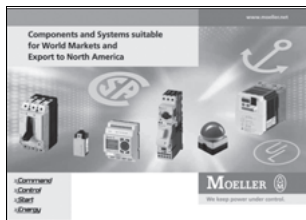


Export to the world market and to North America

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Export to the world market and to North America

Approvals and certificates



Approvals for switching and protective devices or for power distribution systems are national, regional or application-specific approvals for the use of these products.

- Additional tests by independent and nationally approved test bodies are often required and some approvals require the regular production monitoring by the approval authority.
- Approvals often require mandatory marking on the approved products.
- Some approvals require the modification of the permissible technical data of the approved products.
- At present, application restrictions apply to the approved products.
- The flexibility of the manufacturer is restricted by the fact that each product modification has to be approved.

Further information is provided in the Main Catalogue for Industrial Switchgear, in the chapter "Approvals for the World Market".

www.moeller.net/en/support/pdf_katalog.jsp

Approved products on their own are not always enough for successful exporting.

A good knowledge of the relevant standards and the special characteristics of the market for the application must be taken into account in addition to the approved products themselves.

A check list may help to clarify important questions and take them into account at the quotation stage. After a system is completed, any special requirements that were not taken into account in the engineering stage may require a high level of cost and time for their implementation.

Special characteristics for the export to North America (USA, Canada)

What has become well-established worldwide is not necessarily also acceptable in North America. The following should be taken into account for exports to North America:

- North American approvals,
- North American product and installation standards,
- Special market practices,
- Approval by local inspectors (AHJ = Authority Having Jurisdiction).

North American practices unknown in the IEC world:

- Device types and main applications,
- Product-specific differences in the scope of the approval,
- Different main circuits (feeder circuits, branch circuits),
- Restrictions according to network types,
- Application-related differences in device selection.

Export to the world market and to North America

Approvals and certificates

Device types in North America

In North America a distinction is made between devices for energy distribution, such as in compliance with UL 489 and industrial switchgear in compliance with UL 508.

UL 489 and CSA-C22.2 No. 5-02 stipulate larger clearance and creepage distances than the IEC standards and the relevant harmonised European standards.

This affects, for example, the European motor-protective circuit breaker, which now has additional terminals on the incoming side to provide the required clearance and creepage distances.

Distribution Equipment

- Circuit breakers
UL 489, CSA-C22.2 No. 5-02
- Disconnectors
UL 489, CSA-C22.2 No. 5-02
- Switch-disconnectors
UL 98, CSA-C22.2 No. 4
- Fuse switch-disconnectors
UL 98, CSA-C22.2 No. 4
- Fuses
UL 248, CSA-C22.2 No. 248

Industrial control equipment

UL 508 and CSA-C22.2 No. 14

- Contactors
- Contactor relays
- Overload relays
- Rotary switches
- Control circuit devices, position switches
- Electronic devices/systems
- User-programmable controllers

Examples of special device selection for North America

- The type of load that a circuit has is important for selecting the correct switching and protective devices.
Motor starters must only switch and protect motors.
- Motor starters on busbar adapters in the feeder circuit only with large clearance and creepage distances¹⁾.
- Small clearance and creepage distances are sufficient for motor starters on busbar adapters in the branch circuit¹⁾.
- Additional handles required for door coupling rotary handles used in North America.

¹⁾ Example circuit → figure, page 9-34

Comprehensive information and tips on the export of low-voltage switchgear and systems to North America can be downloaded free of charge from the Internet.

www.moeller.net/publications



Export to the world market and to North America

Fuses for circuits in North America

Selection and application of fuses suitable for circuits (feeder and branch circuits) in North America.

Type or design in:		Standards UL, CSA	Fuse characte ristics	SCCR	Typical values in A
USA	Canada				
Class H , "Code"	Class H , No. 59 "Code"	UL 248-6/7, C22.2 248-6/7	fast	10 kA, 250 VAC 10 kA, 600 VAC	0...600
Class CC	Class CC	UL 248-4, C22.2 248-4	fast slow	200 kA, 600 VAC	0.5...30
Class G	Class G	UL 248-5, C22.2 248-5	fast slow	100 kA, 480 VAC 100 kA, 600 VAC	21...60 0.5...20
Class J	Class J HRCI-J	UL 248-8, C22.2 248-8	fast slow	200 kA, 600 VAC	1...600
Class K K1, K5	Class K K1, K5	UL 248-9, C22.2 248-9	fast slow	50 kA/100 kA/ 200 kA, 600VAC	0...600
Class L	Class L	UL 248-10, C22.2 248-10	fast slow	200 kA, 600 VAC	601...6000
Class R RK1, RK5	Class R HRCI-R RK1, RK5	UL 248-12, C22.2 248-12	fast slow	50 kA/100 kA/ 200 kA, 600VAC	0...600
Class T	Class T	UL 248-15, C22.2 248-15	fast	200 kA, 300 VAC 200 kA, 600 VAC	0...1200

The characteristics data and the assigned applications are a rough overview only.

