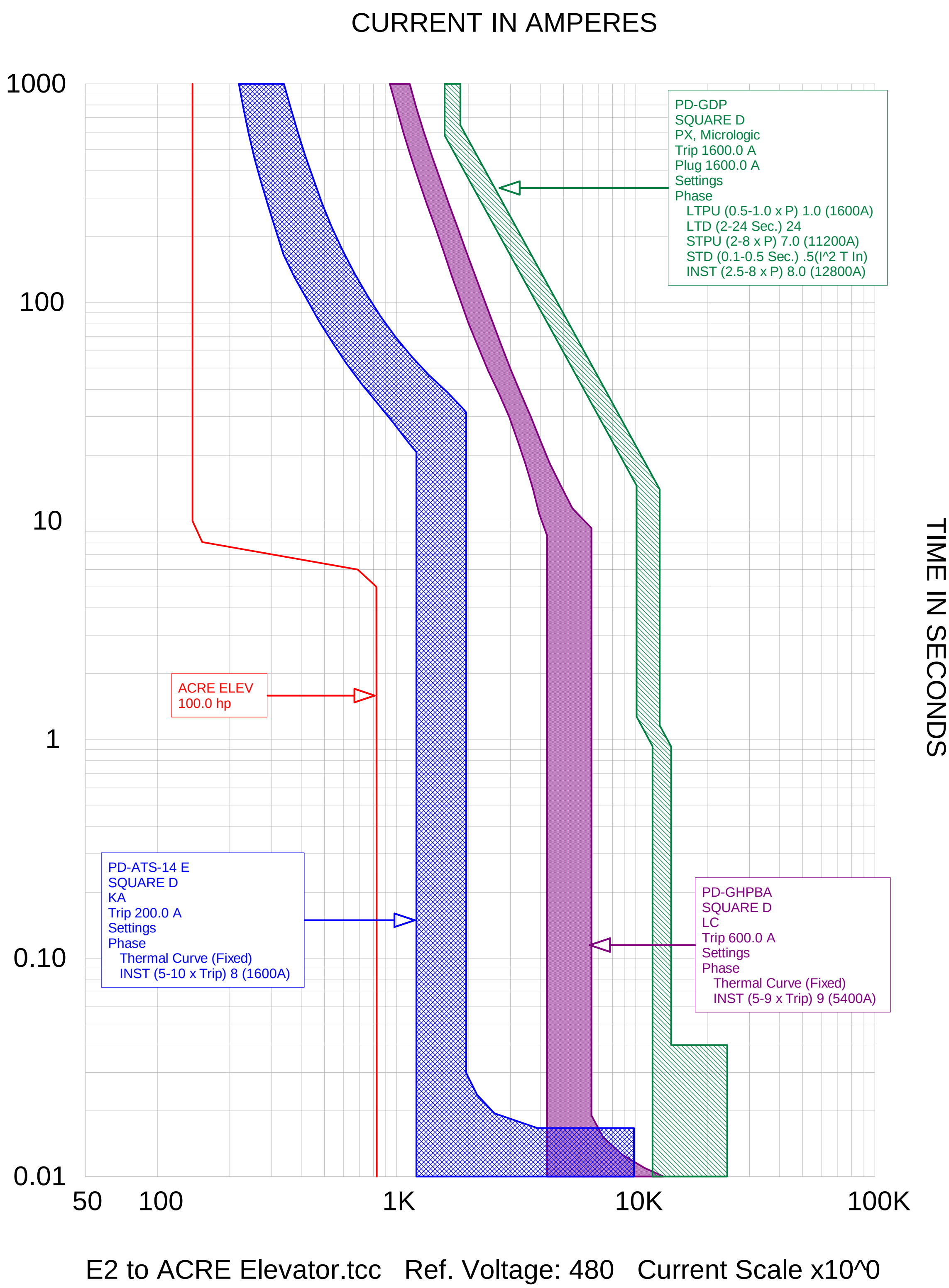

Figure 18 - Emergency Power Feed to ACRE Elevator

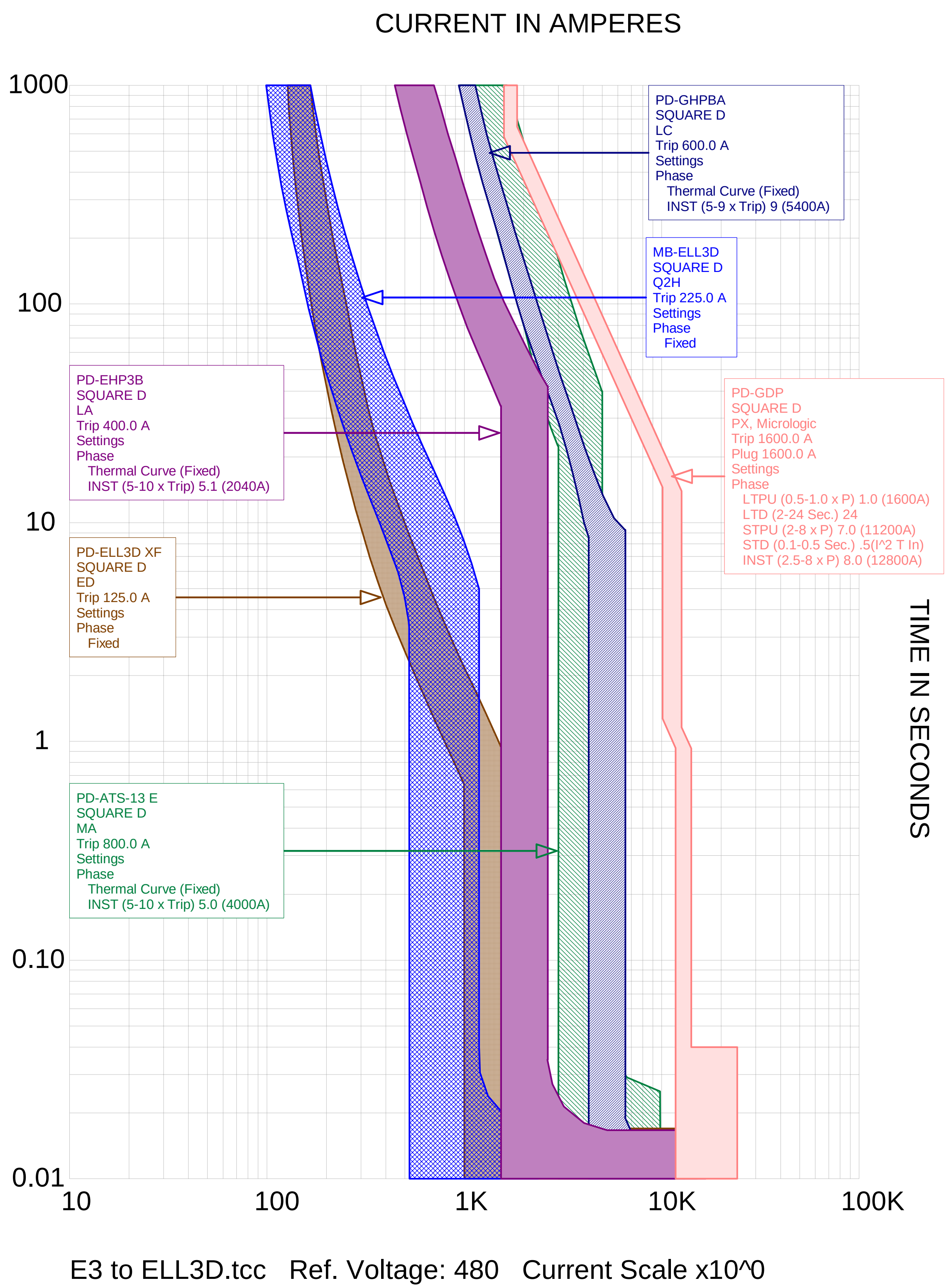

Figure 19 - Emergency Power Feed to ELL3D

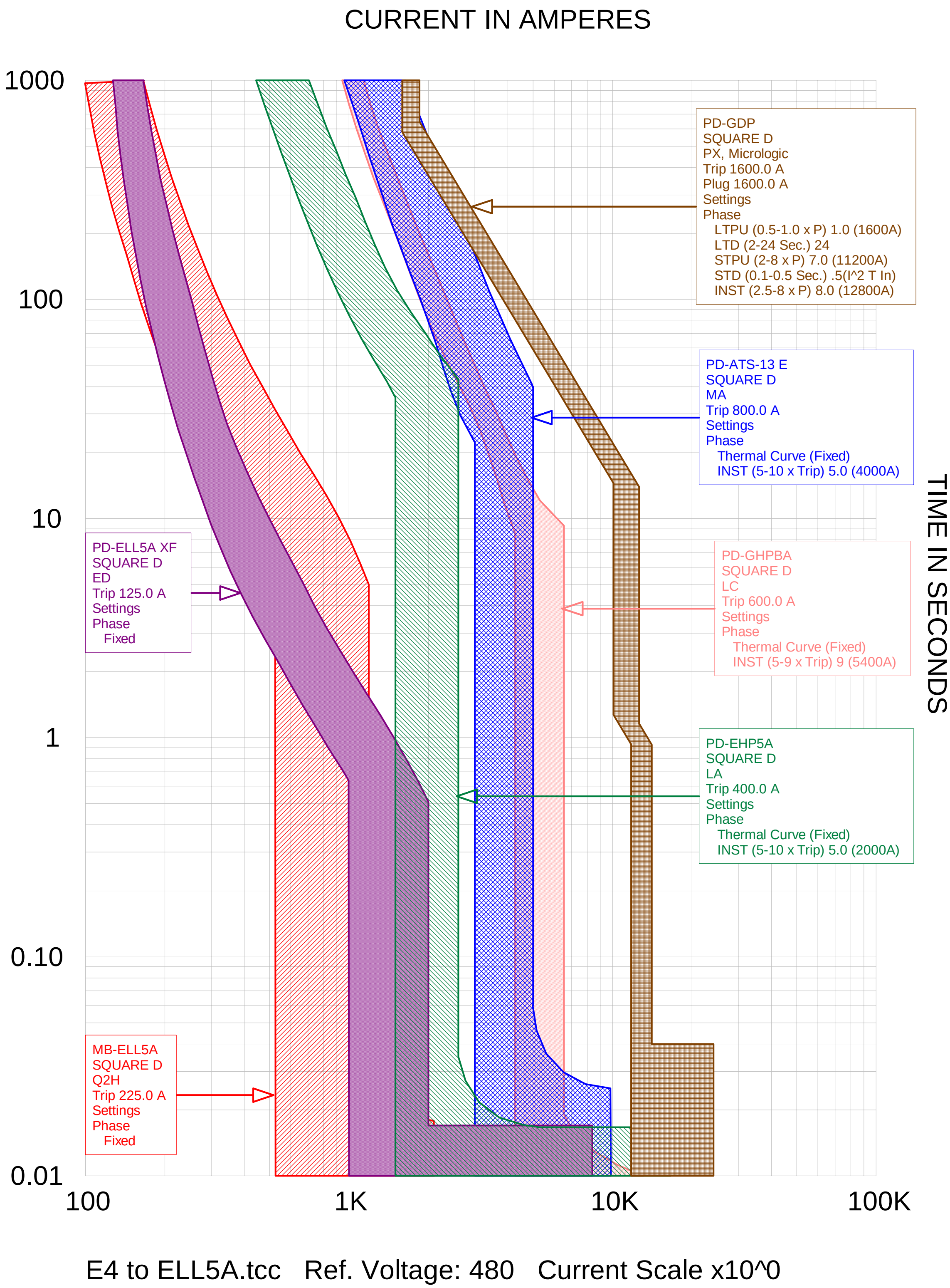

Figure 20 - Emergency Power Feed to ELL5A

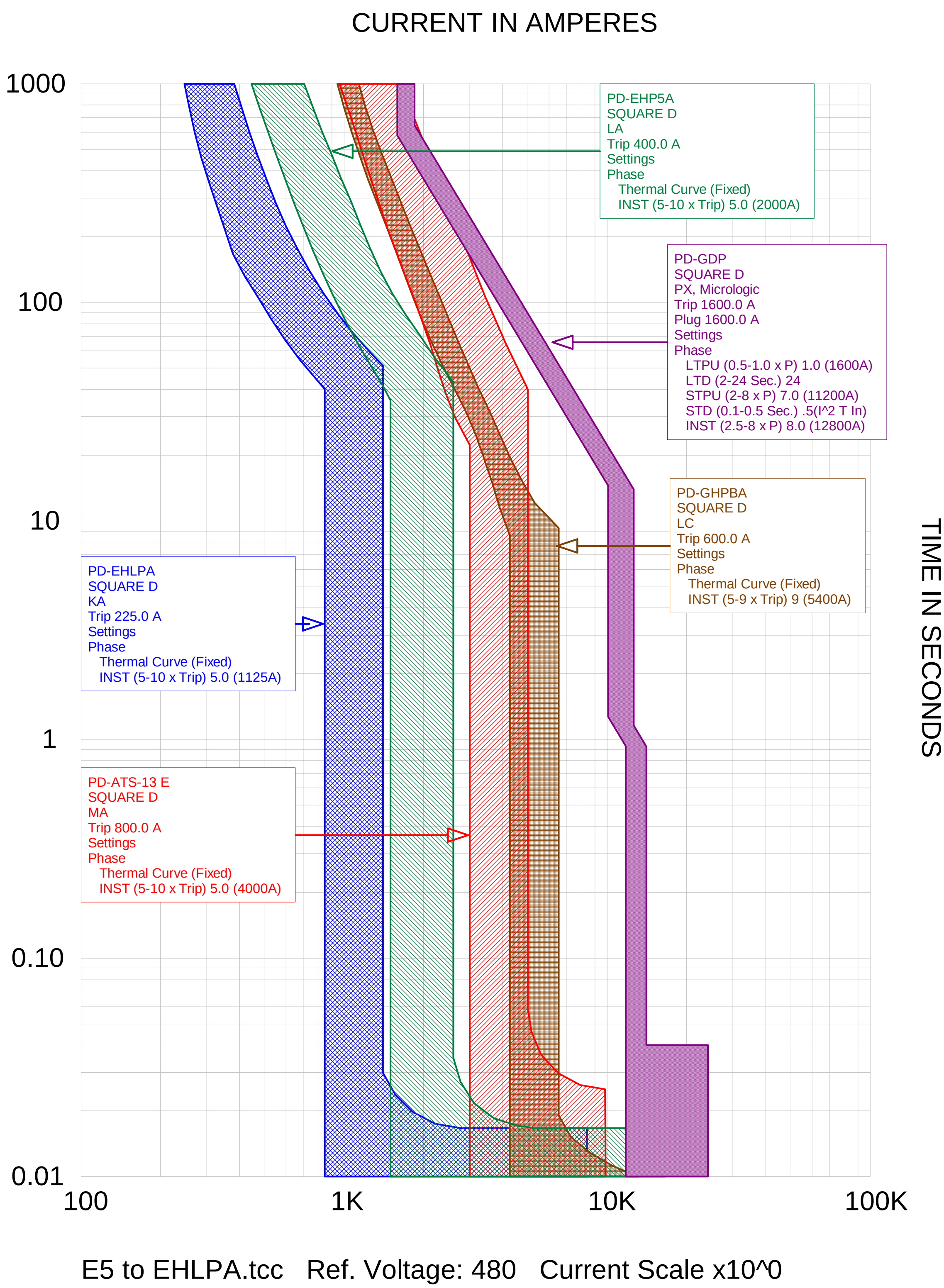

Figure 21 - Emergency Power Feed to EHLPA

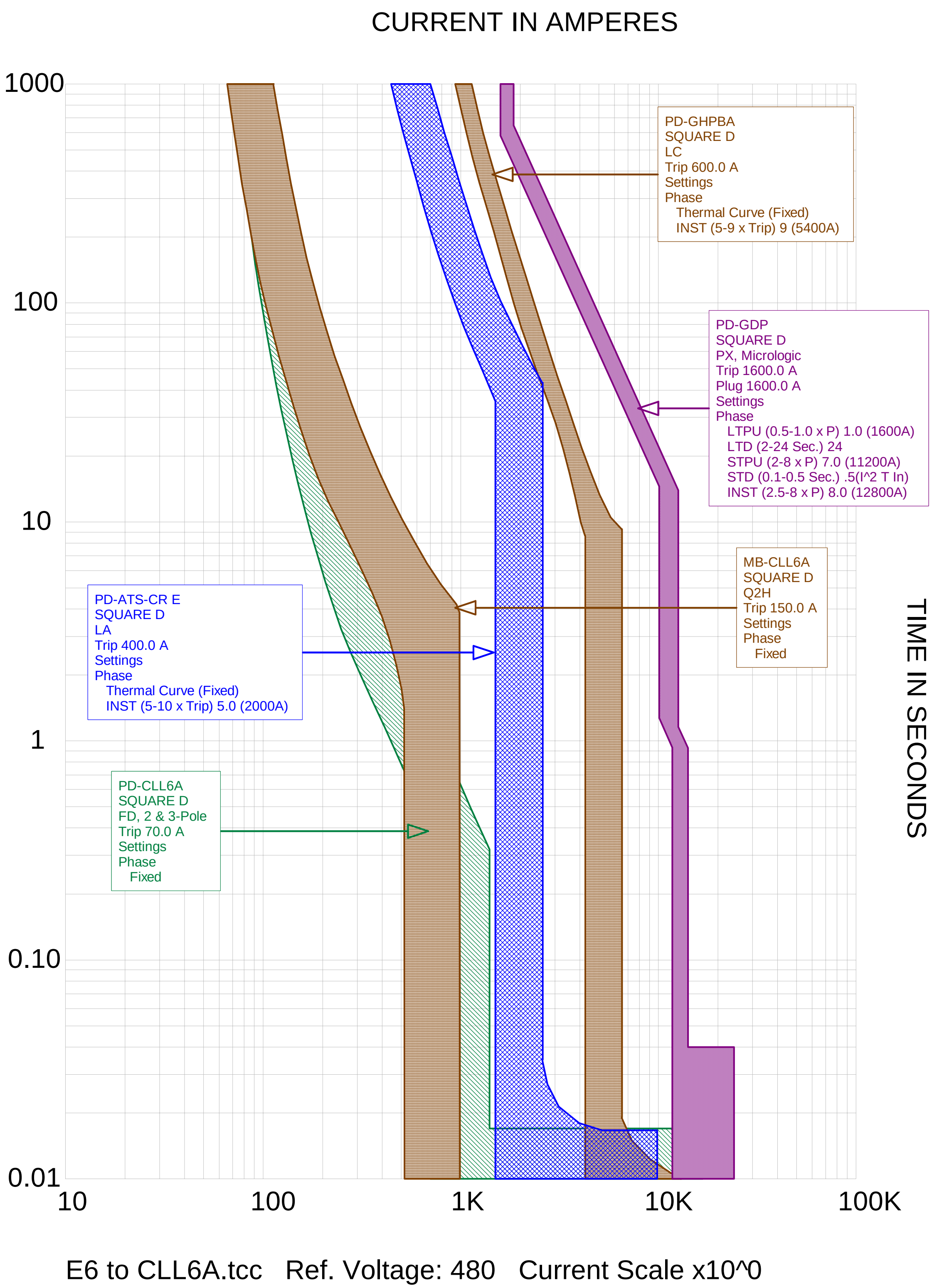

