Table 29-1: UL mark on cables and wires and its significance with regard to intended usage

(UL) or (UL) UL Listing Mark für listed cables & wires

The intended use of cables and wires in this category is for fixed wiring in residential buildings or for commercial or industrial use. For example listed cables and wires not only have to meet individual UL product standards, but must also be applied according to the relevant articles of the National Electrical Code (NEC). The NEC/NFPA 70 contains detailed specifications relating to the correct usage of listed cables and wires.

Such products can be used both for factory wiring of electrical equipment, devices, appliances and machines as well as for on-site or field wiring of industrial machinery and systems according to NFPA 79 or of energy generation installations.

Typical codes for listed cables and wires:

MTW, TC, PLTC, CM, CL2, THHN, THWN; SO, SOO, ST, STO, SJT, SJTO.

A selection of LAPP products with multiple listings/approvals:

ÖLFLEX® CONTROL TM, ÖLFLEX® TRAY II, ÖLFLEX® FD AUTO-X; UNITRONIC® BUS, UNITRONIC® 300.

See table T29-4 for more details.

Approval mark on product:

(UL) = UL Listing Mark

UL Recognition Mark für AWM cables and wires

UL recognized Appliance Wiring Material (abbrev. “AWM”) comprises cables and wires intended for **fully factory-wired** electrical equipment, devices, appliances, control cabinets and industrial machinery.

Commonly AWM is not intended for direct on-site wiring (field wiring). Cables and wires with UL AWM style labelling must be used for the applications stipulated by the relevant style description on the UL Style Sheet (www.ul.com). Since some UL (AWM) Styles are permitted to be applied by equipment manufacturers with particular ratings out of a shortlist of style ratings depending on the style, it will be very recommendable to identify product features considering the product’s technical data as per the LAPP catalogue and LAPP’s product data sheet, especially when it comes down to UL ratings for possible oil resistance, voltage class, flame retardance and operating temperature on the conductor.

If the manufacturer of an electrical device, appliance or machine wishes to obtain an officially recognised “UL listing” to release the relevant item as a series product or acquire a “field labelling” for a stand-alone machine or system, the body tasked with the certification (the National Recognized Testing Laboratory or NRTL) must be provided with all construction-relevant documentation.

The entire listing process will be significantly faster, simpler and cheaper if all installed cables and wires are already “listed” or “recognized”, as any cables that do not meet these criteria will have to be tested for suitability.

NOTE:
Multi-standard cables and wires

Multi-standard cables with mm² and AWG/MCM conductor sizes generally have special conductor stranding, as a result of which one of the specified conductor cross-sections is always a little larger (oversized). In individual cases, this may cause problems when connecting terminals designed for AWG conductor sizes.

For further information on the topic of this appendix, see:

Table T11 “Conductor resistances and conductor stranding (metric)”, Table T16 “Anglo-American dimensions”, Table T13 “Current rating of cables according to NFPA 70 (National Electrical Code) NFPA 79 Electrical Standard of Industrial Machinery”.

Quick and simple: check LAPP UL approvals online

Any Internet user can visit http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm to gain direct access to the Online Certification Directory of Underwriters Laboratories. Our UL approvals can be viewed by entering “**U. I. Lapp**” or “**Lapp USA**” in the “Company name” field; the individual File Numbers and Control Category Numbers (CCN) are also provided.

Table 29-2: NFPA – using cables in industrial installations in the USA (part 1)

NFPA 79 is the US-american, electrical standard of the USA's NFPA (National Fire Protection Association) about industrial machinery to be operated in the USA. NFPA 79 generally applies to electrical components used in individual machines and machine configurations operating together (machine groups).

