Be more successful in exports to North America – With the use of properly certified equipment

M007B

U_e / U_e	220 230	240	380 400	415	440	500	660 690	V~ V~
AC-3	7	7	7	7	7	5	4	A
AC-3	2.2	2.2	3	4	4.5	3.5	3.5	kW
AC-4	5	5	5	5	5	4.5	4	A

N4246 GB 14048.4

AC-1 $I_e = I_{th}$ 20 A U_{imp} 8000 V IEC/EN 60947-4-1

AUX. CONT A600 P300
3 POLE BREAK 250V DC
MAX 20 A OPEN

120	240	VDC
125	250	VDC
1/4	1	HP

340B LISTED
165628
Elevator Duty

3 PH 600V AC MAX 20A OPEN

AC	115 120	200 208	230 240	460 480	575 600	V V
3 PH	—	1 1/2	2	3	5	HP
1 PH	1/4	3/4	1	—	—	HP
3 PH	—	3/4	1 1/2	2	3	HP

SCCR	kA	max. Fuse	kA	max. CB
BASIC RATING	5	45 A	5	35 A
480V HIGH FAULT	100	20 A Class J	—	Fuses only
600V HIGH FAULT	30	25 A	—	Fuses only

CU 75°C WIRE TIGHTENING TORQUE 1.2 Nm / 10.6 lb.in.
AWG 18 AWG 10 FOR SINGLE AWG 18 AWG 14 FOR DOUBLE
FOR AUX. CONT. TIGHTENING TORQUE 1.2 Nm / 10.6 lb.in.
AWG 18 AWG 14 FOR SINGLE AWG 18 AWG 14 FOR DOUBLE

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53105 Bonn, Germany

Technical Paper

Dipl.-Ing. Wolfgang Esser

Powering Business Worldwide

Be more successful in exports to North America

– With the use of properly certified and marked equipment

Modern international users of electrical equipment have been increasingly tolerant in recent years of North America based textual component markings provided exclusively in English.

In the same vein, however, those who may or may not be conversant enough in English may perhaps be wondering if they are missing out on critical safety related information provided on the product. It's also hard to imagine, in English speaking countries other than North America, that each and every individual involved in technical issues would fully grasp or understand the true meaning behind the often condensed versions of markings appearing on products. Much of the information is, after all, valid only for applications in North America, and would be considered largely irrelevant in countries beyond those borders, such as the UK or Australia.

Is all of the information even really necessary? The answer to that is clearly **„yes"**. For this reason, some key explanatory information relative to these markings has been provided in this paper. World-market rated electrical components are an important economical commodity these days, and a main staple of all industrial segments involved in the export of electrical equipment to North America.