The practice, it is always advisable to find out both this information and the required fuse type from the North American end customer.

Export to the world market and to North America

Fuses for circuits in North America

Fields of application		Notes
Primarily domestic		Types H, K and No. 59 "Code" fit the same bases and are therefore interchangeable. There is therefore a risk that they may be incorrectly used! See also note on K.
fast: Protection from resistive and inductive loads. Circuits for heating, lighting, feeders and branches for mixed loads.	slow: Protection from inductive and highly inductive loads. Circuits for motors, transformers, lighting etc.	Extremely compact design! Current-limiting to UL/CSA!
		Compact design. Current-limiting to UL/CSA! All other fuse types do not fit into bases.
		Compact design. Current-limiting to UL/CSA! All other fuse types do not fit into bases.
		Not current-limiting to UL/CSA! In the USA, the K types are therefore being increasingly replaced by the RK types.
	Current-limiting to UL/CSA! All other fuse types do not fit into bases.	
	Current-limiting to UL/CSA! Types RK1, RK5 and HRCI-R fit the same bases. All other fuse types do not fit into these bases. RK1 fuses have lower let-through values than RK5.	
	–	Extremely compact design! Current-limiting to UL/CSA! All other fuse types do not fit into bases.

The NA fuse types are largely tested and suitable for DC circuits in accordance with UL and CSA.

Export to the world market and to North America

Approval authorities

Code	Full title	Country
ABS	American Bureau of Shipping Ship classification association	USA
AEI	Associazione Elettrotecnica ed Elettronica Italiana Italian electrotechnical industry organisation	Italy
AENOR	Asociacion Española de Normalización y Certificación , Spanish organisation for standards and certification	Spain
ALPHA	Gesellschaft zur Prüfung und Zertifizierung von Niederspannungsgeräten German test laboratories association	Germany
ANSI	American National Standards Institute	USA
AS	Australian Standard	Australia
ASA	American Standards Association American association for standards	USA
ASTA	Association of Short-Circuit Testing Authorities Association of the testing authorities	Great Britain
BS	British Standard	Great Britain
BV	Bureau Veritas , Ship's classification association	France
CEBEC	Comité Electrotechnique Belge , Belgian electro-technical product quality mark	Belgium
CEC	Canadian Electrical Code	Canada
CEI	Comitato Elettrotecnico Italiano Italian standards organisation	Italy
CEI	Commission Electrotechnique Internationale International electrotechnical commission	Switzerland
CEMA	Canadian Electrical Manufacturers' Association Verband der Kanadischen Elektroindustrie	Canada
CEN	Comité Européen de Normalisation European standards committee	Europe
CENELEC	Comité Européen de coordination de Normalisation Électrotechnique , European committee for electro-technical standards	Europe

Export to the world market and to North America

Approval authorities

Code	Full title	Country
CSA	C anadian S tandards A ssociation Canadian standards association, Canadian standard	Canada
DEMKO	D anmarks E lektriske M ateriel k ontrol Danish material control for electrotechnical products	Denmark
DIN	D eutsches I nstitut für N ormung German institute for standardisation	Germany
DNA	D eutscher N ormenausschuss German standards commit- tee	Germany
DNV	Det Norsk Veritas Ship classification association	Norway
EN	European standard	Europe
ECQAC	E lectronic C omponents Q uality A ssurance C ommittee Committee for components with a verified quality	Europe
ELOT	Hellenic Organization for Standardization Greek organization for standardization	Greece
EOTC	E uropean O rganization for T esting and C ertification Europäische Organisation für Konformitätsbewertung	Europe
ETCI	E lectrotechnical C ouncil of I reland Irish organization for standardization	Ireland
GL	G ermanischer L loyd Ship classification association	Germany
HD	Harmonization document	Europe
IEC	I nternational E lectrotechnical C ommission International Electrotechnical Commission	–
IEEE	I nstitute of E lectrical and E lectronics E ngineers Verein der Elektro- und Elektronik-Ingenieure	USA
IPQ	I nstituto P ortuguês da Q ualidade Portuguese quality institute	Portugal
ISO	I nternational O rganization for S tandardization Internationale Organisation für Normung	–

Export to the world market and to North America

Approval authorities

Code	Full title	Country
JEM	Japanese E lectrical M anufacturers Association Electrical industry association	Japan
JIC	Joint Industry C onference Gesamtverband der Industrie	USA
JIS	Japanese Industrial S tandard	Japan
KEMA	K euring van E lektrotechnische M aterialen Testing institute for electrotechnical products	Netherlands
LOVAG	L ow V oltage Agreement Group	—
LRS	L loyd's R egister of S hipping Ship classification association	Great Britain
MITI	M inistry of International T rade and I ndustry	Japan
NBN	N orme B elge, Belgian standard	Belgium
NEC	N ational E lectrical C ode	USA
NEMA	N ational E lectrical M anufacturers A ssociation Electrical industry association	USA
NEMKO	N orges E lektriske M ateriell k ontroll Norwegian testing institute for electrotechnical products	Norway
NEN	N ederlands N orm, Dutch standard	Netherlands
NFPA	N ational F ire P rotection A ssociation US-amerikanische Gesellschaft für Brandverhütung	USA
NKK	N ippon K aiji K yakai Japanese classification association	Japan
OSHA	O ccupational S afety and H ealth A dministration	USA
ÖVE	Ö sterreichischer V erband für E lektrotechnik Austrian electrotechnical association	Austria
PEHLA	P rüfstelle e lektrischer H ochleistungs a pparate der Gesellschaft für elektrische Hochleistungsprüfungen Electrical high-performance apparatus test laboratory of the association for electrical high-performance testing	Germany