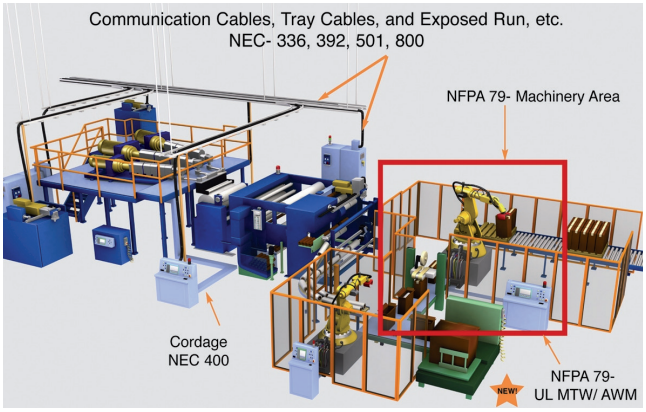
Examples of industrial machinery include: Machine tools, injection moulding, woodworking, assembly and material handling machines – generally, any machines for material processing and transport in the broader sense, but with a clear distinction from "passenger transport", for example.

Important aspects of NFPA 79 were revised in 2006. One of the main objectives of this revision was the further harmonisation of NFPA 79 with its European "counterpart", IEC/EN 60204. As a result, the chapter structure of NFPA 79 has been aligned with IEC/EN 60204 and safety standards adopted to represent the latest state of the art.

In NFPA 79-Edition 2007 – AWM single cores or multi-core AWM cables were explicitly prohibited, with the exception of those with a discretionary provision. Edition 2012 greatly relaxed the strict restrictions regarding the use of AWM cables. As per 2015 Edition, section 12.9.2, AWM cables are permitted, provided that **at least one** of the following conditions is met:

- cable as part of a, for this purpose, "listed assembly"
- cable specified for use in listed system or machine and utilised according to the instructions of the component supplier
- cable meets all design requirements stipulated by NFPA 79 (sections 12.2 to 12.6) incl. modifications with regard to conductor stranding, flame retardancy, insulation wall thickness and insulation/sheath labelling

"Machine Tool Wire (MTW)" – as a single-core or multi-core cable is a permitted alternative. In the case of wiring between elements of a machine group, "Tray Cable" (TC) is often a standard-compliant and cost-effective solution.



This schematic of an industrial machine shows the main applications of cables and wires with reference to the relevant sections in NEC®/NFPA. "NEC®" is a trademark of the National Fire Protection Association (NFPA).

As of NFPA 79, 2012 Edition, particular significance is attached to the selection of cables. This reflects the high demands placed on the reliability of industrial machines as well as the frequently draconian impact of liability claims. The global means of cable procurement also carry a certain amount of risk. It is therefore all the more important that the relevant technical standards are met.

We are committed to informing our customers of any significant changes to important technical standards. For this purpose, we work closely together with our colleagues at the production and sales location in Florham Park, New Jersey (www.lappusa.com).

LAPP offers a range of products with the "UL – Recognition Mark" and "UL – Listing", fully compliant with the specifications of NFPA 79, 2015 Edition.

Examples are: ÖLFLEX® TRAY II, UNITRONIC® 300 STP, MULTI-STANDARD SC 2.1.

Further information on this topic can be found at:
www.lappkabel.de → SERVICE → Knowledge Centre → NFPA 79.

Table 29-3: NFPA – using cables in industrial installations in the USA (part 2)

The following general rules apply to the construction and operation of machinery in the USA:

The machinery must comply with federal safety laws issued by the Occupational Safety and Health Administration (OSHA.: www.osha.gov) as well as the national or local codes (legal regulations) applicable at the installation location.

Machines are only deemed safe if they have been constructed and manufactured in accordance with the relevant standards (NFPA 70, NFPA 79, ...) and their safety both tested and confirmed by a Nationally Recognized Testing Laboratory (NRTL: www.osha.gov/dts/otpca/nrtl/). Meeting of the above conditions must be clearly indicated to the local inspector/safety officer/authority (Authority Having Jurisdiction, AHJ) by the attachment of an NRTL label (listing or field labelling) to the machine.

