

Building Wire Types – Thermoplastic Insulation

Building Wire (sometimes referred to as “construction wire”) is usually **rated 600 volts** and includes some of the more common UL types: **THHN**, THWN, THWN-2, THW, THW-2, **MTW**, TW, TFN and TFFN which are thermoplastic insulated, and XHHW-2, USE-2, RHH and RHW-2 which are thermoset insulated. The conductor size of building wire typically ranges from #14 AWG up to 1000 kcmil. **This Wire Wisdom addresses the thermoplastic types.** Thermoset types are addressed in Wire Wisdom B-3.

THHN, THWN and THWN-2

Underwriters Laboratory (UL) Types THHN, THWN and THWN-2 building wires are used in residential, commercial and industrial buildings for general-purpose lighting, appliance, power, control and relay panel applications. These types of building wire may be installed in conduit, duct or other raceways. In some cases, one product (one part number) has two or more ratings — for example THHN/THWN. **Type THWN can be installed in 75°C dry or wet locations.** A wire with a combination THHN/THWN rating (most common), can be installed in 90°C dry or in 75°C wet locations. THWN-2 rated wire can be installed in 90°C dry or wet locations. Sizes 1/0 AWG and larger are suitable for cable tray use when identified with the optional UL marking “For CT Use”. The smaller diameter of these particular wires is appropriate for new work and rewiring applications, because it allows additional circuits or larger conductors to be installed in conduit, without exceeding maximum fill limitations. **The insulation is a heat and moisture resistant polyvinyl chloride compound (PVC) that meets UL requirements. A nylon jacket applied over the insulation provides abrasion-resistance and has good resistance to acids, alkalis, chemicals, oil, gasoline and grease.** The mechanical toughness of the nylon jacket is what allows the thickness of the PVC insulation to be reduced and thus permits a smaller overall diameter. The **“T”** in these wire designations stands for **thermoplastic**, the **“H”** for **heat resistant**, the **“N”** for **nylon** and the **“-2”** for a **90°C rating** in **both** wet and dry locations.

T = THERMOPLASTIC
H = HIGH
H = HEAT
N = NYLON

THW and THW-2

UL Type THW and THW-2 building wires are also used in residential, commercial, and industrial buildings for general-purpose lighting, appliance, power, control and relay panel applications. These types of building wire may be installed in conduit, raceways, masonry or in direct contact with the earth. THW rated wire can be installed in 75°C dry or wet

(B-2 continued)

locations in accordance with the National Electrical Code (NEC). THW-2 rated wire can be installed in both 90°C dry or wet locations. The combination insulation/jacket is a heat and moisture resistant polyvinyl chloride compound (PVC) that meets UL requirements. The “W” in the designation stands for water-resistant.

MTW

Type MTW wire is used for wiring of machine tools, internal wiring of appliances and control circuits at voltages not exceeding 600 volts. This type of wire can be installed in 90°C dry or 60°C wet locations. The insulation is a heat and moisture resistant polyvinyl chloride compound (PVC) that meets the UL requirements. The letters “MTW” stand for machine tool wire.

TW

Type TW building wire is used in residential, commercial and industrial buildings for general-purpose lighting, appliance, power, control and relay panel applications. This type of wire may be installed in conduit, duct or other raceways. UL Type TW wire can be installed in 60°C dry or wet locations. TW rated building wire is also suitable for installations in ambient temperatures down to -10°C. The insulation is a heat and moisture resistant polyvinyl compound (PVC) that meets UL requirements.

TFN and TFFN

Type TFN and TFFN wires are recommended in most types of industrial and commercial applications where fixture wires are required. These types of wire can be installed in 90°C dry locations. The insulation is a heat resistant polyvinyl compound (PVC) that meets UL requirements. The nylon jacket is abrasion-resistant and has good resistance to acids, alkalis, chemicals, oil, gasoline and grease. The first “F” in the type designation stands for fixture wire, the second “F” for flexible.

CB

Wire - THHN Type and MTW Type



139100905440
THHN10GYL



106101401440
THHN4BK



187100602440
MTW16WH



187100902440
MTW10WH

Applications

Type **THHN** building wire is intended for general purpose applications as defined by the National Electrical Code (NEC). It is appropriate for new construction or rewiring for **600-volt applications**. When used as type THHN, the conductor is suitable for use in wet or dry locations at temperatures not to exceed 90°C or not to exceed 75°C in oil or coolants. When used as type MTW, the conductor is suitable for use in dry locations at 90°C, or not to exceed 60°C in wet locations or where exposed to oils or coolants.

Type **MTW** conductors are primarily used in control cabinets, in machine tool applications and appliance wiring applications at temperatures **-25°C to 90°C**. They comply with the National Electrical Code (NEC) and NFPA Standard 79. Voltage rating for all applications is **600 volts**.

