COMPONENTS GROUP

The Registered Number of this Handbook is :

CH 6268

Any correspondence concerning additional copies, new sheets, etc., should bear this number, and be addressed to :

Standard Telephones and Cables Limited

COMPONENTS GROUP

EDINBURGH WAY, HARLOW, ESSEX

For technical enquiries please see Page A—2

Volume 4

RECORD OF AMENDMENTS

AMDT. NO.	INSERTED	
	Date	Initials
~~4/1~~	7th July, 1969.	P. Lea.
~~4/2~~	8th June, 1970.	P. Lea.
~~4/3~~	26th August, 1971.	P. Knight.
~~4/4~~	27th October, 1972.	P. Knight.
4/5		
4/6		
4/7		
4/8		
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Volume 4

RECORD OF AMENDMENTS

AMDT. NO.	INSERTED	
	Date	Initials
4/26		
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4/50		

Components Handbook

Volume 4

Capacitors

Mica

Motor

Paper

Polymer

Power

Tantalum

Vacuum

Preface

This volume is one of a set that provides comprehensive technical information on the full range of components manufactured and marketed by STC Components and S.T.C. Semiconductors Ltd.

A regular amendment service ensures that the data in these volumes is kept up to date with changes and additions. Data marked with an 'M' or 'Maintenance' refer to components that are only supplied as replacements for use in existing equipment and should not be used when designing new equipments.

Enquiries regarding this Handbook service should be addressed to Standard Telephones and Cables Ltd., Department 14531. Components Marketing Division, Edinburgh Way, Harlow, Essex or Telephone Harlow (STD code 0279 6) 26811, Ext. 249.

Technical and commercial enquiries concerning specific products should be addressed to the Sales Office of the appropriate Division.

Ref.	Sales Office Address	Telephone No.	Extensions for enquiries Technical	Commercial
1	**Capacitor Division** Brixham Road, Paignton, Devon	Paignton 50762†	Capacitors 477 Film Circuits 523	 418 418
2	**Electro-Mechanical Division** West Road, Harlow, Essex	Harlow 26811*	643 663	636 542
3	**Magnetic Materials Division** Edinburgh Way, Harlow, Essex	Harlow 26811*	735	735
4	**Modular Electronics Division** Cefndy Road, Rhyl, Flint	Rhyl 4507	13	13
5	**Potentiometer Division** Broad Lane, Leeds 13, Yorkshire	Pudsey 77261	7	15
6	**Quartz Crystal Division** Edinburgh Way, Harlow, Essex	Harlow 26811*	585	560
7	**Rectifier Division** Edinburgh Way, Harlow, Essex	Harlow 26811*	449 253	446 251
8	**Thermistor Division** Edinburgh Way, Harlow, Essex	Harlow 26811*	502	503
9	**Valve Division** Brixham Road, Paignton, Devon	Paignton 50762†	536	532
10	**S.T.C. Semiconductors Ltd.** Footscray, Sidcup, Kent	Footscray 3333‡	524	571

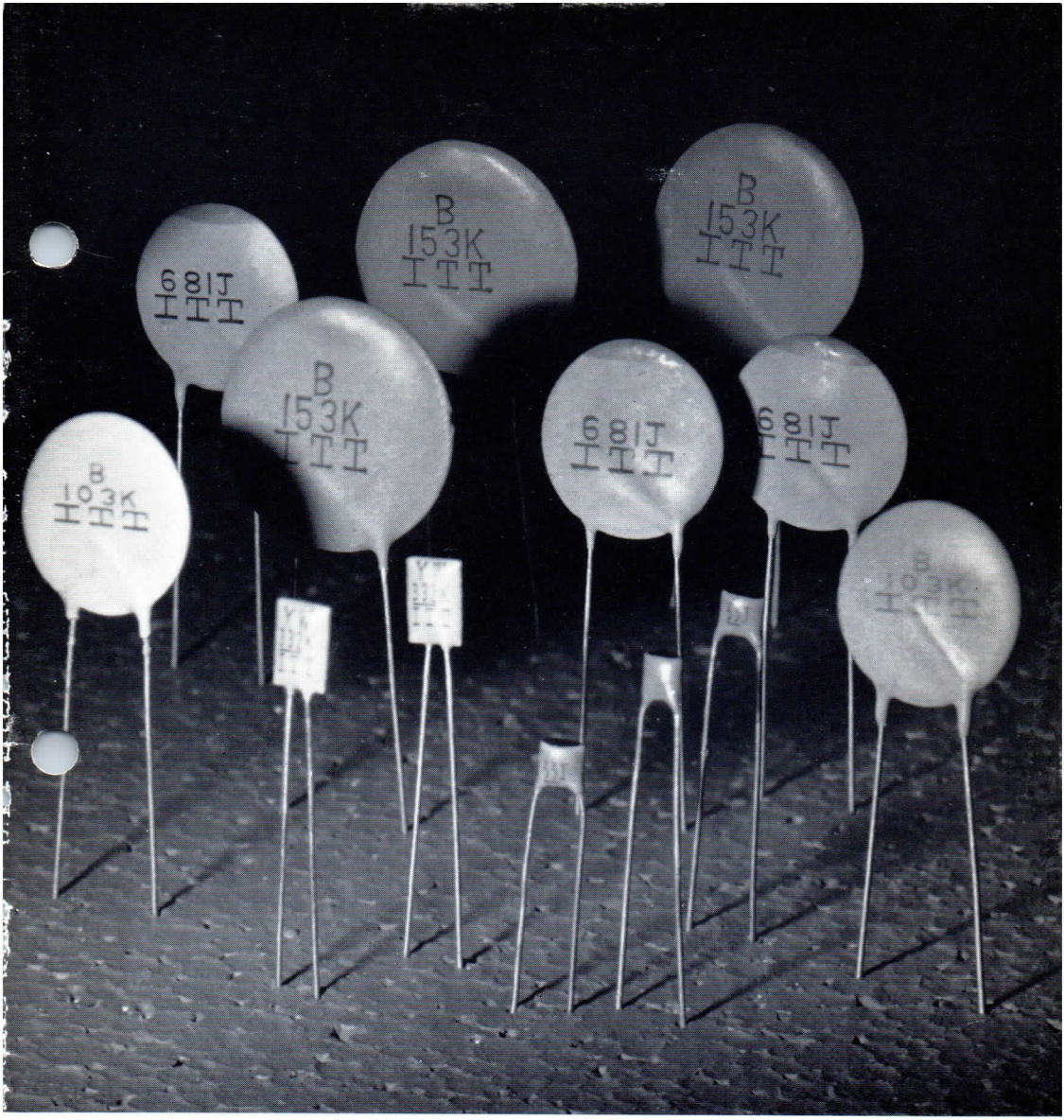
* STD code 0279 6 26811. † STD code 0803 50762. ‡ STD code 01 300 3333.

STC

List of Products

The following list gives the products on which data is included in the Components Handbook, the volume in which the data appears and the Sales Office Code (see previous page) to which technical and commercial enquiries should be addressed.

Product	Handbook Volume	Sales Office
Brimistors (see Thermistors)	7	8
Capacitors	4	1
Crystal Filters	8	6
Diodes and Photo Devices	6A	10
Film Circuits	5	1
Hermetic Seals	1	9
Infra-Red Filters	1	7
Klystrons	3	9
Knobs and Dials	7	5
Lamps	1	9
Logic Modules	5	4
Magnetic Materials	9	3
Microwave Oscillators	3	9
Microwave Tubes	3	9
Ministac	5	4
Photo Devices (see Diodes and Photo Devices)	6A	10
Potentiometers	7	5
Quartz Crystal Units	8	6
Rectifiers, Selenium	5	7
Rectifiers, Silicon	6A	10
Rectifiers, Silicon Assemblies	5	7
Rectifiers, Valve	2C	9
Relays	10	2
Resistors, Carbon Film	7	7
Resistors, Temperature Sensitive (see Thermistors)	7	8
SafeTstaC Selenium Surge Suppressors	5	7
Silistors (see Thermistors)	7	8
Solenoids	10	2
Switches	10	2
Thermal Delay Switches	1	9
Thermistors	7	8
Thermocouples	3	9
Thyristors	6A	10
Transformers	9	3 or 7
Transistors	6B	10
Travelling Wave Tubes	3	9
Vacuum Gauges	1	9
Valves	2A, B and C	9
Varactor Diodes	3	9
Wound Components	9	3 or 7
Zener Diodes (see Diodes and Photo Devices)	6A	10



Ceramic Capacitors
1971/72

6470/460 E

COMPONENTS ITT

Ceramic Capacitors

- ITT is engaged in the manufacture and supply of components world wide. Components are sourced by ITT in more than 50 factories in Europe, as well as from plants in the Americas, Africa and the Far East. The components described in this publication may or may not be made in the country where this publication is circulated.

- All Ceramic Capacitors quoted in this publication are made to the German Industry Specification DIN 41920.

- The smallest package for any one type, value and tolerance is 1 000 pieces.

- Capacitance is measured under the following conditions:

Type EB 1B	1 MHz and 25°C at 0,5 V to 5,0 V
SB 1B	1 MHz and 25°C at 0,5 V to 5,0 V
ED 2	1 kHz and 25°C at 1,0 V
SD 2	1 kHz and 25°C at 1,0 V
SD 3	1 kHz and 25°C at 0,3 V.

- It is usually possible to provide other capacitance values to special order.

Printed in England by Martins Press Ltd.

Ceramic Capacitors

Contents

TYPE			PAGE
ED 1B:	50 V d.c.	Temperature Compensating	4– 7
SD 1B:	500 V d.c.	Temperature Compensating	8–11
ED 2:	50 V d.c.	High K (Dielectric Constant)	12–13
SD 2:	500 V d.c.	High K (Dielectric Constant)	14–15
SD 3:	12 V d.c.	Barrier Layer	16–17
SD 3:	25 V d.c.	Barrier Layer	18–19

Ceramic Capacitors

ED 1 B

Rated Voltage	**50 V d.c.**
Test Voltage	150 V d.c.
Temperature Range	−25 to +85°C
Minimum Storage Temperature	−40°C

Coating:
Fully Coated and Impregnated

Leads: Tinned Copper

Insulation Resistance at 10 V $> 10^{10}\ \Omega$

Range
(Preferred Types in Bold Characters)

Material	Temperature Coefficient $\times 10^{-6}/°C$	Colour Code	Loss Factor tan δ $C < 30$ pF $\times 10^{-3}$	Loss Factor tan δ $C \geqslant 30$ pF $\times 10^{-3}$
P 100	**+ 100**	**Gold** or **Violet/Violet**	**< 2,7**	**< 1,1**
NP 0	**± 0**	**Black**	**< 2,7**	**< 1,1**
N 033	− 33	Brown	< 2,7	< 1,1
N 075	− 75	Red	< 2,7	< 1,1
N 150	**− 150**	**Orange**	**< 2,7**	**< 1,1**
N 220	− 220	Yellow	< 2,7	< 1,1
N 330	− 330	Green	< 2,7	< 1,1
N 470	− 470	Blue	< 2,7	< 1,1
N 750	**− 750**	**Violet**	**< 2,7**	**< 1,1**
N 1500	− 1500	W	< 2,7	< 1,1
N 2200	− 2200	X	< 3,7	< 2,25
N 3300	− 3300	Y	< 3,7	< 2,25
N 4700	− 4700	Z	< 3,7	< 2,25
SL	**−1000 to + 300**	—		

Capacitance

Nominal Values to IEC E 12 Range

E 24 Range on request

$C < 100$ pF marked in pF

$C \geqslant 100$ pF number coded in pF as follows:

1st Number = 1st Digit of Capacitance

2nd Number = 2nd Digit of Capacitance

3rd Number = Multiplier 1 = × 10

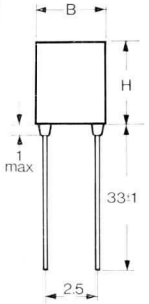
Capacitance Tolerance
Marking by Letter Code

Capacitance	Tolerance	Code
⩽ 10 pF	± 0,25 pF	C
	± 0,5 pF	D
	± 1,0 pF	F
> 10 pF	± 5 %	J
	± 10 %	K
	± 20 %	M

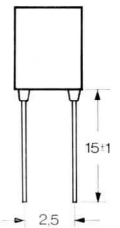
Outlines

Dimensions in mm

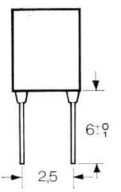
PU-1
(Standard Version)



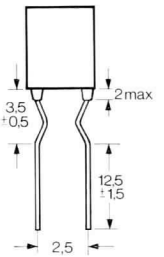
PU-3



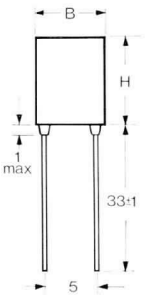
RU-4



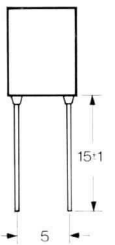
ZU-5



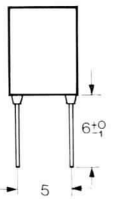
PU-2
(Standard Version)
not 3,5 × 4



PU-6
not 3,5 × 4



RU-7
not 3,5 × 4

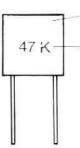


Thickness

PU-3 to RU-7 are special versions

Thickness: T

SL/P 100 to N 750	
C ⩽ 4 pF	T = 4 mm
4 pF < C ⩽ 10 pF	T = 3 mm
C > 10 pF	T = 2,2 mm
N 1500 to N 4700	
10 pF ⩽ C ⩽ 60 pF	T = 4 mm
C > 60 pF	T = 2,2 mm



Temp. Coefficient Coding
Capacitance and Tolerance

Ordering Code

Example:
Ceramic Capacitor ED 1 B
N 150 / 47 pF / 10% / 50 V / PU-1

Material
Capacitance
Capacitance Tolerance
Rated Voltage
Outline

Ceramic Capacitors

ED 1 B

Material:	**P 100**	**NPO**	N 033	N 075	**N 150**	N 220	N 330
Capacitance pF	Dimensions (B × H) mm						
0,82							
1,0	**3,5×4**						
1,2	**3,5×4**						
1,5	**3,5×4**						
1,8	**3,5×4**						
2,2	**3,5×4**	**3,5×4**	3,5×4				
2,7	**3,5×4**	**3,5×4**	3,5×4				
3,3	**3,5×4**	**3,5×4**	3,5×4	3,5×4	**3,5×4**		
3,9	**3,5×4**	**3,5×4**	3,5×4	3,5×4	**3,5×4**		
4,7	**3,5×4**	**3,5×4**	3,5×4	3,5×4	**3,5×4**	3,5×4	3,5×4
5,6	**3,5×4**	**3,5×4**	3,5×4	3,5×4	**3,5×4**	3,5×4	3,5×4
6,8	**3,5×4**	**3,5×4**	3,5×4	3,5×4	**3,5×4**	3,5×4	3,5×4
8,2	**4 ×4**	**3,5×4**	3,5×4	3,5×4	**3,5×4**	3,5×4	3,5×4
10	**5 ×5**	**3,5×4**	3,5×4	3,5×4	**3,5×4**	3,5×4	3,5×4
12	**5 ×5**	**3,5×4**	3,5×4	3,5×4	**3,5×4**	3,5×4	3,5×4
15	**5 ×7**	**3,5×4**	3,5×4	3,5×4	**3,5×4**	3,5×4	3,5×4
18	**5 ×7**	**3,5×4**	3,5×4	3,5×4	**3,5×4**	3,5×4	3,5×4
22	**5 ×8,5**	**4 ×4**	4 ×4	4 ×4	**3,5×4**	3,5×4	3,5×4
27	**6 ×8,5**	**5 ×5**	5 ×5	5 ×5	**4 ×4**	3,5×4	3,5×4
33	**8 ×8**	**5 ×5**	5 ×5	5 ×5	**5 ×5**	4 ×4	3,5×4
39		**5 ×5**	5 ×5	5 ×5	**5 ×5**	5 ×5	4 ×4
47		**5 ×7**	5 ×7	5 ×7	**5 ×5**	5 ×5	5 ×5
56		**5 ×7**	5 ×7	5 ×7	**5 ×7**	5 ×5	5 ×5
68		**5 ×8,5**	5 ×8,5	5 ×8,5	**5 ×7**	5 ×7	5 ×7
82		**6 ×8,5**	6 ×8,5	6 ×8,5	**5 ×8,5**	5 ×7	5 ×7
100		**8 ×8**	8 ×8	8 ×8	**6 ×8,5**	5 ×8,5	5 ×8,5
120		**8 ×8**	8 ×8	8 ×8	**8 ×8**	6 ×8,5	6 ×8,5
150						8 ×8	8 ×8
180							8 ×8
220							
270							
330							
390							
470							
560							
680							
820							

N 470	**N 750**	N 1500	N 2200	N 3300	N 4700	**SL**	Material
Dimensions mm	(B × H)						Capacitance pF
						3,5×4	0,82
						3,5×4	1,0
						3,5×4	1,2
						3,5×4	1,5
						3,5×4	1,8
						3,5×4	2,2
						3,5×4	2,7
						3,5×4	3,3
						3,5×4	3,9
3,5×4						**3,5×4**	4,7
3,5×4	**3,5×4**					**3,5×4**	5,6
3,5×4	**3,5×4**					**3,5×4**	6,8
3,5×4	**3,5×4**					**3,5×4**	8,2
3,5×4	**3,5×4**	3,5×4	3,5×4	3,5×4		**3,5×4**	10
3,5×4	**3,5×4**	3,5×4	3,5×4	3,5×4		**3,5×4**	12
3,5×4	**3,5×4**	3,5×4	3,5×4	3,5×4	3,5×4	**3,5×4**	15
3,5×4	**3,5×4**	3,5×4	3,5×4	3,5×4	3,5×4	**3,5×4**	18
3,5×4	**3,5×4**	3,5×4	3,5×4	3,5×4	3,5×4	**3,5×4**	22
3,5×4	**3,5×4**	3,5×4	3,5×4	3,5×4	3,5×4	**3,5×4**	27
3,5×4	**3,5×4**	3,5×4	3,5×4	3,5×4	3,5×4	**3,5×4**	33
3,5×4	**3,5×4**	3,5×4	3,5×4	3,5×4	3,5×4	**3,5×4**	39
4 ×4	**3,5×4**	3,5×4	3,5×4	3,5×4	3,5×4	**3,5×4**	47
5 ×5	**3,5×4**	3,5×4	3,5×4	3,5×4	3,5×4	**3,5×4**	56
5 ×5	**4 ×4**	3,5×4	3,5×4	3,5×4	3,5×4	**4 ×4**	68
5 ×5	**5 ×5**	3,5×4	3,5×4	3,5×4	3,5×4	**5 ×5**	82
5 ×7	**5 ×5**	4 ×4	3,5×4	3,5×4	3,5×4	**5 ×5**	100
5 ×7	**5 ×7**	5 ×5	4 ×4	4 ×4	3,5×4	**5 ×7**	120
6 ×8,5	**5 ×7**	5 ×5	5 ×5	5 ×5	3,5×4	**5 ×7**	150
8 ×8	**5 ×8,5**	5 ×7	5 ×5	5 ×5	5 ×5	**5 ×8,5**	180
8 ×8	**6 ×8,5**	5 ×7	5 ×7	5 ×7	5 ×5	**6 ×8,5**	220
	8 ×8	5 ×8,5	5 ×7	5 ×7	5 ×5	**8 ×8**	270
	8 ×8	6 ×8,5	5 ×8,5	5 ×8,5	5 ×7	**8 ×8**	330
		8 ×8	6 ×8,5	6 ×8,5	5 ×7		390
		8 ×8	8 ×8	8 ×8	5 ×8,5		470
					6 ×8,5		560
					8 ×8		680
					8 ×8		820

Ceramic Capacitors

SD 1 B

Rated Voltage **500 V d.c.**

Test Voltage 1250 V d.c.

Temperature Range −25 to +85°C

Minimum Storage Temperature −40°C

Coating:

Fully Coated and Impregnated

Leads: Tinned Copper

Insulation Resistance at 100 V $>10^{10}\ \Omega$

Range

(Preferred Types in Bold Characters)

Material	Temperature Coefficient $\times 10^{-6}/°C$	Colour Code	Loss Factor tan δ $\times 10^{-3}$ C < 30 pF	C ⩾ 30 pF
P 100	**+ 100**	**Gold** or **Violet/Violet**	**< 2,5**	**⩽ 1,0**
NP 0	**± 0**	**Black**	**< 2,5**	**⩽ 1,0**
N 033	− 33	Brown	< 2,5	⩽ 1,0
N 075	− 75	Red	< 2,5	⩽ 1,0
N 150	**− 150**	**Orange**	**< 2,5**	**⩽ 1,0**
N 220	− 220	Yellow	< 2,5	⩽ 1,0
N 330	− 330	Green	< 2,5	⩽ 1,0
N 470	− 470	Blue	< 2,5	⩽ 1,0
N 750	**− 750**	**Violet**	**< 2,5**	**⩽ 1,0**
N 1500	− 1500	W	< 2,5	⩽ 1,0
N 2200	− 2200	X	< 3,2	⩽ 2,0
N 3300	− 3300	Y	< 3,2	⩽ 2,0
N 4700	− 4700	Z	< 3,2	⩽ 2,0
SL	**−1000 to + 300**	—		

Capacitance

Nominal Values to IEC E 12 Range

E 24 Range on request

C < 100 pF marked in pF

C ⩾ 100 pF number coded in pF as follows:

1st Number = 1st Digit of Capacitance

2nd Number = 2nd Digit of Capacitance

3rd Number = Multiplier 1 = × 10

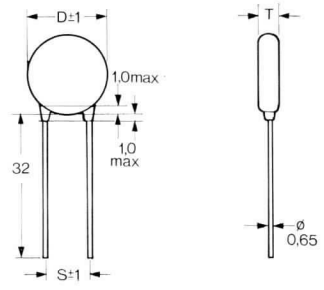
2 = × 100

Capacitance Tolerance

Marking by Letter Code

Capacitance	Tolerance	Code
⩽ 10 pF	± 0,25 pF	C
	± 0,5 pF	D
	± 1,0 pF	F
> 10 pF	± 5 %	J
	± 10 %	K
	± 20 %	M

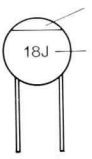
Dimensions in mm



D (Diameter)	S (Lead Spacing)
5,0	2,5
6,3	5,0
8,0	5,0
10,0	7,5
12,5	7,5
14,0	7,5
12,5	7,5
14,0	7,5
16,0	7,5
20,0	10,0

Thickness: T

SL/P 100 to N 750	
C > 20 pF	T = 4 mm
C ⩽ 20 pF	T = 4,5 mm
N 1500 to N4700	
All Values	T = 4,5 mm



Temp. Coefficient Coding
Capacitance
and Tolerance

Ordering Code

Example:

