3M Test-Report

Electrical Markets Division

No.: TR-000080#2

Subject:	**ELPRESS Low Voltage Cold Shrink Inline Splice KSC25-1-x to KSC240-1-x For multicore polymeric insulated cables 0,6/1kV**
Type of Test:	**Type Test without Impact Test**
Specification:	**EN 50393 : 2006**
Date of Test :	**May 15, 2006 to June 30, 2006**
Test Summary:	**The test specimens passed the Type Test successfully according to the requirements**
Date:	**July 21, 2006**

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Manager
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1 . Description of Samples

Two test loops of about 5 m length each with ELPRESS Low Voltage Cold Shrink Inline Splices KSCxxx-1-4 were prepared according to the attached Installation Instruction Drawing XE-0091-2994-3 (Appendix B).

Used cable type: XLPE insulated, PVC jacketed cable 0.6/1 kV , N1XV-U 4G10 Ericsson
XLPE insulated, PVC jacketed cable 0.6/1 kV , N1XV-AS 4G240 Ericsson

Used Insulation: Connector Insulation : Scotch® 2228 Mastic Tape and Cold Shrink PST
Cable Jacket Insulation : Scotch® 2228 Mastic Tape and Cold Shrink PST

Loop 1: KSC25-1-4, 4 x 10 mm² Cu, round solid; ELPRESS mechanical connector SC25

Loop 2: KSC240-1-4, 4 x 240 mm² Al, sector stranded, ELPRESS mechanical connector SC240

Picture 1 : Installed Test Loop 1

Picture 2 : Installed Test Loop 2

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2. Test Sequence

Test	Type of Test according to EN 50393 sequence Ⅰ A1		Section
2.1	AC Voltage Withstand Test in air	4 kV AC / 1 min	8.3
2.2	Insulation Resistance Test in air	with 1kVDC	8.4
2.3	AC Voltage Withstand Test in water	4 kV AC / 1 min	8.3
2.4	Insulation Resistance Test in water	with 1kVDC	8.4
2.5	Load Cycling Test, 5h/3h Loop1: $I_{heating}$ = 90A, $\vartheta_{conductor}$ = 95°C Loop2: $I_{heating}$ = 350A, $\vartheta_{conductor}$ = 95°C		8.6
2.6	AC Voltage Withstand Test in water	4 kV AC / 1 min	8.3
2.7	Insulation Resistance Test in water	with 1kVDC	8.4
2.8	Examination		8.8.

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2.1 AC Voltage Withstand Test in air

An AC voltage of 4 kV was applied between phases and phases to neutral for 1 minute.

Requirement:	no breakdown
Result:	Loop 1: passed Loop 2: passed
Used Equipment:	3M No. 115 246

2.2 Insulation Resistance Test in air

The insulation resistance was checked between phases and phases to neutral with a test voltage of 1000 V DC.

Requirement:	The insulation resistance must be > 50 MΩ		
Result:	Loop 1:	Phase - Phase	min. 10.000 MΩ
		Phase - Neutral	min. 10.000 MΩ
	Loop 2:	Phase - Phase	min. 10.000 MΩ
		Phase - Neutral	min. 10.000 MΩ
Used Equipment:	3M No. 71751		

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2.3 AC Voltage Withstand Test in water

An AC voltage of 4 kV was applied between phases and neutral and phases and neutral to water for 1 minute.

Requirement:	no breakdown
Result:	Loop 1: passed Loop 2: passed
Used Equipment:	3M No. 115 246

2.4 Insulation Resistance Test in water

The insulation resistance was checked between phases and neutral and phases and neutral to water with a test voltage of 1000 V DC.

Requirement:	The insulation resistance must be > 50 MΩ		
Result:	Loop 1:	Phase - Phase	min. 10.000 MΩ
		Phase - Neutral	min. 10.000 MΩ
		Phase - Water	min. 10.000 MΩ
		Neutral - Water	min. 10.000 MΩ
	Loop 2:	Phase - Phase	min. 10.000 MΩ
		Phase - Neutral	min. 10.000 MΩ
		Phase - Water	min. 10.000 MΩ
		Neutral - Water	min. 10.000 MΩ
Used Equipment:	3M No. 71751		

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2.5 Load Cycling Test

Each thermal cycle consisted of a 5h heating and a 3h cooling period. During the heating period the conductors were heated up to the following temperatures using the following currents:

Loop 1: $I_{heating}$ = 90 A, $\vartheta_{conductor}$ = 95°C
Loop 2: $I_{heating}$ = 350 A, $\vartheta_{conductor}$ = 95°C

A total of 126 cycles was conducted of which the first 63 were performed in air, and for the remaining 63 cycles the joints were immersed in water.