Features

Conductors

- THHN: stranded, uncoated copper conductors per ASTM-B3, ASTM-B787 and ASTM-B8
- MTW: bare, annealed copper per ASTM-B3, -B8 and -B787

Insulation

Color-coded, Polyvinyl Chloride (PVC) heat and moisture-resistant, flame-retardant compound per UL 1063 and UL 83

Jacket

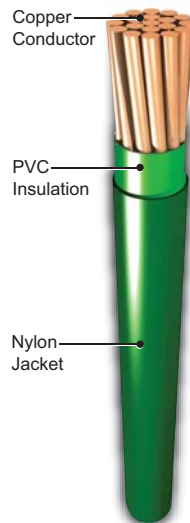
THHN: tough, polyamide, Nylon outer covering per UL 1063 and UL 83 . Slick Nylon outer jacket for easy pulling

Ratings

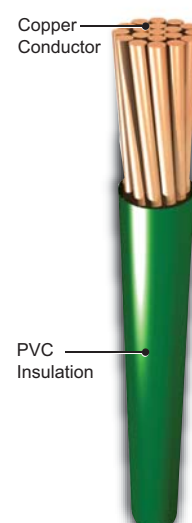
VW-1 rated 14 AWG - 1 AWG
1/0 AWG and larger is rated for CT (cable tray) use.
6 AWG and larger is rated for sunlight resistance in all colors. All sizes are rated "gasoline and oil resistant II."

Standards and Agency Approvals

- UL Standard UL 83, UL 1063, UL 758, UL file: E156879 and E123774
- AWM Spec 1316, 1317, 1318, 1319, 1320, 1321
- ASTM Stranding Class B3, B8, B787
- Federal Specification A-A-59544
- CSA C22.2 No. 75, UL E156879 and E123774
- NEMA WC70/ICEA S-95-658



THHN
Type



MTW
Type

Wire - THHN Type

Type THHN Wire Specifications											
Size (AWG or kcmil)	Number of Strands	Cross-sectional Area (mm ²)	Insulation Thickness (inches)		Overall Outside Diameter		Allowable Ampacities*			Approximate Weight (lbs)	Standard Packaging spool/reel
			PVC	Nylon	(inches)	(mm)	60°C	75°C	90°C		
14	19	2.08	0.015	0.004	0.109	2.77	15	15	15	7.8	500'
12	19	3.31	0.015	0.004	0.127	3.23	20	20	20	11.7	
10	19	5.26	0.020	0.004	0.160	4.07	30	30	30	18.7	
8	19	8.37	0.030	0.005	0.212	5.39	40	50	55	31.4	
6	19	13.3	0.030	0.005	0.248	6.30	55	65	75	48.5	
4	19	21.2	0.040	0.006	0.317	8.06	70	85	95	75.4	

*Note: Allowable ampacity shown above is per the 2005 National Electrical Code. The above data is approximate and subject to normal manufacturing tolerances.

Type THHN Wire							
Catalog Number	Color	Gauge	Part Number	Description	Spool/Reel Length	Approx. Weight	Price
THHN14BK	Black	14 AWG	106100701440	Type THHN copper wire, 19 strands, 600 Volts	500'	7.8 lbs.	<-->
THHN14WH	White		106100702440				<-->
THHN14RD	Red		106100703440				<-->
THHN14BL	Blue		106100704440				<-->
THHN14GN	Green		106100705440				<-->
THHN14YL	Yellow		106100706440				<-->
THHN14OR	Orange		106100707440				<-->
THHN14BR	Brown		106100708440				<-->
THHN14PK	Pink		106100709440				<-->
THHN14PL	Purple		106100710440				<-->
THHN14GY	Gray		106100711440				<-->
THHN14TN	Tan		106100712440				<-->
THHN14GYL	Green/Yellow stripe		139100705440				<-->
THHN12BK	Black		12 AWG				106100801440
THHN12WH	White	106100802440		<-->			
THHN12RD	Red	106100803440		<-->			
THHN12BL	Blue	106100804440		<-->			
THHN12GN	Green	106100805440		<-->			
THHN12YL	Yellow	106100806440		<-->			
THHN12OR	Orange	106100807440		<-->			
THHN12BR	Brown	106100808440		<-->			
THHN12GY	Gray	106100811440		<-->			
THHN12GYL	Green/Yellow stripe	139100805440		<-->			
THHN10BK	Black	10 AWG	106100901440	Type THHN copper wire, 19 strands, 600 Volts	500'	18.7 lbs	<-->
THHN10WH	White		106100902440				<-->
THHN10GN	Green		106100905440				<-->
THHN10YL	Yellow		106100906440				<-->
THHN10OR	Orange		106100907440				<-->
THHN10BN	Brown		106100908440				<-->
THHN10GYL	Green/Yellow stripe		139100905440				<-->
THHN8BK	Black	8 AWG	106101001440	Type THHN copper wire, 19 strands, 600 Volts	500'	31.4 lbs	<-->
THHN8GN	Green		106101005440				<-->
THHN8GYL	Green/Yellow stripe		139101005440				<-->
THHN6BK	Black	6 AWG	106101201440	Type THHN copper wire, 19 strands, 600 Volts	500'	48.5 lbs	<-->
THHN4BK	Black	4 AWG	106101401440	Type THHN copper wire, 19 strands, 600 Volts	500'	75.4 lbs	<-->

Wire - Gauge Conversion Tables

American Wire Gauge Conversion Chart*			
This cross reference shows equivalent nominal values. Actual cross sections may vary.			
AWG	mm²	AWG	mm²
30	0.05	6	16
28	0.08	4	25
26	0.14	2	35
24	0.25	1	50
22	0.34	1/0	55
21	0.38	2/0	70
20	0.50	3/0	95
18	0.75	4/0	120
17	1.00	300MCM	150
16	1.50	350MCM	185
14	2.50	500MCM	240
12	4	600MCM	300
10	6	750MCM	400
8	10	1000MCM	500

***Note: Table shows commercially used equivalent values.**

You will find product MSDS sheets and a complete glossary of wire terminology on our Web site at <http://support.automationdirect.com/products/wire.html>