Ceramic Capacitor SD 1B
N 750 / 18 pF / 5% / 500 V

Material
Capacitance
Capacitance Tolerance
Rated Voltage

Ceramic Capacitors

SD 1 B

Material:	**P 100**	**NPO**	N 033	N 075	**N 150**	N 220	N 330
Capacitance pF	Diameter mm						
0,56	**5**						
0,68	**5**						
0,82	**5**						
1,0	**5**						
1,2	**5**						
1,5	**5**						
1,8	**5**						
2,2	**5**	**5**	5	5	**5**	5	
2,7	**5**	**5**	5	5	**5**	5	
3,3	**5**	**5**	5	5	**5**	5	5
3,9	**5**	**5**	5	5	**5**	5	5
4,7	**5**	**5**	5	5	**5**	5	5
5,6	**5**	**5**	5	5	**5**	5	5
6,8	**6,3**	**5**	5	5	**5**	5	5
8,2	**6,3**	**5**	5	5	**5**	5	5
10	**8**	**5**	5	5	**5**	5	5
12	**8**	**5**	5	5	**5**	5	5
15	**8**	**6,3**	6,3	6,3	**5**	5	5
18	**8**	**8**	8	8	**6,3**	6,3	5
22	**10**	**8**	8	8	**8**	6,3	6,3
27	**12,5**	**8**	8	8	**8**	8	8
33	**12,5**	**8**	8	8	**8**	8	8
39	**12,5**	**10**	8	8	**8**	8	8
47	**14**	**10**	10	10	**10**	8	8
56	**14**	**12,5**	12,5	12,5	**10**	10	8
68	**16**	**12,5**	12,5	12,5	**12,5**	10	10
82	**20**	**12,5**	12,5	12,5	**12,5**	12,5	12,5
100	**20**	**14**	14	14	**14**	12,5	12,5
120	**20**	**14**	14	14	**14**	14	12,5
150		**16**	16	16	**16**	14	14
180		**20**	20	20	**16**	16	16
220		**20**	20	20	**20**	20	16
270					**20**	20	20
330							20
390							
470							
560							
680							
820							
1000							
1200							
1500							
1800							

N 470	N 750	N 1500	N 2200	N 3300	N 4700	SL	Material
Diameter mm							Capacitance pF
						5	0,56
						5	0,68
						5	0,82
						5	1,0
						5	1,2
						5	1,5
						5	1,8
						5	2,2
						5	2,7
5						**5**	3,3
5						**5**	3,9
5	**5**					**5**	4,7
5	**5**					5	5,6
5	**5**					**5**	6,8
5	**5**					**5**	8,2
5	**5**					**5**	10
5	**5**		5			**5**	12
5	**5**	5	5			**5**	15
5	**5**	5	5			**5**	18
6,3	**5**	5	5	5		**5**	22
8	**5**	5	5	5		**5**	27
8	**5**	5	5	5	5	**5**	33
8	**5**	5	5	5	5	**5**	39
8	**6,3**	5	5	5	5	**6,3**	47
8	**8**	6,3	5	5	5	**8**	56
10	**8**	6,3	5	5	5	**8**	68
12,5	**8**	8	6,3	6,3	5	**8**	82
12,5	**8**	8	8	8	5	**8**	100
12,5	**10**	8	8	8	6,3	**10**	120
14	**10**	8	8	8	8	**10**	150
16	**12,5**	10	8	8	8	**12,5**	180
16	**12,5**	12,5	10	10	8	**12,5**	220
20	**14**	12,5	10	10	8	**14**	270
20	**14**	12,5	12,5	12,5	10	**14**	330
	16	14	12,5	12,5	10	**16**	390
	20	14	14	14	12,5	**20**	470
	20	16	14	14	12,5	**20**	560
	20	20	16	16	14	**20**	680
		20	16	16	14		820
			20	20	16		1000
			20	20	16		1200
					20		1500
					20		1800

Ceramic Capacitors

ED 2

Rated Voltage	**50 V d.c.**
Test Voltage	150 V d.c.
Temperature Range for M 700 to 6500	−25 to +85°C
Temperature Range for M 9000 and M 12000	−10 to +60°C
Minimum Storage Temperature for M 700 to 6500	−40°C
Minimum Storage Temperature for M 9000 and M 12000	−25°C

Coating:
Fully Coated and Impregnated

Leads: Tinned Copper

Insulation Resistance at 10 V $> 10^{10}\ \Omega$

Range

Material	Marking†	Loss Factor tan δ $\times 10^{-3}$
M 700	Y 5 P	< 25
M 2000	YW	< 25
M 4000	YY	< 25
M 6500	YZ	< 25
M 9000	YV	< 50
M 12000	YM	< 50

Capacitance

Nominal Values to IEC E 6 Range

E 12 Range on request

C < 100 pF marked in pF

C ⩾ 100 pF number coded in pF as follows:
1st Number = 1st Digit of Capacitance
2nd Number = 2nd Digit of Capacitance
3rd Number = Multiplier 1 = × 10
2 = × 100
3 = × 1000

Capacitance Tolerance

Marked by Letter Code

Tolerance	Code	Material
±10%	K	M 700, M 2000
±20%	M	M 700, M 2000, M 4000
−0 +100%	P	M 6500
−20 + 50%	S	M 6500, M 9000, M 12000
−20 + 80%	Z	M 9000, M 12000

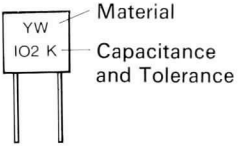
†*For smaller sizes marking may be shown only on package.*

Outlines and Dimensions:

Please see page 5

Thickness: T

C > 470 pF	T = 2,2 mm
C ≤ 470 pF	T = 4 mm



Ordering Code

Example:

Ceramic Capacitor ED 2
M 700 / 1000 pF / 10% / 50 V / PU-1

Material
Nominal Capacitance
Capacitance Tolerance
Rated Voltage
Outline

Material:	M 700	M 2000	M 4000	M 6500	M 9000	M 12000
Capacitance pF	Dimensions (B × H) mm					
220	3,5×4					
330	5 ×5	3,5×4				
470	5 ×5	3,5×4				
680	5 ×7	4 ×4				
1 000	6 ×8,5	5 ×5		3,5×4		
1 500		5 ×5	4 ×4	3,5×4		
2 200		5 ×7	5 ×5	4 ×4	3,5×4	
3 300		6 ×8,5	5 ×7	5 ×5	4 ×4	3,5×4
4 700		8 ×8	5 ×8,5	5 ×7	5 ×5	4 ×4
6 800			8 ×8	6 ×8,5	5 ×7	5 ×5
10 000				8 ×8	6 ×8,5	5 ×7
12 000					6 ×8,5	5 ×8,5
15 000					8 ×8	6 ×8,5
22 000						8 ×8

Ceramic Capacitors

SD 2

Rated Voltage	**500 V d.c.**
Test Voltage	1250 V d.c.
Temperature Range	−25 to +80°C
Minimum Storage Temperature	−40°C

Coating:
Fully Coated and Impregnated

Leads: Tinned Copper

Insulation Resistance at 100 V $> 10^{10}\ \Omega$

Range

Material	Letter Code	Loss Factor tan δ $\times 10^{-3}$
M 700, M 2500	B	< 25
M 4000	D	< 25
M 6500	E	< 25

Capacitance

Nominal Values to IEC E 6 Range

E 12 Range on request

C < 100 pF marked in pF

C ⩾ 100 pF number coded in pF as follows:

1st Number = 1st Digit of Capacitance
2nd Number = 2nd Digit of Capacitance
3rd Number = Multiplier 1 = × 10
2 = × 100
3 = × 1000

Capacitance Tolerance

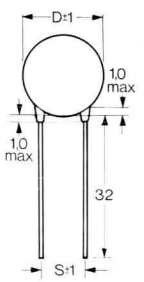
Marked by Letter Code

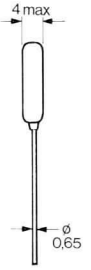
Tolerance	Code	Material
±10%	K	M 700, M 2500
±20%	M	M 700, M 2500, M 4000
−20% +80%	Z	M 6500
−0% +100%	P	M 6500

Ceramic Capacitors

SD 2

Dimensions in mm



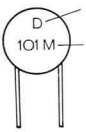


D (Diameter)	S (Lead Spacing)
6,3	5,0
8,0	5,0
10,0	7,5
12,5	7,5
14,0	7,5
16,0	7,5
20,0	10,0
25,0	10,0

Ordering Code

Example: Ceramic Capacitor SD 2
M 4000 / 100 pF / 20% / 500 V

Material
Capacitance
Capacitance Tolerance
Rated Voltage



Material
Capacitance
and Tolerance

Material:	M 700 M 2500	M 4000	M 6500
Capacitance pF	Diameter mm		
100	6,3	6,3	
150	6,3	6,3	
220	6,3	6,3	
330	6,3	6,3	
470	6,3	6,3	
680	6,3	6,3	
1 000	8	6,3	6,3
1,500	8	8	8
2 200	10	8	8
3 300	12,5	10	10
4 700	14	12,5	12,5
6 800	16	14	14
10 000	20	16	16
15 000	25	20	20
22 000		25	25

Ceramic Capacitors

SD 3 Barrier Layer Type

Rated Voltage	**12 V d.c.**
Test Voltage	24 V d.c.
Temperature Range	−30 to +85°C
Minimum Storage Temperature	−40°C

Coating:
Fully Coated and Impregnated

Leads: Tinned Copper

Insulation Resistance:

C = 0,047 μF	R = 1 MΩ
C = 0,1 μF	R = 1 MΩ
C = 0,22 μF	R = 0,5 MΩ
C = 0,47 μF	R = 0,25 MΩ
C = 1,0 μF	R = 0,1 MΩ

Material	Letter Code†	Less Factor tan δ $\times 10^{-3}$
M 4000	BC	$\leqslant 70$

Capacitance

Nominal Values (see table, page 17) marked in μF

Capacitance Tolerance

Marked by Letter Code

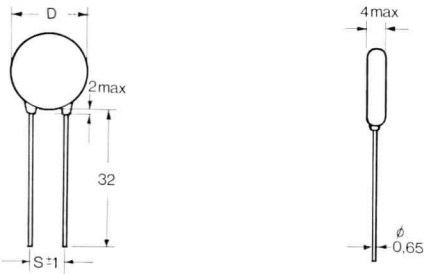
Tolerance	Code
±20%	M
−20 +80%	Z

†*Marked only on pack*

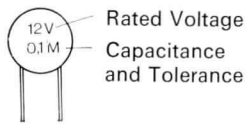
Ceramic Capacitors

Barrier Layer Type SD 3

Dimensions in mm



Material:	M 4000	
Capacitance µF	D (Diameter)	S (Lead Spacing)
0,047	6	5
0,1	7,9	5
0,22	9,5	5
0,47	15,1	10
1,0	21,4	10



Ordering Code

Example:

Ceramic Capacitor SD 3
M 4000 / 0,1 / 20% / 12 V

Material
Capacitance
Capacitance Tolerance
Rated Voltage

Ceramic Capacitors

SD 3 Barrier Layer Type

Rated Voltage	**25 V d.c.**
Test Voltage	50 V d.c.
Temperature Range	−30 to +70°C
Minimum Storage Temperature	−40°C

Coating:
Fully Coated and Impregnated

Leads: Tinned Copper

Insulation Resistance:

C = 0,01 µF	R = 50 MΩ
C = 0,022 µF	R = 25 MΩ
C = 0,047 µF	R = 10 MΩ
C = 0,068 µF	R = 5 MΩ
C = 0,1 µF	R = 5 MΩ

Material	Letter Code†	Loss Factor tan δ $\times 10^{-3}$
M 4000	BC	≤ 70

Capacitance

Nominal Values (see table, page 19) coded in pF as follows:

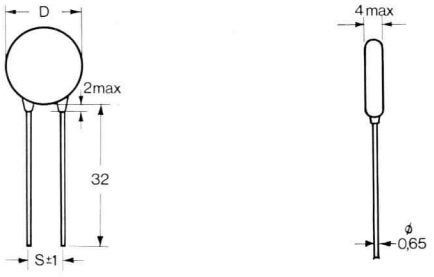
1st Number = 1st Digit of Capacitance
2nd Number = 2nd Digit of Capacitance
3rd Number = Multiplier 3 = × 1 000
4 = × 10 000

Capacitance Tolerance
Marked by Letter Code

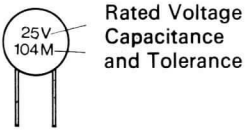
Tolerance	Code
±20%	M
−20 +80%	Z

†*Marked only on pack*

Dimensions in mm



Material:	M 4000	
Capacitance µF	D (Diameter)	S (Lead Spacing)
0,01	7,9	5
0,022	9,5	5
0,047	11,8	5
0,068	15,1	10
0,1	16	10



Ordering Code

Example: Ceramic Capacitor SD 3
M 4000 / 0,1 / 20% / 25V

Material
Capacitance
Capacitance Tolerance
Rated Voltage

ITT Components are available from:

or directly from:

ITT COMPONENTS GROUP EUROPE
Standard Telephones and Cables Limited
Capacitor Product Division
Brixham Road
PAIGNTON, Devon
Tel: 0803-50762 Telex: 42951

CAPACITORS

CAPACITORS

Introduction

For more than half a century Standard Telephones and Cables Limited has manufactured capacitors of outstanding reliability and performance for use in the communication systems for which the Company is world famous. As one of the largest users of capacitors in the country it has a wide knowledge of the conditions and requirements in the electronic field. This, coupled with the continuous search for new materials and the progressive development of manufacturing techniques, has resulted in a wide range of capacitors to meet the changing requirements of the electronics industry. The demand for lower working voltages and smaller physical size, created by the advent of the transistor, has been met by the development of the tantalum electrolytic capacitor; and synthetic dielectric capacitors now play an important part in many applications where paper and mica dielectrics were previously the only choice.

With the expansion of world communications, climatic and temperature considerations become more important in capacitor design, and because communication systems are generally expected to operate reliably for twenty years or more, STC capacitors are expected to retain their characteristics over this period without material change. To achieve this careful attention is given to the selection of materials for purity and endurance. Particular importance is attached to protective cases and methods of sealing to prevent the ingress of moisture and other sources of contamination, and to prevent diffusion of electrolyte in wet electrolytic capacitors.

Full Quality Control is in operation, from the intake of raw materials to the finished product. An extensive Quality Assurance testing programme supplies essential information on the overall quality of the outgoing product.

Reference standards of ambient climatic conditions and temperatures are specified in British Standards Specification 2011 and Joint Services Specification DEF–5011. Associated with these general specifications for electronic components are others, e.g. BS2131 and DEF–5131, relating to specified types of capacitors, and the ratings of STC capacitors are chosen to conform to these specifications. The endurance tests stipulated in these specifications are for periods of the order of 1 000 to 2 000 hours, at maximum rated voltage and temperature, the life of a capacitor is, however, extended considerably by a reduction of operating conditions.

The ratings of STC Capacitors are such that the number of failures on the endurance tests is generally less than one per cent. For operating conditions and life requirements materially different from those covered by the above specifications, our Engineering Department should be consulted.

TYPE	SECTION
INTERFERENCE SUPPRESSION	I.S.
SILVERED MICA	MICA
FOIL AND PAPER	PAPER
POST OFFICE TYPES	P.O.
POWER CAPACITORS	POWER
SYNTHETIC DIELECTRIC CAPACITORS	SYNTHETIC
TANTALUM ELECTROLYTIC	TANTALUM
VACUUM CAPACITORS	VACUUM

Standard Telephones and Cables Limited
COMPONENTS GROUP
CAPACITOR DIVISION, PAIGNTON, DEVON Tel.: Paignton 58685 Telex: 4251
LONDON SALES OFFICE, FOOTSCRAY, SIDCUP, KENT Tel.: Footscray 3333 Telex: 21836

CAPACITORS

Radio Interference Suppressors

INTRODUCTION

Contemporary advances in technology have resulted in a large increase in the amount and complexity of electrical equipment aboard aircraft and ships and a wider need than ever exists for effective interference suppression.

The efficiency of vital navigational aids and communication equipment can be seriously impaired by radio interference emanating from such sources as silicon diodes, transistors used for switching, relays, actuators and electric motors. In view of this, specifications laying down the maximum permissible interference levels over the various frequency bands have been issued by the Ministry of Aviation and the British Standards Institution. STC manufactures a range of high quality capacitors designed and tested to the appropriate specification for use specifically as radio interference suppressors. Because of their special performance these high-efficiency suppressors reduce interference noise levels to the specified degree without the need for chokes and their associated mounting boxes. This results in lower cost, reduction of weight and saving in space.

Economy in weight and space is particularly important in interference suppression aboard modern aircraft—a field of activity in which STC is the undoubted leader. The range of suppressors for aircraft conforms to the requirements of British Standard 2G 100 and Appendix D of the British Standards Code of Practice CP 1012 (1961). To meet the growing requirements for higher operating temperatures the paper dielectric range is supplemented by a metallised polyester series rated for operation at +125°C but suitable for use up to 150°C for a period of three thousand hours.

The Marine types conform to the requirements of British Standard 1597, the main points of which have been incorporated by Lloyd's Register of Shipping in "Regulations for Electrical Propelling Machinery and Electrical Equipment on Ships (Section 22)". They are oil-impregnated foil and paper capacitors of rugged construction with H1 humidity protection over the temperature range −40°C to +85°C.

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Radio Interference Suppressors

CONTINUED

RADIO INTERFERENCE MEASUREMENT SERVICE

To help manufacturers in the most efficient use of suppressors a Radio Interference Measurement service is operated by the Capacitor Division of STC. It consists of a fully equipped laboratory and mobile service, and measurements can be made on all types of equipment over *all* the frequencies covered in the various specifications, either at the customer's site or at Paignton. The mobile service is particularly useful for carrying out investigations of the electrical installation aboard ship.

The measurement service department is approved by the Ministry of Aviation and the Air Registration Board for type testing of equipment for radio interference. The approval includes flight trials, electrical installations, and also design and development of suppressors and networks to the requirements of British Standard 2G 100 and Section "J" of B.C.A.R. It is widely used by aircraft constructors, airline operators, commercial shipfitting companies and by the Admiralty.

TRANSFER IMPEDANCE

Fig. 1 shows in schematic form a noise generator with a suppressor connected between the source and the supply to be protected.

$$\text{Transfer Impedance } Z_t = \frac{\text{Output noise voltage}}{\text{Input noise current}} \text{ in ohms}$$

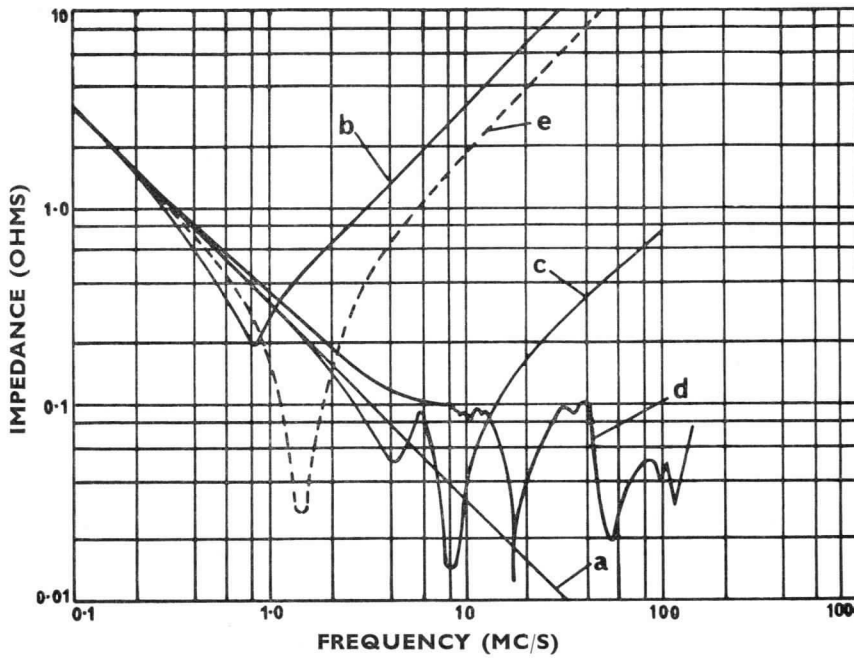
Therefore the lower the transfer impedance the more efficient the suppressor will be.

Fig. 1

When transfer impedance is plotted against frequency, using logarithmic scales, the graph for an "ideal" two-terminal capacitor, with zero inductance and power factor, is a straight line—Graph "a", Fig. 2.

Radio Interference Suppressors

CONTINUED



IMPEDANCE–FREQUENCY CHARACTERISTICS OF VARIOUS TYPES OF SUPPRESSORS

Fig. 2

A practical unit, however, will have inductance owing to the winding and the internal and external leads. The impedance/frequency characteristic for a 0·5 μF capacitor will therefore be similar to Graph "b" of Fig. 2. Here the self-inductance has caused resonance to occur at approximately 0·9 Mc/s giving a minimum impedance at this frequency. The capacitor will act as a highly efficient acceptor for signals of this frequency and they will be by-passed to earth. Above 0·9 Mc/s the unit acts as an inductor and the impedance increases rapidly until at 3 Mc/s it has reached one ohm.

TYPES OF SUPPRESSORS

(i) TWO-TERMINAL SUPPRESSORS. These are similar in construction to conventional capacitors and are intended for connection between the line to be suppressed and earth. They are effective up to approximately 10 Mc/s and are primarily intended for fitting to appliances after samples have been measured and corrected. They have further application as an auxiliary to the lead-through type for suppressing secondary circuits such as relay contacts, field circuits, etc.

Radio Interference Suppressors

CONTINUED

(ii) LEAD-THROUGH SUPPRESSORS. In the case of lead-through types the line to be suppressed is taken through the centre of the unit, thus eliminating the inductance of both the internal and external leads. This results in a vast improvement in the impedance/frequency characteristic and they are suitable for use up to 100 Mc/s. (Graph "c" of Fig. 2.)

These are general purpose suppressors which can be readily fitted to any appliance, within their current and voltage rating, without having to dismantle the apparatus and do not require expert knowledge to fit.

(iii) DUCT OR BUSHING TYPE. These are lead-through type suppressors of a special design which results at high frequencies in a characteristic approaching that of a transmission line. Graph "d" of Fig. 2 is a typical transfer impedance characteristic for a 0·5 μF duct suppressor. Provided that they are correctly mounted to ensure radial current flow, the impedance becomes almost constant at 0·04 ohms above 30 Mc/s up to extremely high frequencies. This unit is ideal for suppressing all supplies to the Radio Room.

The performance of duct suppressors is greatly dependent on the way in which they are mounted. It is essential that the unit be mounted through the walls of a metal container enclosing either the noise source or the apparatus to be protected from the noise. Graph "e" of Fig. 2 shows the effect of mounting a duct suppressor incorrectly. The performance is reduced to a level similar to that of a two-terminal capacitor.

All three types of suppressor are available from the STC range of interference suppressors. For further information please contact the Capacitor Division at Paignton.

For most applications an effective suppressor should have a transfer impedance of less than one ohm—particularly at frequencies above 1 Mc/s. The two-terminal unit represented by Graph "b" of Fig. 2 has an effective frequency range of 0·3 Mc/s to 3 Mc/s.

The frequency of minimum impedance could be raised by reducing the capacitance, but this, of course, would increase the impedance at lower frequencies.

CAPACITORS

Radio Interference Suppressors for Aircraft

INTRODUCTION

The STC suppressor range 335–LWA–120A to 127A is a series of high temperature lightweight capacitors, designed specifically for the suppression of radio interference aboard aircraft.

The capacitor units are wound from metallised polyester film. These units are housed in tubular tinned-brass cases and sealed with thermosetting resin. Code numbers 335–LWA–120A to 123A inclusive, are based on the conventional two terminal capacitor design—the case being one terminal. Code numbers 335–LWA–124A to 127A are "lead-through" types in which the line to be suppressed is taken through the centre of the unit.

Electrical ratings given in this data sheet have been reduced in accordance with Code of Practice CP 1012 App. D. to permit the capacitors to be used for aircraft interference suppression. No further derating is necessary.

