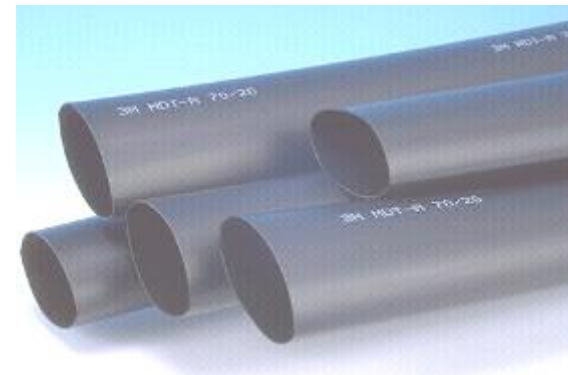


# Energy / Power Utility Market

## Main Customers:

- Power Utilities (e.g. E.ON, RWE, EnBW, Vattenfall, etc....)
- Contractors
- Electrical Installers



## HEAT SHRINKABLE Energy PRODUCTS



- Tubes
  - MDT / MDT-A
  - HDT / HDT-A >>> HDT-AN
  - **BBI-A Tubes for Bus Bar Applications**
- **MOLDED SHAPES**
  - **END CAPS**
  - **BREAKOUT BOOTS**
  - **WRAP AROUND SLEEVES**
  - **WALL CABLE DUCTS**
- Heat Shrink Kits

# Halogen containing

- one of the most FAQ by customer
- Halogenes: Bromin, Iodine, Chlorine and Flour
- Background:  
Dangerous substances can escape when parts  
are burning

# Halogen

- Halogenfree / RoHS compliant:  
MDT, MDT-A, HDT-AN,
- Breakout Boots, End Caps, Wrap Around Sleeves
- Halogen containing:  
HDT, HDT-A

# MDT

## Medium Wall Tubing

- ✓ Medium-wall polyolefin tubing
  - ✓ Shrink ratio up to 4.5:1
  - ✓ Provides tough and flexible insulation
  - ✓ Halogen free and RoHS compliant
- 
- Sizes: from 12/3mm to 120/40mm
  - Wall thickness (recovered): 2.5 – 3.3mm
  - Standard packaging: 1m pieces in standard pack.
  - Certificates / Approvals:
    - Lloyd's Register of Shipping Certificate 95/30032



# MDT-A

## Medium Wall Adhesive Coated Tubing

- ✓ Medium-wall polyolefin tubing with hot melt adhesive
  - ✓ Excellent sealing properties, due to smooth, constant adhesive layer applied during extrusion
  - ✓ Shrink ratio up to 4.5:1
  - ✓ Provides tough and flexible insulation; ideal for protection of cable joints/terminations
  - ✓ Flame-retardant version for offshore/naval applications available (MDT-A-F471)
  - ✓ Halogen free and RoHS compliant
- 
- Sizes: from 12/3mm to 120/40mm
  - Wall thickness (recovered): 2.5 – 3.3mm
  - Standard packaging: 1m pieces in bulk-, standard-, display-pack.
  - Certificates / Approvals:
    - Lloyd's Register of Shipping Certificate 95/30032



# MDT-A-F471

## Medium Wall flame-retardant Adhesive Coated Tubing

- ✓ Medium-wall polyolefin tubing with hot melt adhesive
  - ✓ Special flame-retardant MDT-A version for offshore/naval applications
  - ✓ Excellent sealing properties, due to smooth, constant adhesive layer applied during extrusion
  - ✓ Shrink ratio up to 4.5:1
  - ✓ Provides tough and flexible insulation; ideal for shipbuilding and offshore
- 
- Sizes: from 12/3mm to 120/40mm
  - Wall thickness (recovered): 2.5 – 3.3mm
  - Standard packaging: 1m pieces in standard pack.

# HDT-A

## Thick Wall Adhesive Coated Tubing

- ✓ Thick-wall polyolefin tubing for heavy-duty applications
  - ✓ Excellent sealing properties
  - ✓ Toughness and weatherability makes HDT-A well suited for exposed applications
  - ✓ Flame-retardant
  - ✓ Shrink-ratio up to 4:1
- 
- Sizes: from 12/3mm to 128/38mm
  - Wall thickness (recovered): 3.2 - 4.8 mm
  - Standard packaging: 1m pieces in bulk-, standard-, display-pack.





