



AUSTRALIAN RAIL TRACK CORPORATION LTD

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High Voltage Cable Selection Guide

PDS 14

Applicability

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1.2	11 March 2005	Disclaimer	Minor editorial change
1.3	1 September 2010	2, 6	Replaced reference to superseded NSW Standard BSS 02 with applicable Australian Standard for tunnel fire safety

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Contents

1	Scope and Application.....	3
2	References.....	3
3	Introduction	3
4	Preferred cable Sizes and Applications	4
5	Continuous Ratings.....	5
	5.1 11 kV Cables	5
	5.2 33kV Cables	6
6	Cables for use in Tunnels and Underground Stations	7
7	Conditions used in Determining Current Ratings	7

1 Scope and Application

This publication sets out continuous ratings of common high voltage ac cables used by the Australian Rail Track Corporation.

This publication is a guide for the selection of cables and cable configurations to suit particular applications.

This publication also defines the preferred cable sizes to be used in order to reduce and rationalise the number of different size cables in service.

The requirements of this publication are to be met for the future selection of all high voltage cables.

2 References

- AS3008.1 Electrical installations - Selection of cables – Cables for alternating voltages up to and including 0.6/1kV – Typical Australian installation conditions
- AS/NZS 1660. - Test methods for electric cables, cords and conductors
 - Method 5.2: Fire tests – Smoke density
 - Method 5.4: Fire tests – Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity
 - Method 5.6: Fire tests - Test for combustion propagation
- Applicable Australian Standard for tunnel fire safety
- BS EN 50268-1 Common test methods for cables under fire conditions - Measurement of smoke density of cables burning under defined conditions.
- International Electrotechnical Commission Publication IEC 20A, 1978.
- Olex Cables - High Voltage XLPE Insulated Cables 08/82.
- CMA Power Cables - Paper Insulated, Lead and Aluminium Sheathed Cables up to 19/33kV dated 12/2/87.
- EP 20 01 00 01 SP - 1500 Volt DC Cable Ratings. (RailCorp publication)

3 Introduction

Cable manufacturers usually provide continuous current rating data for cables direct buried, in buried ducts and in air (in shade) conditions.

ARTC cables are often exposed to direct sun and installed in elevated steel troughing which directly affects the current rating of the cable. This standard provides current rating data for the aforementioned conditions.

4 Preferred cable Sizes and Applications

The preferred 11kV and 33kV cable sizes to be used for future work are listed in Table 1. The rationalisation of the cables sizes minimises spare parts requirements.

TABLE 1 - PREFERRED CABLE SIZES, CABLE CONSTRUCTION AND APPLICATION

VOLTAGE	AREA	INSULATION	CABLE CONSTRUCTION	APPLICATION
6.35/11kV	35	XLPE	Single core, stranded compacted copper, XLPE insulated, natural, dry cure CCV/VCV, copper wire screen, PVC sheath, HDPE oversheath, metre mark.	Short cable runs between electrical equipment.
	95	XLPE	3 core, stranded compacted copper, XLPE insulated, natural, dry cure CCV/VCV, individual copper wire screen, PVC sheath, HDPE oversheath, metre mark.	Feeder cable.
	150	XLPE	3 core, stranded compacted copper, XLPE insulated, natural, dry cure CCV/VCV, individual copper wire screen, PVC sheath, HDPE oversheath, metre mark.	Feeder cable.
19/33kV	50	XLPE	Single core, stranded compacted copper, XLPE Insulated, natural, dry cure CCV/VCV, copper wire screen, PVC sheath, HDPE oversheath, metre mark.	AC switchgear to rectifier transformer.
	150	XLPE	Single core, stranded compacted copper, XLPE insulated, natural, dry cure CCV/VCV, copper wire screen, PVC sheath, HDPE oversheath, metre mark.	AC switchgear to rectifier transformer. Feeder cable.
	150	XLPE	3 core, stranded compacted copper, XLPE insulated, natural, dry cure CCV/VCV, individual copper wire screen, PVC sheath HDPE oversheath, metre mark.	Feeder cable.
	185	Paper	Single core, stranded compacted copper, paper insulated ,MIND,lead sheath, PVC oversheath, metre mark.	Feeder cable.
	185	Paper	3 core, stranded compacted copper, paper insulated, MIND, HSL, steel wire armour, PVC oversheath, metre mark.	Feeder cable.
	240	XLPE	Single core, stranded compacted copper, XLPE insulated, natural, dry cure CCV/VCV, copper wire screen, PVCsheath, HDPE oversheath, metre mark.	Feeder cable.
	300	XLPE	Single core, stranded compacted copper, XLPE insulated, natural, dry cure CCV/VCV, copper wire screen, PVC sheath, HDPE oversheath, metre mark.	Feeder cable.