CAPACITANCE VALUES AND CODES

STC CODE No.	CAPACITANCE (μF)
335–LWA–120A	2·0
335–LWA–121A	1·0
335–LWA–122A	0·37
335–LWA–123A	0·2
335–LWA–124A	2·0
335–LWA–125A	1·0
335–LWA–126A	0·4
335–LWA–127A	0·2

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, W.C.2

COMPONENTS GROUP

CAPACITOR DIVISION, PAIGNTON, DEVON Tel.: Paignton 58685

LONDON SALES OFFICE, FOOTSCRAY, SIDCUP, KENT Tel.: Footscray 3333

STC

Radio Interference Suppressors for Aircraft

CONTINUED

TEMPERATURE AND CLIMATIC GRADE

STC suppressors 335–LWA–120A to 127A meet the requirements of Humidity Classification H5 of DEF–5011 over the temperature range −55°C to +125°C. They can be used up to +150°C for a period not exceeding 3 000 hours at 50 volts d.c.

ELECTRICAL LIMITS

For use as Aircraft Suppressors

Capacitance tolerance	±20%
Maximum working voltage at 125°C	65 V d.c.
Maximum working voltage at 150°C	50 V d.c.
Maximum surge voltage at 125°C	125 V d.c.
Maximum surge voltage at 150°C	100 V d.c.
Power factor (900 c/s)	0·008
Insulation resistance at 20°C after 1 minute at 85 V d.c.	5 000 ΩF
Maximum lead through current (335–LWA–124/127)	10 amperes

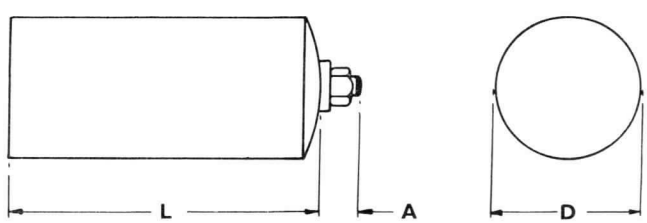
IMPEDANCE FREQUENCY CHARACTERISTICS

Typical Figures

335–LWA–120A	Less than 1 Ω	100 kc/s to 10 Mc/s
	Less than 10 Ω	10 kc/s to 100 Mc/s
335–LWA–122A	Less than 1 Ω	250 kc/s to 4 Mc/s
	Less than 10 Ω	25 kc/s to 400 Mc/s
335–LWA–127A	Less than 1 Ω	1 Mc/s to 80 Mc/s

DIMENSIONS

335–LWA–120A
335–LWA–121A
335–LWA–122A



Radio Interference Suppressors for Aircraft

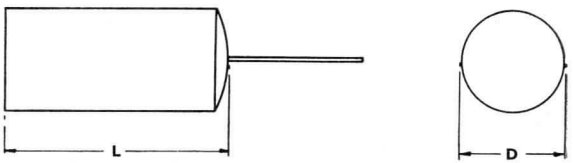
CONTINUED

DIMENSIONS—*continued*

TYPE	MAXIMUM DIMENSIONS						TERMINAL THREAD
	L		D		A		
	in	mm	in	mm	in	mm	
335–LWA–120A	1·93	49,0	0·72	18,3	0·296	7,52	2 BA
335–LWA–121A	1·47	37,3	0·72	18,3	0·408	10,36	2 BA
335–LWA–122A	1·25	31,8	0·47	11,9	0·352	8,94	4 BA

The resin is finished flush with the end of the case on type 335–LWA–122A.

335–LWA–123A



TYPE	MAXIMUM DIMENSIONS			
	L		D	
	in	mm	in	mm
335–LWA–123A	1·00	25,4	0·47	11,9

Terminal Wires

Length	1·5 in (38,1 mm) minimum
Diameter	0·036 in (0,91 mm) nominal

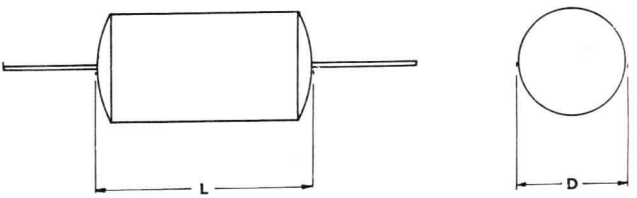
STC

Radio Interference Suppressors for Aircraft

CONTINUED

DIMENSIONS—*continued*

335–LWA–124A
335–LWA–125A
335–LWA–126A
335–LWA–127A



TYPE	MAXIMUM DIMENSIONS			
	L		D	
	in	mm	in	mm
335–LWA–124A	1·91	48,5	0·72	18,3
335–LWA–125A	1·53	38,9	0·72	18,3
335–LWA–126A	1·33	33,8	0·47	11,9
335–LWA–127A	1·05	26,7	0·47	11,9

Terminal Wires

Length	1·5 in (38,1 mm) minimum
Diameter	0·036 in (0,91 mm) nominal

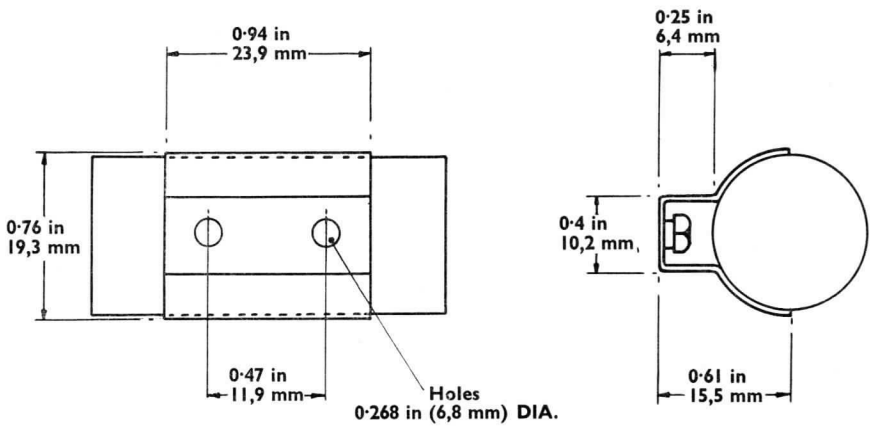
BRACKETS

335–LWA–120A
335–LWA–121A
335–LWA–124A
335–LWA–125A

Code numbers 335–LWA–120A, 121A, 124A and 125A can be supplied with a saddle bracket, as shown here. The bracket is soldered to the case and the standard position is centrally along the length. Other positions by arrangement.

The fixing holes are available with either 4 BA or 6 UNF thread.

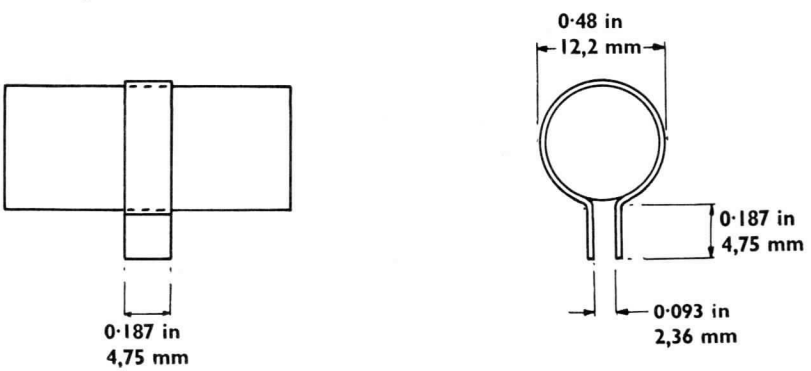
BRACKETS—*continued*



335–LWA–122A 335–LWA–126A
335–LWA–123A 335–LWA–127A

Code numbers 335–LWA–122A, 123A, 126A and 127A are available with any of the following brackets. Brackets are normally soldered centrally along the cases but can be supplied in any position by arrangement.

Solder Clip



The chassis, on which the suppressor is to be mounted, is punched or drilled to receive the clip projections. The projections are passed through the hole, splayed and soldered to the underside of the chassis.

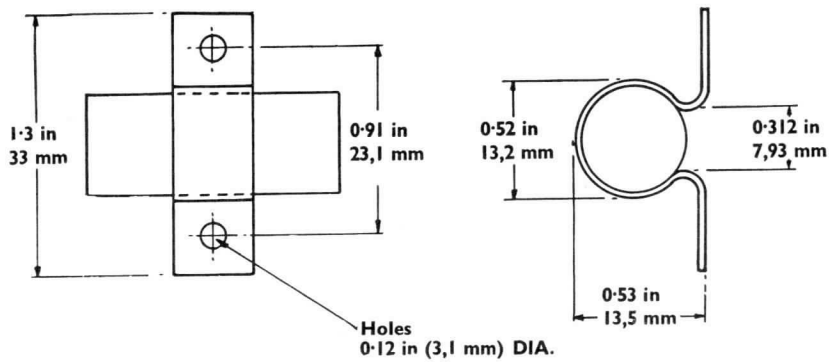
STC

Radio Interference Suppressors for Aircraft

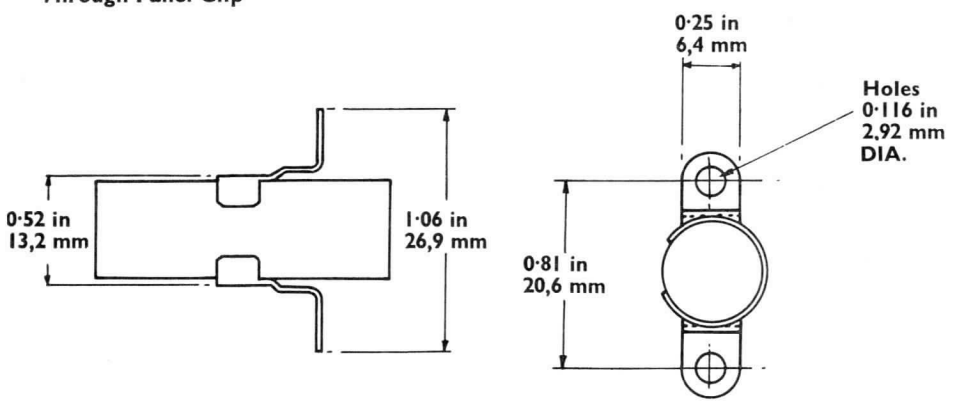
CONTINUED

BRACKETS—*continued*

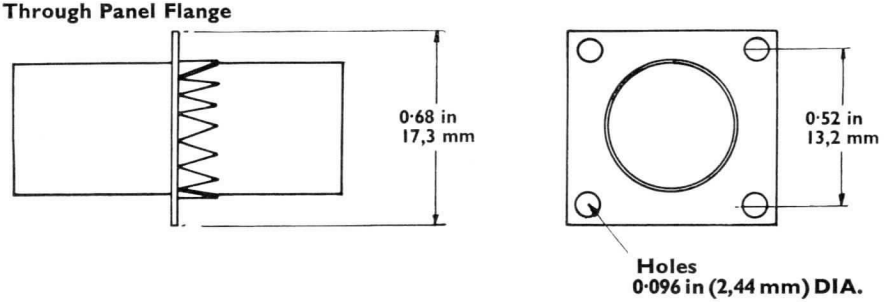
Omega Clip



Through Panel Clip



Through Panel Flange



The bracket dimensions given are nominal. For tolerances and for any further information required please write, phone or telex.

Capacitors

Index

PRODUCT TYPE	ITT CODE	DATA SHEET REFERENCE
Introduction		CAP/GEN
Radio Interference Suppression		
General Information		I.S./GEN
Aircraft Suppressors	335–LWA–120 to 127	I.S./1
Ceramic Capacitors		
	EB, ED, SB and SD	6470/460E
Mica Capacitors		
General Information		MICA/GEN
Waxed Dipped	4807, 4808, 4812, 4836	MICA 1
Standard Resin Moulded	4880 to 4888	
	454–LWA–22 to 41 and	
	454–LWA–273 to 276	MICA 2
Resin Dipped	454–LWA–49 to 54	MICA 3
Modular Resin Moulded	454–LWA–60 to 78	MICA 4
Wax Impregnated Resin Dipped	Series Z	MICA 5
Motor Capacitors		
General Information		MOTOR/GEN
Motor Start	MP 35	MOTOR 1
Motor Start/Run	MP 33, 34 and 36	MOTOR 2
Foil Paper Capacitors		
Miniature Tubular	453–LWA–252 to 254	PAPER 1
Oil Impregnated Tubular	453–LWA–271 to 282	PAPER 2
High Temperature Rectangular	4400 to 4407	PAPER 3
Oil Impregnated Rectangular	4315 to 4318 and	
	4325 to 4328	PAPER 4
British Post Office Types	4048 and 4049	P.O. 1
Thin Film Capacitors		
Miniature Moulded	STATCAP	STATCAP
Polymer Dielectric Capacitors		
Polystyrene and Foil	455–LWA–103 to 111 and	
	455–LWA–303 to 311	SYNTHETIC 2
Polystyrene and Foil	CA41–003, 005 and 007	POLY 1
Metallised Polyester	CA43–001	POLY 4
Metal Cased Metallised Polycarbonate	43–11 to 43–16	POLY 5
Moulded Metallised Plastic Film	PMC/PMT	PMC/PMT

PRODUCT TYPE	ITT CODE	DATA SHEET REFERENCE
Tantalum Capacitors		
85°C Tantalum Foil	472–LWA–1 to 6 and 472–LWA–101 to 106	TANTALUM 1
125°C Tantalum Foil	472–LWA–41 to 46 and 472–LWA–141 to 146	TANTALUM 3
Etched Tantalum Foil	CA51	TANTALUM 5
Miniature Moulded Solid Tantalum	TAJ/TAK	TANTALUM 8
Metal Cased Solid Tantalum	TAA	TAA
Resin Dipped Solid Tantalum	TAG	TAG
	TAM	TAM
	TAP	TAP
Resin Sealed Solid Tantalum	TAR	TAR
Vacuum Capacitors		
	K12 to K25/2L	K12/2L
	K50 and K100/2L	K50/2L

MICA

CAPACITORS

Silvered Mica

INTRODUCTION

The STC range of silvered mica capacitors has been designed to professional equipment standards. Over the past few years, engineering and production developments, notably in printing techniques and the use of thinner mica plates for low voltage operation, have resulted in an increase in the overall range, including a series of miniature mica designs.

The miniature range, available in various encapsulations, is particularly suited to airborne and military equipments and to data processing systems where space is a major consideration.

The data sheets include details of capacitance range and mechanical construction of the three basic series of mica capacitors. Electrical parameters, performance data and life test data are covered on subsequent pages of this section.

Details of the ranges are summarised below:

STANDARD RESIN MOULDED CAPACITORS

These capacitors are intended for applications where full humidity protection and working temperatures up to +100°C are required. The standard types are available with axial or radial terminal wires. Working voltages are 125V, 350V and 750V d.c. and capacitance values range from 4 pF to 100 000 pF according to voltage.

The rectangular shape gives particular economy of space especially when used on printed circuit boards.

These capacitors are described in Mica 2.

RESIN DIPPED CAPACITORS

Resin coating, applied by the fluidised bed process, results in mica capacitors with humidity protection (H3 DEF 5132) which is adequate for use in temperate conditions, in equipments designed with their own protection against ambient humidity or in totally encapsulated circuits.

Working voltage is 350V d.c., capacitance range 4 pF to 100 000 pF and terminal wires are radial. 125V and 750V d.c. capacitors are available to special order.

These capacitors are described in Mica 3.

Standard Telephones and Cables Limited

Capacitor Division, Brixham Road, Paignton, Devon

Telephone: Paignton 50762 Telex: 4251

C O M P O N E N T S G R O U P

Silvered Mica

CONTINUED

MODULAR RESIN MOULDED CAPACITORS

This range is designed for use in 12,7 mm (0·5 in) modular circuitry. Standard voltage ratings are 125V and 350V d.c. 750V d.c. units are available to special order. Capacitance values range from 4 pF to 40 000 pF depending on voltage.

Two major dimensions are constant over the range 454–LWA–73 to 77—width 12,7 mm (0·50 in) and height 12,2 mm (0·48 in). Codes 454–LWA–71 and 72 are the same width but only half the height. The capacitors have radial terminal wires with standard spacing of 10,2 mm (0·40 in).

Code numbers 454–LWA–73 to 77 are Departmentally Approved by S.R.D.E. The approval is based on a successful test programme carried out in accordance with DEF 5132 and covers the range of values 1 500 pF to 33 000 pF at 125V d.c.

Modular Mica capacitors are described in Mica 4.

IEC PREFERRED VALUES

In addition to the list of STC preferred values (Table 1), these capacitors are available to the ½%, 1% and 5% ranges of prefererd values in accordance with IEC 63.

These ranges are as follows:

Narrow tolerance range: Up to 100 pF ±1 pF { for E192 range } or ±1% { for E96 range }
Above 100 pF ±½%

Broad tolerance range: Up to 20 pF ±1 pF for E24 range
Above 20 pF ±5%

The "E" numeral indicates the number of steps per decade. the "lower" series is obtained by using every second value of the next "higher" series.

For practical reasons it has been necessary to modify the narrow tolerance range for capacitance values below 100 pF. This is achieved by reducing the E96 series progressively giving the following capacitance values in pF. There is, of course, rounding off:

10·0, 11·0, 12·0, 13·0, 15·0, 16·0, 18·0, 20·0, 20·5, 21·5, 22·6, 23·7,
24·9, 25·5, 26·1, 27·4, 28·7, 30·1, 31·6, 33·2, 34·8, 36·5, 38·3, 40·2,
41·2, 42·2, 43·2, 44·2, 45·3, 46·4, 47·5, 48·7, 49·9, 51·1, 52·3, 53·6,
54·9, 56·2, 57·6, 59·0, 60·4, 61·9, 63·4, 64·9, 66·5, 68·1, 69·8, 71·5,
73·2, 75·0, 76·8, 78·7, 80·6, 82·5, 84·5, 86·6, 88·7, 90·9, 93·1, 95·3,
97·6.

ORDERING

Data sheets Mica 2, 3 and 4 show the upper and lower limits of capacitance values for each physical size. Any value within these limits is available but, in the interest of cost and delivery time, it is recommended that preferred values (as above or as shown in Table 1) are specified.

To obviate delays in answering inquiries and in delivery of order the following details should always be specified: case code, capacitance value and tolerance, working voltage, quantity required, delivery required and, where partial deliveries are involved, the quantity per delivery and interval.

Silvered Mica

CONTINUED

PERFORMANCE

Resin moulded and resin dipped capacitors meet the requirements of specification DEF 5132, BS 2132 grade 1 and IEC 116.

LIMITS

(Reference temperature 20°C. Test conditions comply with those set down in the appropriate specification).

Capacitance tolerance (measured at 100 kHz up to 1 000 pF and at 1 kHz over 1 000 pF)	1 to 52 pF	±1 pF
	53 to 157 pF	±2 pF
	158 to 299 pF	±3 pF
	300 pF and over	±1%
Minimum tolerance available (to special order)		±½% or ±1 pF whichever is the greater.

N.B.—The above tolerances are applicable to STC preferred values only. Tolerances for the IEC range of preferred values are given under heading IEC PREFERRED VALUES.

Rated working voltage d.c.	125V, 350V and 750V	
Proof test voltage d.c.	3 times d.c. rated voltage	
Insulation resistance		
125V types		25 000 MΩ
350V and 750V types	up to 0·04 μF	25 000 MΩ
	over 0·04 μF	1 000 ΩF
Tan δ (Power factor)		
Over 4 pF up to 100 pF	measured at 100 kHz	0·002
Over 100 pF up to 1 000 pF	,, ,, 100 kHz	0·001
Over 1 000 pF	,, ,, 1 kHz	0·001
Temperature coefficient of capacitance (up to 1 000 pF measured at 100 kHz over 1 000 pF measured at 1 kHz)		−10 to +50 p.p.m/deg C
Scintillation	at 20V r.m.s.	<0·01%

Silvered Mica

CONTINUED

ENVIRONMENTAL TESTS TO DEF 5011

CONDITION	STANDARD	MODULAR	DIPPED
Humidity	H5/H6	H5	H3
Temperature	T4	T4	−40°C to +100°C
Low air density	D3	D3	D3
Shock	S3	S3	S3
Acceleration	A3	A3	A3
Vibration	V3	V3	V3

Bumping.—These capacitors will meet the requirements of the bumping test specified in DEF 5011.

Robustness of terminations.—The terminal wires of these capacitors will withstand the tensile, bending and torsion tests specified in DEF 5011.

Solderability.—The solder coated nickel terminal wires of these capacitors meet the requirements of BS 2011 pt 2T (1966).

TYPICAL PERFORMANCE

Tan δ (Power factor)	
at −30°C and 1 kHz	0·0002
at +20°C and 1 kHz	0·0003
at +70°C and 1 kHz	0·0005
Temperature coefficient of capacitance	+30 p.p.m/deg C
Capacitance stability	0·03% drift over 3 years
Capacitance change with frequency	0·1% between 1 kHz and 400 kHz
Insulation resistance of 500 pF capacitor after 1 min at 20°C	10^6 MΩ

Silvered Mica

CONTINUED

GRAPHS OF TYPICAL PERFORMANCE—These graphs illustrate the performance to be expected from both resin moulded and resin dipped capacitors.