Export to the world market and to North America

Approval authorities

Code	Full title	Country
PRS	Polski Rejestr Statków Ship classification association	Poland
PTB	Physikalisch-Technische Bundesanstalt German physical/technical federal agency	Germany
RINA	Registro Italiano Navale Italian ship classification association	Italy
SAA	Standards Association of Australia	Australia
SABS	South African Bureau of Standards	South Africa
SEE	Service de l'Energie de l'Etat Luxemburg authority for standardisation, testing and certification	Luxemburg
SEMKO	Svenska Elektriska Materielkontrollanstalten Swedish test institute for electrotechnical products	Sweden
SEV	Schweizerischer Elektrotechnischer Verein Swiss electro-technical association	Switzerland
SFS	Suomen Standardisoimislitto r.y. Finnish standardisation association, Finnish standard	Finland
STRI	The Icelandic Council for Standardization Ísländische Normungsorganisation	Iceland
SUVA	Schweizerische Unfallversicherungs-Anstalt Swiss accident insurance federal agency	Switzerland
TÜV	Technischer Überwachungsverein Technical inspection association	Germany
UL	Underwriters' Laboratories Inc. Vereinigete Versicherungslaboratorien	USA
UTE	Union Technique de l'Electricité Electrotechnical federation	France
VDE	Verband der Elektrotechnik, Elektronik, Informationstechnik (Verband Deutscher Elektrotechniker) Association of electrical, electronics and information technology	Germany
ZVEI	Zentralverband Elektrotechnik- und Elektronikindustrie Central association of the electrical and electronic industry	Germany

Export to the world market and to North America

Test authorities and approval stamps

Test authorities and approval stamps in Europe and North America

The standard versions of most Moeller devices are approved for use throughout the world, including the USA and Canada.

Some devices, such as circuit-breakers, are in their basic design usable worldwide with the exception of USA and Canada. For export to North America devices are available with a special UL and CSA approval.

In some cases special country specific installation and operating specifications, installation materials and types must be taken into account as well as special circumstances such as difficult climatic conditions.






Since January 1997 all devices that conform to the European low-voltage guidelines and are for

sale in the European Union must be marked with the CE mark.

The CE mark shows that the marked device corresponds with all relevant requirements and standards. This marking duty allows unlimited use of this device within the European economic area.











As devices provided with the CE mark comply with the harmonised standards, approval in the countries of the European Union is unnecessary.

This does not apply to installation material. Additional marking with a national test mark is often required for device groups of miniature and residual current circuit-breakers. The following table shows a selection of test marks.

Country	Test authority	Characters
Belgium	Comité Electrotechnique Belge Belgisch Elektrotechnisch Comité (CEBEC)	
Denmark	Danmarks Elektriske Materielkontrol (DEMKO)	
Germany	Verband Deutscher Elektrotechniker (VDE)	
Finland	FIMKO	
France	Union Technique de l'Electricité (UTE)	

Export to the world market and to North America

Test authorities and approval stamps

Country	Test authority	Characters
Netherlands	Naamloze Vennootschap tot Keuring van Electrotechnische Materialen (KEMA)	
Norway	Norges Elektriske Materieelkontrol (NEMKO)	
Austria	Österreichischer Verband für Elektrotechnik (ÖVE)	
Russia	Goststandart(GOST)-R	
Sweden	Svenska Elektriska Materieelkontrollanstalten (SEMKO)	
Switzerland	Schweizerischer Elektrotechnischer Verein (SEV)	
USA	Underwriters Laboratories	
	Listing	
	Recognition	
Canada	Canadian Standards Association (CSA)	

Export to the world market and to North America

Marking of electrical equipment for North America

Component marking in the USA and Canada to NEMA ICS 19, ANSI Y32.2/IEEE 315/315 A

In order to differentiate between devices with similar functions, 3 figures and/or letters can be added to the marking. When using two or more of these markings, the function marking is usually put first.

