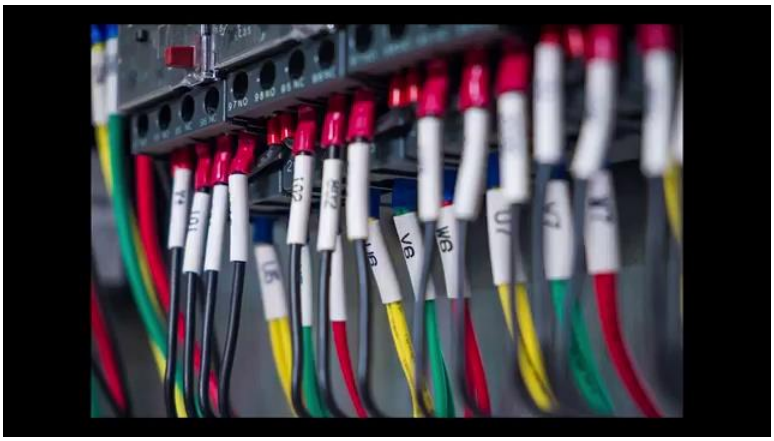
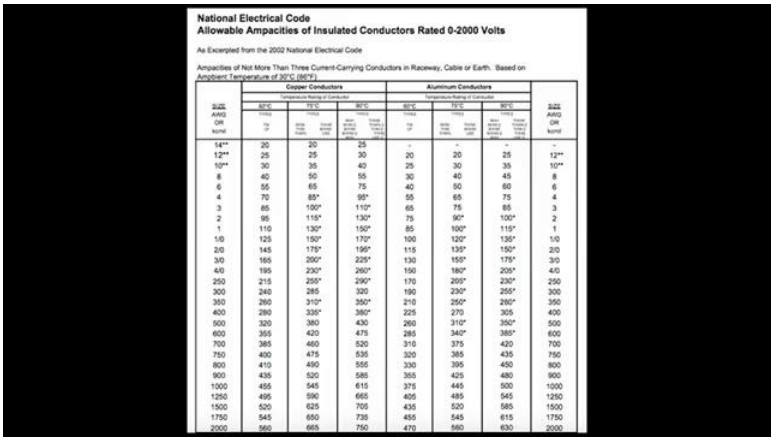
What Causes Wire Insulation to Fail?

[0m:0s]

[0m:4s] Hi, I'm Josh Bloom. Welcome to another video in the RSP Supply Education series. If you find that these videos are helpful to you, it certainly helps us out if you could give us a big thumbs up and subscribe to our channel. In today's video, we are going to be talking about something that is intended to protect us against things like electrocution, electrical arching, fires, and other electrical hazards. I am talking about the insulation that is used on a wire. For the purpose of this video, we want to talk about what would have to occur for the wire insulation to fail to a point where one of the hazards I just mentioned might occur. We will talk about insulation in regards to voltage and current, and we will also look at some different environments that wire might be found in that can have an impact on how well the insulation will do its job in protecting the wire and any persons that might be in that area. As always, the information shared in this video is intended to provide only a basic overview of this topic and should never take the place of proper electrical instruction. With that being said, Let's take a closer look at what needs to occur in order for wire insulation to fail. Some of the first things that you should look at when trying to understand when insulation will no longer do its job



[1m:28s] is to know the ampacity rating of the wire itself and also what the voltage rating of the wire is. The ampacity rating refers to the maximum amount of current that can pass through any given conductor.



National Electrical Code
Allowable Ampacities of Insulated Conductors Rated 0-2000 Volts

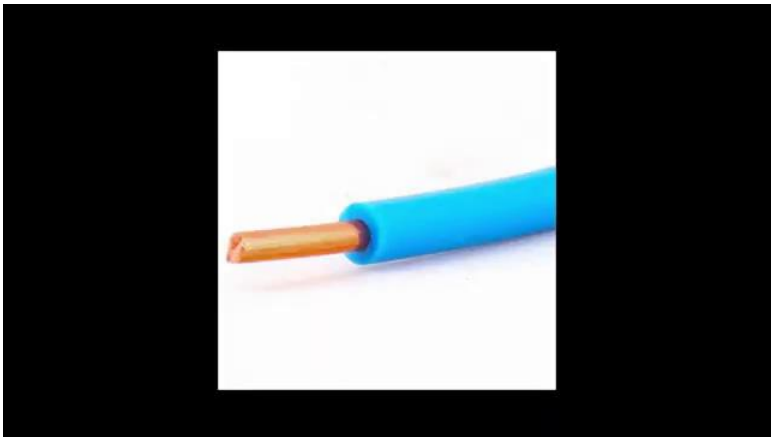
As Excerpted from the 2002 National Electrical Code