Fig. 1.—Variation of Capacitance with Frequency
(measured at 20°C)

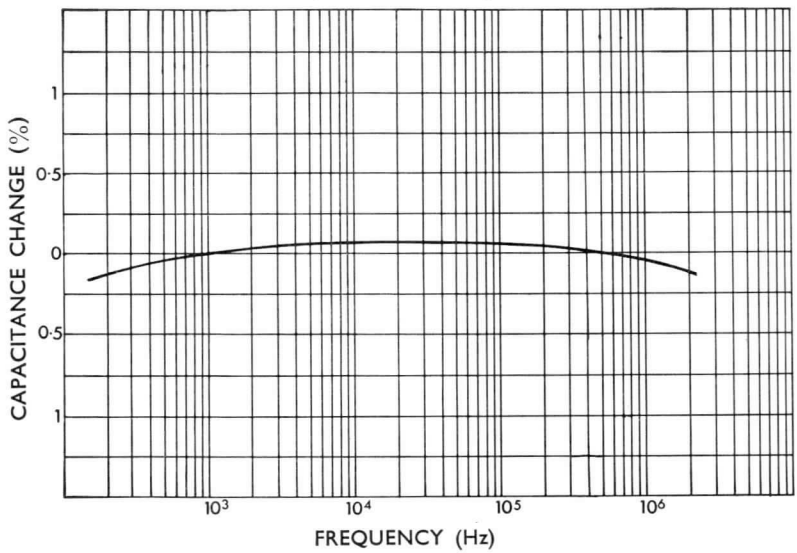
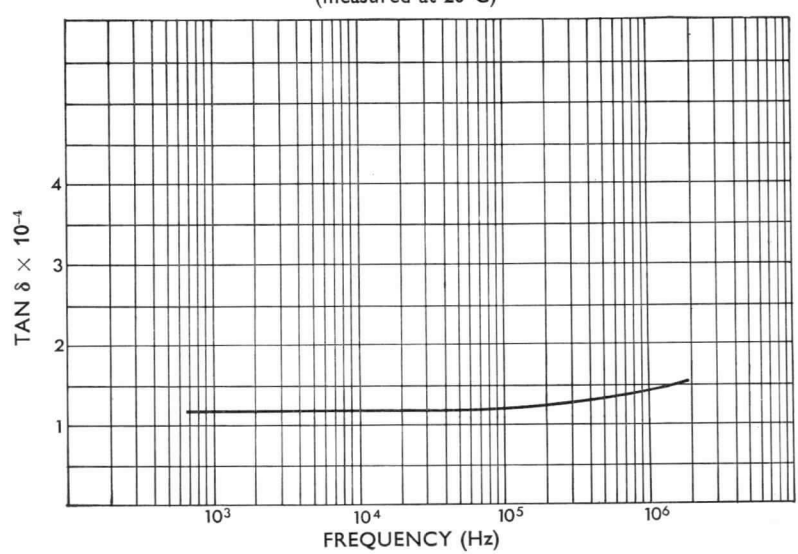


Fig. 2.—Variation of Tan δ with Frequency
(measured at 20°C)



Silvered Mica

CONTINUED

GRAPHS OF TYPICAL PERFORMANCE—*continued*

Fig. 3.—Variation of Tan δ with Temperature
(measured at 1 kHz)

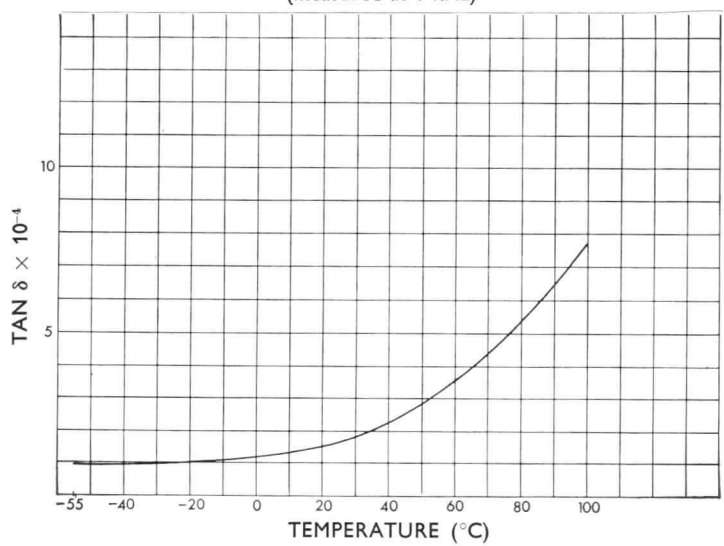
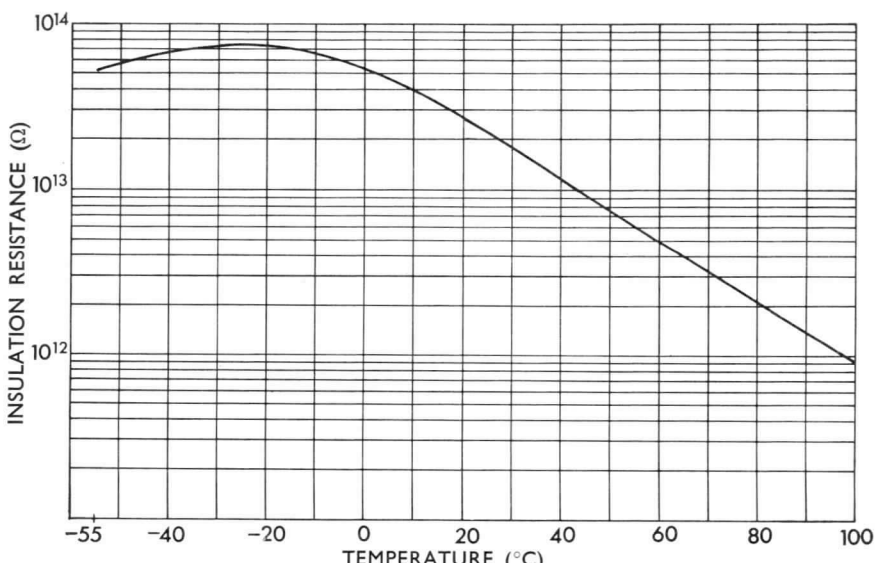


Fig. 4.—Variation of Insulation Resistance with Temperature
(measured on 100 pF capacitor)



Silvered Mica

CONTINUED

Table 1

LIST OF PREFERRED VALUES FOR STC MICA CAPACITORS

Capacitance values (pF) are available in accordance with this list within the range quoted for each code.

4	51	157	390	750	1370	2450	4700	9200	16750	31500	61000
5	52	160	395	760	1385	2475	4750	9300	17000	32000	62000
6	54	165	400	770	1400	2500	4800	9400	17250	32500	63000
7	55	170	405	780	1420	2525	4850	9500	17500	33000	64000
8	56	175	410	790	1440	2550	4900	9600	17750	33500	65000
9	58	180	415	800	1455	2600	5000	9700	18000	34000	66000
10	59	185	420	810	1470	2650	5100	9800	18250	34500	67000
11	60	190	425	820	1500	2700	5200	9900	18500	35000	68000
12	62	195	430	830	1520	2750	5300	10000	18750	35500	69000
13	63	200	435	840	1540	2800	5400	10200	19000	36000	70000
14	65	205	440	850	1555	2850	5500	10350	19250	36500	71000
15	67	210	445	860	1570	2900	5600	10500	19500	37000	72000
16	68	215	450	870	1585	2950	5700	10650	19750	37500	73000
17	70	220	455	880	1600	3000	5800	10800	20000	38000	74000
18	72	225	460	890	1625	3050	5900	11000	20250	38500	75000
19	73	230	465	900	1650	3100	6000	11200	20500	39000	76000
20	75	235	470	910	1675	3150	6100	11350	20750	39500	77000
21	77	240	475	920	1700	3200	6200	11500	21000	40000	78000
22	79	245	480	930	1725	3250	6300	11650	21250	40500	79000
23	80	250	485	940	1750	3300	6400	11800	21500	41000	80000
24	82	255	490	950	1775	3350	6500	12000	21750	41500	81000
25	85	260	495	960	1800	3400	6600	12200	22000	42000	82000
26	87	265	500	970	1825	3450	6700	12400	22250	42500	83000
27	89	270	510	980	1850	3500	6800	12550	22500	43000	84000
28	91	275	520	990	1875	3550	6900	12700	22750	43500	85000
29	93	280	530	1000	1900	3600	7000	12850	23000	44000	86000
30	95	285	540	1020	1925	3650	7100	13000	23250	44500	87000
31	98	290	550	1035	1950	3700	7200	13200	23500	45000	88000
32	100	295	560	1050	1975	3750	7300	13400	23750	45500	89000
33	102	300	570	1065	2000	3800	7400	13550	24000	46000	90000
34	105	305	580	1080	2025	3850	7500	13700	24250	46500	91000
35	108	310	590	1100	2050	3900	7600	13850	24500	47000	92000
36	110	315	600	1120	2075	3950	7700	14000	24750	47500	93000
37	112	320	610	1135	2100	4000	7800	14200	25000	48000	94000
38	115	325	620	1150	2125	4050	7900	14400	25250	48500	95000
39	118	330	630	1165	2150	4100	8000	14550	25500	49000	96000
40	120	335	640	1180	2175	4150	8100	14700	26000	50000	97000
41	124	340	650	1200	2200	4200	8200	14850	26500	51000	98000
42	127	345	660	1220	2225	4250	8300	15000	27000	52000	99000
43	130	350	670	1240	2250	4300	8400	15200	27500	53000	100000
44	134	355	680	1255	2275	4350	8500	15400	28000	54000	—
45	137	360	690	1270	2300	4400	8600	15550	28500	55000	—
46	140	365	700	1285	2325	4450	8700	15700	29000	56000	—
47	144	370	710	1300	2350	4500	8800	15850	29500	57000	—
48	147	375	720	1320	2375	4550	8900	16000	30000	58000	—
49	150	380	730	1340	2400	4600	9000	16250	30500	59000	—
50	154	385	740	1355	2425	4650	9100	16500	31000	60000	—

N.B.—In addition to the preferred values above these capacitors are also available to the ranges of preferred values in accordance with IEC 68 (see Mica/Gen—2).

Silvered Mica

CONTINUED

350V TYPES **LIFE TEST DATA ON STC RESIN MOULDED**

Test Ref. No.	Working Voltage (V d.c.)	Test Conditions V	Test Conditions °C	No. in Test	Hours	Capacitance: Average Initial Value (pF)	Capacitance: Average Change (%)	Capacitance: Total No. Greater Than 5%(a)	Capacitance: Total No. Greater Than 1%
E 47	350	450	125	20		26·6			
					100		+0·1	0	5
					250		+0·4	0	5
					500		0	0	5
					1000		+0·4	0	6
					2000		+0·1	0	6
					3000		+0·5	0	6
E 12	350	300	125	20		9990			
					1000		+0·10	0	1
					2000		+0·12	0	1
					3000		+0·11	0	1
					4000		+0·09	0	1
					5000		+0·08	0	1
					6000		+0·15	0	1
					9000		+0·09	0	1
					11,000		+0·04	0	1
E 14	350	0	125	20		10·000			
					1000		+0·01	0	0
					2000		+0·02	0	0
					3000		+0·02	0	0
					4000		+0·03	0	0
					5000		+0·07	0	0
					6000		+0·01	0	0
					7000		+0·02	0	0
					8000		0	0	0
E 16	350	450	100	20		9990			
					1000		+0·02	0	0
					2000		0	0	0
					3000		+0·1	0	0
					4000		+0·02	0	0
					5000		+0·05	0	0
					6000		+0·06	0	0
					7000		+0·08	0	0
					9000		+0·04	0	0
					11,000		0	0	0
E 15	350	300	100	20		9990			
				19	1000		−0·01	0	0
					2000		0	0	0
					3000		0	0	0
					4000		0	0	0
					5000		+0·03	0	0
					6000		+0·02	0	0
					7000		+0·03	0	0
				17	8000		0	0	0
					10,000		−0·01	0	0

(a) These capacitors excluded from averages.

Silvered Mica

CONTINUED

SILVERED MICA CAPACITORS

Table 2

Power Factor				Insulation Resistance				No. Short Circuited (a)
Average Initial Value (%)	Average Change (%)	Total No. Greater Than 0·5%(a)	0·3%	Average Initial Value MΩ×10³	Average After Test MΩ×10³	Total No. Less Than 1000 MΩ	100 MΩ (a)	
0·03				20,000				
	0	0	0		19,200	0	0	0
	0	0	0		19,500	0	0	0
	0	0	0		18,100	0	0	0
	0	0	0		11,410	0	0	0
	0	0	0		5,800	0	0	0
	0	0	0		7,510	0	0	0
0·03				513				
	0	0	0		281	0	0	0
	0	0	0		820	0	0	0
	0	0	0		630	0	0	0
	0	0	0		670	0	0	0
	0	0	0		700	0	0	0
	0	0	0		640	0	0	0
	0	0	0		430	0	0	0
	0	0	0		750	0	0	0
0·03				2000				
	0	0	0		1900	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
0·03				750				
	0	0	0		351	0	0	0
	0	0	0		1240	0	0	0
	0	0	0		630	0	0	0
	0	0	0		610	0	0	0
	0	0	0		751	0	0	0
	0	0	0		770	0	0	0
	0	0	0		650	0	0	0
	0	0	0		490	0	0	0
	+0·01	0	0		580	0	0	2
0·03				545				
	0	0	0		340	0	0	0
	0	0	0		810	0	0	0
	0	0	0		620	0	0	0
	0	0	0		630	0	0	0
	0	0	0		631	0	0	0
	0	0	0		631	1	1	0
	0	0	0		610	0	0	0
	0	0	0		380	0	0	0
	0	0	0		700	0	0	0

Silvered Mica

CONTINUED

350V TYPES **LIFE TEST DATA ON STC RESIN MOULDED**

Test Ref. No.	Working Voltage (V d.c.)	Test Conditions V	Test Conditions °C	No. in Test	Hours	Capacitance: Average Initial Value (pF)	Capacitance: Average Change (%)	Capacitance: Total No. Greater Than 5%(a)	Capacitance: Total No. Greater Than 1%
E 17	350	0	100	20		1000			
					1000		+0·01	0	0
					2000		+0·04	0	0
					3000		+0·02	0	0
					4000		+0·03	0	0
					5000		+0·04	0	0
					6000		+0·06	0	0
					7000		+0·02	0	0
					9000		0	0	0
					11,000		0	0	0
E 19	350	450	70	20		10,000			
					1000		−0·03	0	0
					2000		0	0	0
					3000		−0·02	0	0
					4000		−0·01	0	0
				19	5000		0	0	0
					6000		+0·23	0	0
					7000		−0·02	0	0
					9000		—	0	0
E 18	350	300	70	19		10,000			
					1000		0	0	0
					2000		−0·05	0	0
					3000		0	0	0
					4000		0	0	0
					5000		−0·03	0	0
					6000		+0·01	0	0
					7000		0	0	0
					9000		0	0	0
					11,000		0	0	0
E 20	350	0	70	20		9990			
					1000		−0·02	0	0
					2000		+0·02	0	0
					3000		−0·02	0	0
					4000		−0·02	0	0
					5000		+0·01	0	0
					6000		+0·22	0	0
					7000		−0·01	0	0
					9000		0	0	0

(a) These capacitors excluded from averages.

Silvered Mica

CONTINUED

SILVERED MICA CAPACITORS

Table 2 (continued)

Power Factor				Insulation Resistance				No. Short Circuited (a)
Average Initial Value (%)	Average Change (%)	Total No. Greater Than 0·5%(a)	0·3%	Average Initial Value MΩ×10³	Average After Test MΩ×10³	Total No. Less Than 1000 MΩ	100 MΩ(a)	
0·03				2000				
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		1910	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	+0·01	0	0		2000	0	0	0
0·03				930				
	0	0	0		1110	0	0	0
	0	0	0		600	0	0	0
	0	0	0		760	0	0	0
	0	0	0		1020	0	0	0
	0	0	0		730	0	0	1
	0	0	0		700	0	0	0
	0	0	0		460	0	0	0
	0	0	0		480	0	0	0
0·03				750				
	0	0	0		589	0	0	0
	0	0	0		800	0	0	0
	0	0	0		1080	0	0	0
	0	0	0		810	0	0	0
	0	0	0		750	0	0	0
	0	0	0		650	0	0	0
	0	0	0		740	3	3	0
	0	0	0		751	0	0	0
	0	0	0		1090	0	0	0
0·03				2000				
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		1910	0	0	0

Silvered Mica

CONTINUED

125V TYPES **LIFE TEST DATA ON STC RESIN MOULDED**

Test Ref. No.	Working Voltage (V d.c.)	Test Conditions V	Test Conditions °C	No. in Test	Hours	Capacitance: Average Initial Value (pF)	Capacitance: Average Change (%)	Capacitance: Total No. Greater Than 5%(a)	Capacitance: Total No. Greater Than 1%
E 56	125	200	125	20		25298			
					100	(b)	−0·2	0	0
					250		+0·1	0	1
					500		+0·6	0	3
					1000		+0·5	0	2
E 21	125	150	125	20		1005			
					1000		0	0	0
					2000		−0·1	0	0
					3000		−0·1	0	1
					4000		−0·2	0	1
					5000		−0·1	0	1
				19	6000		−0·2	0	1
					7000		−0·2	0	1
					9000		−0·2	0	1
					11,000		−0·1	0	1
E 23	125	0	125	20		1004			
					1000		−0·2	0	0
					2000		−0·1	0	0
					3000		−0·1	0	0
					4000		−0·3	0	0
					5000		−0·1	0	0
					6000		−0·1	0	0
					9000		−0·2	0	0
					11,000		0	0	0
E 24	125	200	100	19		1004			
					1000		0	0	1
					2000		+0·1	0	0
					3000		−0·2	0	0
					4000		−0·1	0	0
					5000		−0·1	0	0
					6000		−0·2	0	1
					7000		−0·1	0	0
					8000		−0·2	0	2
					10,000		−0·1	0	0
E 25	125	150	100	20		1004			
					1000		0	0	1
					2000		0	0	1
					3000		0	0	1
					4000		−0·2	0	1
					5000		−0·1	0	1
					6000		0	0	1
					7000		−0·2	0	1
					9000		−0·2	0	1
					11,000		0	0	1

(a) These capacitors excluded from averages.

Silvered Mica

CONTINUED

SILVERED MICA CAPACITORS

Table 3

Power Factor				Insulation Resistance				No. Short Circuited (a)
Average Initial Value (%)	Average Change (%)	Total No. Greater Than 0·5%(a)	0·3%	Average Initial Value MΩ×10³	Average After Test MΩ×10³	Total No. Less Than 1000 MΩ	100 MΩ(a)	
0·08				1800				
	0	0	0		1910	0	0	0
	−0·02	1	0		1900	0	0	0
	+0·03	0	0		1900	0	0	0
	+0·04	0	1		1460	0	0	0
0·04				1910				
	0	0	0		1850	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		2000	0	0	1
	0	0	0		1940	0	0	0
	+0·02	0	0		2000	0	0	0
	+0·01	0	0		2000	0	0	0
	+0·01	0	0		2000	0	0	0
0·05				2000				
	−0·02	0	0		2000	0	0	0
	−0·02	0	0		2000	0	0	0
	−0·03	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
0·05				1810				
	+0·02	0	0		1890	0	0	0
	+0·01	0	0		2000	1	1	0
	+0·01	0	0		2000	0	0	0
	0	0	0		1900	0	0	0
	+0·01	0	0		1950	0	0	0
	+0·01	0	0		1950	0	0	0
	+0·02	0	0		1900	0	0	0
	+0·02	0	0		1550	0	0	0
	+0·03	0	0		1910	0	0	0
0·06				1900				
	−0·02	0	0		1930	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·02	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	0	0	0		1900	0	0	0
	0	0	0		1800	0	0	0
	+0·02	0	0		1900	0	0	0

(b) Mixed capacitance values (range 100 pF to 1000 pF).

Silvered Mica

CONTINUED

125V TYPES **LIFE TEST DATA ON STC RESIN MOULDED**

Test Ref. No.	Working Voltage (V d.c.)	Test Conditions V	Test Conditions °C	No. in Test	Hours	Capacitance: Average Initial Value (pF)	Capacitance: Average Change (%)	Capacitance: Total No. Greater Than 5%(a)	Capacitance: Total No. Greater Than 1%
E 26	125	0	100	20		1003			
					1000		−0·1	0	0
					2000		−0·1	0	0
					3000		−0·1	0	0
					4000		0	0	0
					5000		0	0	0
					6000		0	0	0
					7000		−0·1	0	0
					9000		0	0	0
					11,000		0	0	0
E 27	125	200	70	20		1004			
				18	1000		−0·1	0	0
					2000		0	0	0
					3000		+0·1	0	0
				17	4000		0	0	0
					5000		0	0	0
					6000		0	0	0
					7000		0	0	0
					9000		0	0	0
					11,000		0	0	0
E 28	125	150	70	20		1003			
					1000		0	1	1
					2000		0	1	1
				19	3000		0	0	0
					4000		0	0	0
				18	5000		+0·01	0	0
					6000		0	0	0
					9000		0	0	0
					11,000		+0·1	0	0
E 29	125	0	70	20		1003			
					1000		−0·1	0	0
					2000		−0·1	0	0
					3000		0	0	0
					4000		−0·1	0	0
					5000		0	0	0
					6000		−0·1	0	0
					7000		−0·2	0	0
					9000		−0·1	0	0
					11,000		−0·1	0	0

(a) These capacitors excluded from averages.

Silvered Mica

CONTINUED

SILVERED MICA CAPACITORS

Table 3 (continued)

Power Factor				Insulation Resistance				No. Short Circuited (a)
Average Initial Value (%)	Average Change (%)	Total No. Greater Than 0·5%(a)	0·3%	Average Initial Value MΩ × 10^3	Average After Test MΩ × 10^3	Total No. Less Than 1000 MΩ	100 MΩ(a)	
0·06				2000				
	−0·01	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·02	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
0·05				1810				
	0	0	0		1800	0	0	0
	+0·02	0	0		2000	1	0	0
	+0·01	0	0		2000	1	1	0
	0	0	0		2000	0	0	0
	0	0	0		1900	0	0	0
	+0·04	0	0		1930	0	0	0
	0	0	0		1900	0	0	0
	0	0	0		2000	0	0	0
	0	0	0		1900	0	0	0
0·05				2000				
	0	0	2		2000	2	2	0
	0	0	1		2000	1	1	0
	0	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	−0·01	0	0		1910	0	0	0
	+0·01	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
0·04				2000				
	0	0	0		2000	0	0	0
	+0·01	0	0		2000	0	0	0
	0	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	−0·01	0	0		2000	0	0	0
	+0·03	0	0		2000	0	0	0
	−0·01	0	0		1910	0	0	0
	0	0	0		2000	0	0	0
	+0·01	0	0		2000	0	0	0

CAPACITORS

Silvered Mica

(Wax Dipped Series)

Code Nos. 4812, 4836, 4807 & 4808

MAINTENANCE TYPE

INTRODUCTION

Wax dipped mica capacitors are primarily intended for use in sealed filter networks in telecommunication systems and similar equipment, where a high stability capacitor of small physical size is required.

Working voltage is 350V d.c., capacitance range 6 pF to 100000 pF and terminal wires are axial.

CONSTRUCTION

High quality ruby mica plates are silvered with a high temperature firing silver paste to produce capacitors of extremely good capacitance stability with change of frequency and temperature.

The mica laminations are supported between mica cover plates which are silvered at the edges and the assembly is bonded together by a metallic silver paste reinforced with high temperature solder.

Additional reinforcement is provided by the axial terminal wires which are secured to each end of the capacitors and also soldered with a high temperature solder. They are vacuum impregnated with a high melting point wax and an additional protection of high melting point compound is given to make the capacitor suitable for use in non-tropical systems without further protection.

TEMPERATURE AND CLIMATIC GRADE

Wax-protected capacitors are rated to operate over the temperature range −25°C to +70°C and although intended for use in sealed equipments will also operate satisfactorily in temperate conditions.