A water level of 1000 mm above the joint was applied 50 mm apart from the splice end, the jackets of cable had been removed for a length of 50 mm.

After completion of thermocycling in water the AC Voltage Withstand Test was performed and the insulation resistance was checked.

Used Equipment: 3M No. 71544

2.6 AC Voltage Withstand Test in water

An AC voltage of 4 kV was applied between phases and neutral and phases and neutral to water for 1 minute.

Requirement: no breakdown

Result: Loop 1: passed
Loop 2: passed

Used Equipment: 3M No. 115 246

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2.7 Insulation Resistance Test in water

The insulation resistance was checked between phases and neutral and phases and neutral to water with a test voltage of 1000 V DC.

Requirement:	The insulation resistance must be > 50 MΩ		
Result:	Loop 1:	Phase - Phase	min. 10.000 MΩ
		Phase - Neutral	min. 10.000 MΩ
		Phase - Water	min. 10.000 MΩ
		Neutral - Water	min. 10.000 MΩ
	Loop 2:	Phase - Phase	min. 10.000 MΩ
		Phase - Neutral	min. 10.000 MΩ
		Phase - Water	min. 10.000 MΩ
		Neutral - Water	min. 10.000 MΩ
Used Equipment:	3M No. 71751		

2.8 Examination :

Requirement:	No deterioration thay may affect its long term service life
Result:	Loop 1: no evidence of deterioration (Appendix A1) Loop 2: no evidence of deterioration (Appendix A2)

Conclusion : Both loops passed the Type Test successfully.

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Appendix A1 :

Picture 1: Removed Jacket Insulation from Test Loop 1

No evidence of damaged, non functional jacket sealing

Picture 2: Removed Connector Insulation from Test Loop 1

No evidence of damaged, non functional connector sealing.
No evidence of corrosion on connector.

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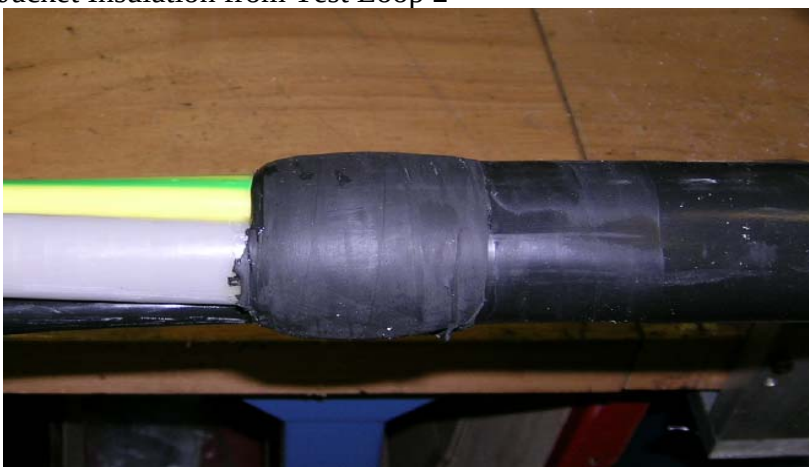
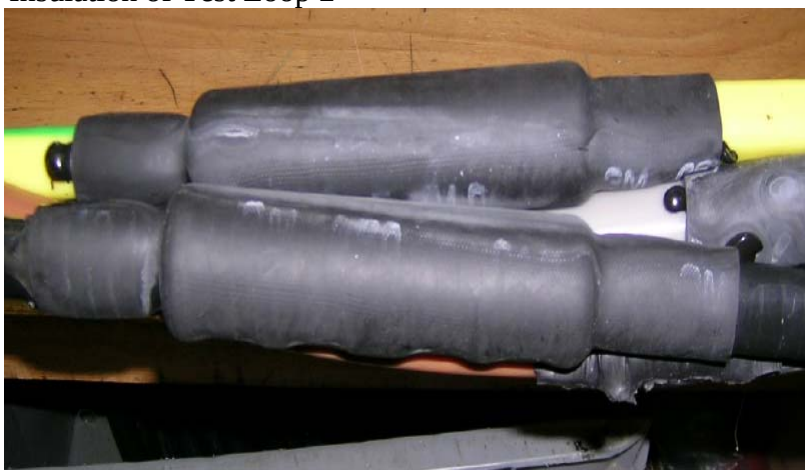
Appendix A2 :

Picture 3: Removed Jacket Insulation from Test Loop 2



No evidence of damaged, non functional jacket sealing

Picture 4: Connector Insulation of Test Loop 2



No evidence of damaged, non functional, connector insulation.

