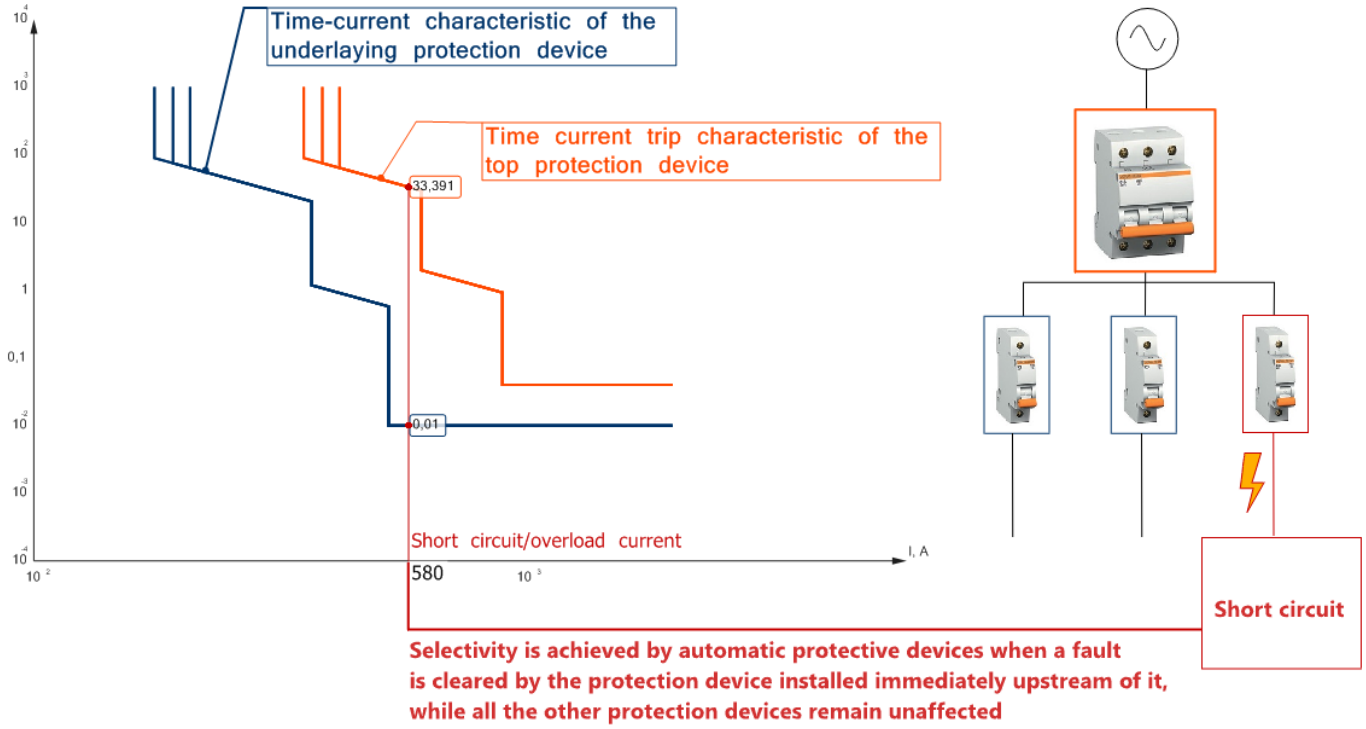
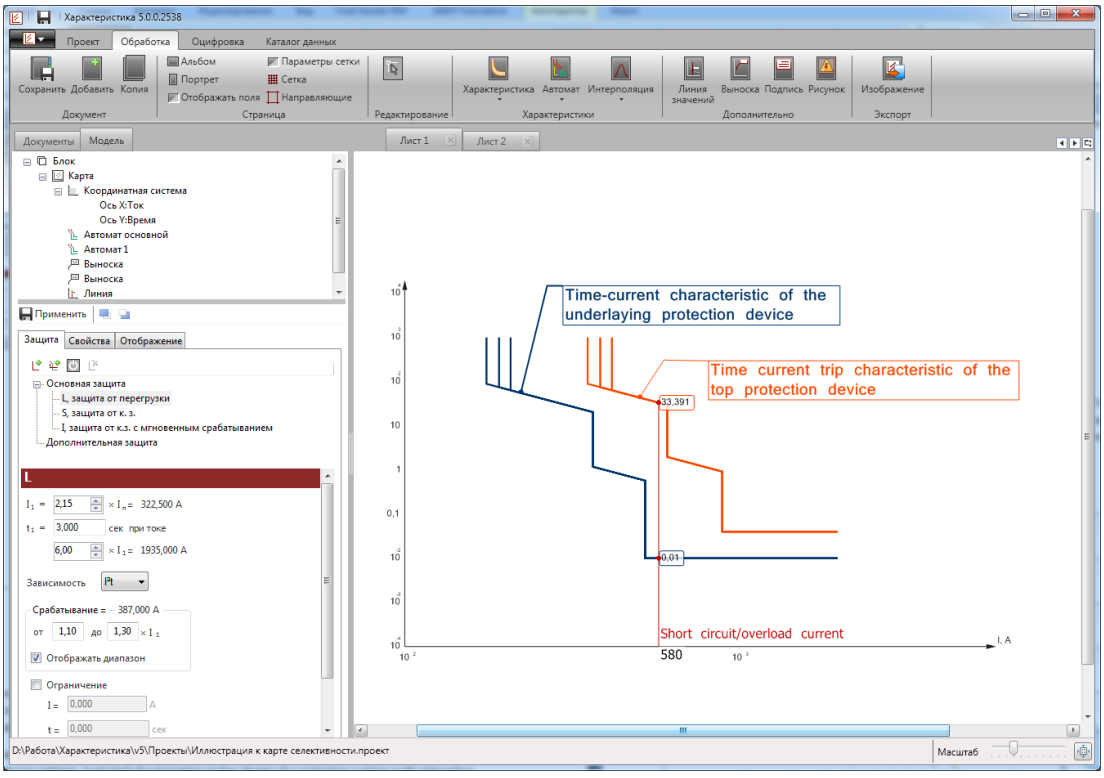
CHARACTERISTIC — ELECTRICAL POWER SYSTEM SELECTIVITY DESIGN SOFTWARE