Example:

The relay which introduces the first jog function is marked with "1 JCR". That means here:

1 = numerical specification

J = jog function of the equipment

CR = control relay (contactor relay) – type of equipment

Export to the world market and to North America

Marking of electrical equipment for North America

Device or Function Code Letters to NEMA ICS 19-2002

Code letter	Device or Function
A	Accelerating
AM	Ammeter
B	Braking
C or CAP	Capacitor, capacitance
CB	Circuit-breaker
CR	Control relay
CT	Current transformer
DM	Demand meter
D	Diode
DS or DISC	Disconnect switch
DB	Dynamic braking
FA	Field accelerating
FC	Field contactor
FD	Field decelerating
FL	Field-loss
F or FWD	Forward
FM	Frequency meter
FU	Fuse
GP	Ground protective
H	Hoist
J	Jog
LS	Limit switch
L	Lower
M	Main contactor
MCR	Master control relay
MS	Master switch

Export to the world market and to North America

Marking of electrical equipment for North America

Code letter	Device or Function
OC	Overcurrent
OL	Overload
P	Plugging, potentiometer
PFM	Power factor meter
PB	Pushbutton
PS	Pressure switch
REC	Rectifier
R or RES	Resistor, resistance
REV	Reverse
RH	Rheostat
SS	Selector switch
SCR	Silicon controlled rectifier
SV	Solenoid valve
SC	Squirrel cage
S	Starting contactor
SU	Suppressor
TACH	Tachometer generator
TB	Terminal block, board
TR	Time-delay relay
Q	Transistor
UV	Undervoltage
VM	Voltmeter
WHM	Watt-hour meter
WM	Wattmeter
X	Reactor, reactance

Export to the world market and to North America

Marking of electrical equipment for North America

As an alternative to device designation with code letter to NEMA ICS 19-2002 the designation to class designation is permissible. Class designation marking should simplify

harmonization with international standards. The code letters used here are, in part, similar to those of IEC 61346-1 (1996-03).

Class designation code letter to ANSI Y32.2/IEEE 315, 315 A

Code letter	Device or Function
A	Separate Assembly
B	Induction Machine, Squirrel Cage Induction Motor Synchro, General <ul style="list-style-type: none"> • Control transformer • Control transmitter • Control Receiver • Differential Receiver • Differential Transmitter • Receiver • Torque Receiver • Torque Transmitter Synchronous Motor Wound-Rotor Induction Motor or Induction Frequency Converter
BT	Battery
C	Capacitor <ul style="list-style-type: none"> • Capacitor, General • Polarized Capacitor Shielded Capacitor
CB	Circuit-Breaker (all)

Export to the world market and to North America

Marking of electrical equipment for North America

Code letter	Device or Function
D, CR	Diode <ul style="list-style-type: none"> • Bidirectional Breakdown Diode • Full Wave Bridge Rectifier • Metallic Rectifier • Semiconductor Photosensitive Cell • Semiconductor Rectifier • Tunnel Diode • Unidirectional Breakdown Diode
D, VR	Zener Diode
DS	Annunciator Light Emitting Diode Lamp <ul style="list-style-type: none"> • Fluorescent Lamp • Incandescent Lamp • Indicating Lamp
E	Armature (Commutator and Brushes) Lightning Arrester Contact <ul style="list-style-type: none"> • Electrical Contact • Fixed Contact • Momentary Contact Core <ul style="list-style-type: none"> • Magnetic Core Horn Gap Permanent Magnet Terminal Not Connected Conductor

Export to the world market and to North America

Marking of electrical equipment for North America

Code letter	Device or Function
F	Fuse
G	Rotary Amplifier (all) A.C. Generator Induction Machine, Squirrel Cage Induction Generator
HR	Thermal Element Actuating Device
J	Female Disconnecting Device Female Receptacle
K	Contactors, Relay
L	Coil <ul style="list-style-type: none"> • Blowout Coil • Brake Coil • Operating Coil Field <ul style="list-style-type: none"> • Commutating Field • Compensating Field • Generator or Motor Field • Separately Excited Field • Series Field • Shunt Field Inductor Saturable Core Reactor Winding, General
LS	Audible Signal Device <ul style="list-style-type: none"> • Bell • Buzzer • Horn
M	Meter, Instrument

Export to the world market and to North America

Marking of electrical equipment for North America

Code letter	Device or Function
P	<ul style="list-style-type: none"> • Male Disconnecting Device • Male Receptable
Q	Thyristor <ul style="list-style-type: none"> • NPN-Transistor • PNP-Transistor
R	Resistor <ul style="list-style-type: none"> • Adjustable Resistor • Heating Resistor • Tapped Resistor • Rheostat Shunt <ul style="list-style-type: none"> • Instrumental Shunt • Relay Shunt
S	Contact <ul style="list-style-type: none"> • Time Closing Contact • Time Opening Contact • Time Sequence Contact • Transfer Contact • Basic Contact Assembly • Flasher

Export to the world market and to North America

Marking of electrical equipment for North America

Code letter	Device or Function
S	Switch <ul style="list-style-type: none"> • Combination Locking and Nonlocking Switch • Disconnect Switch • Double Throw Switch • Drum Switch • Flow-Actuated Switch • Foot Operated Switch • Key-Type Switch • Knife Switch • Limit Switch • Liquid-Level Actuated Switch • Locking Switch • Master Switch • Mushroom Head • Operated Switch • Pressure or Vacuum • Operated Switch • Pushbutton Switch • Pushbutton Illuminated Switch, Rotary Switch • Selector Switch • Single-Throw Switch • Speed Switch Stepping Switch • Temperature-Actuated Switch • Time Delay Switch • Toggle Switch • Transfer Switch • Wobble Stick Switch Thermostat