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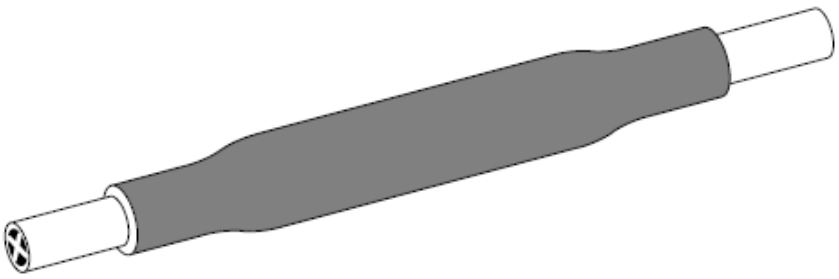
Appendix B : Installation Instruction

click&rip

ELPRESS

3M



SE: För plastisolerad 4- och 3+1 ledarkabel 0.6/1 kV, 10mm² upp till 240mm²
NO: For plastikkisolerte kabler med 4 og 3 + 1 ledere 0,6 / 1 kV 10 mm² opp til 240 mm²
FI: 4-johdin- ja $3^1/_2$ johdin muovieristeisille kaapeleille 0,6/ 1 kV 10 mm², 240 mm² asti
GB: For 4 core and 3+1 core plastic insulated cables 0,6 / 1 kV 10 mm² up to 240 mm²

3M Deutschland GmbH	ISSUE: 1	ISSUE DATE: 20.06.2006

Please note: This product may only be assembled by trained specialized personnel according to these assembly instructions. The preceding specifications are the result of in-depth research. They correspond to the state of our experience. A test by you will convince you of the excellent properties of the 3M products. Verify yourself whether these products are suitable for your purposes. All questions regarding a warranty liability are governed by our terms of sale, unless legal provisions provide differently.

AABBCC28490	1. ISSUE DATE:	20.06.06
LANGUAGE: Multiple Language	1. CHANGE DATE:	
DRAWN: M. Hubrich	2. CHANGE DATE:	
CHECKED: R. Hornig	3. CHANGE DATE:	
	4. CHANGE DATE:	

3M Cold Shrink

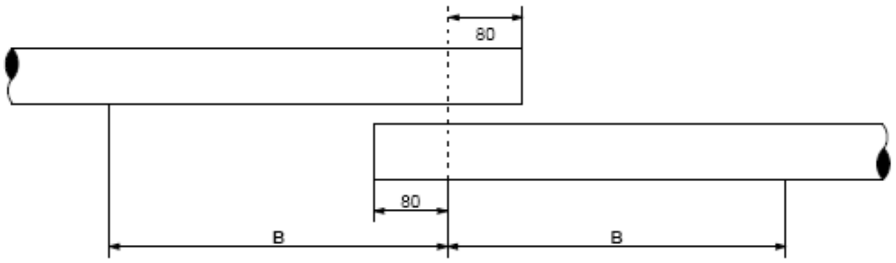
KSC 25-1-4 (10-25 mm²)
KSC 70-1-4 (25-70 mm²)
KSC 95-1-4 (50-95 mm²)
KSC 150-1-4 (95-150 mm²)
KSC 240-1-4 (150-240 mm²)

3M ELECTRICAL PRODUCTS

XE-0091-2994-3

Kit no.	(mm²)	L (mm)	A (mm)	B (mm)
KSC 25-1-4	10-25	20	100	180
KSC 70-1-4	25-70	48	200	300
KSC 95-1-4	50-95	55	200	350
KSC 150-1-4	95-150	70	240	430
KSC 240-1-4	150-250	70	250	480

1



SE: OBS: För installation av 3+1 ledar kabel, fortsätt med steg 2a på sidan 5 av 7.
NO: Bemerk : For installasjon av kabler med 3 + 1 ledere gå til steg 2a på side 5 av 7.
FI: Huom: Kun haluat asentaa $3^1/_2$ - johdin kaapelin, siirry vaiheeseen 2a sivulla 5/7.
GB: Note: For installation of 3 + 1 core cable proceed with step 2a page 5 of 7.