Implemented as planar CAD system rather than a simple calculation program “Characteristic” unites automation of power supply protective system design tools together with rich visualization and document creation abilities. Because of that all selective tripping plan mappings created during design process could be later used to create paper documentation for power facility personnel.



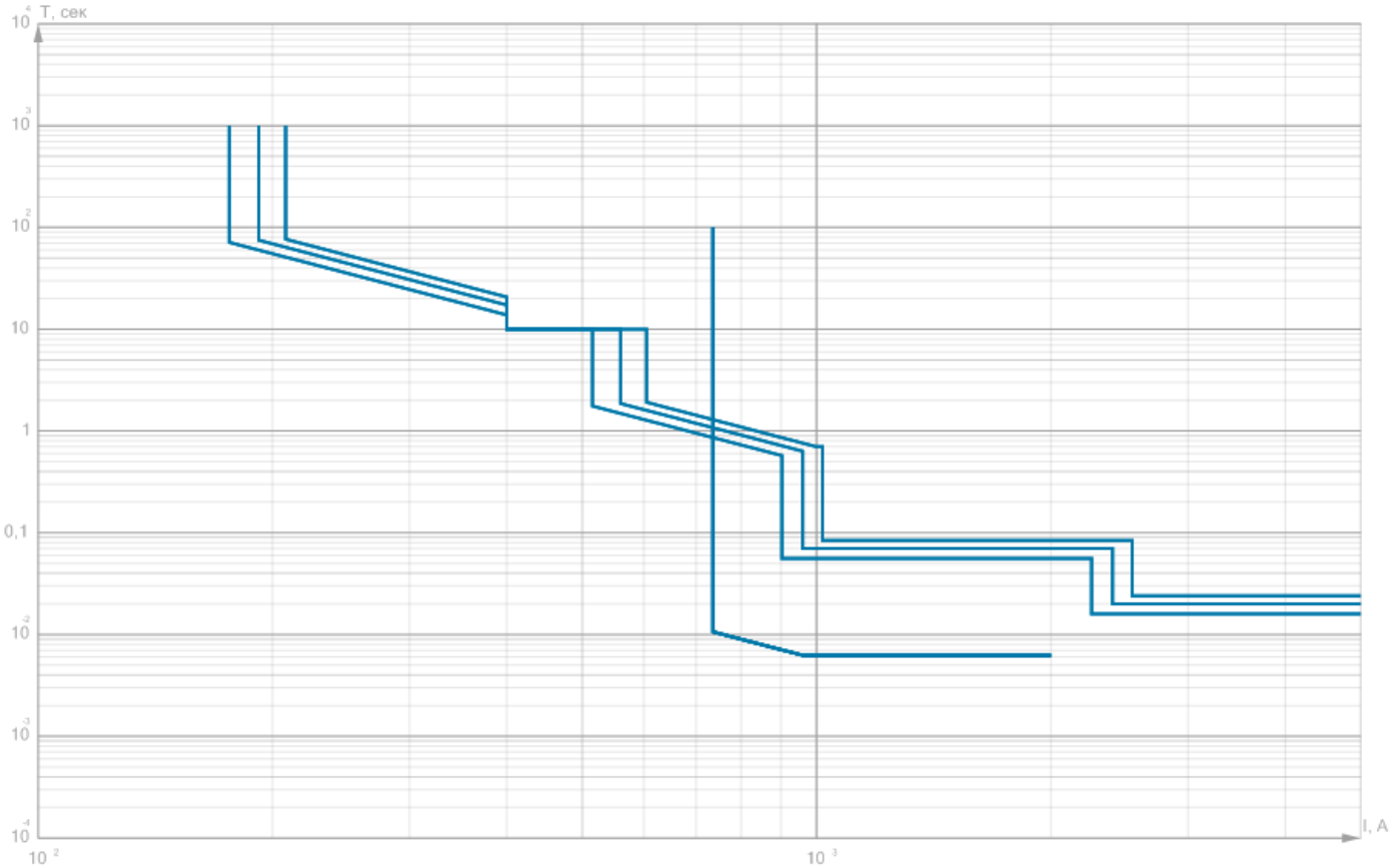
Software was designed in collaboration with engineering companies that has experience of direct and alternating current systems construction at power facilities. It was used during the process of reconstruction of several electro power stations, like 3800 MW Reftinskaya Heat Electro power Station or Novosibirsk Hydro Power Plant.



Program's key feature is ability to visually represent on a paper sheet drawing a single image of a several characteristics like trip characteristic of protection devices (fuse, overcurrent relay, circuit breaker) or a process (for example, starting current characteristic of an electric motor) and provide a set of *interactive* tools for editing and analysis of the time-current, current and time selectivity. That gives an engineer who design a power supply system a clear picture of the *selectivity* between selected devices. Rich visualization facilities together with additional tools for text labeling, callouts creation, document cloning and batch printing simplifies process of documents creation.