5 Continuous Ratings

5.1 11 kV Cables

11kV cables used on the ARTC system shall have minimum continuous current ratings as listed in Table 2. The preferred cables sizes for future use are unshaded for easy identification.

TABLE 2 - 11kv CABLES - CONTINUOUS CURRENT RATINGS IN AMPS

Insulation Type	Cores		Continuous Current Rating In Amps				
	Area mm ²	No.	Direct Buried	In Buried Ducts	In Air in Shade	In Air in Sun	In Elevated Steel Troughing in Sun
XLPE	35	1	175	150	180	160	120
XLPE	35	3	165	145	160	150	120
XLPE	50	1	205	175	215	180	150
XLPE	50	3	195	170	190	175	145
XLPE	95	1	290	250	320	250	200
XLPE	95	3	270	240	275	230	200
XLPE	150	1	370	320	420	330	260
XLPE	150	3	345	305	360	310	260
XLPE	240	1	475	410	560	420	340
XLPE	240	3	440	385	480	390	340
Paper / Lead	25	3	90	80	75	75	65
Paper / Lead	50	1	170	155	160	155	120
Paper / Lead	50	3	160	140	140	140	120
Paper / Lead	95	1	250	255	245	250	180
Paper / Lead	95	3	240	205	210	210	180
Paper / Lead	150	1	325	285	325	290	230
Paper / Lead	150	3	305	255	280	265	230

5.2 33kV Cables

33kV cables used on the ARTC system shall have minimum continuous current ratings as listed in Table 3. The preferred cables sizes for future use are unshaded for easy identification.

TABLE 3 - 33KV CABLES - CONTINUOUS CURRENT RATINGS IN

Insulation Type	Cores		Continuous Current Rating In Amps				
	Area mm ²	No.	Direct Buried	In Buried	In Air in	In Air in Sun	In Elevated Steel Troughing
XLPE	50	1	205	180	225	180	145
XLPE	50	3	190	170	195	170	145
XLPE	95	1	290	255	330	255	-
XLPE	95	3	270	240	280	240	205
XLPE	150	1	370	325	430	350	275
XLPE	150	3	340	305	370	310	260
XLPE	240	1	475	415	570	440	355
XLPE	240	3	440	390	485	425	340
XLPE	300	1	530	460	650	500	400
XLPE	300	3	485	430	550	470	375
XLPE	400	1	590	520	740	590	445
XLPE	400	3	540	480	620	530	-
XLPE	500	1	650	570	830	600	490
HSL Paper / Lead	0.20 in. ²	3	255	225	210	210	140
HSL Paper / Lead	0.25 in. ²	3	285	255	250	235	155
Gas / Paper / Lead	0.25 in. ²	3	310	280	-	-	-
Gas / Paper / Aluminium	0.25 in. ²	3	310	280	-	-	-
Paper / Lead	95	1	235	200	225	200	-
Paper / Lead	95	3	225	195	200	195	-
Paper / Lead	150	1	305	250	295	260	155
Paper / Lead	150	3	285	255	260	265	155
Paper / Lead	185	1	345	280	340	290	175
Paper / Lead	185	3	315	270	295	280	170
Paper / Lead	240	1	395	320	400	350	-
Paper / Lead	240	3	365	325	350	340	-
Paper / Lead	300	1	445	355	455	400	235
Paper / Lead	300	3	405	360	395	380	220
Paper / Lead	400	1	510	395	530	450	-
Paper / Lead	500	1	560	435	600	500	300

6 Cables for use in Tunnels and Underground Stations

Cables for installation in tunnels or underground stations must have a low smoke, low toxicity, halogen free, flame retardant oversheath suitable for installation in damp situations. The oversheath shall comply with the current version of AS 1660 Part 5.2, 5.4, 5.6 and the applicable Australian Standard for tunnel fire safety.

Smoke Emission

When a sample of the complete cable is tested in accordance with BS EN 50268-1:2000, the values for the light transmittance shall not fall below 60% at any time during the test.

Note: "MEGALON" is unsuitable for prolonged immersion in water or water saturated soils.

7 Conditions used in Determining Current Ratings

The conditions used in determining the continuous current ratings in the tables are:

General

Max. allowable Core Temperature:	XLPE insulated cables 90°C Paper Insulated cables 70°C
Buried Cables:	Soil Temperature (Ambient) 25°C Soil Thermal Resistivity 1.2 K.m/W Depth of Burial 800mm Duct Diameter 150mm
Cables in Air:	Air Temperature (Ambient) 40°C Solar Radiation 1000W/m ² Cable Emissivity 0.7 Steel Trough Emissivity 0.3 Trough Size 150mm x 150mm