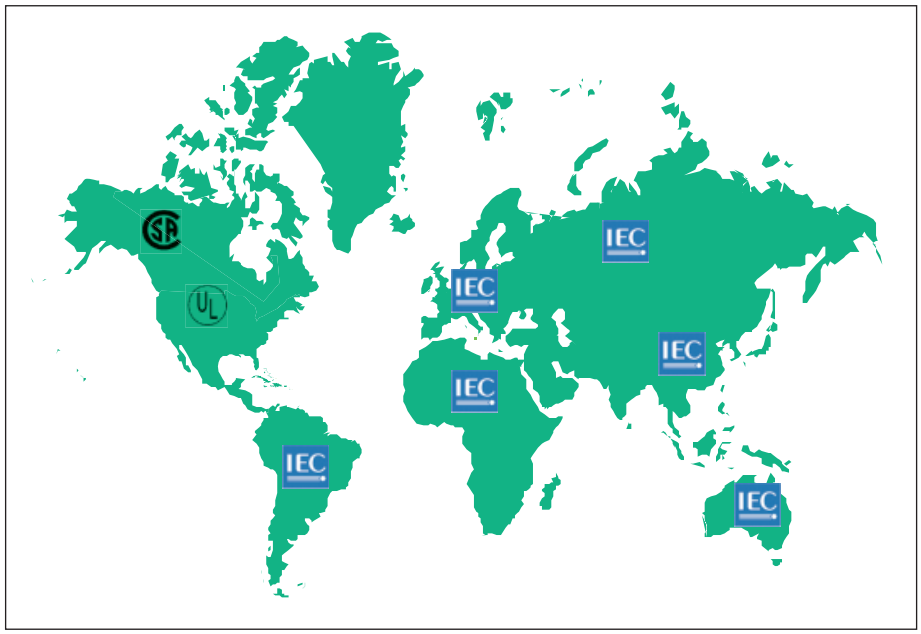


Figure 1: Globally, the great majority of electrical components and assemblies conform to IEC standards. In the US and Canada, the UL and CSA standards help to insure compliance with the NEC and CEC, which are the relevant installation standards in that region.

Electrical Standards – not quite yet truly universal

We have witnessed in the last 30 years many different segments of society coming closer together through economical, cultural and military communities and partnerships. This rapprochement has also been positively felt in the area of electrical standards through the harmonization process. Indeed, harmonization efforts in the electrical industry have greatly enhanced the economical livelihood of many countries involved in the import and export of electrical components and engineered assemblies throughout the world. Many national standards existed only in the background. In Europe, apart from small groupings of very specific national norms, these standards operated in the shadows of European based standards and European Community Directives. The European norms (European EN-Standards) and the international norms (IEC standards) have become nearly fully harmonized in the area of product standards as well as installation codes. The contents of IEC standards are being applied in many industrialized countries world-wide, or the standards themselves have been adopted outright. Unfortunately, that is not the case for North America, still one of the most important markets for global exporters. The newly created series of UL 60947 standards does share a similar sounding name to the established IEC / EN 60 947 family of standards, and thus gives hope that truly meaningful harmonization in this respect will be forthcoming. This unification process would also be of great benefit to North American customers, who have been displaying a much greater interest in products provided with IEC electrical ratings and bearing the European CE mark. IEC based products, which are typically more streamlined dimensionally, are also contributing by design to a more fast paced adoption of a global standard.

Currently, North America represents a second major reservoir of influence in the domain of global standards, inasmuch as many of its core requirements still differ from traditional IEC standards. The US and Canada even possess their own set of standards which, although they are in many respects harmonized, or at least very similar, are not always identical when it comes to the fine print. An additional difference, which has many practical ramifications, can be seen in the varying distribution voltage levels which have been adopted in each country. In the US, the NEC[1] [1] and the UL-Standards[2] form the basis of essential requirements which must be adhered to, whereas in Canada the comparative standards consist of the CEC[3] and the CSA-standards[4]. **Figure 1** shows a map of relevant electro-technical standards which dominate the globe today.

[1] NEC = National Electrical Code
[2] UL = Underwriter's Laboratories (http://www.ul.com)
[3] CEC = Canadian Electrical Code
[4] CSA = Canadian Standards Association (http://www.csa.ca)

The world map from **Figure 1** represents at the same time a key to understanding the necessity of the numerous textual markings found on components, many of which are rooted in the requirements of the UL and CSA standards. These individual markings, which will be expanded upon later in this paper, are absolutely essential for both the export of products to the US and Canada and their application in each country. Separate IEC and North American product ranges, which were previously the norm, are now purposely avoided wherever possible at the insistence of export minded customers, such as those involved in machinery and panel building for global industrial markets.

Fulfilling all the requirements needed for global conformity with standards does afford the assembler or end-user of world market devices a much greater measure of safety and dependability, even when the product is only applied regionally and thus not necessarily in need of universal compliance. That can be readily substantiated when one takes into account the higher demands placed on the quality of plastics and materials used in production, the emphasis on proper creepage and clearance distances during design stages, the greater suitability for a wider range of temperature differences in applications, as well as a more broadly encompassing scope of environmental protection levels.

How is it that proven performance world-wide is still not sufficient in North America?