CIRCUIT BREAKERS

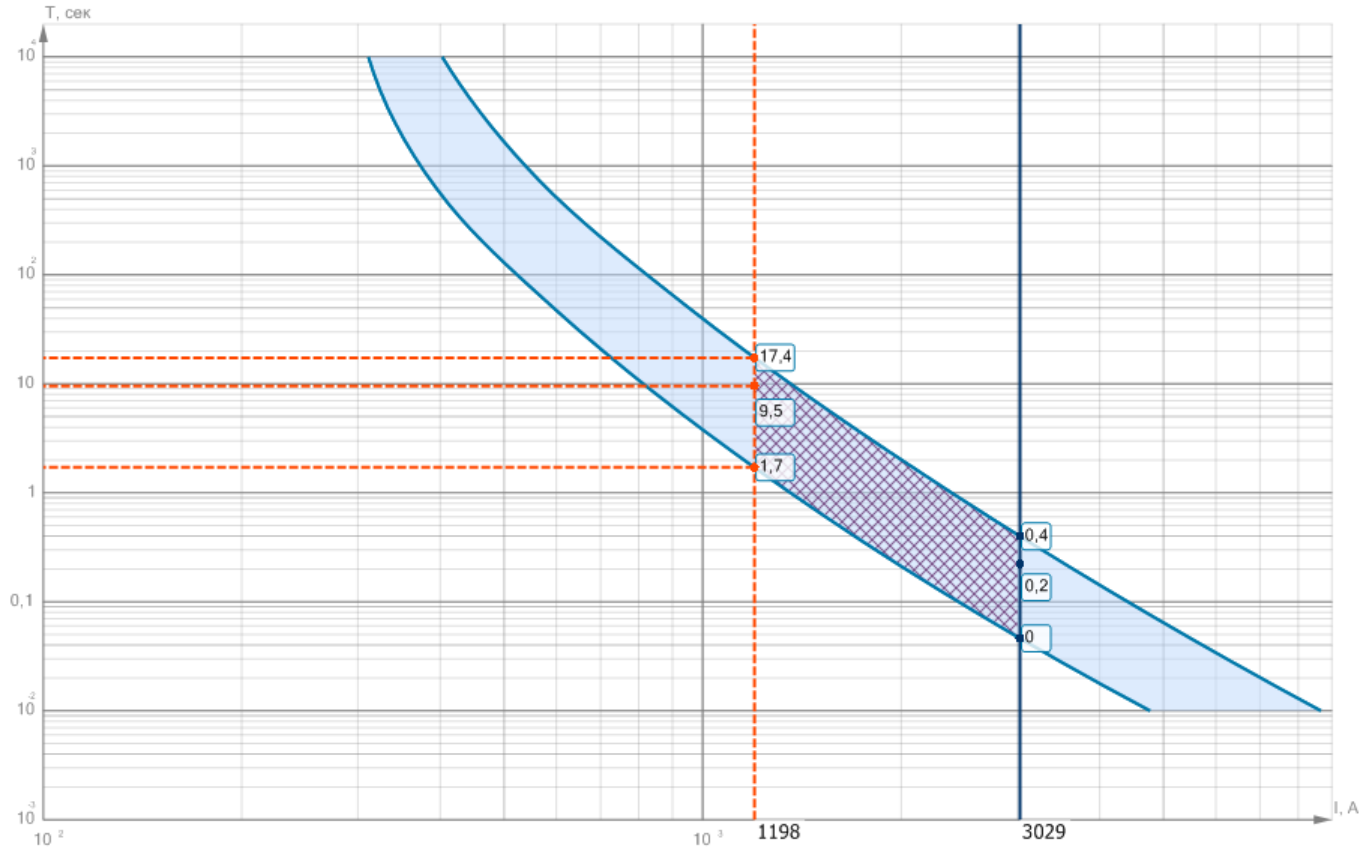
Software has built-in support for interactive visualization of circuit breakers trip characteristics with thermal, magnetic or electronic trip units with overload (L), short-circuit (S) or instantaneous (I) protections. It's possible to change any valuable parameter of device or trip unit like *nominal current,* or *trip threshold of thermal protection*. It's also possible to add or remove additional trip unit to a circuit breaker or temporary turn it off. All changes in device parameters applied immediately and curve automatically changes its form to conform to the new device settings. Such kind of automation makes design of a protection system really interactive.



Time-current characteristic of a circuit breaker with the L, S two I and single additional protection electronic trip units.

Custom characteristics

Besides characteristic of a circuit breakers, which form is controlled by set of parameters, it's also possible to work with characteristics of any kind by digitizing a graphical image or interpolating a set of points from a csv file. Once a curve is digitized it's stored in a database which forms a device catalogue. When a digitized curve is added to a selectivity mapping it's form is automatically recalculated to conform scale (linear or logarithmic) of the working coordinate system.