Standard Telephones and Cables Limited

Capacitor Division, Brixham Road, Paignton, Devon

Telephone: Paignton 50762 Telex: 4251

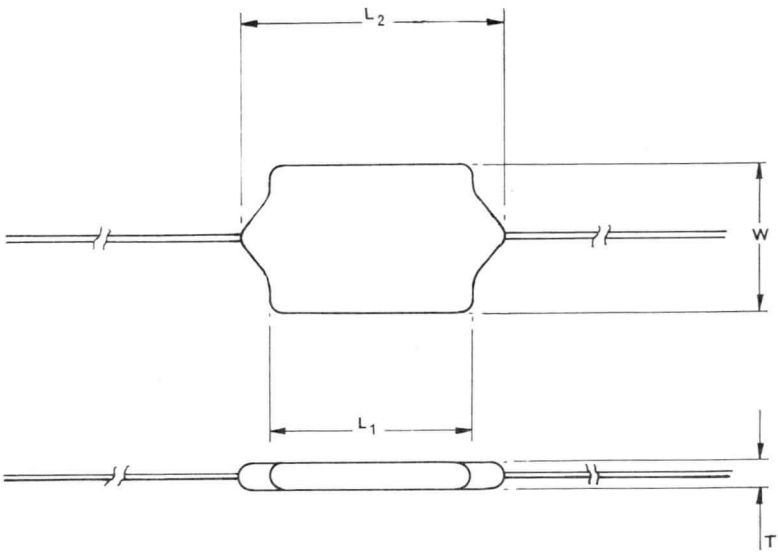
London Sales Office, Telephone: Footscray 3333 Telex: 21836

C O M P O N E N T S G R O U P

STC

Code Nos. 4812, 4836, 4807 & 4808

CONTINUED



STC Code (Axial Terminal Wires only)	Capacitance Range (pF) 350V	Maximum Dimensions							
		L1		L2		W		T	
		mm	in	mm	in	mm	in	mm	in
4812	6– 2,000	16,0	0·63	22,4	0·88	11,2	0·44	4,8	0·19
4836	2,000– 10,000	23,9	0·94	30,2	1·19	17,5	0·69	6,4	0·25
4807	10,000– 30,000	30,2	1·19	36,6	1·44	23,9	0·94	7,1	0·28
4808	30,000–100,000	42,9	1·69	49,3	1·94	30,2	1·19	7,1	0·28

TERMINAL WIRES

Diameter	0,6	mm (0·024 in) nominal
Length	32	mm (1·25 in) minimum

N.B.—Original capacitor dimensions are in inches

M

Code Nos. 4812, 4836, 4807 & 4808

CONTINUED

ELECTRICAL CHARACTERISTICS

		LIMITS (Reference temperature 20°C)
Capacitance tolerance	4 to 52 pF	±1 pF
	53 to 157 pF	±2 pF
	158 to 299 pF	±3 pF
	300 pF and over ...	±1%
Working voltage d.c. ...	... ...	350V
Proof test voltage d.c. ...	... ...	1000V
Insulance after 1 min at 300V	Up to 0·04 pF	25000 MΩ
	Over 0·04 pF	1000 ΩF

Power Factor

Over 1000 pF	Measured at 1 kc/s ...	0·001
,, 100 pF up to 1000 pF	,, ,, 100 ,, ...	0·001
,, 4 pF ,, ,, 100 pF	,, ,, ,, ,, ...	0·002
Temperature coefficient of capacitance		...−10 to +30 parts/million/°C

TYPICAL PERFORMANCE

Capacitance change with frequency		Not greater than 0·1% between 1 kc/s and 400 kc/s
Breakdown voltage		2000V d.c.
Insulance after 1 min at 300V	−30°C	900000 MΩ
	+20°C	470000 MΩ
	+70°C	90000 MΩ
Power factor	−30°C at 900 c/s	·00029
	+20°C at 20 kc/s	·00058
	+70°C at 900 c/s	·00058
Temperature coefficient of capacitance		+ 14 parts/million/°C
Capacitance stability		Not greater than 0·03% drift over 3 years

M

Code Nos. 4812, 4836, 4807 & 4808

CONTINUED

LIST OF PREFERRED VALUES FOR STC MICA CAPACITORS

Capacitance values (pF) are available in accordance with this list within the range quoted for each code.

4	51	157	390	750	1370	2450	4700	9200	16750	31500	61000
5	52	160	395	760	1385	2475	4750	9300	17000	32000	62000
6	54	165	400	770	1400	2500	4800	9400	17250	32500	63000
7	55	170	405	780	1420	2525	4850	9500	17500	33000	64000
8	56	175	410	790	1440	2550	4900	9600	17750	33500	65000
9	58	180	415	800	1455	2600	5000	9700	18000	34000	66000
10	59	185	420	810	1470	2650	5100	9800	18250	34500	67000
11	60	190	425	820	1500	2700	5200	9900	18500	35000	68000
12	62	195	430	830	1520	2750	5300	10000	18750	35500	69000
13	63	200	435	840	1540	2800	5400	10200	19000	36000	70000
14	65	205	440	850	1555	2850	5500	10350	19250	36500	71000
15	67	210	445	860	1570	2900	5600	10500	19500	37000	72000
16	68	215	450	870	1585	2950	5700	10650	19750	37500	73000
17	70	220	455	880	1600	3000	5800	10800	20000	38000	74000
18	72	225	460	890	1625	3050	5900	11000	20250	38500	75000
19	73	230	465	900	1650	3100	6000	11200	20500	39000	76000
20	75	235	470	910	1675	3150	6100	11350	20750	39500	77000
21	77	240	475	920	1700	3200	6200	11500	21000	40000	78000
22	79	245	480	930	1725	3250	6300	11650	21250	40500	79000
23	80	250	485	940	1750	3300	6400	11800	21500	41000	80000
24	82	255	490	950	1775	3350	6500	12000	21750	41500	81000
25	85	260	495	960	1800	3400	6600	12200	22000	42000	82000
26	87	265	500	970	1825	3450	6700	12400	22250	42500	83000
27	89	270	510	980	1850	3500	6800	12550	22500	43000	84000
28	91	275	520	990	1875	3550	6900	12700	22750	43500	85000
29	93	280	530	1000	1900	3600	7000	12850	23000	44000	86000
30	95	285	540	1020	1925	3650	7100	13000	23250	44500	87000
31	98	290	550	1035	1950	3700	7200	13200	23500	45000	88000
32	100	295	560	1050	1975	3750	7300	13400	23750	45500	89000
33	102	300	570	1065	2000	3800	7400	13550	24000	46000	90000
34	105	305	580	1080	2025	3850	7500	13700	24250	46500	91000
35	108	310	590	1100	2050	3900	7600	13850	24500	47000	92000
36	110	315	600	1120	2075	3950	7700	14000	24750	47500	93000
37	112	320	610	1135	2100	4000	7800	14200	25000	48000	94000
38	115	325	620	1150	2125	4050	7900	14400	25250	48500	95000
39	118	330	630	1165	2150	4100	8000	14550	25500	49000	96000
40	120	335	640	1180	2175	4150	8100	14700	26000	50000	97000
41	124	340	650	1200	2200	4200	8200	14850	26500	51000	98000
42	127	345	660	1220	2225	4250	8300	15000	27000	52000	99000
43	130	350	670	1240	2250	4300	8400	15200	27500	53000	100000
44	134	355	680	1255	2275	4350	8500	15400	28000	54000	—
45	137	360	690	1270	2300	4400	8600	15550	28500	55000	—
46	140	365	700	1285	2325	4450	8700	15700	29000	56000	—
47	144	370	710	1300	2350	4500	8800	15850	29500	57000	—
48	147	375	720	1320	2375	4550	8900	16000	30000	58000	—
49	150	380	730	1340	2400	4600	9000	16250	30500	59000	—
50	154	385	740	1355	2425	4650	9100	16500	31000	60000	—

CAPACITORS

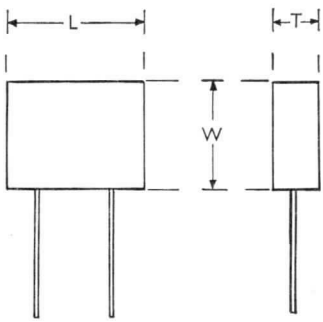
Silvered Mica

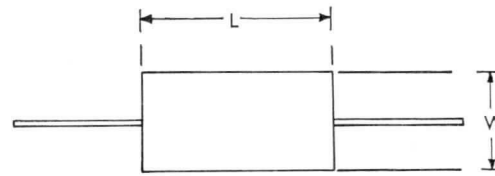
(Resin Moulded—Standard Series)

High quality ruby mica plates with fired-on silver electrodes are fully bonded together and further reinforced by edge bonding. Terminal wires are securely soldered to this reinforced area with high melting point solder. The units are then moulded in thermosetting resin.

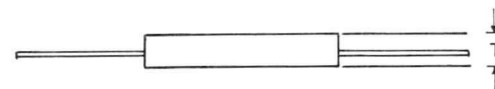
In addition to axial wire terminations this range is manufactured with radial terminal wires for use with printed circuits. The rectangular shape gives economy of space when used with printed circuit boards and in potted circuits.

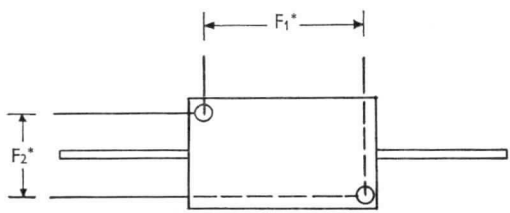
RADIAL TYPE





AXIAL TYPE





*MOUNTING HOLES

Type	F_1 mm	F_1 in	F_2 mm	F_2 in
4887	31,8	1·25	16,0	0·63
4888	46,0	1·81	25,4	1·00

The two 6BA clearance holes are provided on types 4887 and 4888 only.

N.B.—Original dimensions are in inches.

Standard Telephones and Cables Limited

Capacitor Division, Brixham Road, Paignton, Devon

Telephone: Paignton 50762 Telex: 4251

London Sales Office, Telephone: Footscray 3333 Telex: 21836

C O M P O N E N T S G R O U P

STC

Silvered Mica

CONTINUED

RATINGS AND DIMENSIONS

TYPE		CAPACITANCE RANGE (pF)		
Axial	Radial	125V d.c.	350V d.c.	750V d.c.
454–LWA–46	454–LWA–60	100— 250	4— 100	
,, ,, 47	,, ,, 61	255—1,000	102— 300	
—	,, ,, 62	250— 500	4— 250	
—	,, ,, 63	500—1,500	250— 500	
4880	—	250— 500	4— 250	
4881	—	500—1,500	250— 500	
4884	454–LWA–22	500—1,500	6— 500	
4882	,, ,, 23	1,000—3,000	500— 1,000	
—	,, ,, 24	500—1,500	6— 500	
—	,, ,, 25	1,000—3,000	500— 1,000	
*4885	—	2,000—6,000	6— 2,000	6— 500
—	454–LWA–26	,, ,,	,, ,,	,, ,,
4886	,, ,, 31		300— 10,000	300— 2,500
—	,, ,, 36		300— 30,000	300— 7,000
*4887	—		,, ,,	,, ,,
—	454–LWA–41		30,000—100,000	7,000—25,000
4888	—		,, ,,	,, ,,

*DEF 5132 Patterns { 4885 CMM1—G; 4887 CMM3—Y }

The list of capacitance values available within these ranges is given in Mica/Gen.

Silvered Mica

CONTINUED

HUMIDITY GRADE DEF 5132*	MAXIMUM DIMENSIONS						TYPE	
	L		W		T			
	mm	in	mm	in	mm	in	Axial	Radial
H5	8,89	0·350	7,88	0·310	3,56	0·140	46	60
,,	,,	,,	,,	,,	5,16	0·203	47	61
,,	11,93	0·470	9,15	0·360	3,56	0·140	—	62
,,	,,	,,	,,	,,	5,16	0·203	—	63
,,	,,	,,	,,	,,	3,43	0·135	4880	—
,,	,,	,,	,,	,,	5,03	0·198	4881	—
,,	13,20	0·520	10,28	0·405	3,56	0·140	4884	22
,,	,,	,,	,,	,,	5,16	0·203	4882	23
,,	,,	,,	,,	,,	3,56	0·140	—	24
,,	12,94	0·510	,,	,,	5,03	0·198	—	25
H6	18,15	0·715	11,88	0·468	5,94	0·234	4885	—
,,	18,28	0·720	12,19	0·480	5,97	0·235	—	26
,,	29,45	1·160	18,80	0·740	6,73	0·265	4886	31
,,	32,80	1·290	26,40	1·040	8,51	0·335	—	36
,,	38,45	1·515	23,35	0·920	8,26	0·325	4887	—
,,	44,20	1·740	32,80	1·290	8,51	0·335	—	41
,,	52,80	2·080	,,	,,	,,	,,	4888	—

N.B.—Original dimensions are in inches.

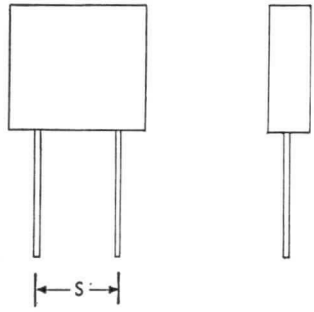
* −55°C to +100°C

STC

Silvered Mica

CONTINUED

TERMINAL WIRE DIMENSIONS



TYPE		DIAMETER		LENGTH				SPACING (s)	
Axial Wires	Radial Wires	Both Types nominal mm	in	Axial minimum mm	in	Radial minimum mm	in	Radial only ±·020 in mm	in
454–LWA–46 & 47	454–LWA–60 & 61	0,5	0·020	32	1·25	32	1·25	5,1	0·20
4880 & 4881	,, ,, 62 & 63	,,	,,	,,	,,	,,	,,	7,6	0·30
4884 & 4882	,, ,, 22 & 23	,,	,,	,,	,,	,,	,,	10,2	0·40
—	,, ,, 24 & 25	,,	,,	—		,,	,,	7,6	0·30
4885	,, ,, 26	0,6	0·024	32	1·25	,,	,,	10,2	0·40
4886 & 4887	,, ,, 31	0,9	0·036	,,	,,	,,	,,	15,2	0·60
—	,, ,, 36	,,	,,	—		,,	,,	20,3	0·80
—	,, ,, 41	,,	,,	—		,,	,,	30,5	1·20
4888	—	,,	,,	32	1·25	—		—	

N.B.—Original dimensions are in inches.

For specification and performance characteristics of these capacitors refer to Mica/Gen.

CAPACITORS

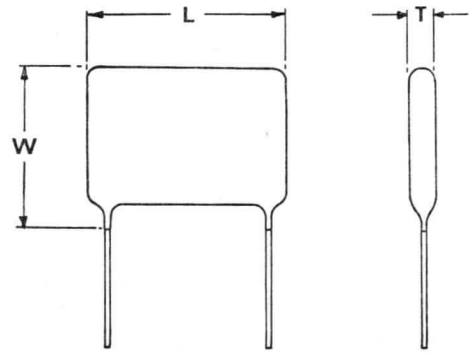
Silvered Mica

(Resin Dipped Series)

Code Nos. 454–LWA–49 to 54

CONSTRUCTION

These capacitors are made of best mica plates with fired on silver electrodes. The plates are fully bonded together and further reinforced by edge bonding. The terminal wires are securely soldered to the reinforced area with a high melting point solder. The units are then dipped in thermosetting resin to give mechanical protection.



RATINGS AND DIMENSIONS

STC Code (Radial Terminal wires only)	Capacitance Range (pF) 350V d.c.	Maximum Dimensions L mm	L in	W mm	W in	T mm	T in	Humidity Grade DEF 5132 −40°C to +100°C
454–LWA–49	4– 300	7,6	0·30	6,4	0·25	3,8	0·15	H3
,, ,, 50	4– 500	10,4	0·41	10,8	0·43	4,8	0·19	,,
,, ,, 51	6– 1,000	13,0	0·51	12,2	0·48	,,	,,	,,
,, ,, 52	6– 2,000	13,3	0·53	,,	,,	5,1	0·20	,,
,, ,, 53	2,000– 10,000	27,9	1·10	21,1	0·83	5,8	0·23	,,
,, ,, 54	10,000– 30,000	30,5	1·20	28,7	1·13	9,1	0·36	,,

N.B.—Original dimensions are in inches.
The list of capacitance values available within these ranges is given in Mica/Gen.

Standard Telephones and Cables Limited

Capacitor Division, Brixham Road, Paignton, Devon

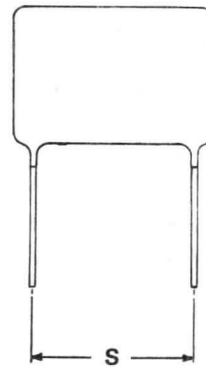
Telephone: Paignton 50762 Telex: 42951

C O M P O N E N T S G R O U P

STC

Code Nos. 454–LWA–49 to 54

CONTINUED



TYPE	TERMINAL WIRES					
	Length Minimum		Diameter Nominal		Spacing (s) $\pm\frac{1}{16}$ in	
	mm	in	mm	in	mm	in
454–LWA–49	32	1·25	0,6	0·024	5,1	0·20
,, ,, 50	,,	,,	,,	,,	7,6	0·30
,, ,, 51	,,	,,	,,	,,	,,	,,
,, ,, 52	,,	,,	,,	,,	10,2	0·40
,, ,, 53	,,	,,	,,	,,	15,2	0·60
,, ,, 54	,,	,,	,,	,,	20,3	0·80

N.B.—Original dimensions are in inches.

For specification and performance characteristics of these capacitors refer to Mica/Gen.

Silvered Mica Capacitors
(Resin Moulded—Modular Series)
Code Nos. 454-LWA-71 to 78

Modular capacitors are made of high-quality mica plates with fired-on silver electrodes. The plates are fully bonded together, being further reinforced by edge bonding. The radial terminal wires are securely soldered to the reinforced area with a high melting-point solder. The capacitors are then moulded in chemically resistant, water impervious, thermosetting resin to give excellent humidity protection.

These data include the optional high capacitance range which is available at extra cost. This range is made possible by the use of extra thin mica material which is considerably more expensive than the thicker grades.

Both the standard range and high capacitance range bear the same basic code. This code refers to mechanical outline only and the suffix letters, not shown in these data, indicate capacitance value, etc., it is therefore important to adhere strictly to the instructions on ordering given in MICA/GEN.

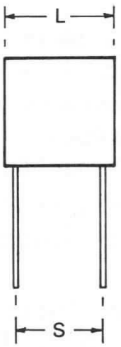
RATINGS

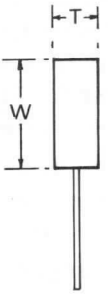
Code (Radial Terminal Wires only)	Capacitance range (pF)			Humidity Grade DEF 5132 −55°C to +100°C
	125 V d.c. Standard Range	125 V d.c. High Capacitance Range	350 V d.c.	
454-LWA-71	4–300			H5
,, ,, 72	304–1000			,,
,, ,, 73	4–2000		4–600	,,
,, ,, 74	2000–10000		600–3000	,,
,, ,, 75	10000–17000	17000–20000	3000–6000	,,
,, ,, 76	17000–26000	26000–30000	6000–10000	,,
,, ,, 77	26000–35000	35000–40000	10000–13000	,,
,, ,, 78	35000–40000			,,

The list of capacitance values within these ranges is given in MICA/GEN.

Standard Telephones and Cables Limited
Capacitor Division, Brixham Road, Paignton, Devon
Telephone: Paignton 50762 (STD Code 0803) Telex: 42951

DIMENSIONS





Code	L (max) mm	L (max) in	W (max) mm	W (max) in	T (max) mm	T (max) in	S (±0,5 mm / ± .020 in) mm	S (±0,5 mm / ± .020 in) in
454-LWA-71	12,7	0.500	6,35	0.250	3,43	0.135	10,2	0.40
,, ,, 72	,,	,,	,,	,,	5,33	0.210	,,	,,
,, ,, 73	,,	,,	12,19	0.480	3,43	0.135	,,	,,
,, ,, 74	,,	,,	,,	,,	5,33	0.210	,,	,,
,, ,, 75	,,	,,	,,	,,	7,87	0.310	,,	,,
,, ,, 76	,,	,,	,,	,,	10.41	0.410	,,	,,
,, ,, 77	,,	,,	,,	,,	12,95	0.510	,,	,,
,, ,, 78	,,	,,	,,	,,	15,49	0.610	,,	,,

Terminal Wires

Length 32 mm (1.25 in) minimum
Diameter 0,5 mm (0.020 in) nominal

N.B.—Original dimensions are in inches.

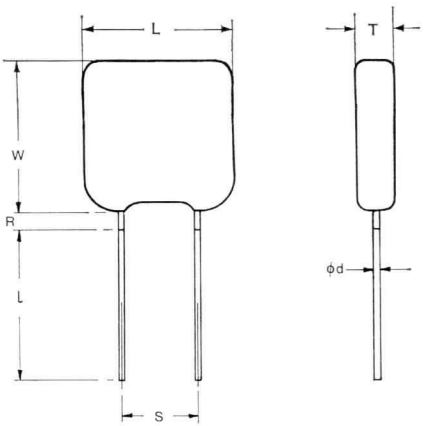
For specification and performance characteristics of these capacitors refer to MICA/GEN.

Silvered Mica Capacitors

Mica 5

Wax impregnated, Resin Dipped, Series Z

These capacitors are of best quality ruby mica silvered, dip-coated with resin, and finished by wax impregnation for better moisture protection. The radial brass wire leads make direct contact with the electrodes. The high Q value, and good Q versus frequency characteristics of these capacitors make them particularly useful in IF tuners and high-frequency circuits. Another attractive feature is their small size. In each case size there are capacitors of 50 V d.c. and 500 V d.c. rating.



Ratings and Dimensions

Case Size	Capacitance (pF) 50 V d.c.	500 V d.c.	Dimensions (m m)* L	W	T	R†	S	φd	l
Z11	1 to 22	1 to 22	5,0	5,0	3,0	3,0	3,0	0,3	20
Z12	27 to 47	27 to 47	6,0	6,0	3,0	3,0	5,0	0,3	20
Z17	68 to 110	56 to 68	8,0	8,0	4,0	3,0	5,0	0,5	20
Z18	120 to 1 200	82 to 620	11,0	11,0	4,0	3,0	7,5	0,5	20
Z21	1 300 to 2 000	680 to 1 100	13,0	13,0	4,5	3,0	10,0	0,5	20
Z30	2 200 to 3 300	1 200 to 3 300	16,0	16,0	4,5	3,0	12,5	0,6	20

*Dimensional tolerances:

L. W and S	±1,0
T & R	Max dimensions
φd	±0,1
l	Min dimension

†Resin encroachment

Electrical Characteristics

Operating temperature:
—25 to +85°C

Environmental Classification:
To BS 2011 Category 25/83/A4
To IEC 68 Severity 657

Insulation resistance:
at 20°C $\geqslant 5 \times 10^4 M\Omega$
at 85°C $\geqslant 3 \times 10^3 M\Omega$

Silvered Mica Capacitors

Wax impregnated, Resin Dipped, Series Z

Capacitance Range and Tolerances

Capacitance Tolerance*	Capacitance (pF)	Temperature Coef. (ppm/deg C)	Capacitance Drift
±0,5 pF (Tolerance code D)	**1** **1,5** **2,2** **3,3** **4,7** **6,8**	—	—
±5% (Code J) or ±10% (Code K)	**10** **12** **15** **18** **22**	Standard: — To order: —200 to +200	— ±(0,5% + 0,5 pF)
or ±20% (Code M) to choice	**27** **33** **39** **47** **56** **68**	Standard: —200 to + 200 To order: —100 to + 100 or —20 to + 100	±(0,5% +0,5 pF) ±(0,3% + 0,1 pF) ±(0,1% + 0,1 pF)
	82,0		
±2% (Code G) or ±5% (Code J) or ±10% (Code K) or ±20% (Code M) to choice	**100** **120** **150** **180** **220** **270** **330** **390** **470** **560** **680** **820** **1 000** **1 200** **1 500** **1 800** **2 200** **2 700** **3 300**	**110** **130** **160** **200** **240** **300** **360** **430** **510** **620** **750** **910** **1 100** **1 300** **1 600** **2 000** **2 400** **3 000**	Standard: —200 to +200 To order: —100 to +100 or —20 to +100 or 0 to +70	±(0,5% + 0,5 pF) ±(0.3% + 0,1 pF) ±(0,1% + 0,1 pF) ±(0,05% + 0,1 pF)

*At 1 MHz for capacitors ≤ 1 000 pF
at 1 kHz for capacitors > 1 000 pF

Silvered Mica Capacitors

Wax impregnated, Resin Dipped, Series Z

Marking

Capacitors of less than 10 pF: Marked with the nominal capitance value, a letter R representing the decimal.

Capacitors of 10 pF and over: Marked with three digits, of which the first two are the significant figures of nominal capacitance and the third the number of noughts; followed by a letter (except on case size Z11) indicating the capacitance tolerance according to the code in the first column of page 2.