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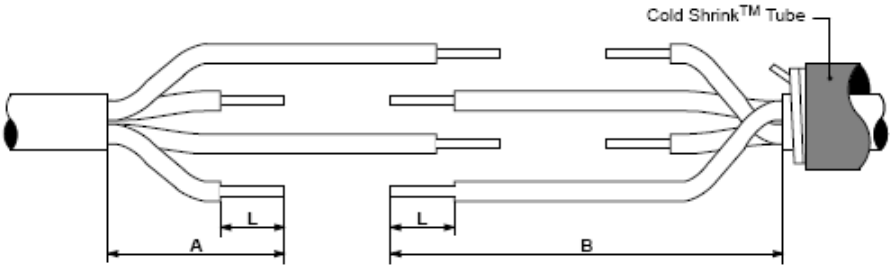
1	AABBCC28490	XE-0091-2994-3

4-ledarkabel, 4-lederkabel, 4-johdinkaapeli, 4 core Cable

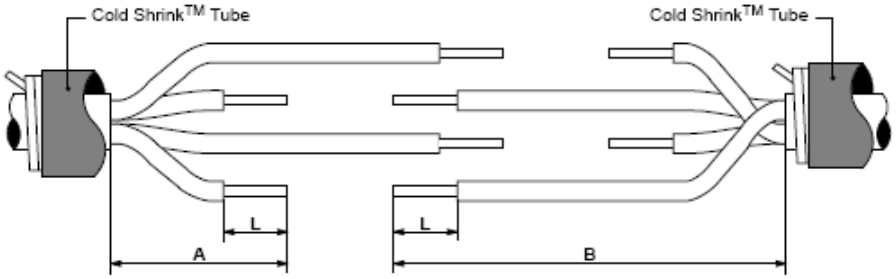
2a

KSC 25-1-4, KSC 70-1-4, KSC 95-1-4, KSC 150-1-4



2b

KSC 240-1-4



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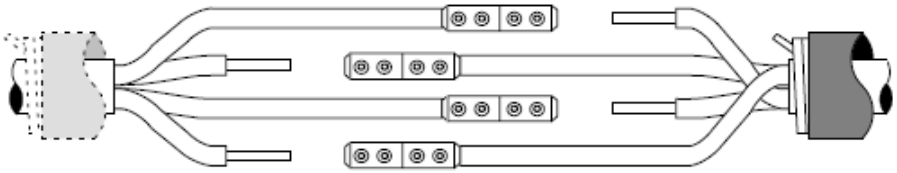

SE: Obs: För installation av hylsorna, se Elpress separata monteringsanvisningar för skruvskarvar.
NO: Bemerk: For installasjon av koblinger, se separat veiledning for installasjon av ELPRESS.
FI: Huom: Katso liittimien asennusohjeet erillisestä ELPRESSin asennusohjeesta ruuviliittimille.
GB: Note: for installation of the connectors see the separate ELPRESS connector installation instruction.

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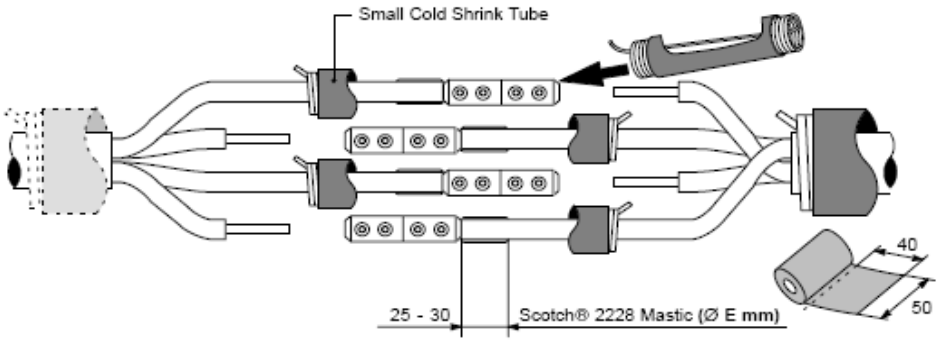
Kit no.	Ø over Mastic E (mm)	F (mm)
KSC 25-1-4	11	25
KSC 70-1-4	16	35
KSC 95-1-4	16	40
KSC 150-1-4	21	45
KSC 240-1-4	21	52