NFPA 79 Electrical Standard for Industrial Machinery – 2015 Edition

This important standard is published by the National Fire Protection Association (www.nfpa.org).

It is basically the US counterpart of IEC 60204-1, which equates to the European standard EN 60204-1 for machine safety. As a rule, only "listed cables" must be used – although "UL AWM recognized cables & wires" can be used for "factory-wired equipment" if one of the conditions specified in table T29-2 is met.

Any lines laid on (open) cable conduits or cable trays must be approved for this purpose (cable tray rating).

In the case of industrial installations, in which permanent maintenance and repair by qualified electricians is assured, cables with the addition "ER" (which stands for "exposed run" and replaces the previous designation "open wiring") can also be applied for unprotected (Exposed) transitions of not longer than 6 ft. or 1.8 metres each between cable trays or between cable tray and machine/cabinet, for example.

The use of cables with such ratings – such as the LAPP types: ÖLFLEX® TRAY II, ÖLFLEX® FD AUTO-X, ÖLFLEX® AUTO-I, UNITRONIC® 300 – enables significant material and time savings during installation.

In many sections, NFPA 79 refers to the US National Electrical Code (NEC®). This applies particularly to wiring between machines or machine groups where the cable routing utilises the building structures. In such cases, the wiring must comply with the appropriate wiring method specified by the NEC®.

NEC® (National Electrical Code) Handbook Edition NEC® <NFPA 70> 2017

This code contains the standard NFPA 70. As well as the normative content, the handbook also provides many useful explanations, tables, graphics, photos and comments. Both the NEC® and the NFPA 79 standard can be ordered via the website at www.nfpa.org.

UL 508-A

In addition to the aforementioned basic and technical standards, there are also special standards such as UL 508-A, according to which control cabinets for machines can also be configured and labelled on the basis of this separate standard for industrial control panels (www.ul.com).

Table 29-4: overview of corresponding products in this catalogue – type “Listed”

