

# WIRE AND CABLE MINIMUM OPERATING TEMPERATURE AND MINIMUM INSTALLATION TEMPERATURE

Low ambient temperatures are a cause for concern when installing cables. During cold weather, cables become stiff, brittle, and less flexible, and should be pulled slower and handled carefully. This document is important to understanding the minimum operating temperature and minimum installation temperature.

## PRODUCT TESTS - COLD BEND AND COLD IMPACT

Cold bend and cold impact tests provide the minimum cold temperature rating (minimum operating temperature, aka “low-temperature rating”) of a cable. These tests were designed to assess the entire cable (conductors, insulation, fillers, binders, armors, jackets, etc.) under low temperature conditions.

- Cold bend test drives the cable’s flexibility and plasticity while being bent.
- Cold impact test addresses the cable’s ability to resist damage at low temperatures.

*These test requirements are given based on applicable industry standards (UL, ICEA, CSA, NMX).*

## INSTALLATION TEMPERATURES

- The minimum installation temperature is the lowest ambient temperature recommended for cable installation. This temperature is higher than the minimum operating temperature, and is based on installation experience rather than industry standard design/test requirements.
- When cables are to be installed in cold weather, they should be kept in heated storage for at least 24 hours before installation. The cables should be not installed at ambient temperatures lower than the following:

TYPE OF INSULATION OR JACKET	MINIMUM INSTALLATION TEMPERATURE	
PVC	-10°C	14°F
NYLON	-10°C	14°F
PVC (Cables with -40°C rating/markings or lower)	-20°C	-4°F
CPE OR CSPE	-20°C	-4°F
EPR	-40°C	-40°F
PE	-40°C	-40°F
XLPE	-40°C	-40°F
SOLONON® JACKET	-40°C	-40°F
TPE	-20°C	-4°F
EPDM	-40°C	-40°F



In climates where there are large temperature swings, either intermittently or from summer to winter, jacket movement and shrink back can occur at splices and terminations. This can be due to a ratcheting effect associated with the expansion and contraction cycles of the environment and cable. Under certain conditions, terminations can allow entry of moisture and contaminants into the cable, therefore precipitating insulation failure. Mechanical restraints, such as hose clamps and shrinkable sleeves that extend over part of the jacket and termination and apply pressure at those points, have proven to be effective at restraining the jacket movement.

Engineers or cable users usually specify the normal operating, emergency, and short circuit temperature ratings when a cable is requested, but do not specify a low temperature range or do not understand the cable’s low temperature limitations based on the materials included as part of the cable.

**WIRE AND CABLE MINIMUM COLD TEMPERATURE RATINGS ACCORDING TO UL AND ICEA STANDARDS**

STANDARD	CABLE TYPE	COLD BEND		COLD IMPACT		MARKING COLD TEMPERATURE RATING
		REQUIRED TEMPERATURE RATING (°C)	OPTIONAL TEMPERATURE RATINGS (°C)	REQUIRED TEMPERATURE RATING (°C)	OPTIONAL TEMPERATURE RATINGS (°C)	
UL 83 Thermoplastic Insulated Wire and Cable, 2020	THW, THW-2, THHW, THHN	-25	-40	-	-40	A wire or cable marked "-40°C" shall meet the requirements for -40°C cold bend and cold impact
UL 1063 Machine Tool Wires, 2018	MTW	-25	-40	-	-	As per UL 83 a wire or cable marked "-40°C" shall meet the requirements for -40°C cold bend and cold impact
UL 44 Thermoset Insulated Wire and Cable, 2018	RHW, RHW-2, RHH, XHH, XHHW, XHHW-2, SIS	-25	-40	-	-40	Required if the cable passed -40°C cold bend and impact testing
UL 62 Flexible Cords and Cable, 2023	SO, SOO, SOOW, SJ, SJO, SJOO, SJOW, SJOOW, STO, STW, SJTO, SJTOW, SJEO, SJEOW, SEOOW, and SJEOW	-20	Any "W" cord: -40, -50, -60, -70	-	-	Required for "W" type cords when rated -50°C, -60°C, or -70°C
UL 1277 Tray Cable, 2021	TC, TC-ER, TC-ER-HL	-25	-	-	-40	Required if the cable passed -40°C cold impact testing
UL 1569 Metal Clad Cables, 2018	MC, MC-HL	-25	-	-	-40	Required if the cable passed -40°C cold impact test
UL 4703 Photovoltaic Wire, 2014	PV	-40	-50, -60	-	-40, - 50, -60	Optional "-40°C" or "-50°C" or "-60°C" for wire complying with cold bend and cold impact tests



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UL 1072 Medium Voltage Cables, 2020	MV-90, MV-105	-35	-	-	-40	Required if the cable passed -40°C cold impact test
UL 2263 Electric Vehicle Cable, 2022	EV, EVE, EVJ, EVJT, EVT, EVJE	-40, -50, -60, -70	-	-25, -40, -50, -60, -70	-	Low temperature rating as per cold impact test
UL 444 Communication Cables, 2017	CMP, CMR, CMX, CM	-20	-	CMX outdoor, -10	-	Not required
UL 13 Power-Limited Circuit Cables, 2015	CL3P, CL2P, CL3R, CL2R, CL3, CL2, PLTC	-20	-30, -40, -50, -60, -70	-	-	Required for cold bend temperatures lower than -20°C
UL 1424 Power-Limited Fire Alarm Circuits, 2015	FPLP, FPLR, FPL	-20	-30, -40, -50, -60, -70	-	-	For the cable to be credited with the rating below -20°C
UL 1425 Non-Power-Limited Fire Alarm Circuits, 2015	NPLFP, NPLFR, NPLF	-20	-30, -40, -50, -60, -70	-	-	For the cable to be credited with the rating below -20°C
UL 854 Service Entrance Cables, 2023	USE, USE-2 (below-ground) and SE (above-ground)	-	-	-40	-	A Type USE cable that complies with cold impact shall be surface marked -40°C

*Cables manufactured according to ICEA S-96-659, ICEA S-95-658, or ICEA S-94-649 can be safely handled if not subjected to temperatures lower than -10°C in the 24-hour period immediately preceding installation.*