4



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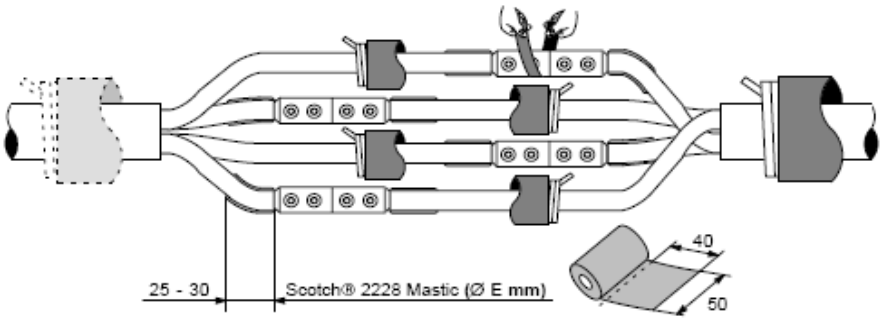
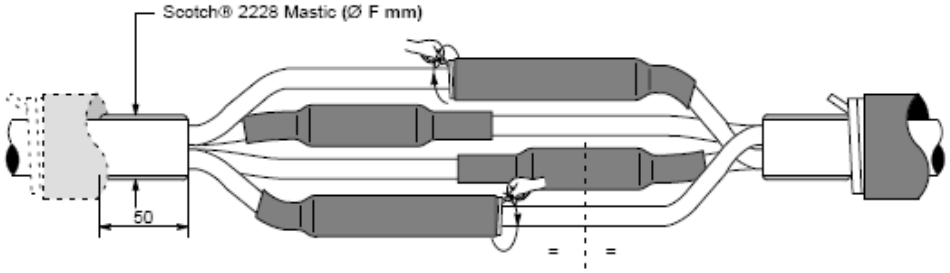


SE: OBS: Slipa av alla skarpa kanter på skruvarna och rengör hylsorna.
NO: Bemerk: Skrap bort alle skarpe kanter fra skruene og rengjør koblingene.
FI: Huom: Poista kaikki terävät reunat ruuveista ja puhdista liittimet.
GB: Note: Abrade all sharp edges of the screws and clean the connectors.

6



SE: Fortsätt med steg 7 eller steg 9a(KSC240-1-4) på sidan 7 av 7.
NO: Bemerk: Fortsett med steg 7 eller steg 9a (KSC 240-1-4) på side 7 av 7.
FI: Huom: Jatka vaiheesta 7 tai vaiheesta 9a (KSC 240-1-4) sivulla 7/7.
GB: Note: continue with step 7 or step 9a (KSC 240-1-4) on page 7 of 7.

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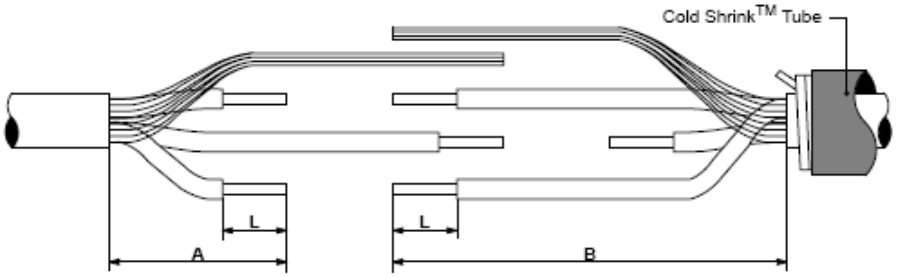
1	AABBCC28490	XE-0091-2994-3

3+1 kabel, 3+1 lederkabel, $3^1/_2$ -johdin kaapeleille, 3+1 core Cable

Kit no.	L (mm)	A (mm)	B (mm)
KSC 25-1-4	20	100	180
KSC 70-1-4	48	200	300
KSC 95-1-4	55	200	350
KSC 150-1-4	70	240	430
KSC 240-1-4	70	250	480

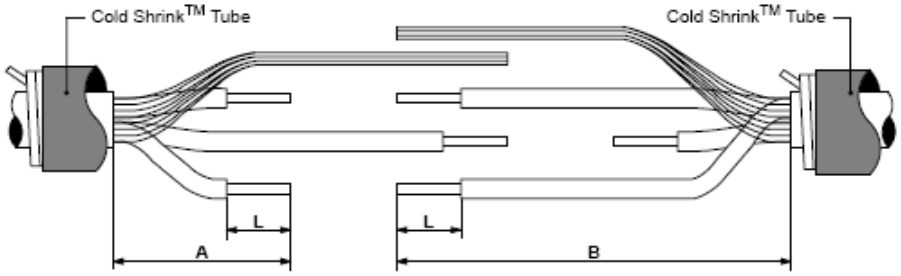
2a

KSC 25-1-4, KSC 70-1-4, KSC 95-1-4, KSC 150-1-4



2b

KSC 240-1-4



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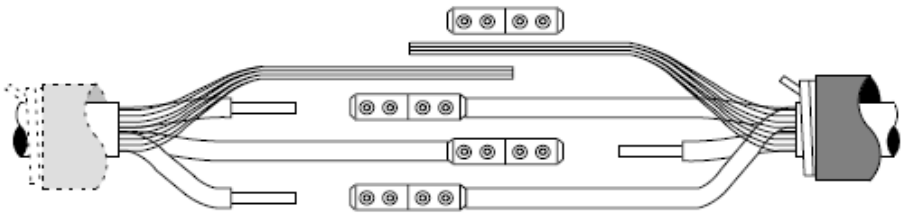

SE: Obs: För installation av hylsorna, se Elpress separata monteringsanvisningar för skruvskarvar.
NO: Bemerk: For installasjon av koblinger, se separat veiledning for installasjon av ELPRESS.
FI: Huom: Katso liittimien asennusohjeet erillisestä ELPRESSin asennusohjeesta ruuviliittimille.
GB: Note: for installation of the connectors see the separate ELPRESS connector installation instruction.