Figure 22 - Emergency Power Feed to CLL6A

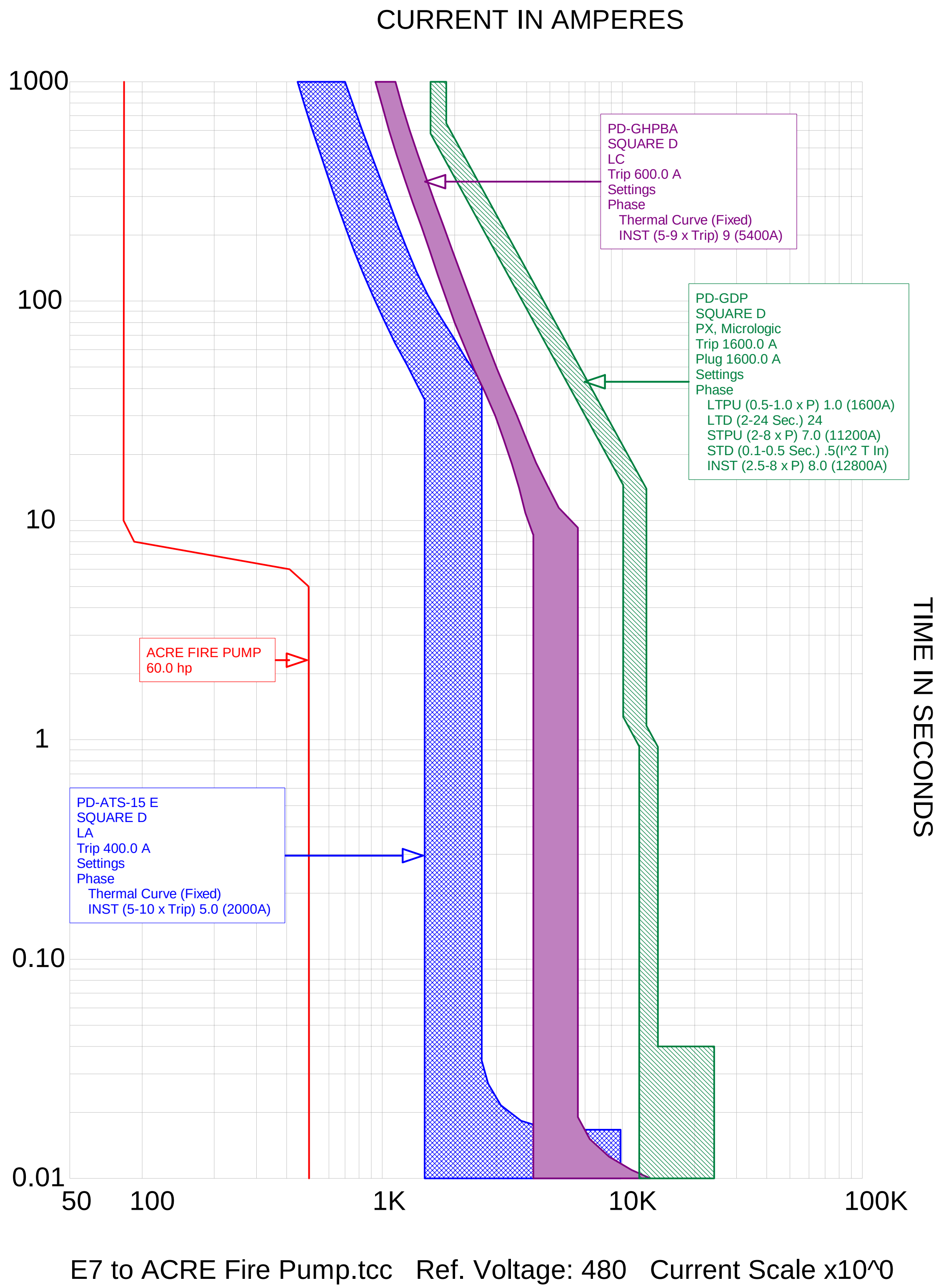

Figure 23 - Emergency Power Feed to ACRE Fire Pump

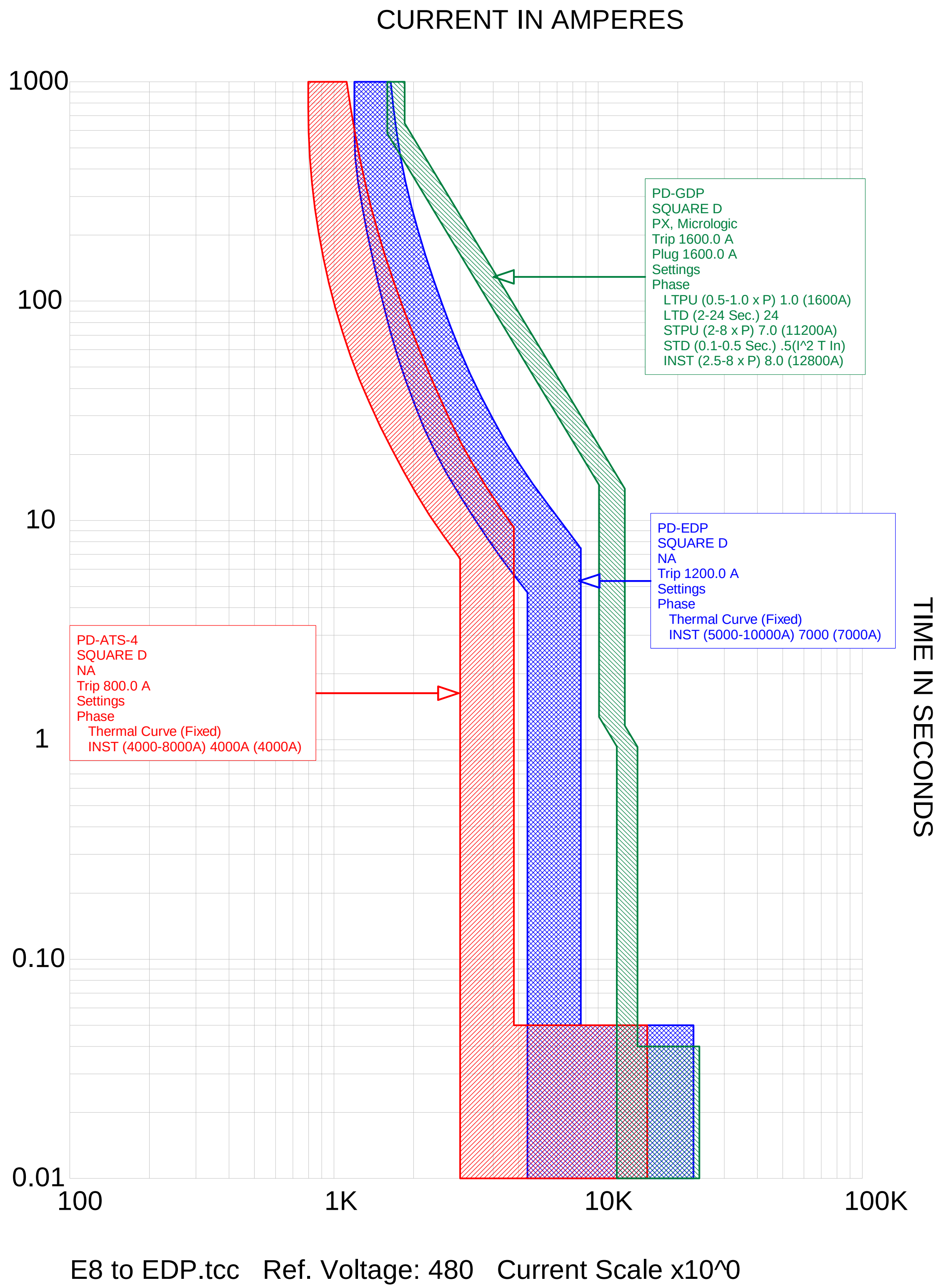

Figure 24 – Coordination of Breakers in EDP

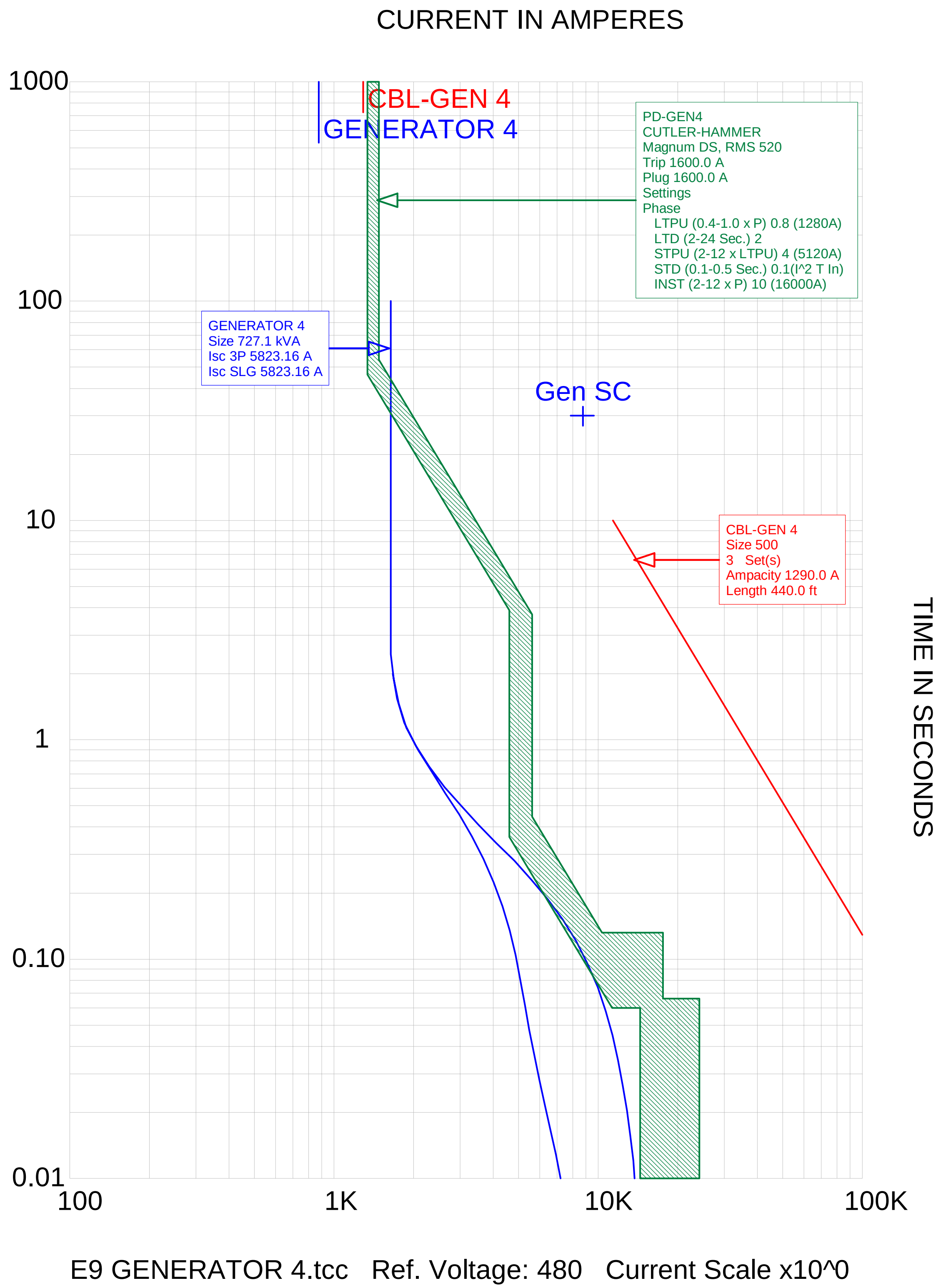

Figure 25 - Breaker Setting and Degradation Curve for Generator 4

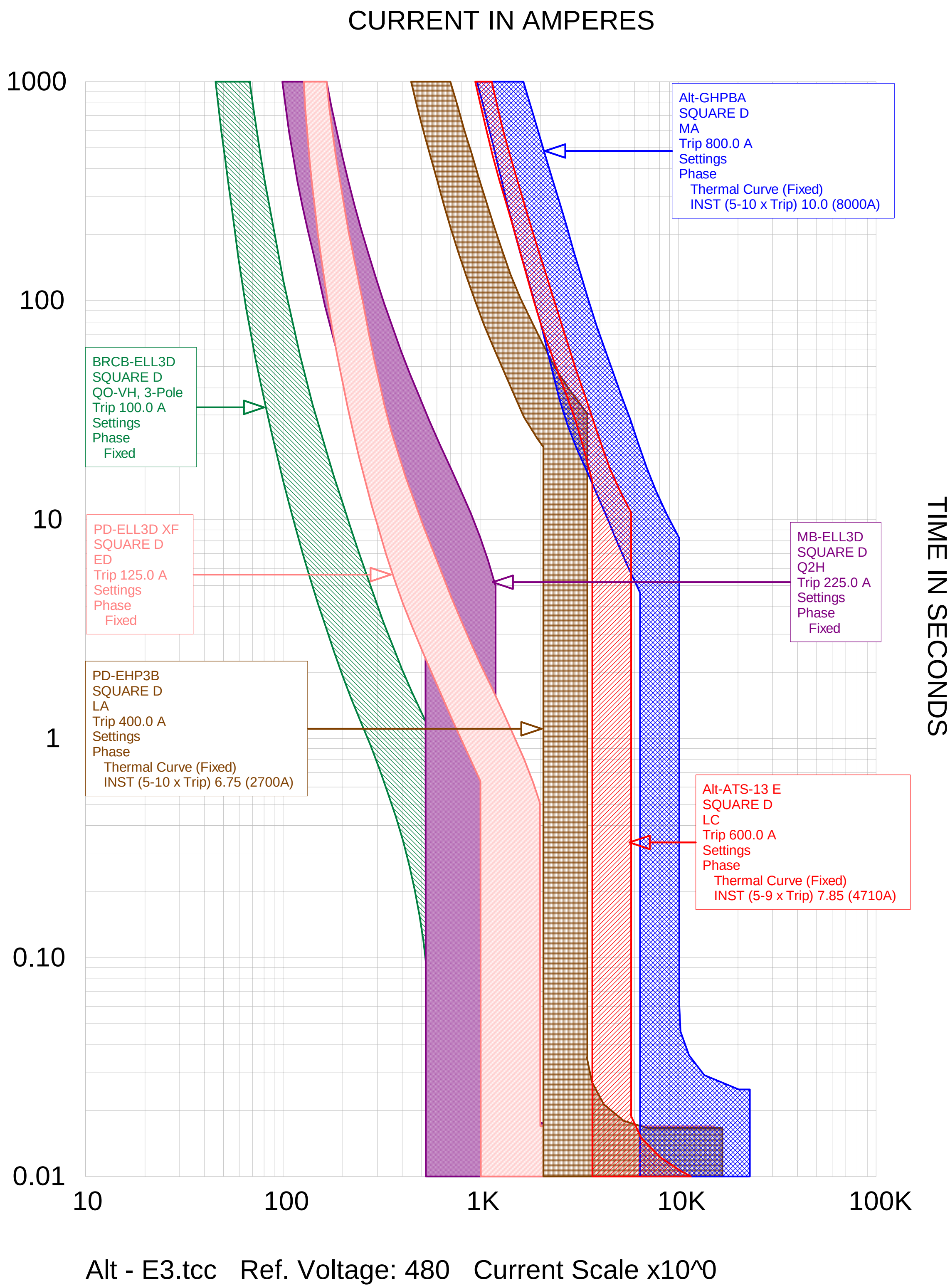