Additionally, 50V capacitors in case sizes Z17 to Z30 bear the suffix 05. The absence of this suffix from these case sizes indicates 500 V rating.

Examples:

1R0	indicates	1 pF	capacitor		no indication of tolerance	no indication of voltage rating
4R7	,,	4,7 pF	,,			
100	,,	10 pF	,,			
220	,,	22 pF	,,			
270J	,,	27 pF	,,	5%	tolerance	
470K	,,	47 pF	,,	10%	,,	
680K	,,	68 pF	,,	10%	,,	500V rating
680K05	,,	68 pF	,,	10%	,,	50V ,,
681M	,,	680 pF	,,	20%	,,	500V ,,
222G05	,,	2 200 pF	,,	2%	,,	50V ,,

Typical Performance Curves

Q
(min values at 1 MHz)

and

tan δ
(max values at 1 kHz)
v
Capacitance

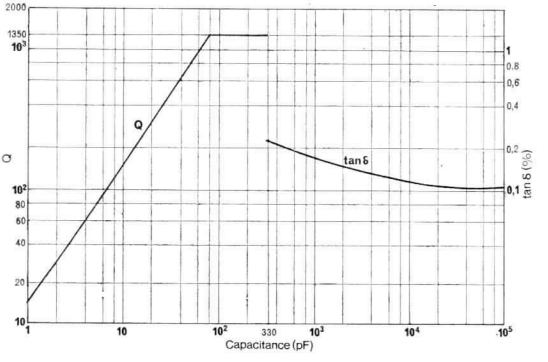


Fig. 1

Insulation Resistance v Capacitance

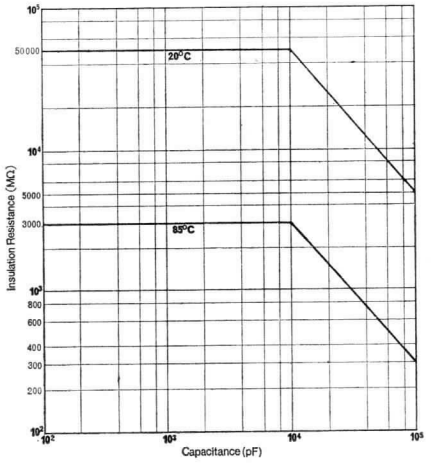


Fig. 2

Q v Frequency Characteristics

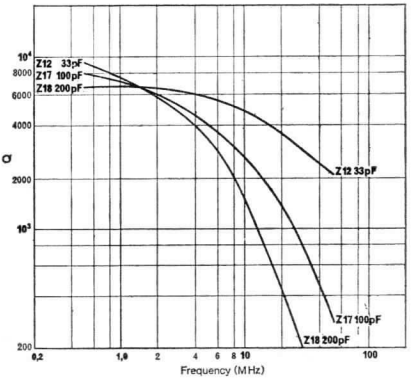


Fig. 3

Distribution of Temperature Coefficient as a function of Capacitance

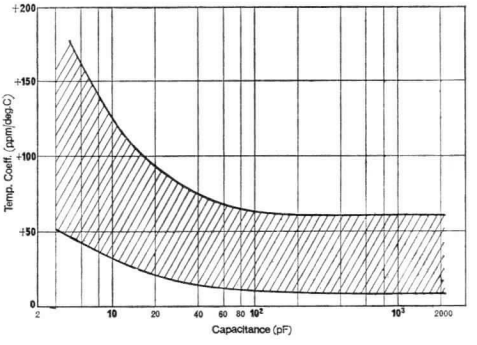


Fig. 4

ITT Components are available from:

or directly from:

ITT Components Group Europe
Standard Telephones and Cables Limited
Capacitor Product Division
Brixham Road
PAIGNTON, Devon
Tel: 0803 50762. Telex: 42951

● Printed by Williams Lea ● London England

MOTOR

CAPACITORS

Motor Capacitors

INTRODUCTION

This data sheet describes metallised Paper Capacitors suitable for "Motor Start" and "Motor start/run" applications.

Starting Capacitors are used on single-phase induction motors with separate starting winding to generate or increase the starting torque. The motor has to be equipped with a cut-out device (such as a centrifugal switch) to switch out the capacitor while the motor is still gaining speed.

Starting Capacitors (Code MP 35) are described in Motor 1.

Start/run Capacitors remain connected to the windings of single-phase induction motors. They improve motor efficiency and produce increased torque while running. In addition they allow operation of polyphase induction motors on a single-phase power supply.

Three types of start/run capacitor are available in this range and a study of the "specification" section will aid selection of the most economical capacitor for the motor.

The three types are:

MP 33 for continuous operation.

MP 34 for intermittent operation.

MP 36 for short term operation.

Start/run Capacitors are described in Motor 2.

CONSTRUCTION

The capacitor elements are wound from multiple layers of metallised paper. They are housed in aluminium cases with screw base fixing and a variety of terminal arrangements.

Standard Telephones and Cables Limited

Capacitor Division, Brixham Road, Paignton, Devon

Telephone: Paignton 58685 Telex: 4251

London Sales Office, Telephone: Footscray 3333 Telex: 21836

C O M P O N E N T S G R O U P

Motor Capacitors

CONTINUED

SPECIFICATION

For details of working voltage, capacitance, capacitance tolerance, temperature range and climatic grade refer to individual data sheets.

Limits of variation of capacitance with temperature (based on nominal at 20°C):

Temp °C	Variation %
+85	+5·5
+70	+4·5
+60	+3·5
0	−2
−10	−3
−25	−4·5

Power Factor (tan δ)

Upper Temp. Limit °C	Motor Run		Motor Start
	MP 33	MP 34 and 36	MP 35
60	6×10^{-3}	8×10^{-3}	15×10^{-3}
70	7×10^{-3}	9×10^{-3}	,,
85	8×10^{-3}	10×10^{-3}	,,

Proof Test Voltage

Test	Multiplier of working voltage			Duration
	MP 33	MP 34 and 36	MP 35	
Between Terminals	2·15	1·4	1·3	2 s
Terminals to Case	6	with minimum of 2·5 kV		1 min

Motor Capacitors

CONTINUED

TYPES OF OPERATION

Motor start capacitors are designed for intermittent use not exceeding 60 start seconds per hour with a maximum duration of 3 seconds per start.

Start/run capacitors are designed for continuous, intermittent or short term operation.

For INTERMITTENT OPERATION a cycle of 10 minutes is usually assumed and a 25% period is to be preferred, i.e. during a connection cycle of 10 minutes the capacitor is connected for $2\frac{1}{2}$ minutes and disconnected for $7\frac{1}{2}$ minutes.

For SHORT TERM OPERATION the capacitor may remain continuously connected to the voltage for a maximum period of 60 minutes. To enable the capacitor to cool to room temperature a cooling off period of at least four times the thermal time constant (approx. 30 minutes for MP 36 capacitors), i.e. at least 120 minutes must follow each period of use.

INSTALLATION INSTRUCTIONS

Mounting position: Any.

(A special design is available for inverted mounting.)

Care should be taken that the upper temperature limit (max. capacitor surface temperature) is not exceeded. This particularly applies when the capacitors are mounted near equipment radiating a large amount of heat (e.g. motors, heating devices, etc.). Motor capacitors should not be enclosed since the lack of circulating air can result in overheating.

SOLDERED JOINTS

To avoid endangering internal soldered joints low melting point (approx. 180°C) solder should be used. When joining to the tag on a capacitor make the solder joint as near the end of the tag as possible, preferably using a pair of pliers on the tag as a heat sink. Resin cored solder is recommended. Fluxes containing acids must not be used.

These capacitors are manufactured by our German Associate, Standard Elektrik Lorenz, to conform with VDE specification 0560 parts 8 and 8A "Specification of Motor Capacitors" and draft DIN 48501.

CAPACITORS

Motor Start Capacitors

Code MP 35

These capacitors are designed for intermittent use not exceeding 60 start seconds per hour with a maximum duration of 3 seconds per start.

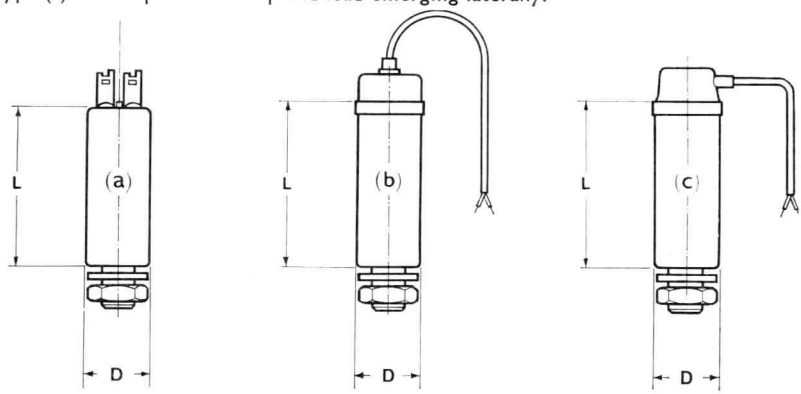
NOTE: Before attempting to select a capacitor from the ranges described on the following pages, it is important to ascertain that the duty cycle will comply with that described above.

All the capacitors are available with alternative terminal arrangements.

Type (a) Without protective cap or lead but fitted with solder tags. Can be supplied, if desired, with AMP connectors or screw connector.

Type (b) With protective cap and centrally attached lead.

Type (c) With protective cap and lead emerging laterally.



DIMENSIONS OF SCREW BASE

Case Diameter D			Metric Thread		Thread Length (max)		Terminal Spacing	
	mm	in	Number	Clearance Drill	mm	in	mm	in
To	45,5	1·80	8	P	9,0	0·35	10,0	0·39
From	50,5	2·00	12	$\frac{31}{64}$ in.	16,0	0·63	19,0	0·75

Standard Telephones and Cables Limited

Capacitor Division, Brixham Road, Paignton, Devon

Telephone: Paignton 58685 Telex: 4251

London Sales Office, Telephone: Footscray 3333 Telex: 21836

C O M P O N E N T S G R O U P

STC

Code MP 35

CONTINUED

CLIMATIC GRADE

Temperature range ... ... −25°C to +60°C

Permissible Humidity†

Max value 95%*

Annual average 75%

† Water should not be allowed to condense on the case.

* Maximum value only on 30 days distributed evenly over the year; on other days max 85% relative humidity.

RATINGS AND DIMENSIONS

WORKING VOLTAGE: 240V

Capacitance Range μ	Capacitance Tolerance %	Maximum Dimensions L mm	L in	D mm	D in	Weight g	Weight oz
10		82	3·23	30,5	1·20	120	4·2
12		82	3·23	35,5	1·40	140	4·9
16		82	3·23	35,5	1·40	140	4·9
20		82	3·23	40,5	1·60	170	6·0
25		82	3·23	45,5	1·80	220	7·8
30	±10	155	6·10	35,5	1·40	210	7·4
40		155	6·10	40,5	1·60	250	8·8
50		155	6·10	45,5	1·80	320	11·3
60		155	6·10	50,5	2·00	410	14·5
80		155	6·10	55,5	2·19	500	17·7
100		155	6·10	60,5	2·38	590	20·8
130		155	6·10	70,5	2·78	800	28·2
160		155	6·10	75,5	2·97	920	32·5

N.B.—Original dimensions are metric.

Code MP 35

CONTINUED

WORKING VOLTAGE: 330V

Capacitance Range μ	Capacitance Tolerance %	Maximum Dimensions L mm	L in	D mm	D in	Weight g	Weight oz
4		82	3·23	25,5	1·00	100	3·5
6		82	3·23	30,5	1·20	120	4·2
8		82	3·23	35,5	1·40	140	4·9
10		82	3·23	40,5	1·60	170	6·0
12		82	3·23	40,5	1·60	170	6·0
16		82	3·23	45,5	1·80	220	7·8
20	±10	155	6·10	40,5	1·60	250	8·8
25		155	6·10	40,5	1·60	250	8·8
30		155	6·10	45,5	1·80	320	11·3
40		155	6·10	50,5	2·00	410	14·5
50		155	6·10	55,5	2·19	500	17·7
60		155	6·10	60,5	2·38	590	20·8
80		155	6·10	70,5	2·78	800	28·2
100		155	6·10	75,5	2·97	920	32·5
130		155	6·10	85,5	3·37	1200	42·4
160		155	6·10	85,5	3·37	1200	42·4

N.B.—Original dimensions are metric.

CAPACITORS

Motor Start/Run Capacitors

Codes MP 33, 34 and 36

These capacitors are designed for continuous, intermittent or short term operation.

MP 33 For CONTINUOUS OPERATION.

MP 34 For INTERMITTENT OPERATION based on a duty cycle of 10 minutes where a 25% period is to be preferred, i.e. during a connection cycle of 10 minutes the capacitor is connected for 2·5 minutes and disconnected for 7·5 minutes.

MP 36 For SHORT TERM OPERATION the capacitor may remain continuously connected to the voltage for a maximum period of 60 minutes. To enable the capacitor to cool to room temperature an interval of at least four times the thermal time constant (which is approximately 30 minutes for MP 36 capacitors), i.e. at least two hours must follow each period of use.

NOTE: Before attempting to select a capacitor from the ranges described on the following pages it is important to ascertain that the duty cycle will comply with one of the three described above.

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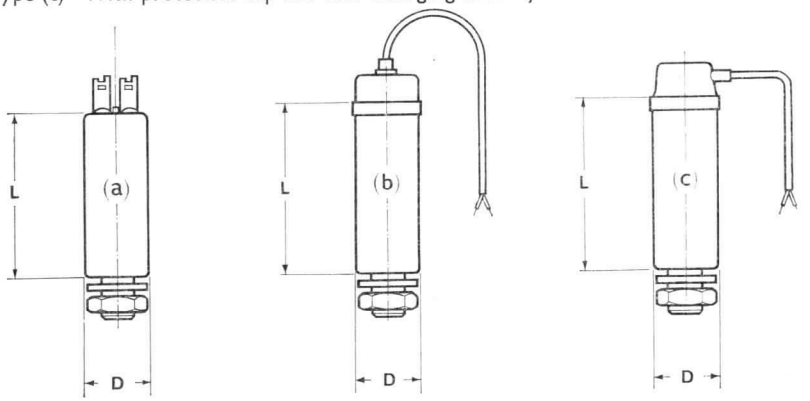
Capacitor Division, Brixham Road, Paignton, Devon
Telephone: Paignton 58685 Telex: 4251
London Sales Office, Telephone: Footscray 3333 Telex: 21836
C O M P O N E N T S G R O U P

STC

Codes MP 33, 34 and 36

CONTINUED

All the capacitors are available with alternative terminal arrangements.
Type (a) Without protective cap or lead but fitted with solder tags. Can be supplied, if desired, with AMP connectors or screw connector.
Type (b) With protective cap and centrally attached lead.
Type (c) With protective cap and lead emerging laterally.



DIMENSIONS OF SCREW BASE

Case Diameter D mm	in	Metric Thread Number	Clearance Drill	Thread Length (Max) mm	in	Terminal Spacing mm	in
20,5	0·80	8	P	9,0	0·35	7,0	0·28
To 45,5	1·80	8	P	9,0	0·35	10,0	0·39
From 50,5	2·00	12	$\frac{31}{64}$ in.	16,0	0·63	19,0	0·75

CLIMATIC GRADE

Reference Letter (Rating Tables)	Temperature Range	Permissible Humidity† Max Value	Annual Average
A	−25°C to +85°C	95%*	75%
B	−25°C to +70°C	,,	,,
C	−25°C to +60°C	,,	,,

† Water should not be allowed to condense on the case.
* Maximum value only on 30 days distributed evenly over the year; on other days max 85% relative humidity.

Codes MP 33, 34 and 36

CONTINUED

WORKING VOLTAGES

MP 33— **220V** —CONTINUOUS OPERATION
MP 34— **350V** —INTERMITTENT OPERATION
MP 36— **300V** —SHORT TERM OPERATION

Each of the above types is available in all the values and sizes listed below.

Capacitance Range μF	Capacitance Tolerance %	Maximum Dimensions L mm	L in	D mm	D in	Weight g	Weight oz	Climatic Grade
0·5		50	1·97	20,5	0·80	60	2·1	A
1·0		50	1·97	20,5	0·80	60	2·1	A
1·5		50	1·97	25,5	1·00	80	2·8	A
2·0		82	3·23	25,5	1·00	100	3·5	A
2·5	±20	82	3·23	25,5	1·00	100	3·5	A
3		82	3·23	25,5	1·00	100	3·5	A
4		82	3·23	30,5	1·20	130	4·6	A
5		82	3·23	30,5	1·20	130	4·6	A
6		82	3·23	35,5	1·40	150	5·3	A
8		82	3·23	40,5	1·60	150	5·3	A
10		82	3·23	40,5	1·60	190	6·7	A
12		155	6·10	35,5	1·40	190	6·7	B
16		155	6·10	40,5	1·60	210	7·4	B
18		155	6·10	40,5	1·60	290	10·2	B
20		155	6·10	40,5	1·60	290	10·2	B
25	±10	155	6·10	45,5	1·80	290	10·2	B
30		155	6·10	50,5	2·00	410	14·5	B
40		155	6·10	55,5	2·19	500	17·7	B
50		155	6·10	65,5	2·58	700	24·7	C
60		155	6·10	70,5	2·78	800	28·2	C
80		155	6·10	80,5	3·17	1050	37·0	C

N.B.—Original dimensions are metric.

STC

Codes MP 33, 34 and 36

CONTINUED

WORKING VOLTAGES

MP 33— **260V** —CONTINUOUS OPERATION
MP 34— **400V** —INTERMITTENT OPERATION
MP 36— **350V** —SHORT TERM OPERATION

Each of the above types is available in all the values and sizes listed below.

Capacitance Range μF	Capacitance Tolerance %	Maximum Dimensions L mm	L in	D mm	D in	Weight g	Weight oz	Climatic Grade
0·5		50	1·97	20,5	0·80	60	2·1	A
1·0		50	1·97	25,5	1·00	80	2·8	A
1·5		50	1·97	30,5	1·20	110	3·9	A
2·0		82	3·23	25,5	1·00	100	3·5	A
2·5	±20	82	3·23	25,5	1·00	100	3·5	A
3		82	3·23	30,5	1·20	130	4·6	A
4		82	3·23	35,5	1·40	150	5·3	A
5		82	3·23	35,5	1·40	150	5·3	A
6		82	3·23	40,5	1·60	190	6·7	A
8		82	3·23	45,5	1·80	230	8·1	A
10		155	6·10	35,5	1·40	210	7·4	B
12		155	6·10	40,5	1·60	290	10·2	B
16		155	6·10	45,5	1·80	320	11·3	B
18		155	6·10	45,5	1·80	320	11·3	B
20		155	6·10	50,5	2·00	410	14·5	B
25	±10	155	6·10	55,5	2·19	500	17·7	B
30		155	6·10	60,5	2·38	590	20·8	B
40		155	6·10	65,5	2·58	700	24·7	C
50		155	6·10	75,5	2·97	920	32·5	C
60		155	6·10	80,5	3·17	1050	37·0	C
80		155	6·10	85,5	3·37	1200	42·4	C

N.B.—Original dimensions are metric.

Codes MP 33, 34 and 36

CONTINUED

WORKING VOLTAGES

MP 33— **320V** —CONTINUOUS OPERATION
MP 34— **480V** —INTERMITTENT OPERATION
MP 36— **450V** —SHORT TERM OPERATION

Each of the above types is available in all the values and sizes listed below.

Capacitance Range μF	Capacitance Tolerance %	Maximum Dimensions L mm	L in	D mm	D in	Weight g	Weight oz	Climatic Grade
0·5		50	1·97	25,5	1·00	80	2·8	A
1·0		50	1·97	30,5	1·20	110	3·9	A
1·5		82	3·23	25,5	1·00	100	3·5	A
2·0		82	3·23	30,5	1·20	130	4·6	A
2·5	±20	82	3·23	30,5	1·20	130	4·6	A
3		82	3·23	35,5	1·40	150	5·3	A
4		82	3·23	40,5	1·60	190	6·7	A
5		82	3·23	40,5	1·60	190	6·7	A
6		155	6·10	35,5	1·40	210	7·4	B
8		155	6·10	35,5	1·40	210	7·4	B
10		155	6·10	40,5	1·60	290	10·2	B
12		155	6·10	45,5	1·80	320	11·3	B
16		155	6·10	50,5	2·00	410	14·5	B
20		155	6·10	55,5	2·19	500	17·7	B
25	±10	155	6·10	60,5	2·38	590	20·8	B
30		155	6·10	70,5	2·78	800	28·2	C
40		155	6·10	75,5	2·97	920	32·5	C
50		155	6·10	85,5	3·37	1200	42·4	C

N.B.—Original dimensions are metric.

Codes MP 33, 34 and 36

CONTINUED

WORKING VOLTAGES

MP 33— **400V** —CONTINUOUS OPERATION
MP 34— **600V** —INTERMITTENT OPERATION
MP 36— **500V** —SHORT TERM OPERATION

Each of the above types is available in all the values and sizes listed below.

Capacitance Range μF	Capacitance Tolerance %	Maximum Dimensions L mm	L in	D mm	D in	Weight g	Weight oz	Climatic Grade
0·5		50	1·97	25,5	1·00	80	2·8	A
1·0		82	3·23	25,5	1·00	100	3·5	A
1·5		82	3·23	30,5	1·20	130	4·6	A
2		82	3·23	35,5	1·40	150	5·3	A
3	±20	82	3·23	40·5	1·60	190	6·7	A
4		82	3·23	45,5	1·80	230	8·1	A
5		155	6·10	40,5	1·60	290	10·2	B
6		155	6·10	40,5	1·60	290	10·2	B
8		155	6·10	45,5	1·80	320	11·3	B
10		155	6·10	50,5	2·00	410	14·5	B
12		155	6·10	55,5	2·19	500	17·7	B
16	±10	155	6·10	60,5	2·38	590	20·8	B
20		155	6·10	70,5	2·78	800	28·2	C
25		155	6·10	75,5	2·97	920	32·5	C

N.B.—Original dimensions are metric.

Codes MP 33, 34 and 36

CONTINUED

WORKING VOLTAGES

MP 33— **480V** —CONTINUOUS OPERATION
MP 34—NOT AVAILABLE
MP 36— **600V** —SHORT TERM OPERATION

Each of the above types is available in all the values and sizes listed below.

Capacitance Range μF	Capacitance Tolerance %	Maximum Dimensions L mm	L in	D mm	D in	Weight g	Weight oz	Climatic Grade
0·5		50	1·97	30,5	1·20	110	3·9	A
1·0		82	3·23	30,5	1·20	130	4·6	A
1·5		82	3·23	35,5	1·40	150	5·3	A
2·0		82	3·23	40,5	1·60	190	6·7	A
2·5	±20	82	3·23	45,5	1·80	230	8·1	A
3		155	6·10	35,5	1·40	210	7·4	B
4		155	6·10	40,5	1·60	290	10·2	B
5		155	6·10	45,5	1·80	320	11·3	B
6		155	6·10	50,5	2·00	410	14·5	B
8		155	6·10	55,5	2·19	500	17·7	B
10		155	6·10	60,5	2·38	590	20·8	B
12	±10	155	6·10	65,5	2·58	700	24·7	C
16		155	6·10	75,5	2·97	920	32·5	C

N.B.—Original dimensions are metric.