HDT-AN

## Technical Requirements

- Meet IEC 60684-3-247 table B
- Meet DIN 47640
- Meet HD 631.2
- Tubes to shrink as specified ( ID of tube measured w/o adhesive )
- Halogen free – not flame retardant
- RoHS compliant
- with hot-melt adhesive inside
- Application temperature -55°C to +130°C
- UV resistant



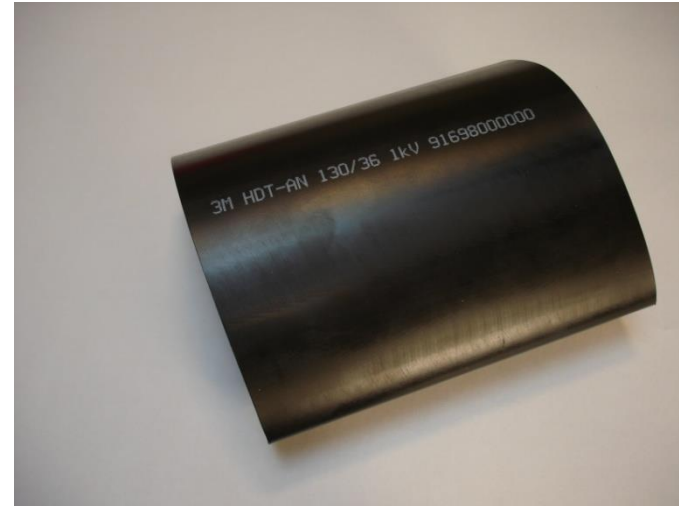
## Type HDT-AN(new)

DIN IEC 60684-3-247			3M HDT-A			DIN 47 640			MDTH-A			SIZING PROPOSAL		
Thick wall									available 13.11.2008			HDT-A new		
D	d	s	D	d	s	D	d	s	D	d	s	D	d	s
min	max	min	min	max	min	min	max	min	min	max	min	min	max	min
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
9	3	1,8	12.0	3.0	2,5							12.0	3.0	2,5
13	4	2,4				15	4	2,4				15	4	2,5
19	6	2,4	19.0	6.0	2,5	22	6	2,4				22	6.0	2,5
28	9	3,0												
33	8	3,2	30.0	8.0	4,0	33	8	3,2				33	8.0	3,2
38	12	4,0	38.0	12.0	4,0							43	12	4,0
43	12	4,0				43	12	4,0				48	15	4,0
48	15	4,0	48.0	15.0	4,0				48	15	4,0			
51	16	4,0	55.0	15.0	4,0	55	16	4,0	65	15	4,0	65	15	4,0
68	22	4,0	65.0	16.0	4,0	70	21	4,0	72	20		72	20	4,0
85	25	4,0	85.0	26.0	4,0	85	25	4,0	85	26	4,0	85	25	4,0
90	30	4,0							90	26		90	26	4,0
105	30	4,0	95	38	4,0	105	26	4,0	105	30		105	26	4,0
115	40	4,0	115.0	38.0	4,0				115	26		115	26	4,0
130	40	4,2	128	38	4,0	130	36	4,0	128	38	4,0	130	36	4,0
150	48	4,3												
160	50	4,3												
170	60	4,3												
200	77	4,3												

# HDT - AN

## Thick Wall Adhesive Coated Tubing

- ✓ Thick-wall polyolefin tubing for heavy-duty applications
- ✓ Well suited for exposed applications due to toughness and weatherability
- ✓ RoHS compliant, halogen free
- ✓ DIN – Standard compliant wall thickness
- ✓ Shrink-ratio up to 4:1
- Sizes: from 12/3mm to 130/36mm
- Wall thickness (recovered): 1.8 - 4.0 mm
- Standard packaging: 1m pieces in display-pack

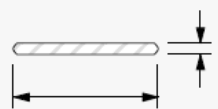
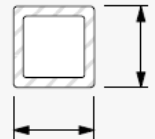



# BBI-A

## Thick Wall Adhesive Coated Tubing

- ✓ Designed for insulating rectangular, square and round bus bar rated from 5 kV through 35 kV ( IEEE )
  - ✓ Specially formulated cross-linked polyolefin, halogen free
  - ✓ High resistance to splitting
  - ✓ Good solvent resistance
  - ✓ Excellent tracking resistance properties
  - ✓ Good thermal endurance
  - ✓ Flame retardant; self extinguishing
  - ✓ Colored orange-red
- Sizes: BBI-3A to BBI-10A
  - Max Operating Temperature 110°C



		
Rectangular *	Square *	Round

## End caps

- ✓ **For sealing of cable ends**
  - ✓ **Provide perfect watertight seal**
  - ✓ Internally coated with hot melt adhesive
  - ✓ Operating temperature range -35°C to +135°C
  - ✓ **RoHS compliant and halogen free**
- 
- 7 Sizes: from SKE 4/10 to SKE63/158
  - Wall thickness (recovered): 2,5mm – 4,5 mm

Product Description	Application Range	Ø Exp.	Ø Recov.	Length Recov.	Wall Thickness Recov.
	mm	mm	mm	mm	mm
SKE 4/10	4 - 8	10	4	40	2.5
SKE 8/20	8 - 16	20	8	65	2.5
SKE 15/40	15 - 32	40	15	105	3.0
SKE 25/63	25 - 51	63	25	160	4.5
SKE 30/76	30 - 61	76	30	140	4.5
SKE 45/100	45 - 80	100	45	160	4.0
SKE 63/158	63 - 126	158	63	190	4.0