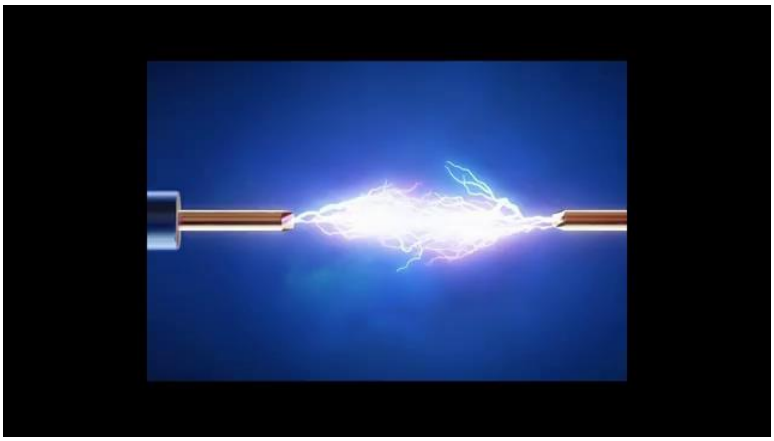
Ampacities of Not More Than Three Current-Carrying Conductors in Raceway, Cable or Earth. Based on Ambient Temperature of 30°C (86°F)

Size AWG or kcmil	Copper Conductors			Aluminum Conductors			Size AWG or kcmil
	Temperature Rating of Conductor			Temperature Rating of Conductor			
	60°C	75°C	90°C	60°C	75°C	90°C	
	Type UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Type UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
14**	20	20	25	-	-	-	-
12**	25	25	30	20	20	25	12**
10**	30	35	40	25	30	35	10**
8	40	50	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85*	95*	55	65	75	4
3	85	100*	110*	65	75	85	3
2	95	115*	130*	75	90*	100*	2
1	110	130*	150*	85	100*	115*	1
1/0	125	150*	170*	100	120*	135*	1/0
2/0	145	175*	195*	115	135*	150*	2/0
3/0	165	200*	225*	130	155*	175*	3/0
4/0	195	230*	260*	150	180*	205*	4/0
250	215	255*	290*	170	205*	230*	250
300	240	285	320	190	230*	255*	300
350	260	310*	350*	210	250*	280*	350
400	280	335*	380*	225	270	305	400
500	320	380	430	260	310*	350*	500
600	355	420	475	285	340*	385*	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	450	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	520	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	560	665	750	470	560	630	2000

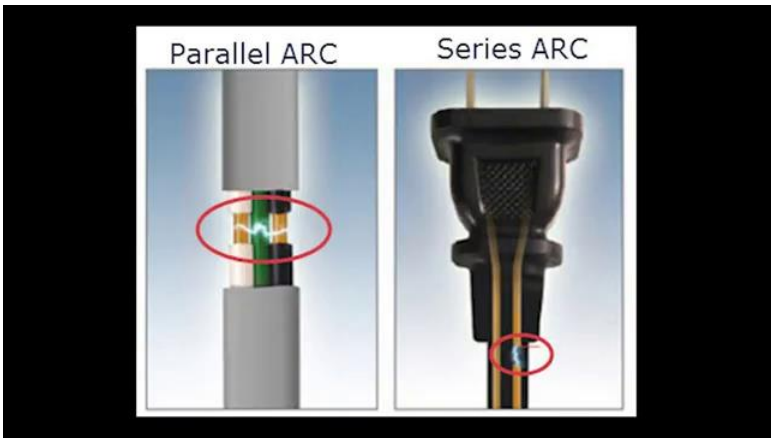
[1m:42s] If the rating is exceeded, heat can build up on that wire. If enough heat is present, it can start to break down the insulation on that wire. When this happens, the raw metal wire is exposed, jeopardizing any people or other electrical hardware in the vicinity of that wire. So, it is important to make sure that the ampacity rating is not exceeded. Voltage

should also be taken into consideration when determining when wire insulation might fail. If a wire is rated for 600 volts or less, it is imperative that no more than 600 volts be applied to that wire. When the voltage rating of the wire is exceeded, it is possible to see electrical arching occur right through the wire insulation.





[2m:30s] This arching can start fires, causal execution, and create many other very dangerous hazards. If you make sure that both the current rating and voltage rating of the wire are never exceeded, you will more than likely avoid seeing the wire insulation fail. However, if either of these levels exceed the rating of the wire, it is a matter of time before the insulation will break down and no longer be able to do or perform its job. Some other factors can also play a role in whether wire insulation will fail or not.



[3m:3s] The most common factors for this happening have to do with the environment the wire is actually located in. Some examples of this include areas where the wire might be exposed to large amounts of UV light. Most wire insulation is not intended to be exposed directly to the Sun. This is why we commonly see electrical conduit being used not just to protect people from electrical hazards, but to protect the wire. Uv light can break down the wire insulation over time and cause it to wear away and fail completely. In situations where wire must be exposed to UV light, special UV rated wire must be used. Another area where you might see wire insulation break down is in an areas where chemicals and chemical gases exist. These areas, such as Class one div 1 and Class one div 2 environments, will more quickly degrade the wire and the wire insulation. It is important to understand what gases and chemicals exist and how they affect the wire that is being used.

[4m:8s] In some cases, it may be necessary to use a different kind of wire with insulation that is rated for those kinds of environments. Other environments where wire insulation can fail include situations where the wire is being exposed to water or when the wire is being directly buried in the ground. It is important to think about the wire that you are using and make sure that both the wire and the wire insulation are rated for the specific application you intend to use it in. By understanding some of the limitations of wire insulation and in what environments and situations will cause it to fail, you will better be prepared to avoid that failure. Make sure to always pay attention to situations that can cause these kinds of problems and make sure to plan accordingly. For a full line of wire, as well as thousands of other products, please go to our website. For more information or other educational videos, go to RSPSupply.com, the Internet's source for industrial hardware. Also, don't forget, like and subscribe.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