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ENGINEERING DESIGN STANDARD

EDS 02-0087

LV TRANSFORMER TAIL CABLE RATINGS

Network(s):	EPN, LPN, SPN		
Summary:	This standard provides the technical and practical information required for the safe, effective design and installation of LV transformer tails.		
Author:	Jesse Garcia	**Date:**	01/08/2022
Approver:	Barry Hatton	**Date:**	10/08/2022

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Revision Record

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Minor version update: correction of sentence on B1 and B2 from Unarmoured to Armoured.			
Version	1.0	**Review Date**	10/08/2027
Date	01/08/2022	**Author**	Jesse Garcia
New standard detailing the technical and practical information required for the safe, effective design and installation of LV transformer tails.			

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1 Introduction

The purpose of this engineering standard is to provide designers, installers and operators with the necessary technical and practical information required to enable the safe and efficient design and installation of LV transformer tails within UK Power Networks.

2 Scope

This standard covers all LV single XLPE core cables in trefoil formation in both laid direct and ducted installations for use as transformer tails:

- 600mm^2 unarmoured aluminium single core XLPE cable with a PVC sheath.
- 600mm^2 armoured aluminium single core XLPE cable with a PVC sheath.

3 Glossary and Abbreviations

Term	Definition
A	Amps
Al	Aluminium
C	Centigrade
F	Farad
kA	Kilo amps
kg	Kilogram
kN	Kilo newtons
kVA	Kilo volt amperes
LV	Low voltage
M	Metre
mm	Millimetre
mm²	Square millimetre
mV	Milli volts
PVC	Polyvinylchloride
Single Point Bonded	An installation condition where the wire screens of a screened or armoured cable, are only connected to earth at one end to prevent the generation of circulating currents.
XLPE	Cross linked polyethylene

4 Distribution Transformer LV Tail Cable Sizes

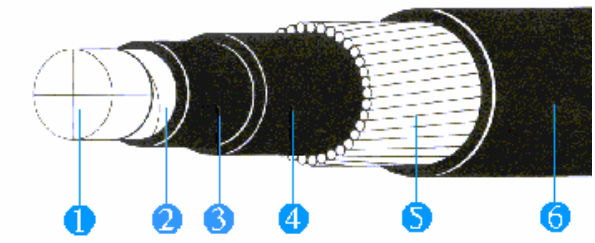
This section provides a guide to the selection of a particular cable sizes to suite individual distribution transformer sizes. The cable sizes quoted are for one single core transformer tail only and are calculated in accordance with the relevant national and international standards. The kVA ratings are for a three-phase supply. Appendix A and Appendix B of this document provides more details on the individual ratings for each cable type in each installation situation.

Table 4-1 – Distribution Transformer Size against Minimum Cable Size

Transformer Size (kVA)	Substation Type	Minimum Cable Size & Type (mm^2)	Cores per Phase	Installed in Ducts	Wire Screen Bonding Arrangement
315	Outdoor	600 Al Armoured	1	No	Single Point Bonded
315	Outdoor	600 Al Armoured	1	Yes	Single Point Bonded
500	Outdoor	600 Al Armoured	1	No	Single Point Bonded
500	Outdoor	600 Al Armoured	1	Yes	Single Point Bonded
500	Indoor	600 Al Unarmoured	1	N/A	N/A
800/1000	Outdoor	600 Al Armoured	2	No	Single Point Bonded
800/1000	Outdoor	600 Al Armoured	2	Yes	Single Point Bonded
800/1000	Indoor	600 Al Unarmoured	2	N/A	N/A

5 LV Single Core Cable Datasheets

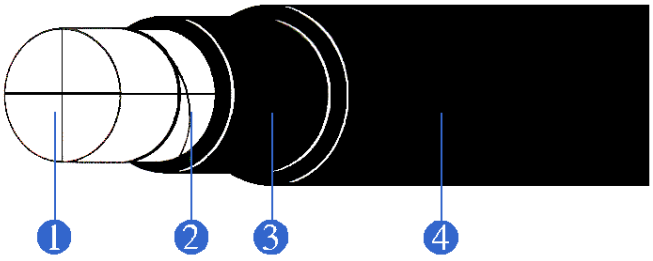
5.1 Armoured Cable Details and Drawing



1. Solid aluminium conductor
2. Binder tape
3. XLPE insulation
4. PVC Bedding
5. Aluminium wire screen
6. Black PVC sheath