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Kit no.	Ø over Mastic E (mm)	F (mm)
KSC 25-1-4	11	25
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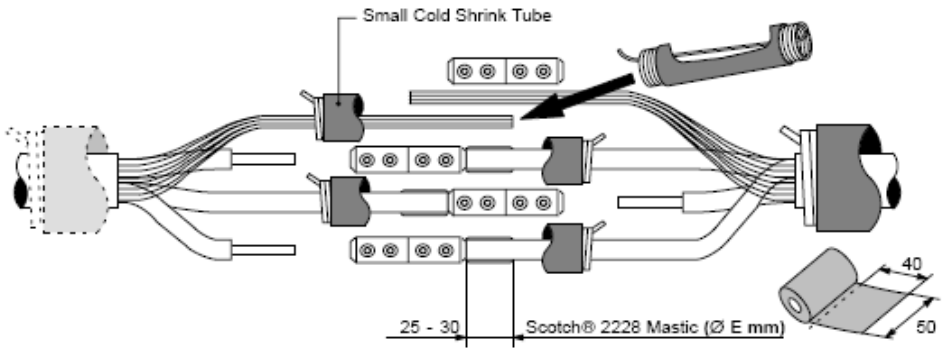
KSC 95-1-4	16	40
KSC 150-1-4	21	45
KSC 240-1-4	21	52

4



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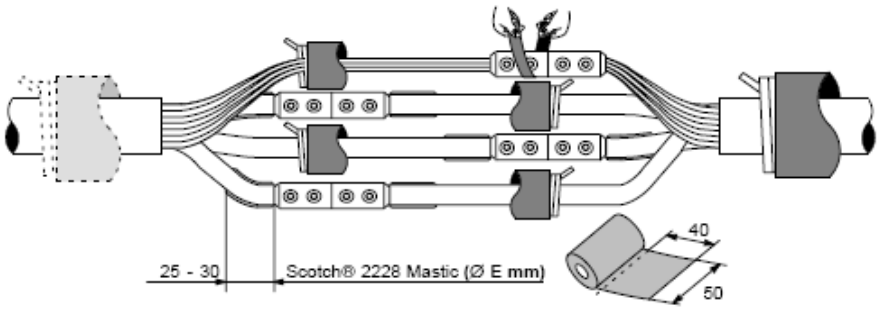
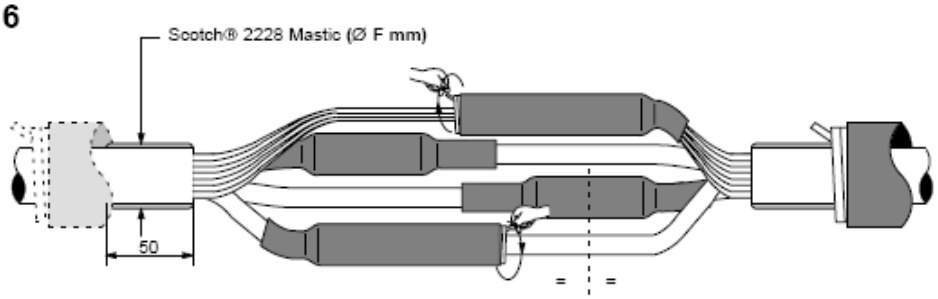


SE: OBS: Slipa av alla skarpa kanter på skruvarna och rengör hylsorna.
NO: Bemerk: Skrap bort alle skarpe kanter fra skruene og rengjør koblingene.
FI: Huom: Poista kaikki terävät reunat ruuveista ja puhdista liittimet.
GB: Note: Abrade all sharp edges of the screws and clean the connectors.

6



SE: Fortsätt med steg 7 eller steg 9a (KSC240-1-4) på sidan 7 av 7.
NO: Bemerk: Fortsett med steg 7 eller steg 9a (KSC 240-1-4) på side 7 av 7.
FI: Huom: Jatka vaiheesta 7 tai vaiheesta 9a (KSC 240-1-4) sivulla 7/7.
GB: Note:continue with step 7 or step 9a (KSC 240-1-4) on page 7 of 7.