The question is often asked but is difficult for non-North Americans to answer. Fact is, millions of electrical components, such as the European style manual motor protector, have been installed worldwide and have proven themselves many times over in terms of function and reliability. Yet, they still cannot be applied in North America to the same degree of performance capability. One of the main reasons for this lies in the manner in which industrial switching and protective devices are evaluated in North America based on their application as Industrial Control (UL 508/ UL 60947) and/or Energy Distribution equipment (such as molded case circuit breakers per UL 489). The Canadian based CSA standards also view this differentiation in identical fashion. The IEC standards do not recognize such a difference. [2]. Each of these product groupings place differing levels of emphasis on critical design aspects, such as creepage and clearance distances for example.

From a historical point of view, many of the predominant North American electrical safety standards originated from the efforts of fire insurance underwriters in the early part of the last century and today, fire protection still holds a prominent position in guiding the formulation of standards. Many North Americans still consider typical european power switching and protective gear to be frightfully compact, and tend to take a dim view of the propensity of European based control panels, however performance proven, to be so tightly laid out as to hardly leave any room to spare. There is a prevalent thought amongst exporting countries too that regional manufacturers of NEMA[5] based equipment in North America, whose equipment historically tends to be physically larger in size, do enjoy some favoritism there locally when it comes to product selection and viewpoints.

Tradition and broad experience

The tradition of the Moeller series products from Eaton with regards to switchgear for the North American market is very rich, successful, and very well known amongst exporters and certification agencies alike. Customers, as well as North American producers who wish to purchase IEC based products, value the broad experience of Eaton in the areas of design, manufacture and application oriented technical support. Thus the commitment from Eaton's side to prepare, certify, and mark accordingly, its latest generation of products for the North American market including *NZM* molded case circuit breakers and *NS* molded case switches, as well as trend-setting new developments in technology featuring System *xStart* motor starters and components. European style products that have been optimized with great effort to conform to the demanding requirements of the North American market.

Certification requirements in North America

In the US, the government based agency OSHA[6] and the NEC mandate that electrical components and assemblies be approved by local jurisdictions which in turn rely on nationally recognized agencies (NRTL)[7] for product certifications to US requirements, like for example, UL listings. Similarly in Canada, all electrical apparatus falling under the CEC must be by law certified in accordance with Canadian requirements. This usually involves full compliance with CSA standards.

The approval process in North America is thus associated with the use of third party certification marks issued by recognized agencies and testing laboratories. Listed or certified equipment must be identified with the appropriate agency mark and provided accordingly with corresponding electrical ratings. **(Table 1)**. In the US and Canada, product listings and certifications are now mostly accessible from certification agency internet sites. The link to UL's on-line data resources base is: *http://www.ul.com/usa/eng/pages/*. CSA's is: *http://directories.csa-international.org/*. Certification related information on Eaton Moeller equipment is located at: *http://www.moeller.net/eaton-approbationen/en/*.

As a consequence of the NAFTA-Trade relations agreement[8] it became possible for manufacturers to pursue certification with either UL or CSA which would cover both sets of requirements. Accordingly, these products bear a special marking, which in theory provides an equal basis for approval in both countries by local authorities. However, Eaton Moeller seldom makes use of this option in view of the fact that local jurisdictions and end-users can be at times somewhat reluctant to abide by new agreements and tend to prefer and insist on certification marks with which they are familiar.

Two product strategies have emerged for Eaton from the oligatory certification process:

- If it's possible to incorporate, into a uniform design concept, both UL and CSA certification requirements with those of international countries, the end product will be offered as a World Market device, and it will feature all the necessary certification marks and appropriate electrical ratings to make it universally compliant in all major world markets. (Examples include IEC devices with North American certification marks and ratings, such as motor contactors, overload relays, motor protectors and control circuit devices).