Export to the world market and to North America

Marking of electrical equipment for North America

Code letter	Device or Function
T	Transformer <ul style="list-style-type: none"> • Current Transformer • Transformer, General • Polyphase Transformer • Potential Transformer
TB	Terminal Board
TC	Thermocouple
U	Inseparable Assembly
V	Pentode, Equipotential Cathode Phototube, Single Unit, Vacuum Type Triode Tube, Mercury Pool
W	Conductor <ul style="list-style-type: none"> • Associated • Multiconductor • Shielded Conductor, General
X	Tube Socket

Export to the world market and to North America

Circuit symbols, European – North America

Circuit symbols to DIN EN, NEMA ICS/ANSI/IEEE/CSA




















The following comparison of circuit symbols is based upon the following international/national specifications:

- IEC 60617 graphic symbol database (DIN EN 60617-2 to DIN EN 60617-12)
- NEMA ICS 19-2002, ANSI Y32.2/IEEE 315/315 A, CSA Z99

Description	IEC (DIN EN)	NEMA ICS/ANSI/IEEE
Conductors, connectors		
Junction of conductors	 03-02-04 or 03-02-05	 or
Connection of conductors (node)	 03-02-01	
Terminal	 03-02-02	
Terminal strip/block	 03-02-03	
Conductors	 03-01-01	

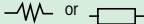
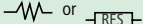

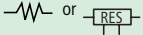






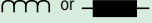



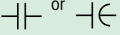
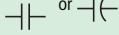

Export to the world market and to North America

Circuit symbols, European – North America

Description	IEC (DIN EN)	NEMA ICS/ANSI/IEEE
Conductor (for later expansion)	 103-01-01	
Line of application, general symbol	 02-12-01	
Line of application, optional, denoting small interval	 02-12-04	
Separation between two fields	 02-01-06	
Line of separation between functional units	 02-01-06	
Shielding	 02-01-07	
Earth, general symbol Ground, general symbol	 02-15-01	
Protective earth Protective ground	 02-15-03	
Connector with plug and socket	 03-03-05 or 03-03-06	
Isolating point, lug, closed	 03-03-18	





















Export to the world market and to North America

Circuit symbols, European – North America

Description	IEC (DIN EN)	NEMA ICS/ANSI/IEEE
Passive components		
Resistor, general symbol	 04-01-02 or 04-01-02	 or RES
Resistor with fixed tapings	 04-01-09	 or RES
Variable resistor, general	 04-01-03	 RES
Adjustable resistor		 RES
Resistor with sliding contact, potentiometer	 04-01-07	 RES
Winding, inductance, general	 04-03-01 or 04-03-02	
Winding with fixed tapping	 04-03-06	
Capacitor, general symbol	 04-02-01 or 04-02-02	 or RES
Variable capacitor	 104-02-01	













Export to the world market and to North America

Circuit symbols, European – North America


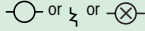

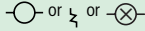
Description	IEC (DIN EN)	NEMA ICS/ANSI/IEEE
Control circuit devices		
Visual indicator, general symbol		 *with colour stated
Indicator light, general symbol	 08-10-01	 or  or  *with colour stated
Buzzers	 or  08-10-11 08-10-10	 ABU
Horn, claxon	 08-10-05	 HN
Drives		
Manual operation, general use	 02-13-01	
Operated by pushing	 02-13-05	
Operated by pulling	 02-13-03	
Operated by turning	 02-13-04	
Operated by key	 02-13-13	
Operated by rollers, sensors	 02-13-15	

Export to the world market and to North America

Circuit symbols, European – North America


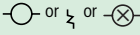

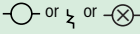

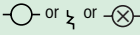







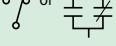




Description	IEC (DIN EN)	NEMA ICS/ANSI/IEEE
Stored energy mechanism, general symbol	 02-13-20	
Switch mechanism with mechanical release	 102-05-04	
Operated by motor	 02-13-26	
Emergency switch	 02-13-08	
Operated by electromagnetic overcurrent protection	 02-13-24	
Operated by thermal overcurrent protection	 02-13-25	OL 
Electromagnetic operation	 02-13-23	
Control by fluid level	 02-14-01	

Electromechanical, electromagnetic operating devices

Electromechanical operating device, general symbol, relay coil, general symbol	 07-15-01	 × device code letter → table, page 9-13
Operating device with special features, general symbol		 × device code letter → table, page 9-13






















Export to the world market and to North America

Circuit symbols, European – North America

Description	IEC (DIN EN)	NEMA ICS/ANSI/IEEE
Electromechanical operating device with On-delay	 07-15-08	 × device code letter → table, page 9-13
Electromechanical device with Off-delay	 07-15-07	 × device code letter → table, page 9-13
Electromechanical device with On- and Off-delay	 07-15-09	 × device code letter → table, page 9-13
Electromechanical device of a thermal relay	 07-15-21	
Contacts		
N/O contact	 07-02-01 or 07-02-02	
N/C contact	 07-02-03	
Changeover contact with interruption	 07-02-04	
Early-make N/O contact of a contact assembly	 07-04-01	 TC or TDC
Late-break N/C contact of a contact assembly	 07-04-03	 T0 or TDO