Figure 26 - Emergency Feed to ELL3D with ATS-13 and GHPBA Breakers Swapped

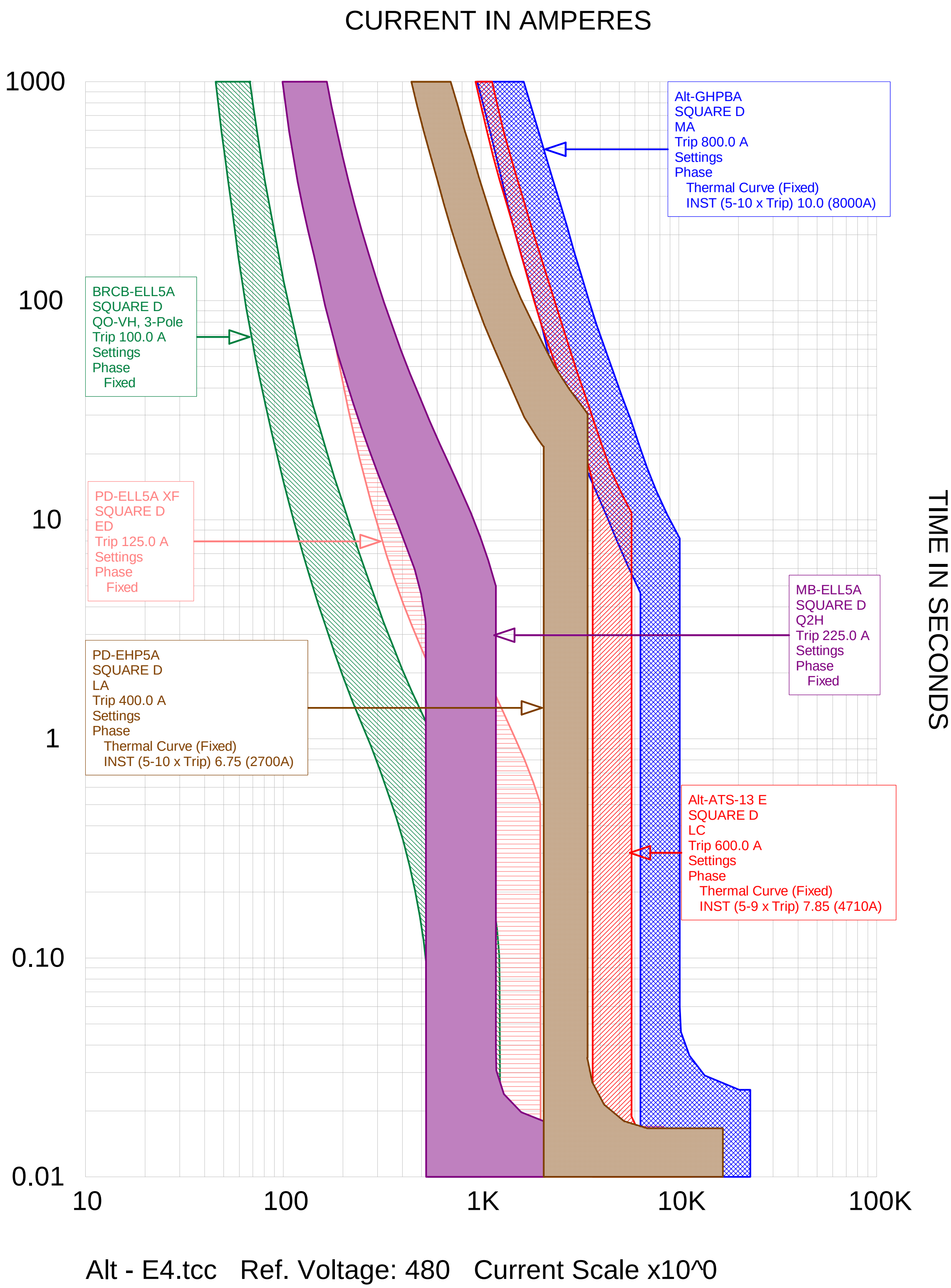

Figure 27 - Emergency Feed to ELL5A with ATS-13 and GHPBA Breakers Swapped

Corrective Action

In order to completely correct the lack of coordination occurring between the breaker feeding GHPBA and the breaker feeding ATS-13, there are three possible solutions.