PAPER

CAPACITORS

STC

PAPER 1

Foil and Paper

(TUBULAR METAL CASES)

Codes 453–LWA–252, 253 & 254

These capacitors form a range of sub-miniature capacitors specially designed for miniature equipments and for applications where a high insulance at elevated temperatures is needed. They are mounted by means of the axial terminal wires or alternatively by means of a spring clip.

CONSTRUCTION

Each capacitor is wound of high grade linen or Kraft tissue and interleaving aluminium foil. It is housed in a tinned copper case, sealed with a metallised ceramic bush. Connections are made with 24 swg. tinned copper wire through the metal end cap at one end and through a solder seal in the ceramic bush at the other end. The complete assembly is vacuum impregnated and filled with Stantelene VI, a high grade thermo-setting compound. By virtue of the solid impregnant, the capacitor may be used in assembly processes involving temperatures up to 160°C for short periods.

In order to preserve the hermetic seal, the soldering bit should not be applied to the terminal wires nearer than $\frac{1}{8}$ in, but should the solder seal be impaired a secondary seal is formed by the Stantelene VI.

ELECTRICAL CHARACTERISTICS

Limits

(Reference temperature 20°C)

Capacitance Tolerance	$\pm 20\%$
Insulance at 85 volts after one minute	5 000 ΩF or $1{\cdot}5 \times 10^6$ MΩ whichever is less
Proof Test Voltage	600V d.c.
Rated Working Voltage	See Table

Typical Performance

Insulance at 85 volts after one minute (20°C)	8 000ΩF
Mean Insulance (70°C)	500ΩF
D.C. Breakdown Voltage	Greater than 1 500 volts
Capacitance Stability	Less than 2% over 2 years

TEMPERATURE AND CLIMATIC GRADE

These capacitors are rated to conform to the requirements of category H1 40/100°C in accordance with British Standard 2131.

Above 70°C voltage derating is required as shown overleaf.

Standard Telephones and Cables Limited

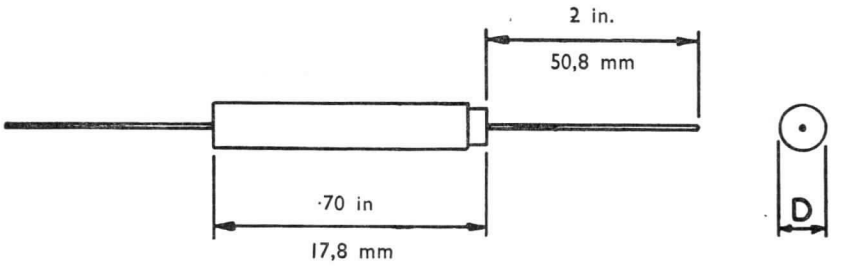
Registered Office: Connaught House, Aldwych, W.C.2

COMPONENTS GROUP

CAPACITOR DIVISION, PAIGNTON, DEVON Tel.: Paignton 58685 Telex: 4251

LONDON SALES OFFICE, FOOTSCRAY, SIDCUP, KENT Tel.: Footscray 3333 Telex: 21836

DIMENSIONS AND RATINGS



D.C. Working Voltage	Capacitance (μF)	D in	D mm	Code 453–LWA–
200V at 70°C 140V at 85°C 90V at 100°C	0·001	0·175	4,45	–252E
	0·002	0·175	4,45	–252B
	0·005	0·175	4,45	–252A
	0·01	0·195	4,95	–253B
	0·02	0·195	4,95	–253A
	0·04	0·235	5,97	–254A

Capacitors are normally supplied without insulating sleeves. If sleeves are required a suffix letter "Z" should be added to the code.

CAPACITORS

Oil-Impregnated Foil and Paper

(TUBULAR METAL CASES)

Codes 453–LWA–271 to 282

This range of capacitors in tubular cases with sintered glass compression-type seals has a wide range of application in electronic equipment where high reliability is required at temperatures up to 100°C. A special feature is that the oil-filled construction makes the capacitor suitable either for a.c. or d.c. applications, and the design is such that they can withstand severe vibration conditions.

CONSTRUCTION

The units are wound with high grade capacitor tissue and aluminium foil and impregnated with a modified mineral oil. They are housed in a case of tinned drawn—brass or copper with grooves at each end to locate the seals. The seals used are of the sintered glass compression-type which have proved to be extremely robust and reliable. They are mechanically locked against the grooves by spinning over the end of the case and sealing is achieved by the final soldering operation. All sizes have axial terminal wires which may be used to support the capacitor in the smaller types.

The capacitors are normally supplied fitted with a silicone rubber or polyester film sleeve.

Connection is made to the foil electrodes by means of tape inserts and this construction is suitable for normal requirements. Where the capacitors are for use under very low and stable d.c. voltage conditions the Series B construction is recommended, in which the tape insert is welded to the foil electrodes.

TEMPERATURE AND CLIMATIC GRADE

These capacitors are designed to conform to the requirements of Humidity Class H6 in the temperature range −55°C to +100°C of DEF–5011.

D.C. VOLTAGE RATING

These capacitors are marked with the rated working voltage for 70°C. For operation at higher temperatures voltage derating is necessary as shown in Table 1.

The capacitors will give a "communication performance" at an average temperature of 40°C at their rated working voltage.

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Capacitor Division, Brixham Road, Paignton, Devon
Telephone: Paignton 58685 Telex: 4251
London Sales Office, Telephone: Footscray 3333 Telex: 21836
C O M P O N E N T S G R O U P

Codes 453-LWA-271 to 282

CONTINUED

TABLE 1—D.C. VOLTAGE DERATING

Average Working Temperature °C	Percentage of Rated Working Voltage	
	1 000 hours endurance	"Communication Rating"
100	50%	25%
90	67%	30%
80	83%	38%
70	100%	50%
60	—	67%
50	—	83%
40	—	100%

Reliability will be increased further if the combined voltage and temperature is less than the rated values.

A.C. VOLTAGE RATING

The a.c. ratings quoted in Table 3 are given as a guide only. Varying conditions of use such as high ambient temperature, frequency variation from 50 c/s and harmonics may reduce the possible voltage for continuous operation below these values. The ratings shown are correct at 50 c/s up to 70°C. Derating factors for higher temperatures can be obtained on request.

ELECTRICAL CHARACTERISTICS

Limits

(Reference temperature 20°C)

Capacitance Tolerance	
Up to and including 0·01 μF	±25%
Greater than 0·01 μF	±15%
Insulance after 1 min at 300V	5 000ΩF or 25 000 MΩ whichever is less
D.C. test voltage	3 times the rated working voltage at 70°C

Typical Performance

Mean Insulance after 1 min at 300 volts	20°C	6 700ΩF
	100°C	20ΩF
Temp. coefficient of capacitance (ref. 20°C)	+0·0005μF per °C per μF	
Power Factor (ref. 20°C)	50 c/s	0·0030
	900 c/s	0·0038
	10 kc/s	0·0087
	1 Mc/s	0·073

Codes 453–LWA–271 to 282

CONTINUED

DIMENSIONS

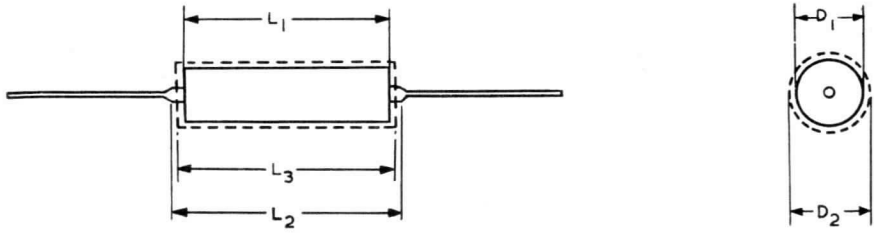


TABLE 2

STC CODE	MAXIMUM DIMENSIONS									
	L_1		L_2		L_3		D_1		D_2	
	mm	in	mm	in	mm	in	mm	in	mm	in
453–LWA–271	18,1	0·71	23,8	0·94	23,8	0·94	5,23	0·206	6,25	0·246
,, 272	18,1	0·71	23,8	0·94	23,8	0·94	7,24	0·285	8,26	0·325
,, 273	26,0	1·02	31,8	1·25	31,8	1·25	7,24	0·285	8,26	0·325
,, 274	24,7	0·97	30,4	1·20	30,2	1·19	10,44	0·411	11,46	0·451
,, 275	34,9	1·38	41,0	1·61	41,3	1·63	10,44	0·411	11,46	0·451
,, 276	41,3	1·63	47,3	1·86	47,6	1·88	10,44	0·411	11,46	0·451
,, 277	32,1	1·26	37,8	1·49	38,1	1·50	13,95	0·549	14,10	0·555
,, 278	49,1	1·93	54,8	2·16	55,6	2·19	13,95	0·549	14,10	0·555
,, 279	42,1	1·66	48,8	1·92	47,6	1·88	18,85	0·742	19,00	0·748
,, 280	60,3	2·38	67,4	2·65	66,7	2·63	18,85	0·742	19,00	0·748
,, 281	48,4	1·91	55,2	2·17	54,0	2·13	25,45	1·002	25,60	1·008
,, 282	60,3	2·38	67,4	2·65	66,7	2·63	25,45	1·002	25,60	1·008

TERMINAL WIRES

Diameter

453–LWA–270 to 273 — 0,51 mm (0·020 in) nominal

453–LWA–274 to 282 — 0,81 mm (0·032 in) nominal

The minimum length of the wire, measured from the end of the case, is 41,3 mm (1·625 in)

N.B.—Metric dimensions are derived from original inch dimensions.

Codes 453-LWA-271 to 282

CONTINUED

TABLE 3—ELECTRICAL RATINGS

RATED WORKING VOLTAGE AT 70°C		CAPACITY (μF)	STC CODE
D.C.	A.C. 50 c/s		
100	75	0·01	453-LWA-271AA
		0·022	,, 272AA
		0·075	,, 274AA
		0·15	,, 275AA
		0·22	,, 277AA
150	105	0·0075	453-LWA-271BA
		0·033	,, 273BA
		0·075	,, 274BA
		0·15	,, 276BA
		0·20	,, 277BA
		0·40	,, 278BA
		0·60	,, 279BA
		1·00	,, 280BA
250	175	0·0047	453-LWA-271CA
		0·01	,, 272CA
		0·022	,, 273CA
		0·047	,, 274CA
		0·10	,, 275CA
		0·15	,, 277CA
		0·47	,, 279CA
		0·75	,, 280CA
		1·00	,, 281CA
		1·50	,, 282CA
350	250	0·01	453-LWA-273DA
		0·047	,, 275DA
		*0·10	,, 276DA
		*0·10	,, 277DA
		0·22	,, 278DA
		0·47	,, 280DA
		0·75	,, 281DA
		1·00	,, 282DA
750	530	0·022	453-LWA-274GA
		0·033	,, 275GA
		0·047	,, 276GA
		0·068	,, 277GA
		0·22	,, 279GA
		0·33	,, 280GA
		0·47	,, 281GA
		0·68	,, 282GA

* *See Table 2 for difference in dimensions.*

Codes 453–LWA–271 to 282

CONTINUED

TABLE 3—(continued)

RATED WORKING VOLTAGE AT 70°C		CAPACITY (μF)	STC CODE
D.C.	A.C. 50 c/s		
1 000	700	0·010	453–LWA–274HA
		0·022	,, 275HA
		0·033	,, 276HA
		0·047	,, 277HA
		0·10	,, 278HA
		0·15	,, 279HA
		0·22	,, 280HA
		0·33	,, 281HA
		0·47	,, 282HA
1 250	880	0·022	453–LWA–277JA
		0·047	,, 278JA
		0·068	,, 279JA
		0·10	,, 280JA
		0·22	,, 281JA
		0·33	,, 282JA

TABLE 4—R.C.L. SIZES

STC CODE	R.C.L. SIZE
453–LWA–271	CP 31 A
,, ,, –272	CP 31 C
,, ,, –273	CP 31 G
,, ,, –275	CP 31 H
,, ,, –276	CP 31 J
,, ,, –277	CP 31 F
,, ,, –278	CP 31 L
,, ,, –280	CP 31 N
,, ,, –282	CP 31 P

CAPACITORS

STC

PAPER 3

Oil-Impregnated Foil and Paper

(RECTANGULAR METAL CASES)

Codes 4400, 4401, 4402, 4405, 4406 & 4407

This is a range of high quality oil impregnated paper capacitors for use where a relatively high stability of electrical characteristics is required under the severest of tropical conditions at temperatures up to 100°C. The range is housed in cases of four different cross-sections and two heights, the case width and terminal spacing being the same throughout.

CONSTRUCTION

The units are wound with high-grade Kraft paper and aluminium foil and impregnated in a specially modified mineral oil suitable for high temperature operation. The tinned brass case consists of two drawn hollow sections, one of which is fitted into the other; the edge of the outer section is swaged over the rounded corners of the inner section to form a mechanical reinforcement of the soldered joint. The units are suitably insulated and clamped in the case to ensure a high degree of stability of the electrical characteristics. Termination is by means of corundite seals with solder tag connections.

The type of case construction employed is such that the external contours of the capacitor presents a smooth outline, free from moisture traps, thus minimising the possibility of subsequent corrosion and mould growths which are prevalent under very humid conditions.

TEMPERATURE AND CLIMATIC GRADE

D.C. Voltage Rating

These capacitors are rated to conform to the requirements of Humidity Class H6 of DEF–5011 over the temperature range −55°C to +100°C. They are marked with the rated working voltage for 70°C and for higher temperatures voltage derating is necessary as shown in the table.

The capacitors will also give a communication performance at an average temperature of 40°C at their rated working voltage.

A.C. Voltage Rating

The a.c. rating quoted in the following tables is given as a guide only. Varying conditions of use such as high ambient temperature, frequency variation from 50 c/s and harmonics may reduce the possible voltage for continuous operation below these values. Alternatively, if the capacitor is only subjected to stress intermittently for short periods, as in the case of motor starting capacitors, higher voltages may be permissible. The ratings shown are correct at 50 c/s up to 70°C. Derating factors for higher temperatures can be obtained on request.

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, W.C.2

COMPONENTS GROUP

CAPACITOR DIVISION, PAIGNTON, DEVON Tel.: Paignton 58685 Telex: 4251

LONDON SALES OFFICE, FOOTSCRAY, SIDCUP, KENT Tel.: Footscray 3333 Telex: 21836

ELECTRICAL CHARACTERISTICS

Limits

(Reference temperature 20°C)

Capacitance tolerance	±15%
Insulance at 300 volts after one minute ...	5 000ΩF or 25 000MΩ whichever is less.
Proof test voltage	Three times the rated d.c. voltage at 70°C
Power factor (50 c/s)	0·005

Typical Performance

Capacitance stability	Less than 1·5% variation after 3 years at 20°C
Insulance at 300 volts after one minute ...	20°C 12 000ΩF 70°C 200ΩF 100°C 25ΩF
Power factor (50 c/s)	0·004

RATINGS

Rated Working Voltage at 70°C		Capacitance (μF)	STC Code
D.C.	A.C. 50 c/s		
150	75	8·0 10·0	4406 JA 4407 JA
200	100	1·0 2·0 4·0	4400 KB 4400 KA 4402 KA
350	200	1·0 2·0 4·0 6·0 8·0	4400 LA 4401 LA 4405 LA 4406 LA 4407 LA
600	350	1·0 2·0 4·0 6·0	4400 MA 4402 MA 4406 MA 4407 MA
800	400	1·0 2·0 4·0	4401 NA 4405 NA 4407 NA
1 000	550	0·25 0·5 1·0 2·0	4400 PB 4400 PA 4405 PA 4406 PA
1 500	750	0·25 0·5 1·0 1·5	4400 QA 4402 QA 4406 QA 4407 QA

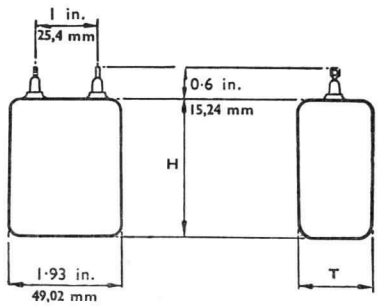
Capacitors are marked with the rated working voltage at 70°C.

D.C. VOLTAGE DERATING TABLE

Average Working Temperature °C	Percentage of rated working voltage	
	1 000 Hours Endurance	Communication Rating
100	50%	25%
90	67%	30%
80	83%	38%
70	100%	50%
60	—	67%
50	—	83%
40	—	100%

Reliability will be increased further if the combined voltage and temperature is less than the rated values.

DIMENSIONS



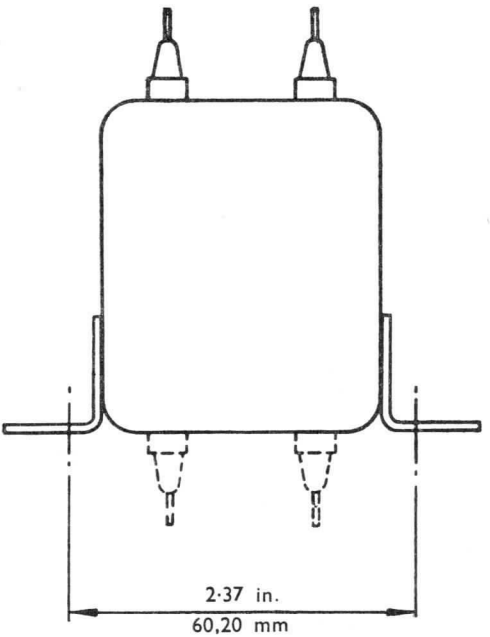
STC Code	H		T	
	in	mm	in	mm
4400	2·30	58,4	0·75	19,1
4401	,,	,,	1·00	25,4
4402	,,	,,	1·25	31,7
4405	3·68	93,5	1·00	25,4
4406	,,	,,	1·25	31,7
4407	,,	,,	1·60	40,6

MOUNTING

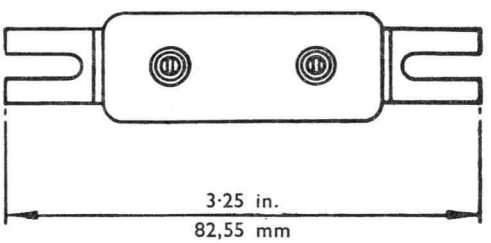
Soldered on mounting brackets are available for both upright and inverted mounting.

For upright mounting the suffix /8 should be added to the code (e.g. 4400 JA/8).

For inverted mounting suffix /7 should be added to the code (e.g. 4400 JA/7).



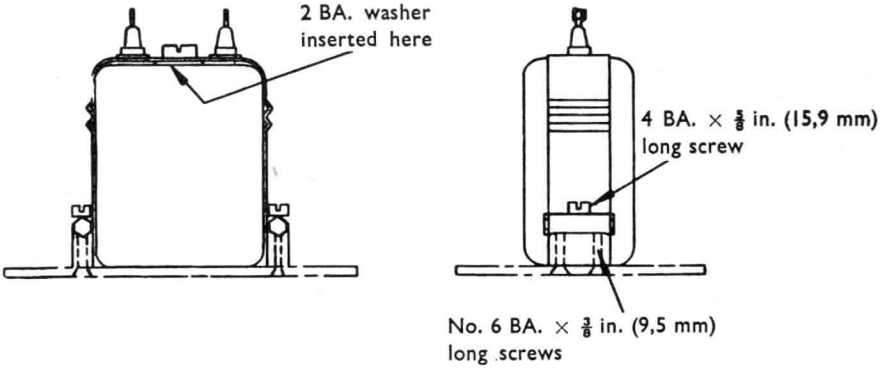
MOUNTING CENTRES



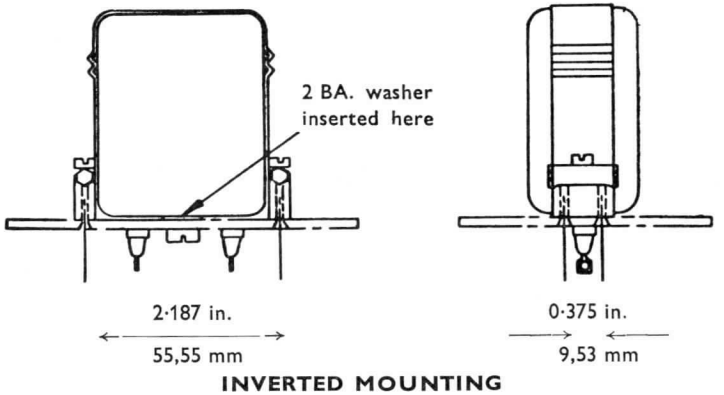
UPRIGHT MOUNTING

MOUNTING—*(continued)*

Alternatively, a mounting strap is available for upright or inverted mounting.



UPRIGHT MOUNTING

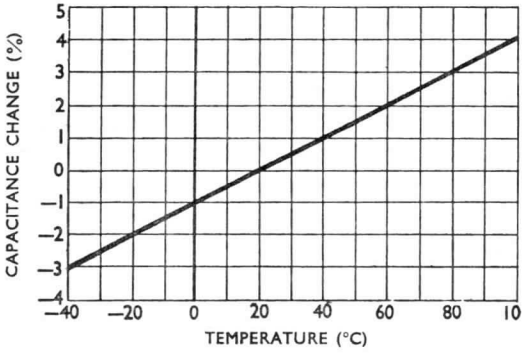


INVERTED MOUNTING

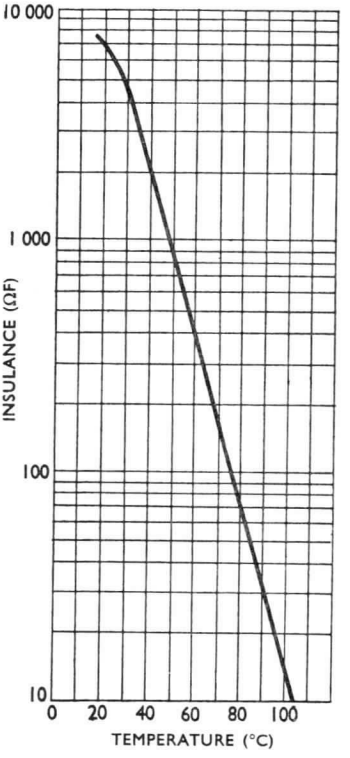
When mounting strap is required a suffix "5" must be added to the code, i.e. 4400JA/5.

To ensure the capacitor is correctly mounted it is important to use the No. 2BA washer in the position shown. Fixing screws are not normally supplied.

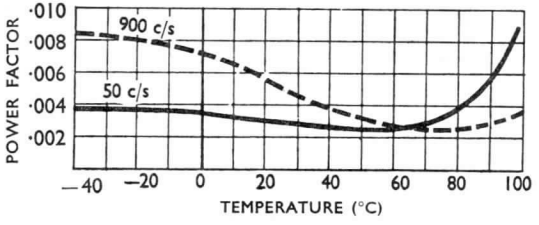
TYPICAL CHARACTERISTICS



VARIATION OF CAPACITANCE WITH TEMPERATURE



VARIATION OF INSULANCE WITH TEMPERATURE



VARIATION OF POWER FACTOR WITH TEMPERATURE

CAPACITORS

STC

PAPER 4

Oil-Impregnated Foil and Paper

(RECTANGULAR METAL CASES)

Codes 4315, 4316, 4317 & 4318
4325, 4326, 4327 & 4328

This range of capacitors has been designed for industrial, electronic and communication equipments where large capacitance for smoothing, motor starting, voltage stabilisation and similar applications are required.

CONSTRUCTION

Each capacitor employs units wound with high grade heavy calendered paper and aluminium foil, vacuum dried and impregnated in STC supertension compound. The units are held rigidly between welded steel clamps and the assembly is enclosed in a hermetically sealed metal case in which all seams are locked and soldered.