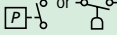

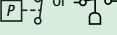




Export to the world market and to North America

Circuit symbols, European – North America

Description	IEC (DIN EN)	NEMA ICS/ANSI/IEEE
N/O contact, delayed when closing	 or  07-05-02 07-05-01	 T.C.
N/C contact, delayed when reclosing	 or  07-05-03 07-05-04	 T.C.
Control devices		
Push-button (not stay-put)	 07-07-02	 PB
Spring-return switches with N/C contact, manually operated by pushing, e.g. push-button		 PB
Spring-return switches with N/O and N/C contacts, manually operated by pushing		 PB
Spring-return switches with latching position and one N/O contact, manually operated by pushing		 PB
Spring-return switches with latching position and one N/C contact, manually operated by striking (e.g. mushroom button)		
Position switches (N/O contacts) Limit switches (N/O contacts)	 07-08-01	 LS
Position switches (N/C contacts) Limit switches (N/C contacts)	 07-08-02	 LS
Spring-return switches with N/O contacts, mechanically operated, N/O contacts closed		 LS

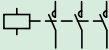
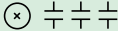
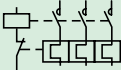
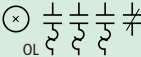




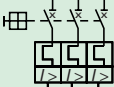



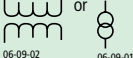
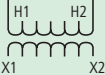
Export to the world market and to North America

Circuit symbols, European – North America

Description	IEC (DIN EN)	NEMA ICS/ANSI/IEEE
Spring-return switches with N/C contacts, mechanically operated, N/C contacts open		
Proximity switches (N/C contacts), actuated by the proximity of iron	Fe  07-20-04	
Proximity switches, inductive, N/O contacts	Fe 	
Proximity switches, block diagram	 07-19-02	
Under-pressure relays, N/O contacts	 07-17-03	
Pressure switches, N/C contact		
Float switches, N/O contact		
Float switches, N/C contact		




















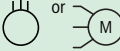


Export to the world market and to North America

Circuit symbols, European – North America

Description	IEC (DIN EN)	NEMA ICS/ANSI/IEEE
Switchgear		
Contactors (N/O contacts)	 07-13-02	 × code letter
Three-pole contactor with bimetal relay (3 thermal elements)		 × code letter
Three-pole switch-disconnector	 07-13-06	 DISC
Three-pole circuit-breaker	 07-13-05	 CB
Three-pole breaker with switch mechanism with three thermoelectric overcurrent releases, three electromagnetic overcurrent releases, motor-protective circuit-breaker	 107-05-01	
Fuse, general symbol	 07-21-01	 FU
Transformers, current transformers		
Transformers with two windings	 06-09-02 or 06-09-01	 H1 H2 X1 X2




















Export to the world market and to North America

Circuit symbols, European – North America

Description	IEC (DIN EN)	NEMA ICS/ANSI/IEEE
Autotransformer	 or  <small>06-09-07</small> <small>06-09-06</small>	 or 
Current transformer	 or  <small>06-09-11</small> <small>06-09-10</small>	 or  <small>(X1) CT</small>
Machines		
Generator	 <small>06-04-01</small>	 or 
Motor, general symbol	 <small>06-04-01</small>	 or  <small>06-04-01</small>
DC motor, general symbol	 <small>06-04-01</small>	
AC motor, general symbol	 <small>06-04-01</small>	
Three-phase asynchronous motor with squirrel-cage rotor	 <small>06-08-01</small>	
Three-phase asynchronous motor with slip-ring rotor	 <small>06-08-03</small>	























Export to the world market and to North America

Circuit symbols, European – North America

Description	IEC (DIN EN)	NEMA ICS/ANSI/IEEE
Semiconductor components		
Static input		
Static output		
Static input with negation	 12-07-01	
Static output with negation	 12-07-02	
Dynamic input, change of status from 0 to 1 (L/H)	 12-07-07	
Dynamic input with negation, change of status from 1 to 0 (H/L)	 12-07-08	
AND gate, general symbol	 12-27-02	
OR gate, general symbol	 12-27-01	
NOT gate, inverter	 12-27-11	
AND with negated output, NAND	 12-28-01	
OR with negated output, NOR	 12-28-02	