- If, on the other hand, North American requirements are substantially different from those of international countries, and/or when regulatory agencies mandate that certain products undergo periodic follow-up testing as a function of

[5] NEMA = National Electrical Manufacturers Association, www.NEMA.org

[6] OSHA = Occupational Safety and Health Administration (http://www.osha.gov)

[7] NRTL = Nationally Recognized Testing Laboratories

[8] NFTA = North American Free Trade Agreement

Listed Industrial Control Equipment **No restrictions in terms of application**	*Component Recognized Industrial Control Equipment* **Application based on Conditions of Acceptability**
• Devices listed for „*field wiring*" • „*factory wiring*" is covered by „*field wiring*" provisions - Listed devices are suitable for industrial control panels when used per the guidelines of the industrial control panel standard (UL 508A). - Listed devices are not subject to additional conditions of acceptability.	• As components, products are suitable for „*factory wiring*" only. - Component selection is conducted by trained personnel and subject to Conditions of Acceptability - For use in control panels; designed, wired and tested by technically trained personnel in certified factories and panel shops.
Certification Mark:	Certification Mark:

Table 1: In the US, industrial control equipment falling under UL 508 can be categorized as *„Listed Industrial Control Equipment "* and *„Recognized Component Industrial Control Equipment"*. A comparable differentiation can also be found in Canadian standards, although their approach is perhaps not as evident and as clearly delineated.

size and production volumes, there normally arises a practical and economical necessity to establish 2 or more separate product lines (e.g. molded case circuit breakers) to accommodate global market needs. These alternative product lines usually undergo some modifications in order to comply with North American certification requirements and are assigned „*-NA*" oder „*-CNA*" part number suffixes to differentiate them from IEC equivalent lines. Eaton also verifies, where applicable, the conformity of such products with the corresponding IEC standard, and is thus able to mark them with international, IEC based ratings. They also bear the CE mark, which is vitally important in Europe for trade reasons, as well as any additional certification marks other countries deemed necessary for market reasons. These products can be, therefore, universally applied.

In the US, as highlighted in **Table 1** for industrial control equipment, there is a differentiation made between *„Listed Equipment"* and *„Component Recognized Equipment"*, which directly impacts the manner in which evaluated components can be installed and used per the intent of UL's safety standards. The use of specific and separate marks denotes each category.

Placement of markings

Information on to the placement of equipment markings can be found both in North American and IEC product relevant standards. Users usually prefer to find as many details as possible on the front side of the product, so that the information can be readily seen when the component is installed in its final assembly. However, there is already so much in the way of required markings that it becomes impossible to place them all where they can be visible at all times. Fortunately, a portion of the necessary information can appear on installation instructions or stuffer sheets supplied with the product. Eaton is especially adept at producing multi-lingual product documentation with precise drawings and pictorial representations. This type of product literature should be an integral part of the engineered system or panel builder's required documentation set so that it can be available at all times to the end-user for reference.

Device part numbers, manufacturer information and file numbers from test agencies readily provide a clear identification and confirmation of certification related criteria. It's also worth noting that, in many cases, combinations of various components into an end-product assembly will be issued their own certification report. Occasionally, as will be described later, combinations of components (e.g. UL 508 Type F combination motor controllers[2]) or component accessories (e.g. field installable terminations for molded case circuit breakers) must be marked directly onto the component. The large quantity of information which must be displayed often requires text letters to be sized at the utmost minimum allowed, which sometimes raises legibility issues amongst users.

The unknown inspector

The scope involved in planning any engineered assembly for installation in North America is truly more comprehensive. There's much more to it than simply selecting suitably certified equipment. The designer's task is multi-faceted:

- The need to properly select all power switching and protective equipment, and:
- to combine them per local requirements and market conventions.
- If fuses are involved, then typical North American style fusing practices must be observed. (Securement of spare parts must be planned in accordance).
- He must select operating handles for switches which are both conventional in North America and, depending on the application, incorporate all the special door interlocking features to make them compliant with the local relevant standards.
- All necessary sizing of components and layout spaces must be done in accordance with North American requirements and practices.
- He must consider the type of application involved, and make sure that any special considerations associated to the end use is taken into account. [3, 4].
- All doubts or concerns in the project design phase must be duly raised with the end-user and/or the approval authorities so that agreement between all vital parties can be reached.
- The wiring diagrams and documentation must naturally be made available in English. For exports to Canada, there may be a further need to clarify up front a requirement for French language documentation

What is generally not known in the IEC world is the required North American practice of having the complete electrical installation be subject to evaluation and approval by local electrical inspectors, before the process of start-up and official release to the end-user can be finalized.