Nominal cross-sectional area	mm²	600
Dimensional data		
Approximate diameter over conductor	mm	28.1
Minimum average thickness of insulation	mm	2.40
Minimum thickness of bedding	mm	1.20
Nominal diameter of armour wire	mm	2.00
Approximate diameter under armour	mm	35.3
Nominal area of aluminium wire screen	mm²	160
Minimum thickness of oversheath	mm	2.2
Approximate overall diameter of Single Core	mm	42.9
Approximate cable weight	kg/m	3.925
Minimum bending radius	mm	350
Maximum pulling tension on Single Core Conductor	kN	17.65
Nominal internal diameter of duct (1 x single Core)	mm	100
Electrical data		
Approximate capacitance (C)	µF/km	0.570
Maximum DC conductor resistance (R) @ 20°C	Ω/Km	0.0515
Maximum AC conductor resistance (R') @ 90°C	Ω/Km	0.067
Reactance (X) @ 50Hz @ 90°C	Ω/Km	0.088
Approximate three phase trefoil volt drop	mV/A/m	0.20
Short circuit ratings		
1 Second short circuit rating of conductor (90 to 250°C)	kA	56.7
1 Second short circuit rating of wire screen (80 to 200°C)	kA	13.5

5.2 Unarmoured Cable Details and Drawing



1. Solid aluminium conductor
2. Binder tape
3. XLPE insulation
4. Black PVC sheath

Nominal cross-sectional area	mm²	600
Dimensional data		
Approximate diameter over conductor	mm	30.7
Minimum average thickness of insulation	mm	2.40
Minimum thickness of oversheath	mm	2.20
Approximate overall diameter of Single Core	mm	36.3
Approximate cable weight	kg/m	2.225
Minimum bending radius	mm	300
Maximum pulling tension on Single Core Conductor	kN	17.65
Electrical data		
Approximate capacitance (C)	µF/km	0.336
Maximum DC conductor resistance (R) @ 20°C	Ω/Km	0.0515
Maximum AC conductor resistance (R') @ 90°C	Ω/Km	0.067
Reactance (X) @ 50Hz @ 90°C	Ω/Km	0.088
Approximate three phase trefoil volt drop	mV/A/m	0.185
Short circuit ratings		
1 Second short circuit rating of conductor (90 to 250°C)	kA	56.7

Appendix A – LV Transformer Tail Cable Ratings

A.1 Laid Direct Circuits – Single Armoured Core per Phase Circuit

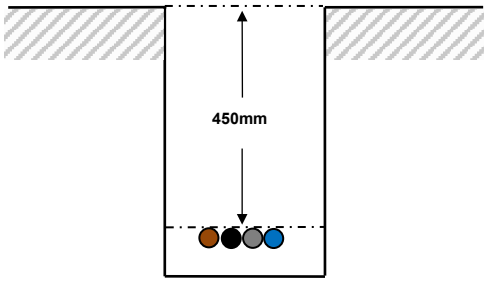


Table A-1 – Single point bonded laid direct cable ratings

Conductor Size and Material	Season	Continuous Rating (A)	Continuous Rating (kVA)	Distribution Rating (A)	Distribution Rating (kVA)
600mm^2 Al	Summer	708	490	898	621
	Winter	829	574	971	672

