Materials Requirements According to ICEA S-75-381

» Table 1 Power Conductor Insulation Requirements.....

The insulation for the power conductor shall meet the requirements given in the table below.

	Ethylene Propylene				Crosslinked Polyethylene	
	Type I		Type II			
	Up to 2 kV	Above 2 kV	Up to 2 kV	Above 2 kV	Up to 2 kV	Above 2 kV
1.INITIAL PHYSICAL PROPERTIES						
Tensile strength, minimum, psi	700	700	1200	1200	1800	1800
Tensile stress@100%						
Elongation, minimum, psi	-	-	500	500	-	-
Elongation at rupture, minimum,%	250	250	150	150	250	250
2.AIR OVEN AGING (After Conditioning@121℃ +/- 1℃ for 168 hours)						
Tensile strength & elongation minimum, percentage of unaged value	75	75	75	75	75	75
3.ACCELERATED WATER ABSORPTION						
Dielectric constant after 24 hours, maximum	6.0	4.0	6.0	4.0	6.0	3.5
Increase in capacitance maximum, percent						
1-14 days	5.0	3.5	5.0	3.5	3.0	3.0
7-14 days	3.0	1.5	3.0	1.5	1.5	1.5
*Stab. factor after 14 days or	1.0	1.0	1.0	1.0	1.0	1.0
*Alternate to Stability Factor (Stability Factor Difference) 1-14 days max.	0.5	0.5	0.5	0.5	0.5	0.5
4.INSULATION RESISTANCE						

	Ethylene Propylene				Crosslinked Polyethylene	
	Type I		Type II			
	Up to 2 kV	Above 2 kV	Up to 2 kV	Above 2 kV	Up to 2 kV	Above 2 kV
IR@15.6℃, minimum, Megohms-1000ft	10,000	20,000	10,000	20,000	10,000	20,000
5.ADDITIONAL REQUIREMENTS						
Power factor maximum, % after 24 hr	-	2.0	-	2.0	-	2.0
**Permittivity (SIC)	-	4.0	-	4.0	-	3.5
Hot creep (ICEA T-28-562) (After conditioning@150℃+/-2℃)					All Voltages	
					***Unfilled	***Filled
Elongation, maximum %	50	50	50	50	175	100
Set, maximum, %	5	5	5	5	10	5

* Only one of these two requirements needs to be satisfied, not both.

**Applies only to cables rated 5,001 volts and above.

***If this value is exceeded, the solvent extraction test may be performed and will serve as a referee method to determine compliance. Requirement shall be 30 percent maximum extractibles after 20 hours drying.

» Table 2 Ground Check Conductor & Control Conductor Insulation

Requirements .....

The insulation for the ground-check and control conductors shall be one of the types given in the table below and shall meet the requirements specified in it.

	Crosslinked					Thermoplastic	
	Ethylene Propylene		Crosslinked Polyethylene	Chlorinated Polyethylene	Chlorosulfonated Polyethylene	Thermoplastic Elastomer	Polypropylene
	Type I	Type II					
1.INITIAL PHYSICAL PROPERTIES (At Room Temperature)							
Tensile strength, minimum, psi	700	1200	1800	1500	1500	1500	3000
Tensile stress@100%							
Elongation, minimum, psi	-	500	-	-	-	-	2500
Elongation at rupture, minimum, percent	250	150	250	300	300	300	300
Set, maximum, percent	-	-		30	30		
2.AIR OVEN AGING REQUIREMENTS							
After conditioning@℃ +/- 1℃	121	121	121	121	121	121	100
Hours	168	168	168	168	168	168	48
Minimum percent retention of original value							
Tensile strength	75	75	75	85	85	75	75
Elongation	75	75	75	55	50	75	75

» Table 3 Extra-Heavy-Duty Crosslinked Jackets and Thermoplastic Polyurethane

The jacket for portable cables shall meet the appropriate requirements in Table 3 and 4