Visualization of a digitized time-current characteristic of a fuse with two "value lines".

Characteristic supports two types of digitization. The simplest one is digitization in absolute coordinates. In that case form of characteristic curve never changes. Second type is digitization in relative coordinates, when a curve value on a drawing represents relation of actual value to a certain device property. For example relation of the trip unit current to a circuit breaker nominal current which is very common case for circuit breakers with thermal trip unit. In that case once such a characteristic is added to a mapping it's possible to edit device property and curve form will be recalculated to conform new relationship.

Tools

Software provides a tool for interactive calculation of a function value at certain point by a simple mouse move and set of statistical functions: minimum, maximum and average values calculation, calculation of the integral and root-mean-square values. This allows to use that software not only for electrical power system design but in any process that needs analysis of functional data.

CONTACT INFORMATION

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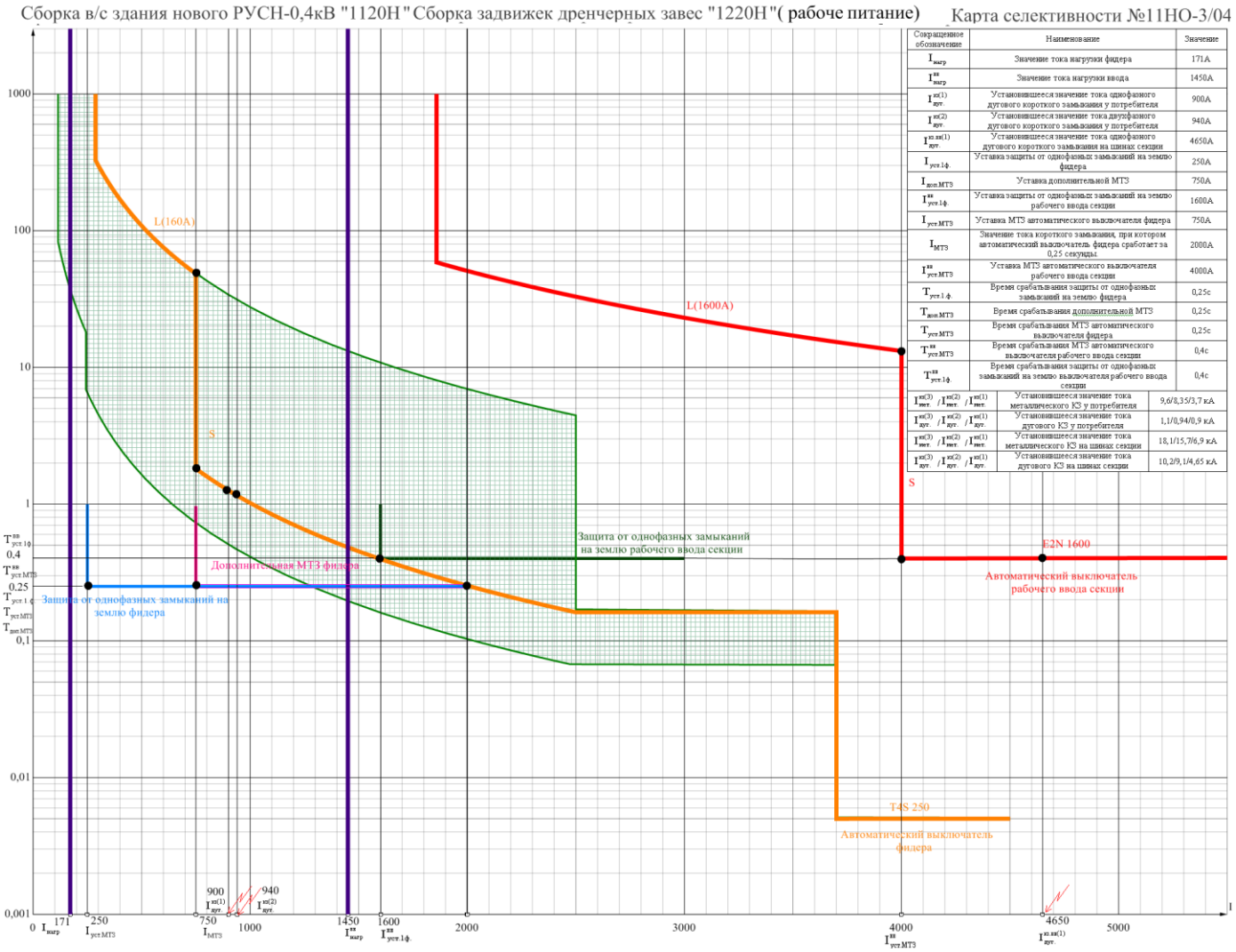
EXAMPLES