LAPP cable type with UL listing	Listed type	Voltage in V	Temperature in °C	Compound	Compliant with NFPA 79, Edition 2015
Multi-Standard SC 2.1	MTW	600	90	PVC	✔
Multi-Standard SC 2.2	MTW	600	90	PVC	✔
ÖLFLEX® CONTROL TM, TM CY	MTW, TC-ER, WTTC	600, 1000	90	Thermopl. Polymer	✔
ÖLFLEX® TRAY II, TRAY II CY	MTW, TC-ER or DP-1, WTTC, SUNRES	600, 1000	90	Thermopl. Polymer	✔
ÖLFLEX® SERVO 7TCE, FD 7TCE	TC-ER, Flexible Motor Supply	600, 1000	90	Thermopl. Elastomer	✔
ÖLFLEX® VFD 2XL, 2XL with Signal	TC-ER, Flexible Motor Supply	600, 1000, 2000	90	Thermopl. Elastomer	✔
ÖLFLEX® CHAIN TM, TM CY	MTW, TC-ER, WTTC	600, 1000	90	Special compound	✔
UNITRONIC® 300, 300 S, 300 STP	CMG, PLTC, Open Wiring, Oil Res 1	300	105	PVC	✔
UNITRONIC® FD CP plus	CMX	250	75	PUR	✔
UNITRONIC® FD CP (TP) plus	CMX	250	75	PUR	✔
UNITRONIC® BUS IBS A	CMX	250	70	PVC	✔
UNITRONIC® BUS IBS P COMBI	CMX	250	75	PUR	✔
UNITRONIC® BUS IBS FD P	CMX	250	70	PUR	✔
UNITRONIC® BUS IBS FD P COMBI	CMX	450	70	PUR	✔
UNITRONIC® BUS IBS Yv	CMX	250	75	PVC	✔
UNITRONIC® BUS IBS Yv COMBI	CMX	250	75	PVC	✔
UNITRONIC® BUS LD	CMX	250	70	PVC	✔
UNITRONIC® BUS LD FD P	CMX	250	75	PUR	✔
UNITRONIC® BUS PB A	CMX	250	75	PVC	✔
UNITRONIC® BUS PB FC	CMG	100	60	PVC	✔
UNITRONIC® BUS PB 7-W FC	CMX	250	75	PVC	✔
UNITRONIC® BUS PB H FC	CMX	100	75	FRNC	✔
UNITRONIC® BUS PB P FC	CMX	100	75	PUR	✔
UNITRONIC® BUS PB FD P A	CMX	250	70	PUR	✔
UNITRONIC® BUS PB TORSION	CMX	300	75	PUR	✔
UNITRONIC® BUS PB FESTOON	CMG	600	75	PVC	✔
UNITRONIC® BUS PB FRNC FC	CM	250	60	PUR	✔
UNITRONIC® BUS PB FD FRNC FC	CM	250	60	PUR	✔
UNITRONIC® BUS PB TRAY	CMG/PLTC-ER	600	75	PVC	
UNITRONIC® BUS PA (BU)	CMX	100	75	PVC	✔
UNITRONIC® BUS PA (BK)	CMX	100	75	PVC	✔
UNITRONIC® BUS PA FC	CMG	100	75	PVC	✔
UNITRONIC® BUS FF 3 (YE)	CMG/PLTC	300	105	PVC	✔
UNITRONIC® BUS FF 3 ARM	CMG/PLTC	300	105	PVC	✔
UNITRONIC® BUS FF 2	CMG	300	105	PVC	✔
UNITRONIC® BUS CC	CM/PLTC	300	75	PVC	✔
UNITRONIC® BUS CAN	CMX	250	75	PVC	✔
UNITRONIC® BUS CAN FD P	CMX	250	70	PUR	✔
UNITRONIC® BUS CAN TRAY	CMG/PLTC-ER	600	75	PVC	
UNITRONIC® BUS ASI (PVC)	CMG	300	80	PVC	✔
UNITRONIC® BUS SAFETY	CMX	250	75	Compound	✔
UNITRONIC® BUS DN THICK FRNC	CMG	300	80	FPE FRNC	✔
UNITRONIC® BUS DN THIN FRNC	CMG	300	80	FPE FRNC	✔
UNITRONIC® BUS DN THICK Y	CMG	300	80	PVC	✔
UNITRONIC® BUS DN THIN Y	CMG	300	80	PVC	✔
UNITRONIC® BUS DN THICK FD P	CMX	300	80	PUR	✔
UNITRONIC® BUS DN THIN FD Y	CMG	300	80	PVC	✔
UNITRONIC® BUS DN THICK FD Y	CMG	300	80	PVC	✔
UNITRONIC® BUS DN THIN FD P	CMX	300	80	PUR	✔
ETHERLINE® PN Cat.5e Y	CMX	300	75	PVC	✔
ETHERLINE® Y FC Cat.5	CMG/PLTC	600	75	PVC	✔
ETHERLINE® PN Cat.5e YY	CMG	300	75	PVC	✔
ETHERLINE® PN Cat.5 Y Flex FC	CMG/PLTC	600	75	PVC	✔
ETHERLINE® FD P FC Cat.5e	CMX	300	75	PUR	✔
ETHERLINE® PN Cat.5e FRNC FLEX FC	CMG/PLTC	300	75	FRNC	✔
ETHERLINE® Y FLEX Cat.5e	CMG	300	75	PVC	✔
ETHERLINE® Y EC FLEX Cat.5e	CMX	300	75	PVC	✔
ETHERLINE® P EC FLEX Cat.5e	CMX	300	75	PUR	✔
ETHERLINE® PN Cat.6_A Y FLEX	CMG	300	75	PVC	✔
ETHERLINE® PN Cat.6_A FRNC FLEX	CM	300	75	FRNC	✔
ETHERLINE® PN Cat.6_A FD Y	CMX	300	75	PVC	✔
ETHERLINE® PN Cat.6_A FD P	CMX	300	75	PUR	✔
ETHERLINE® PN Cat.6_A TORSION Y	CMX	300	75	PVC	✔
ETHERLINE® PN Cat.6_A TORSION P	CMX	300	75	PUR	✔
ETHERLINE® FD P Cat.6	CMX	300	75	PUR	✔
ETHERLINE® TRAY ER PN Y FC	CMG/PLTC-ER	600	75	PVC	✔
ETHERLINE® MARINE FRNC FC	CMG/PLTC	600	75	FRNC	✔
ETHERLINE® TORSION Cat.7	CMX	300	75	PUR	✔
HITRONIC® PCF Duplex PN B PVC-PVC A	OFNG		75	PVC	✔