The North American inspectors (AHJ[9]) are arms of the local governmental jurisdictions and are responsible for evaluating and ultimately approving all electrical installations based on the requirements of the locally adopted electrical codes. The inspector's role is more of an investigator, observer, prosecutor, judge and enforcer all wrapped into one. His decision alone is relevant towards the final determination and outcome. An inspector's approval is a pre-requisite for the supply of electricity from utilities to flow, and for insurance related matters to be fully resolved. The combination of a less than complete understanding of North

[9] AHJ = Authorities Having Jurisdiction

American requirements on the part of the European exporter, and the uncertainty of a local inspector with evaluation of foreign equipment, can often lead to unfortunate misunderstandings and unavoidable delays in the commissioning of newly installed electrical assemblies. This is especially the case when the type of products installed cannot be readily identified, or when application related ratings are neither apparent nor conclusive. Optimally marked components along with appropriate product documentation go a long way towards preventing these problems.

In addition to fulfilling the requirements of the electrical codes (NEC and CEC), the approval of components and assemblies will largely be based on their compliance with testing conducted by nationally recognized testing agencies (NRTL), like UL for example. The inspectors place a high value on the availability of UL listed components and assemblies for their approval, if only because it greatly alleviates the tremendous burden of responsibility imposed upon them in their difficult task. A successful UL evaluation directly at the installation site would, for example, greatly contribute to a smoothly running inspection and commissioning process in North America. The situation as it is presented here for the US is very similarly mirrored in Canada.

The inspectors represent both a looming and somewhat unpredictable variable during the approval process of a machine or assembly. What is deemed acceptable in borderline cases can vary from region to region. There are many municipalities with their own form of adopted installation codes and deviations (e.g. City Codes) and certainly, a fair amount of discretionary judgment on the part of the inspector will always be part of the equation. Maybe It could also be the case that products perceived to be foreign will occasionally and unavoidably be given a more critical eye. From that point of view, there will always remain an element of risk and doubt when approval inspections are conducted.

Besides the testing agency marks displayed on products, the inspectors will want to insure that components are being applied within their allowable technical ratings. Engineered assemblies, such as industrial control panels, will be evaluated to make sure their overall layout is in conformity with the acceptable requirements outlined in nationally recognized standards such as UL 508A and NFPA 79 [3, 4].

Thus, it can't be emphasized enough for exporters to take the smart routeand opt for compliance with North American requirements in order to avoid the needless unpleasant consequences of a failed inspection process. Evidence of conformity with IEC standards may not necessarily translate positively and could even harm overall chances of a successful resolution. Common sources of problems can often be traced to the application of products beyond the scope of their certification and stated electrical ratings. Comprehensive Eaton Moeller information such as this technical paper, can greatly help minimize mistakes in the planning and engineering phases of a project.

Examples of markings for motor protectors and starters

PKZM 0 manual motor protectors each feature a rating label on both the right and left sides of their switch housing. To expand their qualification in North American installations, the devices have been certified for group installations per the electrical codes *(Group Protection)*, and have been additionally evaluated as *Tap Conductor Protectors*. These concepts are thoroughly presented in a technical paper [2] . The tapped conductor concept allows the omission of an overcurrent protective device for certain defined lengths of conductors under specifically described installation conditions.

Sweeping changes in the NEC 2005, and subsequently incorporated into UL 508A [3] in 2006, introduced the requirement to establish short circuit current ratings (SCCR) for all industrial control panels and provide this information as part of the panel's overall required nameplate rating data. The short circuit ratings appearing on the rating labels of each power circuit component is used as a basis to determine the overall rating of the panel into which the components are installed. **Figure 3** shows these values for the manual motor protector both as a stand alone device, and in combination with specific motor contactor types. The optimal results are only possible, of course, when one combines motor protectors and contactors from the same manufacturer, where it is most likely that the combination was properly approved and tested.