## Live End caps ( Stop end kit )

- ✓ **For sealing of max 1kV energized cable ends**
- ✓ 4 pcs small caps for conductors,
- ✓ 1 larger outer protection cap
- ✓ **Provide perfect watertight seal**
- ✓ Internally coated with hot melt adhesive
- ✓ Printed with abrasive resistant voltage arrow
- ✓ **Operating temperature range -30°C to +135°C**
- ✓ **RoHS compliant and halogen free**



- 3 Sizes: from SKE S/1+2 to SKE S/5

Product Description	Application Range	Large cap		Small caps	
		Length mm	Shrink ratio mm	Length mm	Shrink ratio mm
SKE S/1+2	10 – 25	120	40/15	40	14/04
SKE S/2+3	35 - 150	160	62/25	65	24/08
SKE S/5	185 - 400	170	105/45	80	40/15



## Breakout Boots

- ✓ **Cable crutch sealing indoor and outdoor applications**
  - ✓ **2-finger up to 6-finger boots**
  - ✓ **Provide perfect water- and oiltight seal**
  - ✓ **Internally coated with hot melt adhesive**
  - ✓ **Operating temperature range -30°C to +135°C**
  - ✓ **RoHS compliant and halogen free**
- 
- 4 sizes 2-Finger Breakout Boots
  - 6 sizes 3-Finger Breakout Boots
  - 5 sizes 4-Finger Breakout Boots
  - 1 size 5-Finger Breakout Boots ( SOS France )
  - 1 size 6-Finger Breakout Boots ( SOS USA )

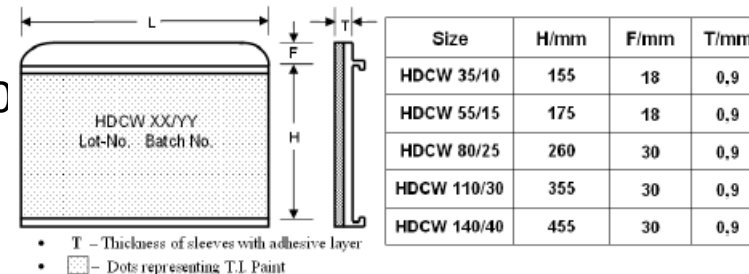


## Wrap around sleeves

- ✓ For cable jacket repair and corrosion protection
- ✓ Provide perfect watertight seal
- ✓ Internally coated with hot melt adhesive
- ✓ Outer surfaces have thermocromic paint
- ✓ Robust stainless steel reel
- ✓ Operating temperature range  $-30^{\circ}\text{C}$  to  $+135^{\circ}\text{C}$
- ✓ RoHS compliant and halogen free



- 5 Sizes: from HDCW 35/10 to HDCW 140/40
- 5 lengths : 250mm to 1200mm





## Wall Cable Duct

- ✓ **Gas and watertight duct for cables and pipes**
- ✓ **Provide perfect watertight seal**
- ✓ Ends are internally coated with hot melt adhesive
- ✓ Corrugated section has special coating to ensure permanent watertight seal to concrete
- ✓ Cables and pipes can be ceiled at a later time
- ✓ **Operating temperature range -30°C to +135°C**
- 4 Sizes: from WMD 16/8 to WMD 59/26



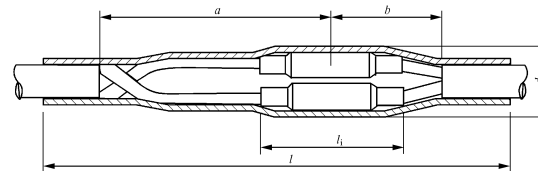
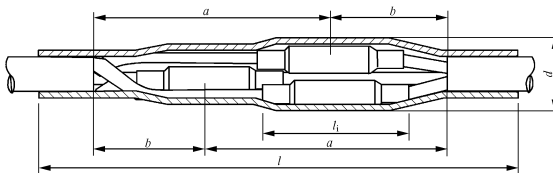
# Installation

- cable cleaning
- cable roughening
- use the yellow part of the flame
- shrink with burner around the part or tube.  
otherwise you will not get an equal wall thickness
- start shrinking in the middle of the tube and then  
move with the burner from the middle to the ends!