Option 1 – Swapping the Breakers

A simple solution is to exchange these two breakers. The result is shown in Figure 26 and Figure 27 on pages 34 and 35. Since the long time trip ratings of the two breakers are close to each other (600 and 800 amps) there is still overlap in the long time (thermal) trip portion of the curve. Due to this problem, this solution is not recommended.

Option 2 – Install Adjustable Breakers for GHPBA and ATS-13

In order to eliminate the possibility that a fault or overload in the equipment system could cause an interruption of the entire emergency feed to the ACRE building, a minimum of two fully adjustable electronic-trip breakers are required. This option is recommended because it will require the fewest number of breakers to be replaced to achieve coordination between the different branches of the essential system in the ACRE building. Also, the breakers that require replacing are on the emergency feed side of the automatic transfer switches. This means the replacement can occur without a power interruption provided the normal utility feeds remain energized during the replacement.

Graphs for loads on each of the transfer switches fed from “GHPBA” are re-plotted in this configuration to demonstrate that there is still coordination between the other branches of the essential system. See Figure 28 through Figure 32 on pages 38-42 for these plots.

Installing electronic breakers on the feed to “GHPBA” and ATS-13 will provide complete selectivity between the two breakers as shown in Figure 30. The graph is representative for both the feeds to panels “EHP3B” and “EHP5A” because they are fed with identical 400 amp Square D type “LA” breakers in panel “EHPBB”. For this coordination, the long time setting on the 400 amp branch breakers must remain at the minimum setting in order for them to coordinate with upstream devices. This causes a lack of selectivity with the breakers feeding downstream transformers. The main breaker on the panels fed from these transformers coordinate with the breakers in “EHPBB”, so a lack of selectivity will only occur if there is a fault between the transformer secondary breaker and the 480 volt primary breaker, but not for faults downstream of the secondary panel’s main breaker. If a fault were to occur in one of these areas, there is a possibility of loosing the feed to panel “EHP3B” or panel “EHP5A”, but the distribution panel “EHPBB” will remain energized. To achieve complete selectivity downstream of panels “EHP3B” and “EHP5A” will require the replacement of several additional breakers.

Settings

The breaker setting for the devices installed under this option are in Appendix B - Overcurrent Device Settings for Option 2 as well as being shown on each graph.

Option 3 – Install Electronic Breakers Downstream of ATS-13

If a completely selective system is desired, then several breakers downstream of ATS-13 will also require replacement with electronic breakers. The two breakers that are replaced under Option 2 are still replaced, but breakers on the load side of ATS-13 feeding panels "EHP3B" and "EHP5A" also are replaced. This will result in the graph shown in Figure 33. In this graph the feed to panel "EHP5A" and two branch breakers in "EHP5A" are shown.

The only electronic breaker available in a 400 amp frame size from Square D is a type "LX", which is shown for the breaker feeding "EHP5A". The curve shows that changing to the electronic breaker creates a coordination problem with the 225 amp branch breaker in "EHP5A". In the plot in Figure 33, the 225 amp breaker is shown as it is now installed. This lack of coordination would also have to be fixed by installing an additional 400 amp frame "LX" electronic trip breaker for the 225 amp breaker also.

This option would create a fully selective equipment system for the ACRE building, but requires a lot of expense to create reliability on a system that is connected to a lower priority transfer switch on the essential system.