Export to the world market and to North America

Circuit symbols, European – North America

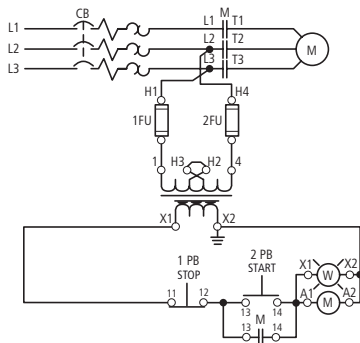
Description	IEC (DIN EN)	NEMA ICS/ANSI/IEEE
Exclusive OR gate, general	 12-27-09	
RS flip-flop	 12-42-01	
Monostable gate, cannot be triggered during the output pulse, general symbol	 12-44-02	
Delay, variable with indication of delay values	 02-08-05	
Semiconductor diode, general symbol	 05-03-01	
Limiting diode Zener diode	 05-03-06	
Light-emitting diode (LED), general symbol	 05-03-02	
Bi-directional diode, diac	 05-03-09	
Thyristor, general symbol	 05-04-04	
PNP transistor	 05-05-01	
NPN transistor, in which the collector is connected to the enclosure	 05-05-02	

Export to the world market and to North America

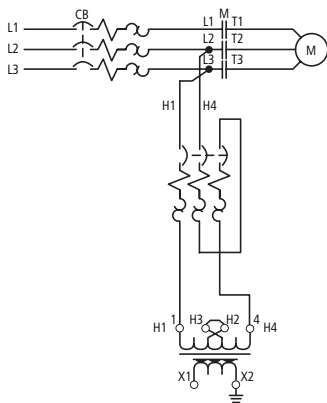
Circuit diagram examples to North American specifications

Direct motor starters, fuseless with circuit-breakers

Control circuit with fuse



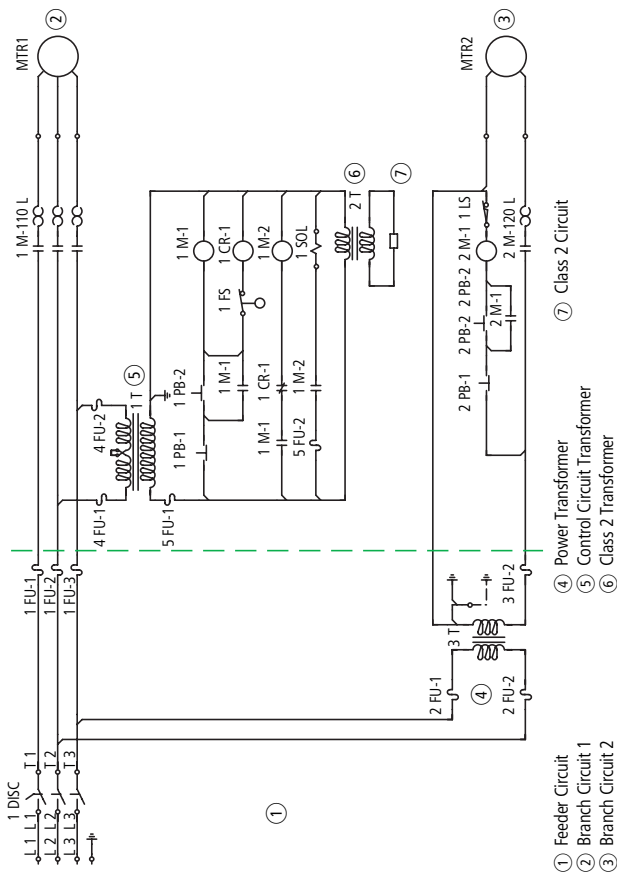
Control circuit, fuseless



Export to the world market and to North America

Circuit diagram examples to North American specifications

Motor starters to UL



Notes

Export to the world market and to North America

North American classification for control switches

Classification	Designation At maximum rated voltage of			Thermal uninter- rupted cur- rent
	600 V	300 V	150 V	
AC voltage	600 V	300 V	150 V	A
Heavy Duty	A600	A300	A150	10
	A600	A300	–	10
	A600	–	–	10
	A600	–	–	10
Standard Duty	B600	B300	B150	5
	B600	B300	–	5
	B600	–	–	5
	B600	–	–	5
	C600	C300	C150	2.5
	C600	C300	–	2.5
	C600	–	–	2.5
	C600	–	–	2.5
	–	D300	D150	1
	–	D300	–	1
	DC voltage			
	Heavy Duty	N600	N300	N150
N600		N300	–	10
N600		–	–	10
Standard Duty	P600	P300	P150	5
	P600	P300	–	5
	P600	–	–	5
	Q600	Q300	Q150	2.5
	Q600	Q300	–	2.5
	Q600	–	–	2.5
	–	R300	R150	1.0
	–	R300	–	1.0
	–	–	–	–

to UL 508, CSA C 22.2-14 and NEMA ICS 5

Export to the world market and to North America

North American classification for control switches

Switching capacity				
Rated voltage V	Make A	Break A	Make VA	Break VA
120	60	6	7200	720
240	30	3	7200	720
480	15	1.5	7200	720
600	12	1.2	7200	720
120	30	3	3600	360
240	15	1.5	3600	360
480	7.5	0.75	3600	360
600	6	0.6	3600	360
120	15	1.5	1800	180
240	7.5	0.75	1800	180
480	3.75	0.375	1800	180
600	3	0.3	1800	180
120	3.6	0.6	432	72
240	1.8	0.3	432	72
125	2.2	2.2	275	275
250	1.1	1.1	275	275
301 – 600	0.4	0.4	275	275
125	1.1	1.1	138	138
250	0.55	0.55	138	138
301 – 600	0.2	0.2	138	138
125	0.55	0.55	69	69
250	0.27	0.27	69	69
301 – 600	0.10	0.10	69	69
125	0.22	0.22	28	28
250	0.11	0.11	28	28
301 – 600	–	–	–	–