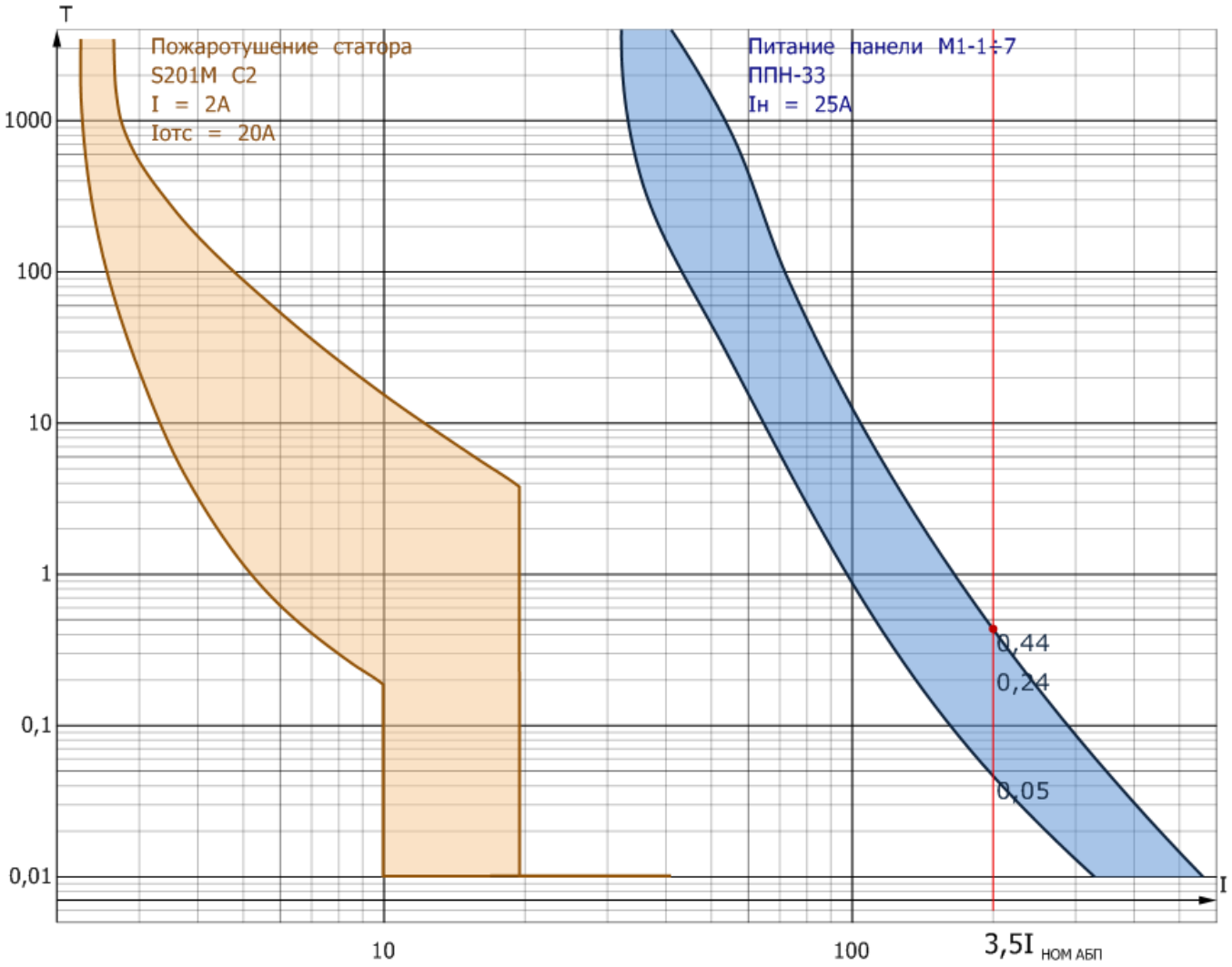
Selective tripping plan mapping, Reftinskaya Heat Electro power Station