	Chlorinated Polyethylene (CPE)	Neoprene (PCP)	Nitrile Butadiene (NBR)/ Polyvinyl Chloride (PVC)	Chlorosulfonated Polyethylene* (CSP/CSPE)	Thermoplastic Polyurethane (TPU)
1. PHYSICAL PROPERTIES					
Tensile strength, minimum, psi	2400	2400	2400	2400	3700
Tensile stress at 200 percent elongation, minimum, psi	700	700	700	700	800
Elongation at rupture, minimum, percent	300	300	300	300	400
Set, maximum, percent	30	20	30	30	N/A
Tear resistance, minimum, ppi	40	40	40	40	80
2.AGING REQUIREMENTS (After air oven test at 100℃ +/- 1℃ for 168 hours)					
Tensile strength, minimum, percentage of unaged value	70	50	50	70	50
Elongation at rupture, minimum, percentage of unaged value	55	50	50	60	75
3.AGING REQUIREMENTS (After oil immersion test at 121℃+/-1℃ for 18 hours)					
Tensile strength and elongation, minimum, percentage of unaged value	60	60	60	60	60
4.ELECTRICAL REQUIREMENTS					
Surface resistance,nonshielded cables minimum, megohms	100	100	100	100	N/A

*Also known as Chlorosulfonyl Polyethylene

» Table 4 Heavy-Duty Crosslinked Jackets .....

The jacket for portable cables shall meet the appropriate requirements in Table 3 and 4.

The jacket for mine power feeder cables shall be a crosslinked jacket meets the requirements of Table 4 or a thermoplastic jacket that meets the requirements of Table 5.

	Chlorinated Polyethylene (CPE)	Neoprene (PCP)	Nitrile Butadiene (NBR)/ Polyvinyl Chloride (PVC)	Chlorosulfonated Polyethylene* (CSP/ CSPE)
1. PHYSICAL REQUIREMENTS				
Tensile strength, minimum, psi	1800	1800	1800	1800
Tensile stress at 200 percent elongation, minimum, psi	500	500	500	500
Elongation at Rupture, minimum, percent	300	300	300	300
Set, maximum, percent	30	20	30	30
2.AGING REQUIREMENTS (After air oven test at 100℃ +/- 1℃ for 168 hours)				
Tensile strength, minimum, percentage of unaged value	85	50	50	85
Elongation at rupture, minimum, percentage of unaged value	55	50	50	65
3.AGING REQUIREMENTS (After oil immersion test at 121℃+/-1℃ for 18 hours)				
Tensile strength and elongation, minimum, percentage of unaged value	60	60	60	60
4.ELECTRICAL REQUIREMENTS				
Surface resistance,nonshielded cables minimum, megohms	100	100	100	100

*Also known as Chlorosulfonyl Polyethylene

» Table 5 Thermoplastic Jacket Requirements

The jacket for mine power feeder cables shall be a crosslinked jacket meets the requirements of Table 4 or a thermoplastic jacket that meets the requirements of Table 5.

	Polyvinyl Chloride (PVC)	Chlorinated Thermoplastic Polyethylene (CM)	Thermoplastic Polyurethane (TPU)
1.INITIAL PHYSICAL PROPERTIES			
Tensile strength, minimum, psi	1500	1400	3700
Elongation at rupture, minimum, percent	100	150	400
2.AIR OVEN AGING REQUIREMENTS			
After conditioning@℃ +/- 1℃	100	121	100
Hours	120	168	168
Tensile strength, minimum, percent of unaged value	85	85	50
Elongation, minimum, percent of unaged value	60	50	75
3.OIL IMMERSION			
After conditioning@℃ +/- 1℃	70	100	121
Hours	4	18	18
Tensile strength, minimum, percent of unaged value	80	60	60
Elongation, minimum, percent of unaged value	60	60	60
4.HEAT DISTORTION,121℃+/-1℃, maximum,percent	50	25	-

» Table 6 Heavy Duty Jackets Requirements (Type A).....

The jacket for portable arc-welding cables shall be a heavy-duty jacket meets the requirements of Table 6 or a medium-duty jacket that meets the requirements of Table 7.

	Natural Rubber (NR)	Styrene Butadiene Rubber (SBR)	Neoprene (PCP)	Nitrile Butadiene (NBR)/ Polyvinyl Chloride (PVC)*	Chlorinated Polyethylene (CPE) ,Crosslinked	Ethylene Propylene Rubber (EPR)	Chloro-sulfonated Polyethylene (CSP/CSPE)
1.PHYSICAL REQUIREMENTS							
Tensile strength, minimum, psi	3500	1800	1800	1800	1800	1800	1800
Tensile strength, minimum, MPa	24.1	12.4	12.4	12.4	12.4	12.4	12.4
Tensile stress at 200 percent elongation, minimum, psi	500	-	500	500	500	500	500
Tensile stress at 200 percent elongation, minimum, MPa	3.45	-	3.45	3.45	3.45	3.45	3.45
Elongation at rupture, minimum, percent	500	300	300	300	300	250	300
Set, Maximum, percent	15	20	20	30	30	-	30
Tear, resistance, mimimum, pounds per inch	40	-	-	-	-	-	-
Tear, resistance, mimimum, kN/m	7.01	-	-	-	-	-	-
2.AGING REQUIREMENTS							
After air oven test at 100℃+/-1℃ for 168 hours							
Tensile strength, minimum, percent of unaged value	-	-	50	50	85	75	85
Elongation at rupture, minimum percentage of unaged value	-	-	50	50	55	75	65
After air oven test at 70℃+/-1℃ for 168 hours							
Tensile strength, minimum, psi	-	1600	-	-	-	-	-
Tensile strength, minimum, MPa	-	11.0	-	-	-	-	-
Elongation at rupture, minimum percentage	-	250	-	-	-	-	-