Installation and maintenance instructions

In addition to comprehensive marking requirements for the components themselves, it's crucial for a manufacturer to keep export related issues in mind when creating instructional documentation to be packaged with the product. Eaton's fundamental approach is to keep text content in such instruction sheets as minimal as possible, partly because, as a global Company, Eaton's products are exported to a number of international countries, each with their own native language, and crowding the instructions with so much varied text would detract from the clarity of the presentation. North Americans, on the other hand, tend to prefer a much more textu-

Marking examples for motor contactors

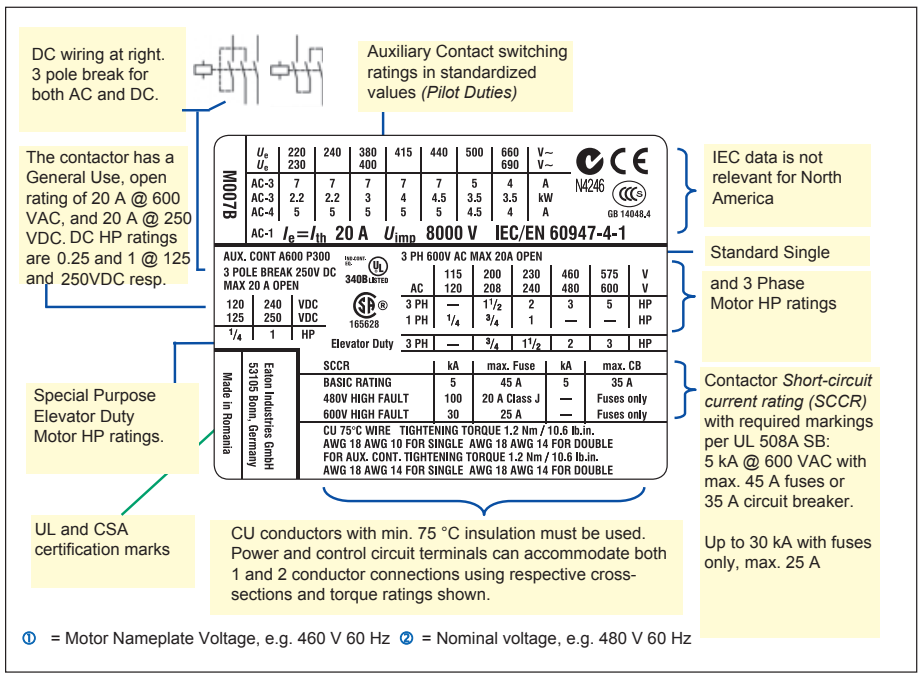
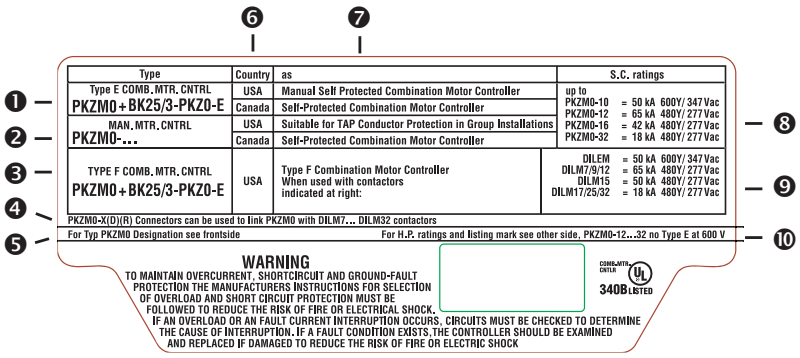


Figure 2: Example of a motor contactor rating label from the Eaton Moeller product line xStart.

ally rich presentation in their documentation versus a predominantly pictorial one, so Eaton strives in its approach to reach the best compromise for both markets. Just like the markings found on the product, the installation instructions can also include information which is critically vital to the proper application of the component per North American requirements. Such textual details particular to North America need to be taken into consideration whenever the product is exported to that market.