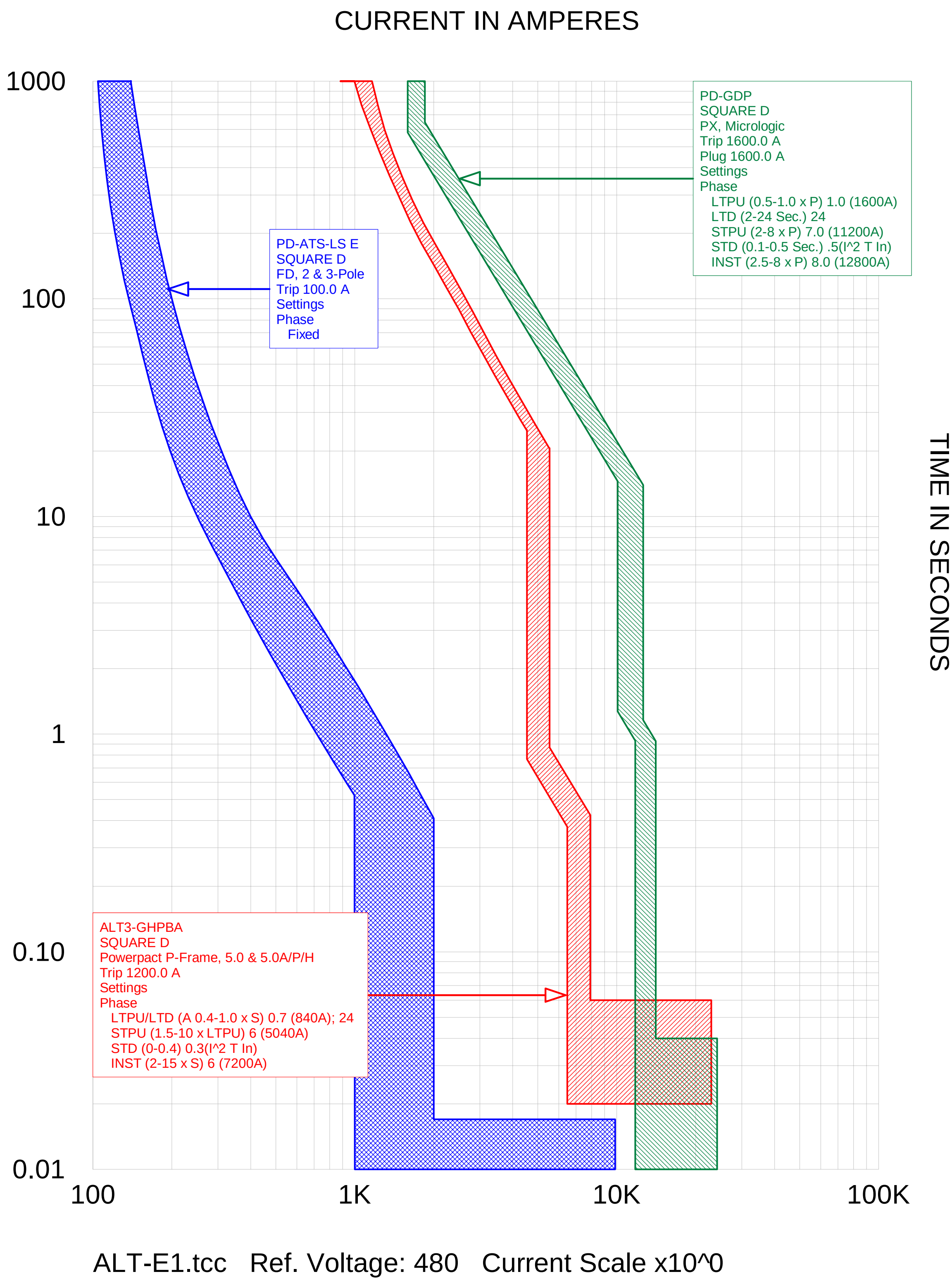

Figure 28 – Emergency Feed to LHPBA for Option 2

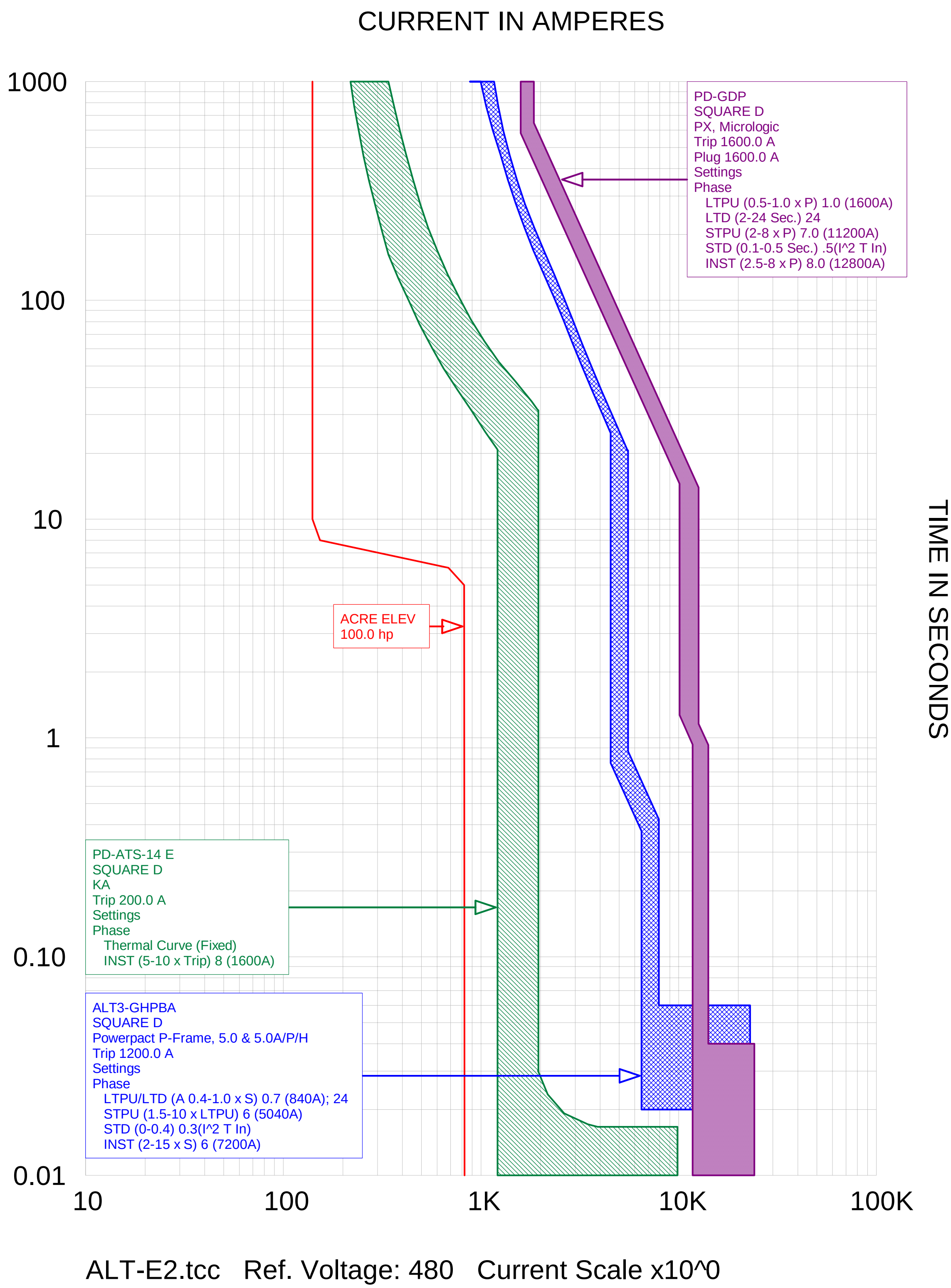

Figure 29 – Emergency Feed to ACRE Elevator for Option 2

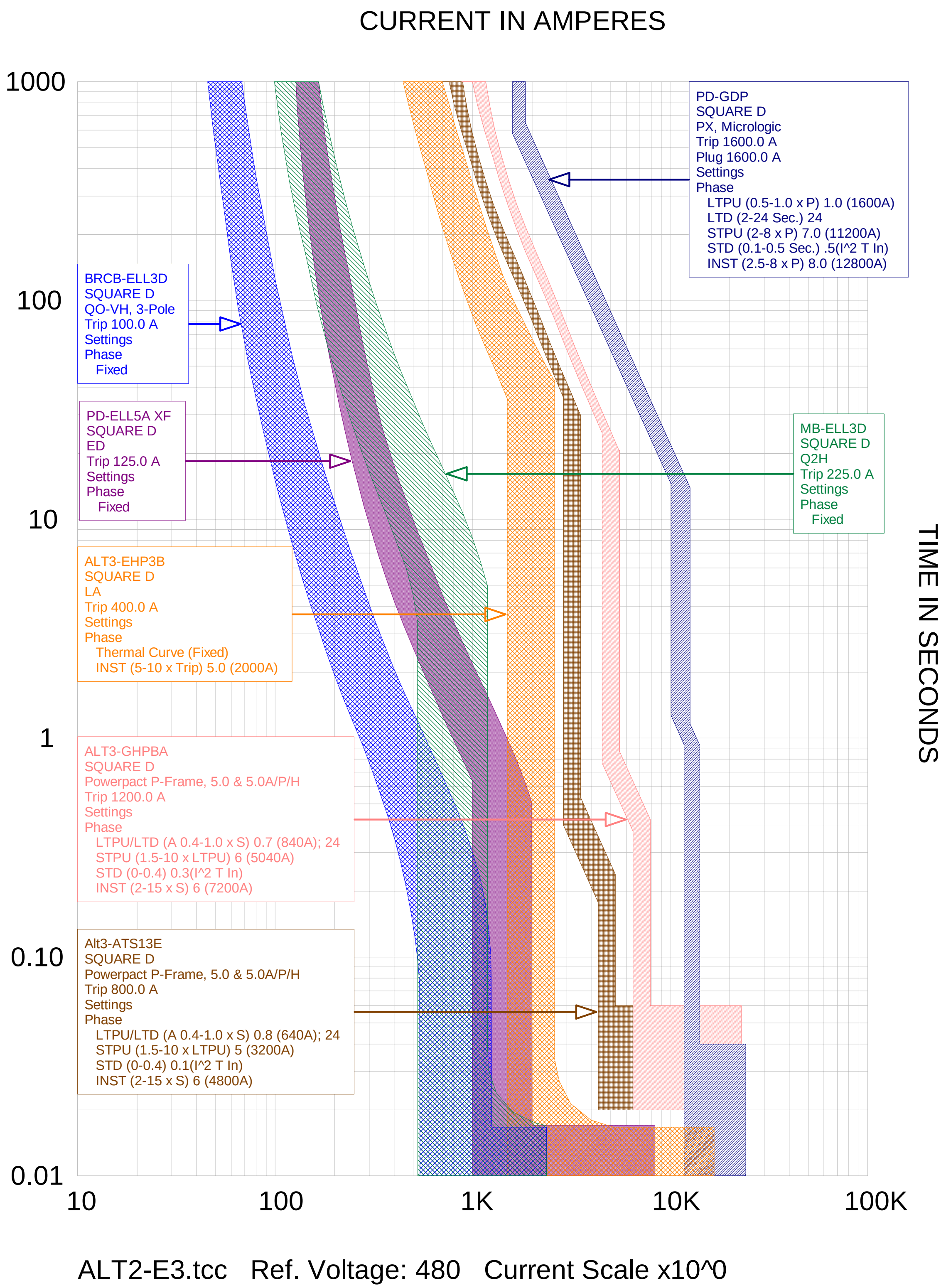

Figure 30 – Emergency Feed to ELL3D for Option 2

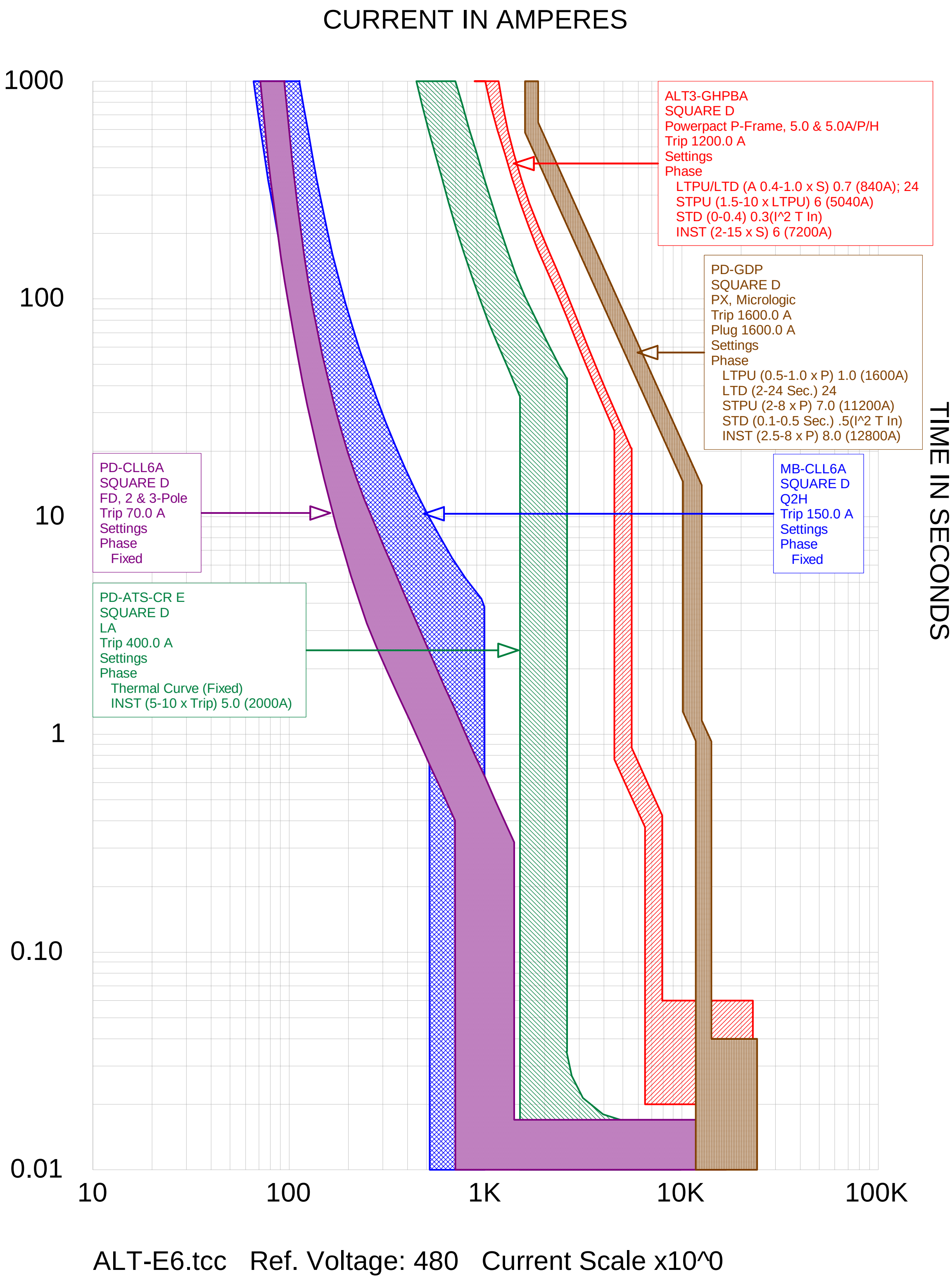

Figure 31 – Emergency Feed to CLL6A for Option 2

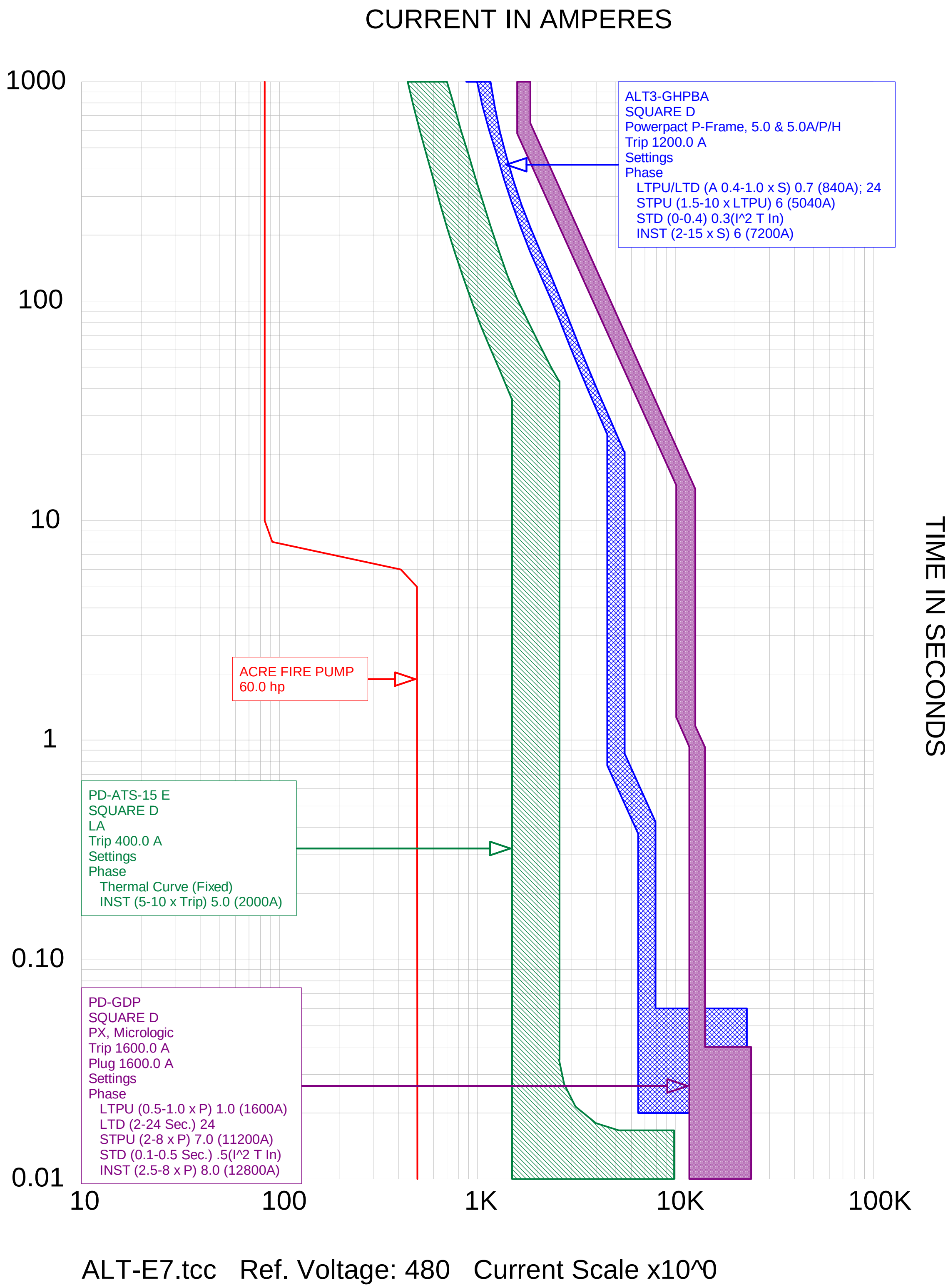

Figure 32 – Emergency Feed to ACRE Fire Pump for Option 2

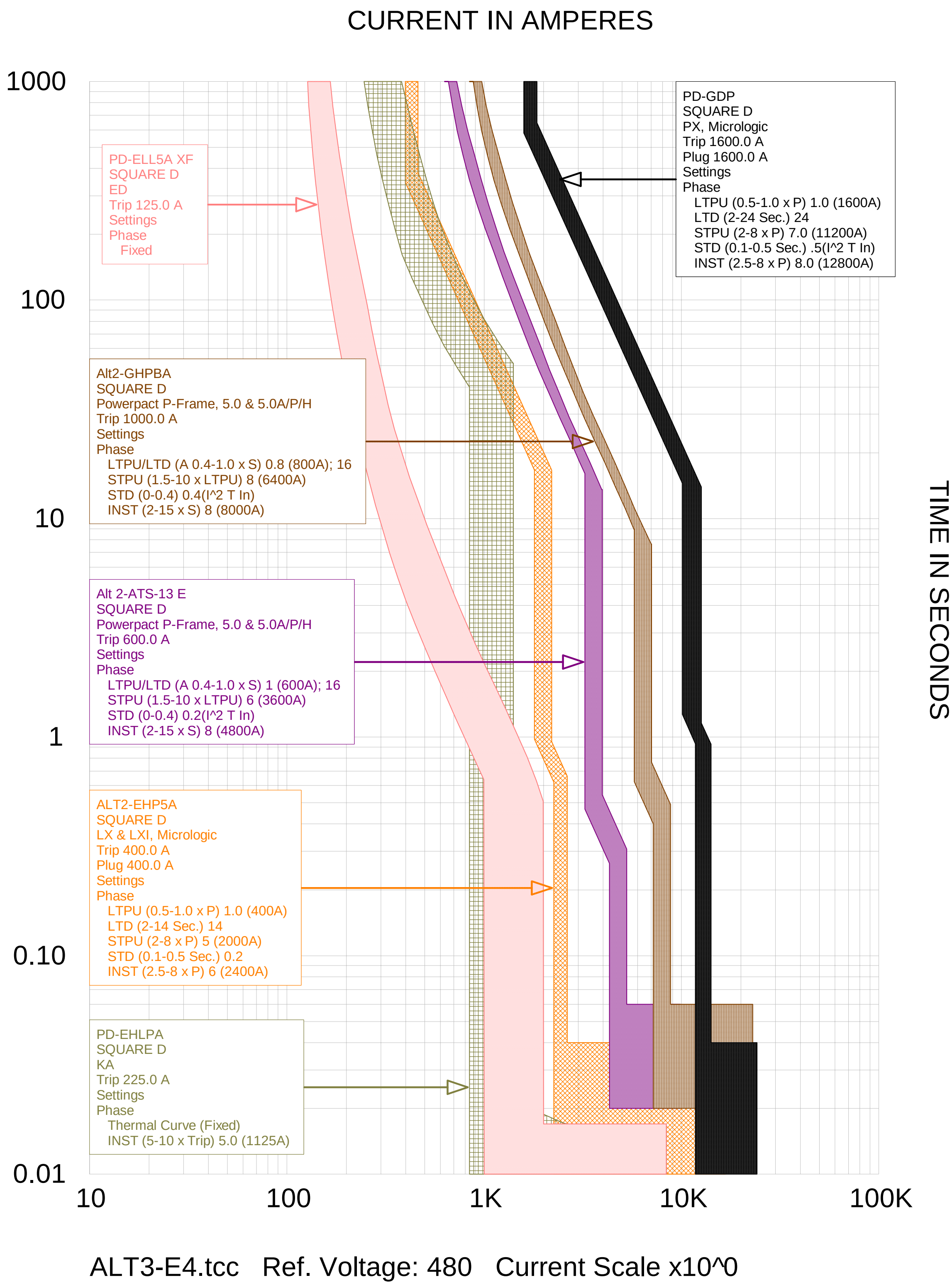

Figure 33 – Emergency Feed to ELL5A for Option 3

Appendix A – Overcurrent Device Settings Report

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Device Name:     ACRE Chiller                           TCC Name:        N15 to ACRE Chill.tcc
Bus Name:        ACRE Chill                             Bus Voltage:     480V
Description:     Motor Starting Curve                   Inrush:          5.9 (2276.4A)
Rated Size:      321KVA    (1 of 1 Plotted)             FLA+Load Adder:  385.8A + 0.0A
Power Factor:    0.800                                  Starting Time:   10.00s
Efficiency:      0.80                                   Full Voltage (Square Transient)
-----------------------------------------------------------------------------------------
Device Name:     ACRE ELEV                              TCC Name:        N3 to Elevator.tcc
Bus Name:        ATS-14 LOAD                            Bus Voltage:     480V
Description:     Motor Starting Curve                   Inrush:          5.9 (827.2A)
Rated Size:      100HP     (1 of 1 Plotted)             FLA+Load Adder:  140.2A + 0.0A
Power Factor:    0.800                                  Starting Time:   10.00s
Efficiency:      0.80                                   Full Voltage (Square Transient)
-----------------------------------------------------------------------------------------
Device Name:     ACRE FIRE PUMP                         TCC Name:        N13 to ACRE Fire Pump.tcc
Bus Name:        ATS-15-LOAD                            Bus Voltage:     480V
Description:     Motor Starting Curve                   Inrush:          5.9 (496.3A)
Rated Size:      60HP      (1 of 1 Plotted)             FLA+Load Adder:  84.1A + 0.0A
Power Factor:    0.800                                  Starting Time:   10.00s
Efficiency:      0.80                                   Full Voltage (Square Transient)
-----------------------------------------------------------------------------------------
Device Name:     BRCB LL3A                              TCC Name:        N4 to LL3A.tcc
Bus Name:        LL3A                                   Bus Voltage:     208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                               Description:     15-150A
Sub Type:        QO-VH, 3-Pole
AIC Rating:      22kA                                   Fault Duty:      5683.6A
Frame:           QO-VH 240V 100A                        Curve Multiplier: 1.00000
Trip:            100A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:     BRCB-CLL6A                             TCC Name:        N10 to CLL6A.tcc
Bus Name:        CLL6A                                  Bus Voltage:     208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                               Description:     15-125A
Sub Type:        QO, 2-Pole
AIC Rating:      10kA                                   Fault Duty:      2290.7A
Frame:           QO2 240V 20A                           Curve Multiplier: 1.00000
Trip:            20A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:     BRCB-ELL3D                             TCC Name:        N5 to ELL3D.tcc
Bus Name:        ELL3D                                  Bus Voltage:     208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                               Description:     15-150A
Sub Type:        QO-VH, 3-Pole
AIC Rating:      22kA                                   Fault Duty:      5458.7A
Frame:           QO-VH 240V 100A                        Curve Multiplier: 1.00000
Trip:            100A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:     BRCB-ELL5A                             TCC Name:        N6 to ELL5A.tcc
Bus Name:        ELL5A                                  Bus Voltage:     208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                               Description:     15-150A
Sub Type:        QO-VH, 3-Pole
AIC Rating:      22kA                                   Fault Duty:      4857.7A
Frame:           QO-VH 240V 100A                        Curve Multiplier: 1.00000
Trip:            100A
Setting: 1) Fixed
```

```
-----------------------------------------------------------------------------------------
Device Name:    BRCB-LL3L                                TCC Name:         N11 to LL3L.tcc
Bus Name:       LL3L                                     Bus Voltage:      208.0V
Function Name:  Phase
Manufacturer:   SQUARE D                                 Description:      15-150A
Sub Type:       QO-VH, 3-Pole
AIC Rating:     22kA                                     Fault Duty:       5225.7A
Frame:          QO-VH 240V 100A                          Curve Multiplier: 1.00000
Trip:           100A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:    BRCB-LL4A                                TCC Name:         N9 to LL4A.tcc
Bus Name:       LL4A                                     Bus Voltage:      208.0V
Function Name:  Phase
Manufacturer:   SQUARE D                                 Description:      15-150A
Sub Type:       QO-VH, 3-Pole
AIC Rating:     22kA                                     Fault Duty:       5604.7A
Frame:          QO-VH 240V 100A                          Curve Multiplier: 1.00000
Trip:           100A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:    BRCB-LL4L                                TCC Name:         N8 to LL4L.tcc
Bus Name:       LL4L                                     Bus Voltage:      208.0V
Function Name:  Phase
Manufacturer:   SQUARE D                                 Description:      15-150A
Sub Type:       QO-VH, 3-Pole
AIC Rating:     22kA                                     Fault Duty:       5513.2A
Frame:          QO-VH 240V 100A                          Curve Multiplier: 1.00000
Trip:           100A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:    CBL-ACRE Chill                           TCC Name:         N15 to ACRE Chill.tcc
Bus Name:       MSBL                                     Bus Voltage:      480V
Description:    Cable Damage Curve                       Qty/Ph:           2
Size:           500                                      Cont. Temp:       90 deg C.
Material:       Copper                                   Damage Temp:      250 deg C.
-----------------------------------------------------------------------------------------
Device Name:    CBL-ATS-15 N                             TCC Name:         N13 to ACRE Fire Pump.tcc
Bus Name:       ACRE MSB                                 Bus Voltage:      480V
Description:    Cable Damage Curve                       Qty/Ph:           1
Size:           2                                        Cont. Temp:       90 deg C.
Material:       Copper                                   Damage Temp:      250 deg C.
-----------------------------------------------------------------------------------------
Device Name:    CBL-GEN 4                                TCC Name:         E9 GENERATOR 4.tcc