A.2 Laid Direct Circuits – Two Armoured Cores per Phase Circuit

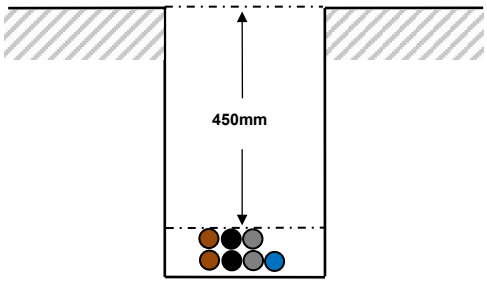
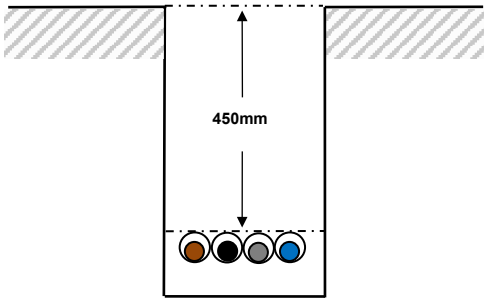


Table A-2 – Single point bonded laid direct cable ratings (two cables per phase)

Conductor Size and Material	Season	Continuous Rating (A)	Continuous Rating (kVA)	Distribution Rating (A)	Distribution Rating (kVA)
600mm^2 Al	Summer	1312	908	1628	1126
	Winter	1561	1080	1886	1305

A.3 Ducted Circuits – Single Armoured Core per Phase Circuit

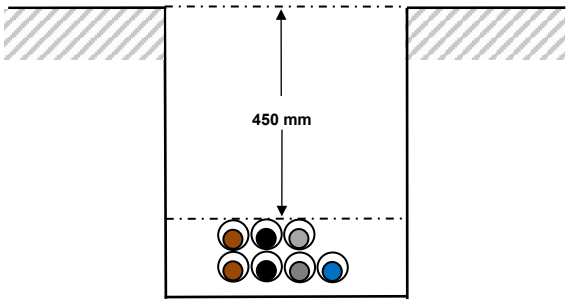


All cables installed in approved 125mm plastic Rigiducts.

Table A-3 – Single point bonded summer ducted cable ratings

Conductor Size and Material	Season	Continuous Rating (A)	Continuous Rating (kVA)	Distribution Rating (A)	Distribution Rating (kVA)
600mm^2 Al	Summer	711	492	880	609
	Winter	786	544	934	646

A.4 Ducted Circuits – Two Armoured Cores per Phase Circuit



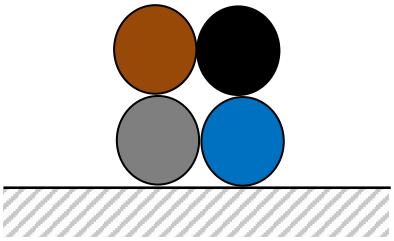
All cables installed in approved 125mm plastic Rigiducts.

Table A-4 – Single point bonded ducted cable ratings (two cables per phase)

Conductor Size and Material	Season	Continuous Rating (A)	Continuous Rating (kVA)	Distribution Rating (A)	Distribution Rating (kVA)
600mm^2 Al	Summer	1340	927	1646	1139
	Winter	1513	1047	1762	1219

Appendix B – Cables installed in air

B.1 Single Unarmoured Core per Phase Circuit



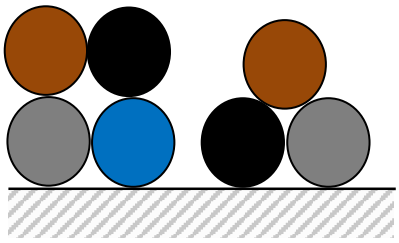
Cables cleated to a wall, floor or in an open cable trench in quadfoil arrangement.

Armoured cables are precluded from this section as they are not required in this situation.

Table B-1 – Cables installed in air ratings

Conductor Size and Material	Season	Continuous Rating (A)	Continuous Rating (kVA)
600mm^2 Al	Summer (25^0 C Ambient)	883	611
	Winter (10^0 C Ambient)	1001	692

B.2 Single Unarmoured Two Cores per Phase Circuit



Cables cleated to a wall, floor or in an open cable trench in a combined quadfoil and trefoil arrangement, with a single neutral conductor.

Armoured cables are precluded from this section as they are not required in this situation.

Table B-2 - Cables installed in air ratings (two cables per phase)

Conductor Size and Material	Season	Continuous Rating (A)	Continuous Rating (kVA)
600mm^2 Al	Summer (25^0 C Ambient)	1766	1222
	Winter (10^0 C Ambient)	2002	1385