Whereas assorted barriers and cover accessories for circuit breakers in the IEC world are used primarily as a means to provide finger and back-of-hand shock hazard protection for personnel, similar parts may take on additional functions in North American versions of the product, for example as a way of establishing necessary creepage and clearance distances. In recent years, the certification process for modern, modularly designed switching and protective devices has grown more difficult and wide ranging. In earlier times, products were more or less installed unchanged in form and shape to the manner in which they had been manufactured. Today's modular building block approach in design provides many logistical advantages, provided of course that the customer is able to take advantage of it by being allowed to perform some light assembly of parts in the field. In this manner he doesn't need to stock his shelves so much with complete versions, and can thereby save himself some capital with reduced inventory requirements. Internationally, a modular design approach versus one that is more rigid in concept should also have a positive impact on availability of parts, or greatly reduce delivery times. That is certainly valid for the North American market. But it also means in return, from a North American perspective, that the user's responsibility for insuring the correctness and permissibility of any necessary field modification is somewhat greater. Eaton does invest a lot of time and effort in making sure that all combination possibilities are easily understandable, are allowed under the product's certification scope, and are presented in the clearest fashion possible in order to make such modifications a safe and reliable process.



Contents under ❻ and ❼ are country specific:

❶ Manual *UL 508 Type E*- Self-Protected Motor Controller, consisting of a PKZM0 manual motor controller and a feeder terminal block *BK25/3-PKZ0-E*

❷ *PKZM0* is additionally evaluated in the US as a tap conductor protector in motor group installations. (special TCP-Approval* is not officially recognized in Canada.)

❸ Electro-magnetically operable *UL 508 Type F*- Combination Motor Controllers are made up of manual *UL 508 Type E*- Self-Protected Motor Controllers and magnetic contactors shown under ❾.

❹ indicates suitability of special plug-in wiring hardware for direct-on-line non-reversing and reversing motor starters.

❺ Refer to markings on front side of the device to determine exact Type reference of the PKZM0 manual starter.

❽ Assigned component Short Circuit Current Ratings (*SCCR*) corresponding to ampere rating of Manual Motor Controller.

❾ Assigned Short Circuit Current Ratings (*SCCR*) corresponding to combinations with magnetic contactors.

❿ Note referring to location of device HP ratings and approval marks on the rating

Figure 3: Explanations of the information appearing on the right side rating label of the PKZM 0 manual motor protector.

Catalog data

It is important for North American applications to select equipment based on the manufacturer's published catalog data of certified ratings for the market. Generally speaking, IEC rating information alone has very little validity in the North American market place. The North American ratings are very often lower than corresponding IEC values, and in some cases, references to North American ratings, such as environmental protection types, e.g. UL/CSA Type 4X, are the only ones mandated by the local electrical codes. The paper describes [2] how individual components are sometimes subject to differing application and selection criteria. What is meant by that is, for example, the need to differentiate between equipment primarily designed for energy distribution (e.g. molded case circuit breakers per UL 489 [5] or industrial control equipment, falling under UL 508 [6]. In addition, specific use standards such as UL 508A [3] or NFPA 79 [4] often become the relevant documents in any given application, and their requirements must be followed at all times. Lastly, it is worth keeping in mind that a good technical grasp of IEC or EN-based conventions and requirements may not necessarily prove useful in a North American environment.

Summary:

The paper describes the necessity for manufacturers to provide additional markings on products, catalogs and instruction sheets in order to fully comply with North American standards and market conventions. North America's particularly strong liability laws play an additional role in the need to make this type of documentation readily available. In other international countries where English is spoken the meaning of the markings often remains largely unknown, and thus without any practical significance. The paper may even be more beneficial to North American users and buyers in this respect.

The use of precise and comprehensive markings on products and instruction sheets and leaflets enable compliance with testing agency requirements, local inspector demands, and conformity with typical market conventions. The combination of these factors greatly simplifies for our Eaton clients the export of their equipment to North America.