Bus Name:       GEN 4                                    Bus Voltage:      480V
Description:    Cable Damage Curve                       Qty/Ph:           3
Size:           500                                      Cont. Temp:       90 deg C.
Material:       Copper                                   Damage Temp:      250 deg C.
-----------------------------------------------------------------------------------------
Device Name:    GENERATOR 4                              TCC Name:         E9 GENERATOR 4.tcc
Bus Name:       GEN 4                                    Bus Voltage:      480V
Description:    Generator Decrement Curve                Size:             727.1KVA
Xd":  0.1000            Td":  0.0150                     Power Factor:     0.800  Lead
Xd':  0.1500            Td':  0.4000                     Ifg:  1.0000
Xd:   1.60              Ta:   0.2000                     If:   3.0000
-----------------------------------------------------------------------------------------
Device Name:    MB-ACRE MSB                              TCC Name:         N1 to LHPBA.tcc
Bus Name:       ACRE MSB                                 Bus Voltage:      480.0V
Function Name:  Phase
Manufacturer:   SQUARE D                                 Description:      LSI, 1800-2000A
Sub Type:       PX, Micrologic
AIC Rating:     100kA Override:17                        Fault Duty:       23931.0A
Frame:          PX 480V 2000A                            Curve Multiplier: 1.00000
Sensor:         2000A
Plug:           2000A
Setting: 1) LTPU (0.5-1.0 x P)     0.75         (1500A)
         2) LTD (2-24 Sec.)        11.0
         3) STPU (2-6 x P)         2.5          (5000A)
         4) STD (0.1-0.5 Sec.)     .1          I^2 t In
         5) INST (2.5-6 x P)       4.5          (9000A)
```

```
-----------------------------------------------------------------------------------------
Device Name:     MB-CLL6A                                 TCC Name:         N10 to CLL6A.tcc
Bus Name:        CLL6A                                    Bus Voltage:      208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                 Description:      100-225A
Sub Type:        Q2H
AIC Rating:      22kA                                     Fault Duty:       2290.7A
Frame:           Q2H 240V 150A                            Curve Multiplier: 1.00000
Trip:            150A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:     MB-ELL3D                                 TCC Name:         N5 to ELL3D.tcc
Bus Name:        ELL3D                                    Bus Voltage:      208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                 Description:      100-225A
Sub Type:        Q2H
AIC Rating:      22kA                                     Fault Duty:       5458.7A
Frame:           Q2H 240V 225A                            Curve Multiplier: 1.00000
Trip:            225A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:     MB-ELL5A                                 TCC Name:         N6 to ELL5A.tcc
Bus Name:        ELL5A                                    Bus Voltage:      208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                 Description:      100-225A
Sub Type:        Q2H
AIC Rating:      22kA                                     Fault Duty:       4857.7A
Frame:           Q2H 240V 225A                            Curve Multiplier: 1.00000
Trip:            225A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:     MB-LL3A                                  TCC Name:         N4 to LL3A.tcc
Bus Name:        LL3A                                     Bus Voltage:      208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                 Description:      125-400A, DC
Sub Type:        LA
AIC Rating:      10kA                                     Fault Duty:       5683.6A
Frame:           LA 250V 400A                             Curve Multiplier: 1.00000
Trip:            350A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     9           (3150A)
-----------------------------------------------------------------------------------------
Device Name:     MB-LL3L                                  TCC Name:         N11 to LL3L.tcc
Bus Name:        LL3L                                     Bus Voltage:      208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                 Description:      100-225A
Sub Type:        Q2H
AIC Rating:      22kA                                     Fault Duty:       5225.7A
Frame:           Q2H 240V 225A                            Curve Multiplier: 1.00000
Trip:            225A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:     MB-LL4A                                  TCC Name:         N9 to LL4A.tcc
Bus Name:        LL4A                                     Bus Voltage:      208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                 Description:      125-400A, DC
Sub Type:        LA
AIC Rating:      10kA                                     Fault Duty:       5604.7A
Frame:           LA 250V 400A                             Curve Multiplier: 1.00000
Trip:            350A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     9           (3150A)
```

```
-----------------------------------------------------------------------------------------
Device Name:     MB-LL4L                                     TCC Name:        N8 to LL4L.tcc
Bus Name:        LL4L                                        Bus Voltage:     208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                    Description:     100-225A
Sub Type:        Q2H
AIC Rating:      22kA                                        Fault Duty:      5513.2A
Frame:           Q2H 240V 225A                               Curve Multiplier: 1.00000
Trip:            225A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:     PD ACRE MSB                                 TCC Name:        N1 to LHPBA.tcc
Bus Name:        MSBR                                        Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                    Description:     LSI, 600-1600A
Sub Type:        PE, Micrologic
AIC Rating:      100kA Override:18                           Fault Duty:      70581.7A
Frame:           PE 480V 1600A                               Curve Multiplier: 1.00000
Sensor:          1600A
Plug:            1600A
Setting: 1) LTPU (0.5-1.0 x P)     0.95         (1520A)
         2) LTD (2-24 Sec.)        24
         3) STPU (2-8 x P)         4.0          (6400A)
         4) STD (0.1-0.5 Sec.)     0.32        I^2 t In
         5) INST (2.5-8 x P)       8.0          (12800A)
-----------------------------------------------------------------------------------------
Device Name:     PD SB1                                      TCC Name:        N14 to HCC.tcc
Bus Name:        MSBL                                        Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                    Description:     LSI, 600-1600A
Sub Type:        PE, Micrologic
AIC Rating:      100kA Override:18                           Fault Duty:      76468.8A
Frame:           PE 480V 1600A                               Curve Multiplier: 1.00000
Sensor:          1600A
Plug:            1600A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (1600A)
         2) LTD (2-24 Sec.)        24
         3) STPU (2-8 x P)         5.0          (8000A)
         4) STD (0.1-0.5 Sec.)     0.1         I^2 t In