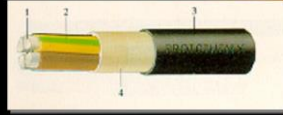
## Low Voltage Kits

### Design:

- ✓ Depends on cable construction ( e.g. 3 or 4 or 5 core, shielded or not shielded)
- ✓ Customer request (max. application range or defined value range, wall thickness etc)
- ✓ With or for compression connectors
- ✓ With or for mechanical connectors
- ✓ For " working under voltage " applications
- ✓ Slim design : connectors installed "offset position "
- ✓ Bulky design : connectors installed at same position
- ✓ DIN V 47640



**Non-Armoured and Non-Shielded  
Low Voltage Cable Type**



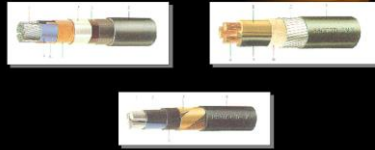
- 1- Conductor 3/4/5-core (Al or Cu; RM, RE, SM, SE)
- 2- Polymeric insulation (PVC, PE, XLPE)
- 3- Jacket (PVC, PE)
- 4- Bedding

91-AH xx N Series @ for compression connectors

91-AHS xx Series @ for screw connectors

91-AHSC xx Series @ with screw connectors

**Armoured or Shielded  
Low Voltage Cable Types**



91-AHA xx S Series @ for compression connectors

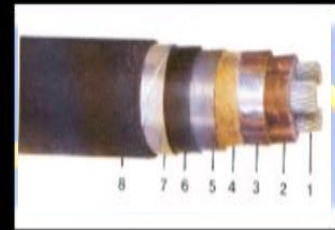
91-AHCA xx Series @ with compression connectors

**Flexible  
Low Voltage Cable Types**



91-AHF xx Series @ for screw or compression connectors

**Paper insulated  
Low Voltage Cable Types**



91-AHT xxx Series @ with screw connectors

## Low Voltage Kits DIN V 47640

### Design:

- ✓ For Inline Joints only
- ✓ Specifies cable cross section ranges
- ✓ Specifies tube sizes, lengths and wall thicknesses for each kit
- ✓ Specifies cable cutback lengths
- ✓ For " working under voltage " applications
- ✓ With or for compression connectors
- ✓ With or for mechanical connectors
- ✓ Specifies mechanical connector ranges and dimensions
- ✓ Slim design : connectors installed "offset position "
- ✓ Bulky design : connectors installed at same position



## 91-AH xx-N series Inline Joint Kit Series for Crimp Connectors

### Product Range

Kit Description	Cable Cross Section range  N(A)YY / N(A)2YY  [mm <sup>2</sup> ]	Tube dimensions				Approx. Joint Length  [mm]
		Inner Tube		Outer Tube		
		E	R	E	R	
		[mm]	[mm]	[mm]	[mm]	
91-AH 20-5N	5 x 1,5 – 5 x 6	12	3	33	8	210
91-AH 21-5N	5 x 6 – 5 x 16	15	4	43	12	370
91-AH 21 N	4 x 6 – 4 x 25 4 x 6 – 4 x 16*	15	4	43	12	520
91-AH 22 N	4 x 25 – 4 x 50*	22	6	55	15	600
91-AH 23 N	4 x 25 – 4 x 95	33	8	65	16	700
91-AH 24 N	4 x 35 – 4 x 150 4 x 70 – 4 x 150*	33	8	105	26	750
91-AH 25 N	4 x 95 – 4 x 300 4 x 185 – 4 x 240*	43	12	130	36	900

E = Expanded Diameter

R = Recovered Diameter

\*Application ranges according DIN V 47640

### Kit content

- Thick Wall, adhesive coated, outer protection tube
- Thick Wall, adhesive coated, connector insulation tube
- Detailed installation instruction





91-AHA xx-N series  
 Inline Joint Kit Series for Crimp Connectors  
 For armored cables

**Product Range**

Kit Description	Cable Cross Section range  N(A)YY / N(A)2YY  [mm <sup>2</sup> ]	Tube dimensions				Approx. Joint Length  [mm]
		Inner Tube		Outer Tube		
		E	R	E	R	
		[mm]	[mm]	[mm]	[mm]	
91-AHA 21N	4 x 6 – 4 x 16	15	4	43	12	450
91-AHA 22N	4 x 25 – 4 x 35	22	6	55	15	610
91-AHA 23N	4 x 50 – 4 x 70	33	8	65	16	700
91-AHA 24N	4 x 95 – 4 x 150	33	8	85	25	810
91-AHA 25N	4 x 185 – 4 x 240	43	12	130	36	900

E = Expanded Diameter

R = Recovered Diameter

**Kit content**

- Thick Wall, adhesive coated, outer protection tube
- Thick Wall, adhesive coated, connector insulation tube
- Shielding socket, constant force spring
- Tape
- Detailed installation instruction

# Summary

- Broad standard range of Heat shrink tubes for all market segments
- Specialized Tubes ...certified, approved, listed by
  - UL, MIL, Lloyds, DNV, Germanischer Lloyd, VDE...
- Customized solutions possible
  - Product sizes
  - Individual length / printing
  - Product kitting