The table displays the state of available certifications at the time of catalogue printing. Please contact us regarding the current certification status of our products.

Table 29-5: overview of corresponding products in this catalogue – type AWM

LAPP cable type with AWM style	Style number	Voltage in V	Temperature in °C	Compound	Compliant with NFPA 79, Edition 2015
Multi-Standard SC 2.1	1015	600	105	PVC	✔
Multi-Standard SC 2.2	10269	1000	105	PVC	✔
Multi-Standard SC 1	1007, 1569	300	105	PVC	✔
ÖLFLEX® CLASSIC 110 H	21089	600	75	Special compound, halogen-free	✔
ÖLFLEX® CLASSIC 110 CH	21089	600	75	Special compound, halogen-free	✔
ÖLFLEX® CLASSIC 130 H	21089	600	75	Special compound, halogen-free	✔
ÖLFLEX® CLASSIC 135 CH	21089	600	75	Special compound, halogen-free	✔
ÖLFLEX® CLASSIC 130 H BK	21156	1000	75	Special compound, halogen-free	✔
ÖLFLEX® CLASSIC 135 CH BK	21156	1000	75	Special compound, halogen-free	✔
ÖLFLEX® 150	21098	600	90	PVC	✔
ÖLFLEX® 150 CY	21098	600	90	PVC	✔
ÖLFLEX® 191	21098	600	90	PVC	✔
ÖLFLEX® 191 CY	21098	600	90	PVC	✔
ÖLFLEX® 409 P	20234	1000	80	PUR	✔
ÖLFLEX® CONTROL TM, TM CY	20886	1000	105	Special PVC compound	✔
ÖLFLEX® CHAIN TM, TM CY	20886	1000	105	Special compound	✔
ÖLFLEX® CHAIN 809	20886	1000	80	PVC	✔
ÖLFLEX® CHAIN 809 CY	20886	1000	80	PVC	✔
ÖLFLEX® CHAIN PN	20886	1000	90	PVC	✔
ÖLFLEX® FD 891	2587, 21098	600	90	PVC	✔
ÖLFLEX® FD 891 CY	2587, 21098	600	90	PVC	✔
ÖLFLEX® CHAIN 819 P, CP	21576	1000	80	PUR	✔
ÖLFLEX® FD 855 P, CP	21576	1000	80	PUR	✔
ÖLFLEX® FD 891 P	20234	600	80	PUR	✔
ÖLFLEX® CHAIN 896 P	20234	1000	80	PUR	✔
ÖLFLEX® CHAIN 809 SC, SC CY	10107	600	90	PVC	✔
ÖLFLEX® FD 90	10107	600	90	PVC	✔
ÖLFLEX® FD 90 CY	10107	600	90	PVC, DESINA®-compliant	✔
ÖLFLEX® CHAIN 90 P, CP	11624	1000	80	PUR	✔
ÖLFLEX® TORSION (D) FRNC	21288	1000	80	Special compound, halogen-free	✔
ÖLFLEX® HEAT 180 MS	4476, 3529	600	150	Silicone compound	✔
ÖLFLEX® HEAT 180 C MS	4476, 3529	600	150	Silicone compound	✔
ÖLFLEX® HEAT 180 SiF A	3644	1000	150	Silicone	✔
ÖLFLEX® PETRO C HFFR	10587, 20234	1000	80	PUR	✔
ÖLFLEX® ROBOT F1	20940	Up to 1.5 mm²: 600 From 2.5 mm²: 1000	80	PUR	✔