Examples of markings for molded case switches and breakers

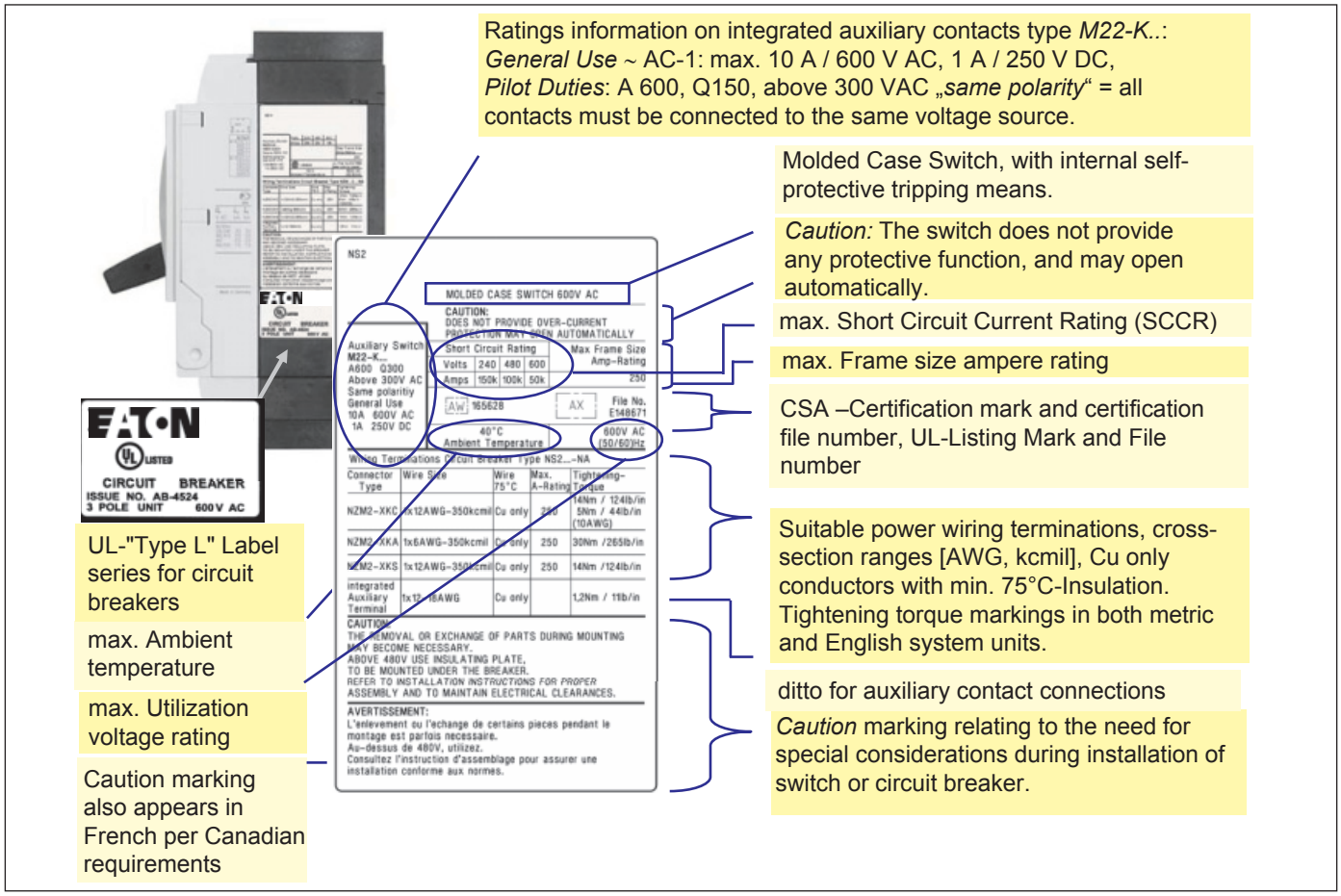


Figure 4: Explanation of a North American rating label for a molded case switch (Eaton Type NS 2) (A molded case circuit breaker of the same frame size, type *NZM 2,* appears in the background.)

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Download: ID-Quicklink:
928de at www.moeller.net

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Download: ID-Quicklink:
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