	Natural Rubber (NR)	Styrene Butadiene Rubber (SBR)	Neoprene (PCP)	Nitrile Butadiene (NBR)/ Polyvinyl Chloride (PVC)*	Chlorinated Polyethylene (CPE) ,Crosslinked	Ethylene Propylene Rubber (EPR)	Chloro-sulfonated Polyethylene (CSP/CSPE)
After air pressure heat test at 127℃+/-1℃ for 20 hours							
Tensile strength and Elongation at rupture, minimum, percent of unaged value	-	-	-	50	-	-	-
After oxygen pressure test at 70℃+/-1℃ for 96 hours							
Tensile strength, minimum, psi	2500	1600	-	-	-	-	-
Tensile strength, minimum, MPa	17.2	11.0	-	-	-	-	-
Elongation at rupture, minimum percentage	400	250	-	-	-	-	-
After oxygen pressure test at 80℃+/-1℃ for 168 hours							
Tensile strength and Elongation at rupture, minimum, percent of unaged value	-	-	-	50	-	-	-
After oil immersion test at 121℃+/-1℃ for 18 hours							
Tensile strength and Elongation at rupture, minimum, percent of unaged value	-	-	60	60	60	-	60

*Suitable for a minimum temperature of minus 10℃ (plus 14℉)

» Table 7 Medium Duty Jackets Requirements (Type B).....

The jacket for portable arc-welding cables shall be a heavy-duty jacket meets the requirements of Table 6 or a medium-duty jacket that meets the requirements of Table 7.

	Styrene Butadiene Rubber (SBR)	Neoprene (PCP)	Nitrile Butadiene (NBR)/ Polyvinyl Chloride (PVC)*	Chlorinated Polyethylene (CPE) ,Crosslinked	Ethylene Propylene Rubber (EPR)	Chloro-sulfonated Polyethylene (CSP/CSPE)
1.PHYSICAL REQUIREMENTS						
Tensile strength, minimum, psi	1200	1200	1500	1500	1200	1200
Tensile strength, minimum, MPa	8.27	8.27	10.3	10.3	8.27	8.27
Elongation at rupture, minimum, percent	250	250	250	300	150	250
Set, Maximum, percent	-	20	30	35	-	30
Tear, resistance, mimimum, pounds per inch						
Tear, resistance, mimimum, kN/m						
2.AGING REQUIREMENTS						
After air oven test at 100℃+/-1℃ for 168 hours						
Tensile strength, minimum, percent of unaged value	-	50	50	85	75	85
Elongation at rupture, minimum percentage of unaged value	-	50	50	55	75	65
After oxygen pressure test at 70℃+/-1℃ for 48 hours						
Tensile strength, minimum, psi	1000	-	-	-	-	-
Tensile strength, minimum, MPa	6.89	-	-	-	-	-
Elongation at rupture, minimum percentage	100	-	-	-	-	-
After oxygen pressure test at 80℃+/-1℃ for 168 hours						
Tensile strength and Elongation at rupture, minimum percent of unaged value	-	-	50	-	-	-

	Styrene Butadiene Rubber (SBR)	Neoprene (PCP)	Nitrile Butadiene (NBR)/ Polyvinyl Chloride (PVC)*	Chlorinated Polyethylene (CPE) ,Crosslinked	Ethylene Propylene Rubber (EPR)	Chloro-sulfonated Polyethylene (CSP/CSPE)
After air pressure heat test at 127℃+/-1℃ for 20 hours						
Tensile strength and Elongation at rupture, minimum, percent of unaged value	-	-	50	-	-	-
After oil immersion test at 121℃+/-1℃ for 18 hours						
Tensile strength and Elongation at rupture, minimum percent of unaged value	-	60	60	60	-	60

*Suitable for a minimum temperature of minus 10℃ (plus 14℉)