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1	AABBCC28490	XE-0091-2994-3

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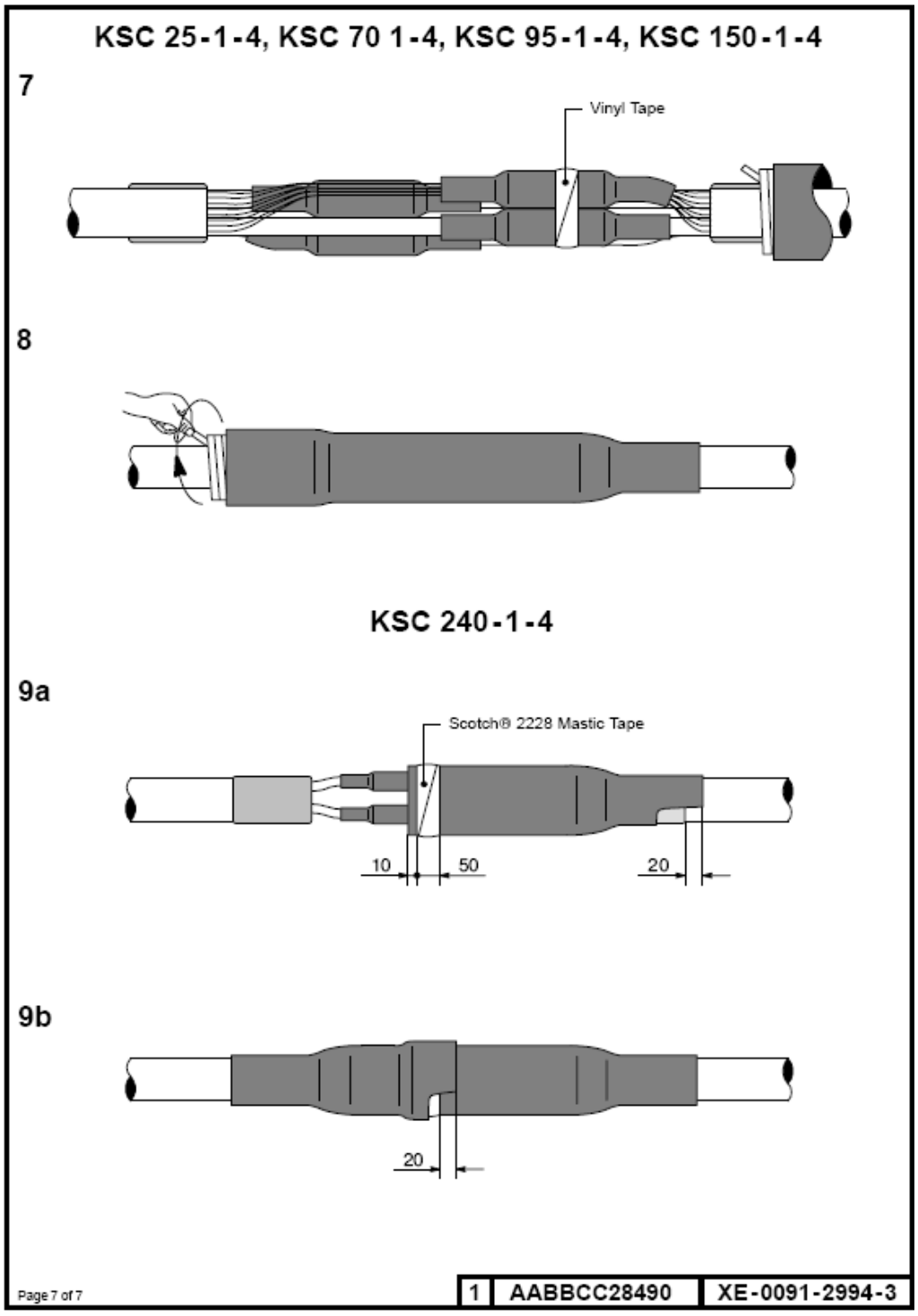

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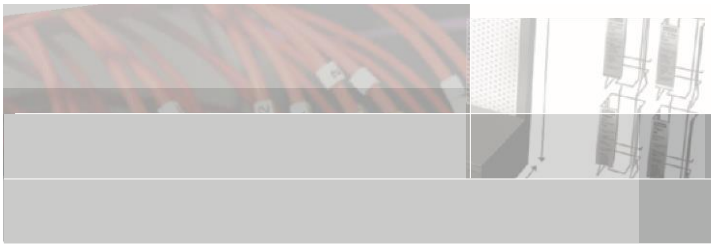