ÖLFLEX® SERVO 719	2570	1000	80	PVC	✔
ÖLFLEX® SERVO 719 CY	2570	1000	80	PVC	✔
ÖLFLEX® SERVO 728 CY	2464	300	80	PVC	✔
ÖLFLEX® SERVO 9YSLCY-JB	2570, 20886	1000	80	PVC	✔
ÖLFLEX® SERVO 7DSL	2570	1000/300	80	PVC	✔
ÖLFLEX® SERVO FD 796 P	20234	1000	80	PUR	✔
ÖLFLEX® SERVO FD 796 CP	20234	1000	80	PUR	✔
ÖLFLEX® SERVO FD 798 CP	20236	30	80	PUR	✔
ÖLFLEX® SERVO FD 7DSL	21223	1000/300	80	PUR	✔
SERVO cables acc. to INDRAMAT® standard INK	Power cables: 20234 Signalling cables: 20236	Power cables: 600/1000 Signalling cables: 300	80	PUR	✔
SERVO cables acc. to LENZE® standard	Resolver + encoder cable: 2464, 21165 Motor cable: 2570, 20940	Resolver + encoder cable: 300 Motor cable: 600	80	PUR	✔
SERVO cables acc. to SIEMENS® standard FX 8PLUS	Power cables: 21223 Signalling cables: 20236	Power cables: 1000 Signalling cables: 30	80	PUR	✔
UNITRONIC® 300, 300 S, 300 STP	2464	300	80	PVC	✔
UNITRONIC® LiYCY A	2464	300	80	Special PVC	✔
UNITRONIC® LiYCY(TP) A	2464	300	80	Special PVC	✔
UNITRONIC® LiYY A	2464	300	80	Special PVC	✔
UNITRONIC® FD P plus	21576	1000	80	PUR	✔
UNITRONIC® FD CP plus	21576	1000	80	PUR	✔
UNITRONIC® FD CP (TP) plus	21576	1000	80	PUR	✔
UNITRONIC® BUS CC FD P FRNC	20233	300	80	PUR	✔
UNITRONIC® BUS ASI (TPE)	2103	300	105	TPE	✔
UNITRONIC® BUS ASI FD FRNC	20549	300	80	PUR	✔
UNITRONIC® SENSOR FD	20549	300	80	PUR	✔
UNITRONIC® SENSOR master cable	21198	300	80	PUR	✔
ETHERLINE® Cat.5 FRNC HYBRID	21282	150	80	FRNC	✔
ETHERLINE® TORSION Cat.5	10532, 21161	300	80	PUR	✔
ETHERLINE® FD P Cat.5e	21576	1000	80	PUR	✔
ETHERLINE® P Cat.5e	21576	1000	80	PUR	✔
ETHERLINE® P Cat.5e Flex	21576	1000	80	PUR	✔
ETHERLINE® FD BK Cat.5	21576	1000	80	PUR	✔
ETHERLINE® FD P Cat.6$_A$	21576	1000	80	PUR	✔
ETHERLINE® FD P Cat.6$_A$	21576	1000	80	PUR	✔
ETHERLINE® TRAY ER PN Y	20201	600	60	PVC	✔
ETHERLINE® Y FC Cat.5	21694	600	75	PVC	✔
ETHERLINE® Cat.7 FLEX	21576	1000	80	PUR	✔

The table displays the state of available certifications at the time of catalogue printing. Please contact us regarding the current certification status of our products.
The use is mentioned in the UL Style pages.