Export to the world market and to North America

Rated motor currents for North American motors

Motor rated currents for North American three-phase motors¹⁾

Motor rating	Motor rated operational current in amperes ²⁾			
	115 V 120 V	230 V ³⁾ 240 V	460 V 480 V	575 V 600 V
1/2	4.4	2.2	1.1	0.9
3/4	6.4	3.2	1.6	1.3
1	8.4	4.2	2.1	1.7
1 1/2	12	6.0	3.0	2.4
2	13.6	6.8	3.4	2.7
3		9.6	4.8	3.9
5		15.2	7.6	6.1
7 1/2		22	11	9
10		28	14	11
15		42	21	17
20		54	27	22
25		68	34	27
30		80	40	32
40		104	52	41
50		130	65	52
60		154	77	62
75		192	96	77
100		248	124	99
125		312	156	125
150		360	180	144
200		480	240	192
250			302	242
300			361	289
350			414	336
400			477	382
450			515	412
500			590	472

¹⁾ Source: 1/2 – 200 HP = NEC Code, Table 430-250
250 – 500 HP = UL 508, Table 45.2

²⁾ The motor full-load current values given are approximate values. For exact values consult the data stated by the manufacturer or the motor rating plates.

³⁾ For motor full-load currents of 208 V motors/200 V motors, use the appropriate values for 230 V motors, increased by 10 – 15 %.

Export to the world market and to North America

Protection types for electrical equipment for North America

Protection types for electrical equipment for USA and Canada to IEC/EN 60529 (VDE 0470 part 1)

The IP ratings quoted in the table represent a rough comparison only. A precise comparison is not possible since the degree of protection tests and the evaluation criteria differ.

Designation of the enclosure and the protection type to:

- NFPA 70 (National Electrical Code)
- CEC (Canadian Electrical Code)
- UL 50
- CSA-C22.2 No. 94-M91 (2006)
- NEMA 250 -2003¹⁾

	Comparable IP protection types to IEC/EN 60529 DIN 40050		Comparable IP protection types to IEC/EN 60529 DIN 40050
UL/CSA type 1 General purpose	IP20	UL/CSA type 4 X dust-tight, water-tight, corrosion-resistant, rain-tight	IP66
UL/CSA type 2 Drip-tight	IP22	UL/CSA type 5 drip-tight, dust-tight	IP53
UL/CSA type 3 Dust-tight, rain-tight, resistant to sleet and ice	IP55	UL/CSA type 6 rain-tight, water-tight, immersible, resistant to hail and ice	IP67
UL/CSA type 3 R Rain-proof, resistant to sleet and ice	IP24	UL/CSA type 12 For use in industry, drip-tight, dust-tight	IP54
UL/CSA type 3 S Dust-tight, rain-tight, resistant to sleet and ice	IP55	UL/CSA type 13 dust-tight, oil-tight, drip-tight	IP54
UL/CSA type 4 dust-tight, water-tight, rain-tight	IP66		

1) NEMA = National Electrical Manufacturers Association

Export to the world market and to North America

Protection types for electrical equipment for North America

Terms German/English:

General purpose:	general purpose
tropfdicht:	drip-tight
staubdicht:	dust-tight
regendicht:	rain-tight
regensicher:	rain-proof
wettersicher:	weather-proof
wasserdicht:	water-tight
eintauchbar:	submersible
eisbeständig:	ice resistant
hagelbeständig:	sleet resistant
korrosionsbeständig:	corrosion resistant
öldicht:	oil-tight

Export to the world market and to North America

North American cable cross-sections

Conversion of North American cable cross sections into mm²

USA/Canada AWG	Europe	
	mm ² (exact)	mm ² (nearest standard size)
22	0.324	0.4
20	0.519	0.5
18	0.823	0.75
16	1.31	1.5
14	2.08	
12	3.31	4
10	5.261	6
8	8.367	10
6	13.30	16
4	21.15	25
3	26.67	
2	33.62	35
1	42.41	
1/0 (0)	53.49	50
2/0 (00)	67.43	70
3/0 (000)	85.01	
4/0 (0000)	107.2	95

Export to the world market and to North America

North American cable cross-sections

USA/Canada kcmil	Europe	
	mm ² (exact)	mm ² (nearest standard size)
250	127	120
300	152	150
350	177	185
400	203	
450	228	
500	253	240
550	279	
600	304	300
650	329	
700	355	
750	380	
800	405	
900	456	
1,000	507	500

In addition to "circular mills", cable sizes are often given in "MCM": 250 000 circular mills = 250 MCM

Notes

Notes