-----------------------------------------------------------------------------------------
Device Name:     PD XF1-2                                    TCC Name:        N14 to HCC.tcc
Bus Name:        Mains L                                     Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                    Description:     LSI, 100-3000A
Sub Type:        SE, SES, SEH Micrologic (Obs.)
AIC Rating:      100kA                                       Fault Duty:      80733.2A
Frame:           SE 480V 2500A                               Curve Multiplier: 1.00000
Sensor:          2500A
Plug:            2500A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (2875A)
         2) LTD (1-4)              4
         3) STPU (2-10 x P)        4            (10000A)
         4) STD (1-4)              2           I^2 t In
-----------------------------------------------------------------------------------------
Device Name:     PD XF3-2                                    TCC Name:        N1 to LHPBA.tcc
Bus Name:        Mains R                                     Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                    Description:     LSI, 100-3000A
Sub Type:        SE, SES, SEH Micrologic (Obs.)
AIC Rating:      100kA                                       Fault Duty:      75702.6A
Frame:           SE 480V 2500A                               Curve Multiplier: 1.00000
Sensor:          2500A
Plug:            2500A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (2875A)
         2) LTD (1-4)              3
         3) STPU (2-10 x P)        4            (10000A)
         4) STD (1-4)              3           I^2 t In
```

```
-----------------------------------------------------------------------------------------
Device Name:     PD-ACRE Chill                                 TCC Name:        N15 to ACRE Chill.tcc
Bus Name:        MSBL                                          Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                      Description:     LSI, 300-1200A
Sub Type:        NE, Micrologic
AIC Rating:      100kA                                         Fault Duty:      76468.8A
Frame:           NE 480V 1200A                                 Curve Multiplier: 1.00000
Sensor:          1200A
Plug:            800A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (800A)
         2) LTD (2-24 Sec.)        7
         3) STPU (2-10 x P)        5            (4000A)
         4) STD (0.1-0.5)          0.32        I^2 t In
         5) INST (3-12 x P)        8.0          (6400A)
-----------------------------------------------------------------------------------------
Device Name:     PD-ATS-13 E                                   TCC Name:        E3 to ELL3D.tcc
Bus Name:        GHPBA                                         Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                      Description:     125-1200A
Sub Type:        MA
AIC Rating:      30kA                                          Fault Duty:      9861.5A
Frame:           MA 480V 1000A                                 Curve Multiplier: 1.00000
Trip:            800A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     5.0          (4000A)
-----------------------------------------------------------------------------------------
Device Name:     PD-ATS-13-N                                   TCC Name:        N5 to ELL3D.tcc
Bus Name:        ACRE MSB                                      Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                      Description:     LSI, 100-800A
Sub Type:        MX, Micrologic
AIC Rating:      65kA Override:11                              Fault Duty:      23931.0A
Frame:           MX 480V 800A                                  Curve Multiplier: 1.00000
Sensor:          800A
Plug:            800A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (800A)
         2) LTD (2-24 Sec.)        24
         3) STPU (2-10 x P)        5.0          (4000A)
         4) STD (0.1-0.5 Seconds   .32         I^2 t In
         5) INST (3-12 x P)        8.0          (6400A)
-----------------------------------------------------------------------------------------
Device Name:     PD-ATS-14 E                                   TCC Name:        E2 to ACRE Elevator.tcc
Bus Name:        GHPBA                                         Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                      Description:     70-250A
Sub Type:        KA
AIC Rating:      25kA                                          Fault Duty:      9861.5A
Frame:           KA 480V 250A                                  Curve Multiplier: 1.00000
Trip:            200A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     8             (1600A)
-----------------------------------------------------------------------------------------
Device Name:     PD-ATS-14 N                                   TCC Name:        N3 to Elevator.tcc
Bus Name:        HPBA                                          Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                      Description:     70-250A
Sub Type:        KA
AIC Rating:      25kA                                          Fault Duty:      21217.2A
Frame:           KA 480V 250A                                  Curve Multiplier: 1.00000
Trip:            200A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     7             (1400A)
```

```
-------------------------------------------------------------------------------------------
Device Name:     PD-ATS-15 E                              TCC Name:         E7 to ACRE Fire Pump.tcc
Bus Name:        GHPBA                                    Bus Voltage:      480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                 Description:      125-400A
Sub Type:        LA
AIC Rating:      30kA                                     Fault Duty:       9861.5A
Frame:           LA 480V 400A                             Curve Multiplier: 1.00000
Trip:            400A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     5.0          (2000A)
-------------------------------------------------------------------------------------------
Device Name:     PD-ATS-15-N                              TCC Name:         N13 to ACRE Fire Pump.tcc
Bus Name:        ACRE MSB                                 Bus Voltage:      480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                 Description:      LSI, 100-600A
Sub Type:        LX & LXI, Micrologic
AIC Rating:      65kA                                     Fault Duty:       23931.0A
Frame:           LX 480V 400A                             Curve Multiplier: 1.00000
Sensor:          400A
Plug:            400A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (400A)
         2) LTD (2-14 Sec.)        14
         3) STPU (2-8 x P)         8            (3200A)
         4) STD (0.1-0.5 Sec.)     0.5
         5) INST (2.5-8 x P)       8            (3200A)
-------------------------------------------------------------------------------------------
Device Name:     PD-ATS-4                                 TCC Name:         E8 to EDP.tcc
Bus Name:        EDP                                      Bus Voltage:      480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                 Description:      600-1200A
Sub Type:        NA
AIC Rating:      50kA                                     Fault Duty:       15364.4A
Frame:           NA 480V 800A                             Curve Multiplier: 1.00000
Trip:            800A
Setting: 1) Thermal Curve (Fixed
         2) INST (4000-8000A)      4000A        (4000A)
-------------------------------------------------------------------------------------------
Device Name:     PD-ATS-CR E                              TCC Name:         E6 to CLL6A.tcc
Bus Name:        GHPBA                                    Bus Voltage:      480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                 Description:      125-400A
Sub Type:        LA
AIC Rating:      30kA                                     Fault Duty:       9861.5A
Frame:           LA 480V 400A                             Curve Multiplier: 1.00000
Trip:            400A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     5.0          (2000A)
-------------------------------------------------------------------------------------------
Device Name:     PD-ATS-CR-N                              TCC Name:         N10 to CLL6A.tcc
Bus Name:        ACRE MSB                                 Bus Voltage:      480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                 Description:      LSI, 100-600A
Sub Type:        LX & LXI, Micrologic
AIC Rating:      65kA                                     Fault Duty:       23931.0A
Frame:           LX 480V 400A                             Curve Multiplier: 1.00000
Sensor:          400A
Plug:            400A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (400A)
         2) LTD (2-14 Sec.)        10
         3) STPU (2-8 x P)         5            (2000A)
         4) STD (0.1-0.5 Sec.)     0.32
         5) INST (2.5-8 x P)       8            (3200A)
```

```
-------------------------------------------------------------------------------------------
Device Name:     PD-ATS-LS E                                      TCC Name:        E1to LHPBA.tcc
Bus Name:        GHPBA                                            Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                         Description:     15-100A
Sub Type:        FD, 2 & 3-Pole
AIC Rating:      18kA                                             Fault Duty:      9861.5A
Frame:           FD 480V 100A                                     Curve Multiplier: 1.00000
Trip:            100A
Setting: 1) Fixed
-------------------------------------------------------------------------------------------
Device Name:     PD-ATS-LS N                                      TCC Name:        N1 to LHPBA.tcc
Bus Name:        HPBA                                             Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                         Description:     15-100A
Sub Type:        FD, 2 & 3-Pole
AIC Rating:      18kA                                             Fault Duty:      21217.2A
Frame:           FD 480V 100A                                     Curve Multiplier: 1.00000
Trip:            100A
Setting: 1) Fixed
-------------------------------------------------------------------------------------------
Device Name:     PD-CLL6A                                         TCC Name:        N10 to CLL6A.tcc
Bus Name:        CHPBA                                            Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                         Description:     15-100A
Sub Type:        FD, 2 & 3-Pole
AIC Rating:      18kA                                             Fault Duty:      16733.8A
Frame:           FD 480V 70A                                      Curve Multiplier: 1.00000
Trip:            70A
Setting: 1) Fixed
-------------------------------------------------------------------------------------------
Device Name:     PD-EDP                                           TCC Name:        E8 to EDP.tcc
Bus Name:        Generator Dist                                   Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                         Description:     600-1200A
Sub Type:        NA
AIC Rating:      50kA                                             Fault Duty:      22959.5A
Frame:           NA 480V 1200A                                    Curve Multiplier: 1.00000
Trip:            1200A
Setting: 1) Thermal Curve (Fixed
         2) INST (5000-10000A)     7000          (7000A)
-------------------------------------------------------------------------------------------
Device Name:     PD-EHLPA                                         TCC Name:        N7 to EHLPA.tcc
Bus Name:        EHP5A                                            Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                         Description:     70-250A
Sub Type:        KA
AIC Rating:      25kA                                             Fault Duty:      8363.6A
Frame:           KA 480V 250A                                     Curve Multiplier: 1.00000
Trip:            225A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     5.0          (1125A)
-------------------------------------------------------------------------------------------
Device Name:     PD-EHP3B                                         TCC Name:        N5 to ELL3D.tcc
Bus Name:        EHPBB                                            Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                         Description:     125-400A
Sub Type:        LA
AIC Rating:      30kA                                             Fault Duty:      16651.0A
Frame:           LA 480V 400A                                     Curve Multiplier: 1.00000
Trip:            400A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     5.1          (2040A)
```

```
-----------------------------------------------------------------------------------------
Device Name:     PD-EHP5A                                TCC Name:        N6 to ELL5A.tcc
Bus Name:        EHPBB                                   Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                Description:     125-400A
Sub Type:        LA
AIC Rating:      30kA                                    Fault Duty:      16651.0A
Frame:           LA 480V 400A                            Curve Multiplier: 1.00000
Trip:            400A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     5.0          (2000A)
-----------------------------------------------------------------------------------------
Device Name:     PD-ELL3D XF                             TCC Name:        N5 to ELL3D.tcc
Bus Name:        EHP3B                                   Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                Description:     15-125A
Sub Type:        ED
AIC Rating:      18kA                                    Fault Duty:      15152.4A
Frame:           ED 480V 125A                            Curve Multiplier: 1.00000
Trip:            125A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:     PD-ELL5A XF                             TCC Name:        N6 to ELL5A.tcc
Bus Name:        EHP5A                                   Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                Description:     15-125A
Sub Type:        ED
AIC Rating:      18kA                                    Fault Duty:      8363.6A
Frame:           ED 480V 125A                            Curve Multiplier: 1.00000
Trip:            125A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:     PD-GDP                                  TCC Name:        E1to LHPBA.tcc
Bus Name:        Paralleling SB                          Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                Description:     LSI, 600-1600A
Sub Type:        PX, Micrologic
AIC Rating:      100kA Override:17                       Fault Duty:      24180.8A
Frame:           PX 480V 1600A                           Curve Multiplier: 1.00000
Sensor:          1600A
Plug:            1600A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (1600A)
         2) LTD (2-24 Sec.)        24
         3) STPU (2-8 x P)         7.0          (11200A)
         4) STD (0.1-0.5 Sec.)     .5          I^2 t In
         5) INST (2.5-8 x P)       8.0          (12800A)
-----------------------------------------------------------------------------------------
Device Name:     PD-GEN4                                 TCC Name:        E9 GENERATOR 4.tcc
Bus Name:        Paralleling SB                          Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    CUTLER-HAMMER                           Description:     LSI, 2000AF, 1600-2000A Plugs
Sub Type:        Magnum DS, RMS 520
AIC Rating:      65kA ShortTime:65                       Fault Duty:      24180.8A
Frame:           MDS-620 480V 2000A                      Curve Multiplier: 1.00000
Sensor:          1600A
Plug:            1600A
Setting: 1) LTPU (0.4-1.0 x P)     0.8          (1280A)
         2) LTD (2-24 Sec.)        2
         3) STPU (2-12 x LTPU)     4            (5120A)
         4) STD (0.1-0.5 Sec.)     0.1         I^2 t In
         5) INST (2-12 x P)        10           (16000A)
```