Сокращенное обозначение	Наименование	Значение
$I_{нагр}$	Значение тока нагрузки фидера	171А
$I^{вв}_{нагр}$	Значение тока нагрузки ввода	1450А
$I^{кз(1)}_{дуг.}$	Установившееся значение тока однофазного дугового короткого замыкания у потребителя	900А
$I^{кз(2)}_{дуг.}$	Установившееся значение тока двухфазного дугового короткого замыкания у потребителя	940А
$I^{в.кз(1)}_{дуг.}$	Установившееся значение тока однофазного дугового короткого замыкания на шинах секции	4650А
$I_{уст.1ф.}$	Уставка защиты от однофазных замыканий на землю фидера	250А
$I_{доп.МТЗ}$	Уставка дополнительной МТЗ	750А
$I^{вв}_{уст.1ф.}$	Уставка защиты от однофазных замыканий на землю рабочего ввода секции	1600А
$I_{уст.МТЗ}$	Уставка МТЗ автоматического выключателя фидера	750А
$I_{МТЗ}$	Значение тока короткого замыкания, при котором автоматический выключатель фидера сработает за 0,25 секунды	2000А
$I^{вв}_{уст.МТЗ}$	Уставка МТЗ автоматического выключателя рабочего ввода секции	4000А
$T_{уст.1ф.}$	Время срабатывания защиты от однофазных замыканий на землю фидера	0,25с
$T_{доп.МТЗ}$	Время срабатывания дополнительной МТЗ	0,25с
$T_{уст.МТЗ}$	Время срабатывания МТЗ автоматического выключателя фидера	0,25с
$T^{вв}_{уст.МТЗ}$	Время срабатывания МТЗ автоматического выключателя рабочего ввода секции	0,4с
$T^{вв}_{уст.1ф.}$	Время срабатывания защиты от однофазных замыканий на землю выключателя рабочего ввода секции	0,4с
$I^{кз(3)}_{мет.}$ /$I^{кз(2)}_{мет.}$ /$I^{кз(1)}_{мет.}$	Установившееся значение тока металлического КЗ у потребителя	9,6/8,35/3,7 кА
$I^{кз(3)}_{дуг.}$ /$I^{кз(2)}_{дуг.}$ /$I^{кз(1)}_{дуг.}$	Установившееся значение тока дугового КЗ у потребителя	1,1/0,94/0,9 кА
$I^{кз(3)}_{мет.}$ /$I^{кз(2)}_{мет.}$ /$I^{кз(1)}_{мет.}$	Установившееся значение тока металлического КЗ на шинах секции	18,1/15,7/6,9 кА
$I^{кз(3)}_{дуг.}$ /$I^{кз(2)}_{дуг.}$ /$I^{кз(1)}_{дуг.}$	Установившееся значение тока дугового КЗ на шинах секции	10,2/9,1/4,65 кА

Selective tripping plan mapping, Novosibirsk Hydro Power Plant

Circuit breaker with thermomagnetic trip unit and fuse



Selective tripping plan mapping, Naberezhno-Chelninskaya Heat Electro power Station

Circuit breaker with thermomagnetic trip unit, starting current characteristic of an electric motor