Scotch® Rubber Mastic Tape 2228

Data Sheet March 2020

Product Description	Scotch® Rubber Mastic Tape 2228 is a conformable self–fusing rubber electrical insulating and sealing tape. Scotch® Rubber Mastic Tape 2228 consists of an ethylene propylene rubber (EPR) backing coated with an aggressive, temperature–stable mastic adhesive. The tape is made 65 mils (1,65 mm) thick for quick application build–up. It is designed for electrical insulating and moisture sealing applications. Scotch® Rubber Mastic Tape 2228 is a UL recognized component for applications up to 130°C. It offers excellent resistance to moisture and ultraviolet exposure and is intended for both indoor and weather exposed outdoor applications.
Agency Approvals & Self Certifications	UL recognized component listing not to exceed 130°C (266°F), Product Category OANZ2, and 3M File No. E17385 For RoHS information, please visit www.3M.com/ROHS
Product Features	• Conformable for application over irregular surfaces. • Compatible with solid dielectric cable insulations. • Self–fusing tape. • Flexible over wide temperature range. • Excellent weather and moisture resistance. • Excellent adhesion and sealing characteristics with copper, aluminum and power cable jacket materials. • Thick construction allows quick application build–up and padding over irregular connections.
Applications	• Primary electrical insulation for cable and wire connections rated up to 1000 volts. • Electrical insulation and vibration padding for motor leads rated up to 1000 volts. • Primary electrical insulation for bus bar connections rated up to 35kV (3M drawing 2047B–106) • Padding for irregular shaped bus bar bolted connections. • Moisture seal for cable and wire connections. • Moisture seal for service drops. • Moisture seal for ground wire and rod connections • Jacket seal on power cable applications

3M

Installation

Scotch® Rubber Mastic Tape 2228 should be applied in half–lapped layers until desired insulation build up is reached. Stretch the tape to 3/4 of its original width during application for good conformability and to obtain a moisture tight seal. Scotch® Rubber Mastic Tape 2228 should be overwrapped for mechanical protection with two half–lapped layers of Scotch® Super 33+™ Vinyl Electrical Tape.

Typical Properties

Properties	Typical Value
Temperature Rating [6]	266°F (130°C)
Color	Black
Thickness [1]	65 mil (1,65mm)
Adhesion [5]	Steel 15.0lb/in (26,2N/10mm) PE 10.0lb/in (17,5N/10mm)
Fusion [4]	Pass (Type I)
Tensile Strength [1]	150psi (1,03N/mm^2)
Elongation [1]	1000%
Dielectric Breakdown [1] (Wet or Dry)	500V/mil (19,7kV/mm)
Dielectric Constant [1]	3.5
Dissipation Factor [1]	1.0%
Water Absorption [3]	0.15%
Water Vapor Transmission Rate [2]	0.1g/100in^2/24hr
Ozone Resistance [2]	Pass
Heat Resistance [4]	Pass, 130°C
UV Resistance [4]	Pass

Note: These are typical values and should not be used for specification purposes.

* Foot notes: 1. ASTM-D-4325 Test method
2. ASTM-D-3833 Test method
3. ASTM-570 Test method
4. ASTM-D-4388 Test method
5. ASTM-D-1000 Test method
6. UL recognized component, Product Category OANZ2, and 3M File No. E17385

3M Water Seal Test

Samples were constructed using Scotch® Rubber Mastic Tape 2228 as a seal between PVC cable jackets and connecting ground wires (3M™ Cable Grounding Kit 2252). The specimens were thermal cycled in water baths at 25°C and 90°C. The total test time of 336 hours revealed no significant change in insulation resistance. The results meet requirements listed in UL 486D Standard for Insulated Wire Connectors for Use
With Underground Connectors for insulation resistance (6.0 megohms, section 7.1) and dielectric voltage withstand (2.2kV, 1 minute, section 8.1).

Specification	The tape shall be 65 mils (1,65 mm) thick. The tape must be ethylene propylene rubber based and coated with a rubber mastic pressure-sensitive adhesive. The tape shall be a UL recognized component for applications up to 130°C. The tape must be applicable at temperatures of 0°C to 38°C without loss of physical properties. The tape must be classified for use in both indoor and weather–exposed outdoor environments. The tape must not split or crack when exposed to normal operating temperatures and environments. The tape must be compatible with synthetic cable and wire insulations. The tape shall not be corrosive to aluminum or copper conductors.
Shelf-Life	Scotch® Rubber Mastic Tape 2228 has a five-year shelf life (from date of manufacture) when stored in a humidity-controlled storage (10°C/50°F to 27°C/80°F and < 75% relative humidity). Good stock rotation is recommended.
Availability	Scotch® Rubber Mastic Tape 2228 is available from your local 3M authorized distributor.

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