```
------------------------------------------------------------------------------------------
Device Name:     PD-GHPBA                                  TCC Name:         E1to LHPBA.tcc
Bus Name:        Generator Dist                            Bus Voltage:      480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                  Description:      300-600A
Sub Type:        LC
AIC Rating:      65kA                                      Fault Duty:       22959.5A
Frame:           LC 480V 600A                              Curve Multiplier: 1.00000
Trip:            600A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-9 x Trip)      9            (5400A)
------------------------------------------------------------------------------------------
Device Name:     PD-HCC                                    TCC Name:         N14 to HCC.tcc
Bus Name:        SB1                                       Bus Voltage:      480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                  Description:      LSI, 100-600A
Sub Type:        LX & LXI, Micrologic
AIC Rating:      65kA                                      Fault Duty:       44484.8A
Frame:           LX 480V 250A                              Curve Multiplier: 1.00000
Sensor:          250A
Plug:            200A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (200A)
         2) LTD (2-14 Sec.)        8
         3) STPU (2-8 x P)         6            (1200A)
         4) STD (0.1-0.5 Sec.)     0.5
         5) INST (2.5-8 x P)       8            (1600A)
------------------------------------------------------------------------------------------
Device Name:     PD-HD                                     TCC Name:         N14 to HCC.tcc
Bus Name:        HCC                                       Bus Voltage:      480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                  Description:      15-125A
Sub Type:        ED
AIC Rating:      18kA                                      Fault Duty:       14397.7A
Frame:           ED 480V 100A                              Curve Multiplier: 1.00000
Trip:            100A
Setting: 1) Fixed
------------------------------------------------------------------------------------------
Device Name:     PD-HP1A                                   TCC Name:         N4 to LL3A.tcc
Bus Name:        ACRE MSB                                  Bus Voltage:      480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                  Description:      LSI, 100-600A
Sub Type:        LX & LXI, Micrologic
AIC Rating:      65kA                                      Fault Duty:       23931.0A
Frame:           LX 480V 600A                              Curve Multiplier: 1.00000
Sensor:          600A
Plug:            600A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (600A)
         2) LTD (2-14 Sec.)        14
         3) STPU (2-8 x P)         6            (3600A)
         4) STD (0.1-0.5 Sec.)     0.1
         5) INST (2.5-8 x P)       8            (4800A)
------------------------------------------------------------------------------------------
Device Name:     PD-HP1B                                   TCC Name:         N11 to LL3L.tcc
Bus Name:        ACRE MSB                                  Bus Voltage:      480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                  Description:      LSI, 100-600A
Sub Type:        LX & LXI, Micrologic
AIC Rating:      65kA                                      Fault Duty:       23931.0A
Frame:           LX 480V 600A                              Curve Multiplier: 1.00000
Sensor:          600A
Plug:            600A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (600A)
         2) LTD (2-14 Sec.)        10
         3) STPU (2-8 x P)         4            (2400A)
         4) STD (0.1-0.5 Sec.)     0.1
         5) INST (2.5-8 x P)       7            (4200A)
```

```
-----------------------------------------------------------------------------------------
Device Name:     PD-HP4A                                      TCC Name:        N9 to LL4A.tcc
Bus Name:        ACRE MSB                                     Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                     Description:     LSI, 100-800A
Sub Type:        MX, Micrologic
AIC Rating:      65kA Override:11                             Fault Duty:      23931.0A
Frame:           MX 480V 800A                                 Curve Multiplier: 1.00000
Sensor:          800A
Plug:            800A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (800A)
         2) LTD (2-24 Sec.)        11
         3) STPU (2-10 x P)        4.0          (3200A)
         4) STD (0.1-0.5 Seconds   .2          I^2 t In
         5) INST (3-12 x P)        8.0          (6400A)
-----------------------------------------------------------------------------------------
Device Name:     PD-HP4B                                      TCC Name:        N8 to LL4L.tcc
Bus Name:        ACRE MSB                                     Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                     Description:     LSI, 100-800A
Sub Type:        MX, Micrologic
AIC Rating:      65kA Override:11                             Fault Duty:      23931.0A
Frame:           MX 480V 800A                                 Curve Multiplier: 1.00000
Sensor:          800A
Plug:            800A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (800A)
         2) LTD (2-24 Sec.)        11
         3) STPU (2-10 x P)        3            (2400A)
         4) STD (0.1-0.5 Seconds   .1          I^2 t In
         5) INST (3-12 x P)        6.0          (4800A)
-----------------------------------------------------------------------------------------
Device Name:     PD-HPBA                                      TCC Name:        N1 to LHPBA.tcc
Bus Name:        ACRE MSB                                     Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                     Description:     LSI, 100-600A
Sub Type:        LX & LXI, Micrologic
AIC Rating:      65kA                                         Fault Duty:      23931.0A
Frame:           LX 480V 600A                                 Curve Multiplier: 1.00000
Sensor:          600A
Plug:            600A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (600A)
         2) LTD (2-14 Sec.)        14
         3) STPU (2-8 x P)         6            (3600A)
         4) STD (0.1-0.5 Sec.)     0.32
         5) INST (2.5-8 x P)       8            (4800A)
-----------------------------------------------------------------------------------------
Device Name:     PD-HPBB                                      TCC Name:        N12 to HPBB.tcc
Bus Name:        ACRE MSB                                     Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                     Description:     LSI, 100-600A
Sub Type:        LX & LXI, Micrologic
AIC Rating:      65kA                                         Fault Duty:      23931.0A
Frame:           LX 480V 400A                                 Curve Multiplier: 1.00000
Sensor:          400A
Plug:            400A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (400A)
         2) LTD (2-14 Sec.)        8
         3) STPU (2-8 x P)         5            (2000A)
         4) STD (0.1-0.5 Sec.)     0.32
         5) INST (2.5-8 x P)       8            (3200A)
```

```
-----------------------------------------------------------------------------------------
Device Name:     PD-LL3A XF                                TCC Name:        N4 to LL3A.tcc
Bus Name:        HP1A                                      Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                  Description:     70-250A
Sub Type:        KA
AIC Rating:      25kA                                      Fault Duty:      15766.5A
Frame:           KA 480V 250A                              Curve Multiplier: 1.00000
Trip:            175A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     9.5          (1662.5A)
-----------------------------------------------------------------------------------------
Device Name:     PD-LL3L XF                                TCC Name:        N11 to LL3L.tcc
Bus Name:        HP1B                                      Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                  Description:     70-250A
Sub Type:        KA
AIC Rating:      25kA                                      Fault Duty:      15961.1A
Frame:           KA 480V 150A                              Curve Multiplier: 1.00000
Trip:            125A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     10.0         (1250A)
-----------------------------------------------------------------------------------------
Device Name:     PD-LL4A XF                                TCC Name:        N9 to LL4A.tcc
Bus Name:        HP4A                                      Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                  Description:     70-250A
Sub Type:        KA
AIC Rating:      25kA                                      Fault Duty:      15221.0A
Frame:           KA 480V 250A                              Curve Multiplier: 1.00000
Trip:            175A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     10.0         (1750A)
-----------------------------------------------------------------------------------------
Device Name:     PD-LL4L XF                                TCC Name:        N8 to LL4L.tcc
Bus Name:        HP4B                                      Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                  Description:     70-250A
Sub Type:        KA
AIC Rating:      25kA                                      Fault Duty:      16515.0A
Frame:           KA 480V 150A                              Curve Multiplier: 1.00000
Trip:            125A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     10.0         (1250A)
-----------------------------------------------------------------------------------------
Device Name:     PD-MCCA                                   TCC Name:        N2 to MCCA.tcc
Bus Name:        HPBA                                      Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                  Description:     70-250A
Sub Type:        KA
AIC Rating:      25kA                                      Fault Duty:      21217.2A
Frame:           KA 480V 250A                              Curve Multiplier: 1.00000
Trip:            225A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     5.0          (1125A)
-----------------------------------------------------------------------------------------
Device Name:     PDM SB1                                   TCC Name:        N14 to HCC.tcc
Bus Name:        SB1                                       Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                  Description:     LSI, 600-1600A
Sub Type:        PX, Micrologic
AIC Rating:      100kA Override:17                         Fault Duty:      44484.8A
Frame:           1600A 480V 1600A                          Curve Multiplier: 1.00000
Sensor:          1600A
Plug:            1600A
Setting: 1) LTPU (0.5-1.0 x P)     0.5          (800A)
         2) LTD (2-24 Sec.)        2.0
         3) STPU (2-8 x P)         2.0          (3200A)
         4) STD (0.1-0.5 Sec.)     .1          I^2 t In
         5) INST (2.5-8 x P)       2.5          (4000A)
```

Appendix B - Overcurrent Device Settings for Option 2

```
-----------------------------------------------------------------------------------------
Device Name:     Alt3-ATS13E                                TCC Name:        ALT-E3.tcc
Bus Name:        GHPBA                                      Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                   Description:     LSI, 250-1200A, UL
Sub Type:        Powerpact P-Frame, 5.0 & 5.0A/P/H
AIC Rating:      35kA                                       Fault Duty:      9861.5A
Frame:           PG 480V 1200A                              Curve Multiplier: 1.00000
Sensor:          800A
Plug:
Setting: 1) LTPU/LTD (A 0.4-1.0    0.8 (640A)  24
         2) STPU (1.5-10 x LTPU)   5            (3200A)
         3) STD (0-0.4)            0.1         I^2 t In
         4) INST (2-15 x S)        6            (4800A)
-----------------------------------------------------------------------------------------
Device Name:     ALT3-EHP3B                                 TCC Name:        ALT-E3.tcc
Bus Name:        EHPBB                                      Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                   Description:     125-400A
Sub Type:        LA
AIC Rating:      30kA                                       Fault Duty:      16651.0A
Frame:           LA 480V 400A                               Curve Multiplier: 1.00000
Trip:            400A
Setting: 1) Thermal Curve (Fixed
         2) INST (5-10 x Trip)     5.0          (2000A)
-----------------------------------------------------------------------------------------
Device Name:     ALT3-GHPBA                                 TCC Name:        ALT-E3.tcc
Bus Name:        Generator Dist                             Bus Voltage:     480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                   Description:     LSI, 250-1200A, UL
Sub Type:        Powerpact P-Frame, 5.0 & 5.0A/P/H
AIC Rating:      25kA                                       Fault Duty:      22959.5A
Frame:           PJ 600V 1200A                              Curve Multiplier: 1.00000
Sensor:          1200A
Plug:
Setting: 1) LTPU/LTD (A 0.4-1.0    0.7 (840A)  24
         2) STPU (1.5-10 x LTPU)   6            (5040A)
         3) STD (0-0.4)            0.3         I^2 t In
         4) INST (2-15 x S)        6            (7200A)
-----------------------------------------------------------------------------------------
Device Name:     BRCB-ELL3D                                 TCC Name:        ALT-E3.tcc
Bus Name:        ELL3D                                      Bus Voltage:     208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                   Description:     15-150A
Sub Type:        QO-VH, 3-Pole
AIC Rating:      22kA                                       Fault Duty:      5458.7A
Frame:           QO-VH 240V 100A                            Curve Multiplier: 1.00000
Trip:            100A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:     MB-ELL3D                                   TCC Name:        ALT-E3.tcc
Bus Name:        ELL3D                                      Bus Voltage:     208.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                   Description:     100-225A
Sub Type:        Q2H
AIC Rating:      22kA                                       Fault Duty:      5458.7A
Frame:           Q2H 240V 225A                              Curve Multiplier: 1.00000
Trip:            225A
Setting: 1) Fixed
```

```
-----------------------------------------------------------------------------------------
Device Name:     PD-ELL5A XF                                     TCC Name:         ALT-E3.tcc
Bus Name:        EHP5A                                           Bus Voltage:      480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                        Description:      15-125A
Sub Type:        ED
AIC Rating:      18kA                                            Fault Duty:       8363.6A
Frame:           ED 480V 125A                                    Curve Multiplier: 1.00000
Trip:            125A
Setting: 1) Fixed
-----------------------------------------------------------------------------------------
Device Name:     PD-GDP                                          TCC Name:         ALT-E3.tcc
Bus Name:        Paralleling SB                                  Bus Voltage:      480.0V
Function Name:   Phase
Manufacturer:    SQUARE D                                        Description:      LSI, 600-1600A
Sub Type:        PX, Micrologic
AIC Rating:      100kA Override:17                               Fault Duty:       24180.8A
Frame:           PX 480V 1600A                                   Curve Multiplier: 1.00000
Sensor:          1600A
Plug:            1600A
Setting: 1) LTPU (0.5-1.0 x P)     1.0          (1600A)
         2) LTD (2-24 Sec.)        24
         3) STPU (2-8 x P)         7.0          (11200A)
         4) STD (0.1-0.5 Sec.)     .5          I^2 t In
         5) INST (2.5-8 x P)       8.0          (12800A)
```