Terminal connections are made to silvered ceramic bushes fitted with terminal tags which are sealed internally to the silvered ceramic bushes with a high melting point solder.

TERMINAL CONNECTIONS

On codes 4315 to 4318 three alternative types of external connections are available:

(1) Terminal Tags for direct solder connections.

(2) Extension Leads as required, terminated in spade connectors (normal core size 23/0·0076).

(3) A moulded terminal block, clamped to the case over the ceramic seals and provided with inserts for the entry of external leads which are locked in with set screws.

The type of termination can be indicated when ordering by adding a prefix to the main code. L, where extension leads are required; B, for the terminal block. Use of the plain code will indicate that the solder tags are required. Where extension leads are ordered the length and type of insulation must be indicated on the order.

On codes 4325 to 4328 only one type of terminal connection is available due to the large flashover path required for the higher voltages involved.

Standard Telephones and Cables Limited
Registered Office: Connaught House, Aldwych, W.C.2
COMPONENTS GROUP
CAPACITOR DIVISION, PAIGNTON, DEVON Tel.: Paignton 58685 Telex: 4251
LONDON SALES OFFICE, FOOTSCRAY, SIDCUP, KENT Tel.: Footscray 3333 Telex: 21836

FIXING BRACKETS

Two types of fixing brackets are available as shown in the diagram. All brackets are securely soldered to the capacitor case to ensure that the capacitor is not subjected to mechanical stresses during assembly into the equipment.

The type of fixing required to be stated on the order.

TEMPERATURE AND CLIMATIC GRADE

D.C. Voltage Rating

These capacitors are rated to conform to the requirements of Category H1 40/70°C in accordance with B.S.2131. They will give a communication performance at an average temperature of 40°C at their rated working voltage. For higher temperatures, voltage derating must be applied as follows:

Average temperature °C	Percentage of Rated Working Voltage
40	100%
50	83%
60	67%
70	50%

A.C. Voltage Rating

The a.c. rating quoted in the table is given as a guide only. Varying conditions of use such as high ambient temperature, frequency variation from 50 c/s and harmonics may reduce the possible voltage for continuous operation below these values. Alternatively, if the capacitor is only subjected to stress intermittently for short periods, as in the case of motor starting capacitors, higher voltages may be permissible. The ratings shown are correct at 50 c/s at temperatures from 0°C to 45°C.

Voltage derating factors for higher temperatures can be obtained on request.

ELECTRICAL CHARACTERISTICS

Limits

(Reference temperature 20°C)

Capacitance Tolerance	±15%
Insulance after one minute at 300 volts ...	5 000 ΩF
Proof test voltage	Not less than three times the rated d.c. voltage
Rated Working Voltage	See table
Power factor (50 c/s)	0·005

Typical Performance

Insulance after one minute at 300 volts ...	7 000ΩF
Breakdown voltage	1½ times the d.c. test voltage
Power factor (50 c/s)	0·004

CAPACITANCE AND RATINGS

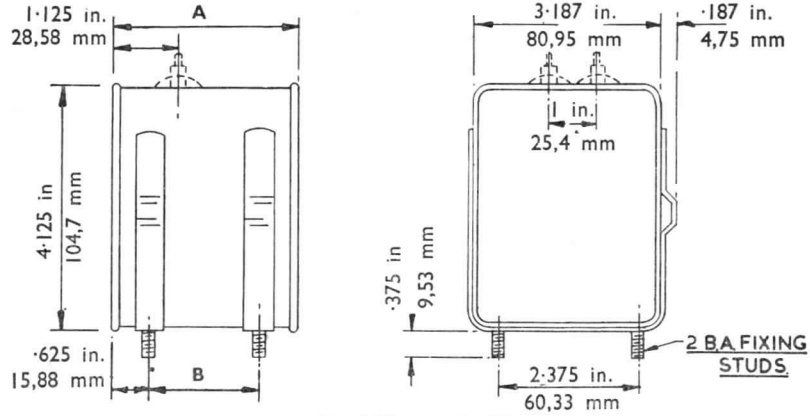
Rated Working Voltage		Capacitance μF	Code
D.C. at 70°C	A.C. (50 c/s) at 45°C		
250	150	17 25 33 42	4315H 4316H 4317J 4318F
350	250	13 20 27 33	4315J 4316J 4317K 4318G
500	350	10 15 20 24	4315C 4316C 4317C 4318C
600	415	8 12 16 20	4315D 4316D 4317D 4318D
750	500	6 9 12 16	4315E 4316E 4317E 4318E
1 000	600	4 6 8 10	4325A 4326A 4327A 4328A
1 500	750	2 3 4 5	4325B 4326B 4327B 4328B
2 000	1 000	1·0 1·5 2 2·5	4325C 4326C 4327C 4328C
3 000	1 500	0·5 0·75 1 1·25	4325D 4326D 4327D 4328D
4 000	2 000	0·2 0·3 0·4 0·5	4325E 4326E 4327E 4328E

The capacitance values shown are the maximum for the voltage specified in a given case size but other values and working voltages can be supplied to customers own requirements.

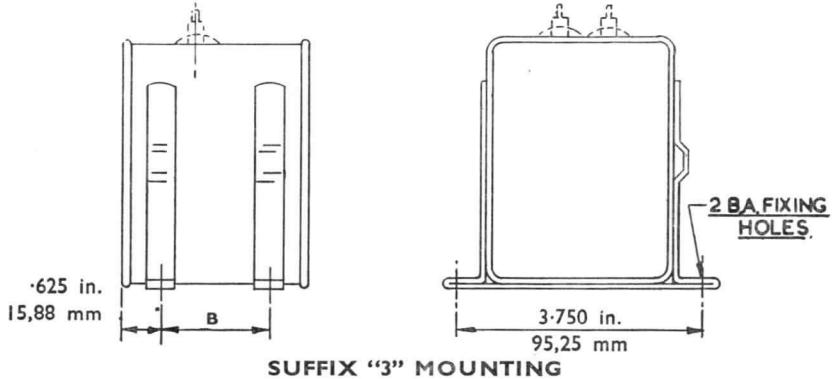
Codes 4315, 4316, 4317 & 4318
4325, 4326, 4327 & 4328

CONTINUED

DIMENSIONS AND MOUNTING BRACKET ARRANGEMENT



SUFFIX "2" MOUNTING

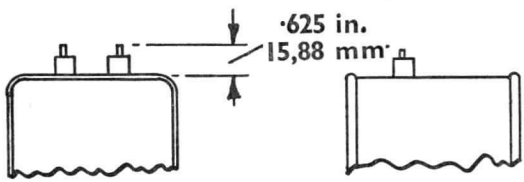


SUFFIX "3" MOUNTING

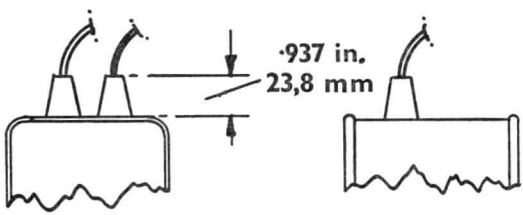
Codes	A		B	
	in.	mm	in.	mm
4315 & 4325	2·250	57,15	1·00	25,40
4316 & 4326	3·125	79,38	1·875	47,63
4317 & 4327	4·00	101,60	2·750	69,85
4318 & 4328	4·937	125,40	3·687	93,65

ALTERNATIVE TERMINATIONS

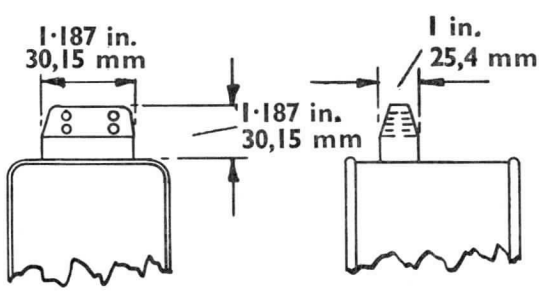
4315, 4316, 4317 AND 4318 CODES ONLY



SOLDER TERMINALS

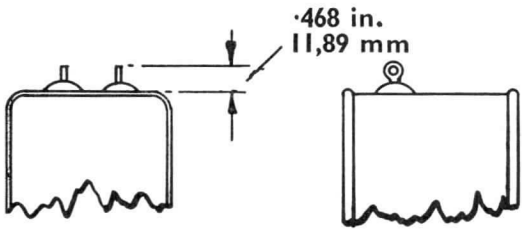


PREFIX "L" (FLEXIBLE LEADS)



PREFIX "B" (TERMINAL BLOCK)

4325, 4326, 4327 AND 4328 CODES ONLY



SOLDER TERMINALS

CAPACITORS

STC

P.O. 1

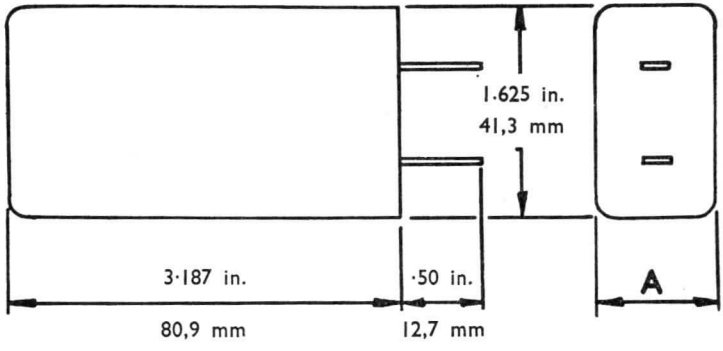
British Post Office Types

"MAINTENANCE TYPE"

CODES 4048 and 4049

STC manufacture the following capacitors in line with British Post Office specifications. They are housed in aluminium cases sealed with a Stantelene thermo-setting resin, and are intended for mounting by means of a loose strap or clip. The units are wound from high grade Kraft tissue interleaved with aluminium foil and vacuum impregnated in a high melting point wax. They conform to the requirements of the latest Post Office specifications D740 and D1000 and are rated to operate at an ambient temperature of 70°C. These designs are capable of withstanding the requirements of British Standard 2131, category H2 25/70°C and are therefore suitable for application where these conditions are required. The types shown in the following table are those in general use, information concerning other Post Office type capacitors is given on page 3.

DIMENSIONS AND RATINGS



Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, W.C.2

COMPONENTS GROUP

CAPACITOR DIVISION, PAIGNTON, DEVON Tel.: Paignton 58685 Telex: 4251

LONDON SALES OFFICE, FOOTSCRAY, SIDCUP, KENT Tel.: Footscray 3333 Telex: 21836

DIMENSIONS AND RATINGS—(*continued*)

British Post Office ref. Number	Capacitance (μF)	Max. D.C. Working Voltage	Dimension "A"		STC Code
			in	mm	
MC.100	0·50	200	0·50	12,7	4049
MC.101	1·00	250	0·50	12,7	4049Y
MC.102C	2·00	200	0·50	12,7	4049BA
MC.103C	4·00	200	1·00	25,4	4048R
MC.104	0·02	200	0·50	12,7	4049H
MC.106	0·05	200	0·50	12,7	4049V
MC.115	0·25	200	0·50	12,7	4049B
MC.119	0·10	200	0·50	12,7	4049C

Limits

(Reference temperature 20°C)

Capacitance tolerance $\pm 15\%$

All the above capacitors proof tested at not less than $2\frac{1}{2}$ times the rated working voltage.

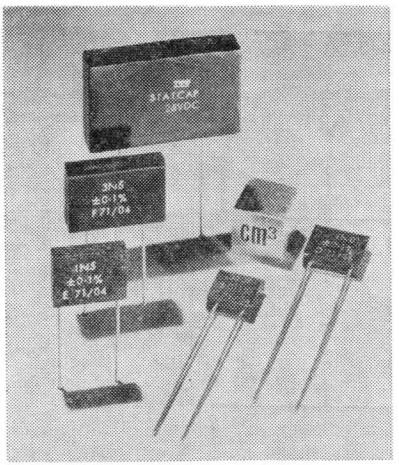
Details of other British Post Office codes are given in the following table.

B.P.O. No.	STC CODE	TYPE	D.C. RATING
94	453–LWA–6B	Foil and Paper	0·5 + 0·5 μF ± 15% 250 V
102	4048	,,	2·0 μF ± 10% 200 V
102CA	4049BB	,,	2·0 μF ± 5% 200 V
103CA	4048P	,,	4·0 μF ± 5% 200 V
105	4711C	,,	1·0 + 1·0 μF ± 15% 350 V
150	4061BA	,,	0·5 μF ± 10% 200 V
151	4061F	,,	1·0 μF ± 10% 200 V
152	4062	,,	2·0 μF ± 10% 200 V
7708	453–LWA–461CA	,,	1·0 μF ± 20% 350 V
7708 pr.	,, 461PA	,,	1·0 + 1·0 μF ± 20% 350 V
7709	,, 461CB	,,	0·5 μF ± 20% 350 V
7710	,, 465CA	Metallised Paper	2·0 μF ± 20% 350 V
7710 pf.	,, 465PA	,,	2·0 + 2·0 μF ± 20% 350 V
7711	,, 461DA	Foil and Paper	0·1 μF ± 20% 500 V
7712	,, 450AA	Metallised Paper	2·0 μF ± 25% 150 V
7718	,, 460CA	Foil and Paper	0·25 μF ± 20% 350 V
7719 Mk. 2	,, 453BA	,,	1·8 + 0·9 μF ± 15% 200 V
7720	,, 1A	,,	0·45 μF ± 15% 50 V
7721	,, 464AA	Metallised Paper	5·0 μF ± 25% 150 V
7723	,, 464BA	,,	4·0 μF ± 20% 250 V
7724	,, 463AA	Foil and Paper	10·0 μF ± 10% 150 V
7725	,, 462BA	,,	2·0 μF ± 20% 200 V
7727	,, 466DA	Metallised Paper	1·8 μF ± 20% 200 V
8001	455–LWA–432CA	Metallised Polyester	0·25 μF ± 20% 250 V
8003	,, 430CA	,,	0·05 μF ± 20% 250 V
8004	,, 431CA	,,	0·1 μF ± 20% 250 V
8005	,, 433CA	,,	0·5 μF ± 20% 250 V
8006	,, 434CA	,,	1·0 μF ± 20% 250 V
8007	,, 435CA	,,	2·0 μF ± 20% 250 V

MINIATURE MOULDED THIN FILM CLOSE TOLERANCE CAPACITORS

PROVISIONAL DATA

CODE: STATCAPS



BRIEF DATA

Capacitance Range	10p to 10n5
Working Voltage	25V d.c. max.
Temperature Range	−40 °C to +100 °C
Capacitance Tolerance	±0,1% to ±1% ± p30 minimum on any tolerance.

N.B. Capacitance values in this data sheet are stated in accordance with BS 1852.
e.g. 10n5 is 10,5 nanofarads (10 500pF)
p30 is 0,3pF

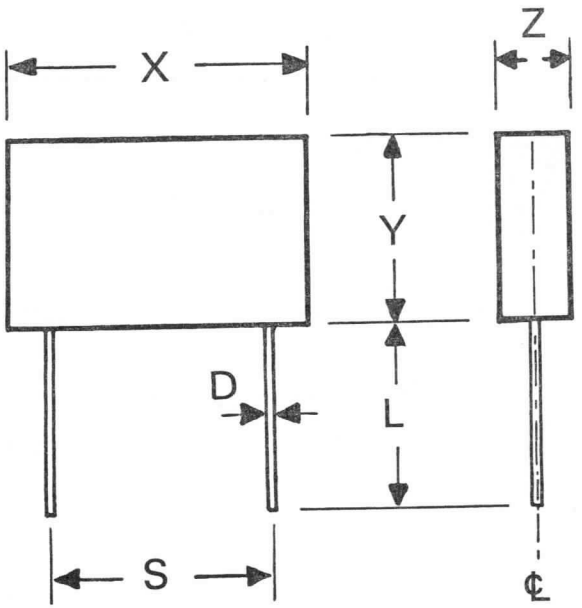
This new range of miniature, close tolerance, capacitors has been developed by ITT Components Group Film Circuit Operation, for application in circuits where precision and stability are of paramount importance. A comprehensive range is available, with values from 10p to 10n5 in 8 case sizes. The Capacitors are bi-polar and are manufactured to customers precise requirements. They are extremely stable and very reliable in operation, having comparable performance to other glass dielectric types.

Thin Film close tolerance capacitors are produced by vacuum deposition of aluminium electrodes and a silica ($Si\ O_2$) dielectric layer onto a glass substrate. The silica has a dielectric constant of 3,75 and a refractive index of 1,458. Close tolerance is obtained by adjustment on computer controlled automatic microengraving machines. The capacitors are moulded in low expansion thermosetting resin with radial, solder coated nickel leadwires.

ITT COMPONENTS GROUP EUROPE
Standard Telephones and Cables Limited
Film Circuit Operation,
Brixham Road, Paignton, Devon.
Telephone: Paignton 50762 (STD Code 0803)
Telex: 42951

ITT
COMPONENTS

DIMENSIONS



CAPACITANCE RANGE	CASE SIZE	MAXIMUM DIMENSIONS						NOMINAL DIMENSIONS			
		X		Y		Z		S		D	
		mm	ins	mm	ins	mm	ins	mm	ins	mm	ins
10p to 64p	A	5,10	0,201	6,70	0,264	3,71	0,146	2,5	0,1	0,25	0,010
20p to 150p	B	8,89	0,350	5,59	0,220	5,15	0,203	5,1	0,2	0,50	0,020
150p to 350p	C	8,89	0,350	7,87	0,310	5,15	0,203	5,1	0,2	0,50	0,020
350p to 1n0	D	11,94	0,470	9,14	0,360	5,15	0,203	7,6	0,3	0,60	0,024
1n0 to 1n5	E	13,21	0,520	10,29	0,405	5,15	0,203	7,6	0,3	0,60	0,024
1n5 to 3n5	F	18,29	0,720	12,19	0,480	5,97	0,235	10,2	0,4	0,80†	0,032
3n5 to 6n5	G	29,46	1,160	12,19	0,480	6,73	0,265	15,2	0,6	0,80	0,032
6n5 to 10n5	H	29,46	1,160	18,80	0,740	6,73	0,265	15,2	0,6	0,80	0,032

NOTE 1 The length of the terminations (L) is 31,7mm (1,25 inches) minimum.

NOTE 2 The manufacturing dimensions are inches.

NOTE 3 The tolerance on the wire spacing (Dimension S) is ±0,5mm (±0,020 inches).

NOTE 4 The tolerance on the terminal wires (Dimension D) are as follows:—
Case size A +0,03mm −0,02mm (+0,0011in −0,0008in)
All other case sizes +10% −0,05mm (−0,002 inches)

† At present, case size F capacitors are supplied with 0,60mm (0,024 inch) dia. terminal wires. A change to 0,80mm (0,032 inch) dia. will be made to fall in line with BS 9070-N-002 at a later date. PCB's should be compatible with the larger diameter.

ELECTRICAL CHARACTERISTICS

Capacitance Range	10p to 10n5
Working Voltage	25V d.c.
Capacitance Tolerance	±0,1% ±0,2% ±0,3% ±0,4% ±0,5% ±1% with a minimum capacitance value of ±0,3p on any tolerance.
Rated Temperature Range	−40 °C to +100 °C
Temperature Coefficient at 1 kHz	±20 ppm/ °C
Averaged long term Capacitance Stability at 12V d.c.	±0,025% per 1000 hrs.
at 25V d.c.	±0,035% per 1000 hrs.
Capacitance change with frequency (dependent on value and case size)	1% between 1 kHz and 1 MHz
Insulation resistance at +25 °C	10^{13} ohms typical, 10^{11} ohms minimum
Dissipation factor (tan delta.)	
from −40 °C to +100 °C at 1kHz—1 MHz	0,0003 typical
25 °C at 5MHz	<0,002 (0,0015 typical)

N.B. When measuring these close tolerance components, care must be taken to eliminate the effect of stray capacitance and interference.

ENVIRONMENTAL CHARACTERISTICS

The capacitors will meet the following environmental test requirements in accordance with BS 2011 and IEC 68.

Item	IEC 68 BS 2011	Description	Conditions
Temperature	A & B	Rated temperature range	−40 °C to +100 °C
Humidity	C	Damp heat (long term exposure)	21 days
Vibration	Fc	Resonance search	5—5 000 Hz (2g)
		Endurance	30—2 000 Hz (0,75mm/10g) 100 hrs.
Acceleration	Ga	Acceleration steady state	100g
Low Air Density	M		Relative Density 0,003 mean altitude 130 000 ft.
Shock	Ea	Trapezoidal Pulse	100g for 6ms 390 m/s² (40g)
Bump Severity	Eb		4 000 ±10 bumps
Robustness of Terminations	Ua	Tensile	½kg (1 lb) load
	Ub	Bending	¼kg (½ lb) 4 bends through 90°
Solderability	T (method 3)	Solder globule method	235 °C ±2 °C

CODING

ORDERING CODE EXAMPLE

STATCAP 250p ±1% C 25 K

Thin Film Capacitor

Capacitance

Tolerance
± p30, ±0,1% ±0,2% ±0,3%
±0,4% ±0,5% ±1%

Case Size Code
A, B, C, D, E, F, G, H.

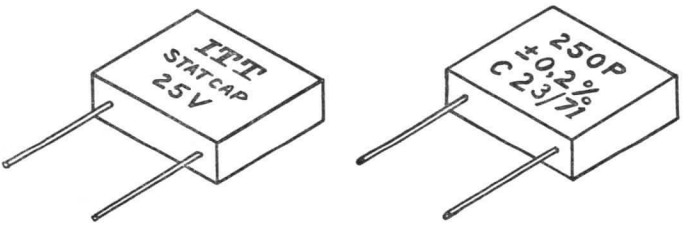
Working Voltage

Terminal Configuration
K : Radial

CAPACITOR MARKING

The capacitors will be marked with the following information:—

	One Face	Reverse Face
1st Line	ITT	Capacitance
2nd Line	STATCAP	Tolerance
3rd Line	Working Voltage (25V)	Case Size and Date Code



"Performance figures and data quoted in this document are typical and must be specifically confirmed in writing by Standard Telephones and Cables Limited before they become applicable to any particular tender, order or contract".

POLYMER

CAPACITORS

Polystyrene

(UNPROTECTED TUBULAR)

Codes 455–LWA–103 to 111 *Close tolerance types*
455–LWA–303 to 311 *Wide tolerance types*

INTRODUCTION

Polystyrene is a non-polar thermoplastic material and therefore has a low dielectric constant and low loss which is substantially independent of frequency. The negative temperature coefficient may in some cases be useful for the compensation of that of the coils in a tuned circuit but it should be noted that it is time dependent. The actual value is also determined by the size and construction of the capacitor. These capacitors are unprotected and a change of the ambient relative humidity causes a slow change of capacitance. This is of the order of +30 to +60 parts per million per cent increase of relative humidity and may take a month or more to occur.

The power factor at radio frequencies is affected by the resistance of the tapes and foils.

CONSTRUCTION

These capacitors are wound with polystyrene film and aluminium foil electrodes. Connection is made by means of tinned copper tapes spot welded to the foils. The terminal wires are secured axially in the ends of the winding and the tapes are soldered to them. Stability of capacitance is achieved by a heat treatment which causes the ends to fuse together and the film to shrink until the unit is solid and dimensionally stable.

STABILITY OF CAPACITANCE

The stability of capacitance of the 500V types has been found to be better than 0·1% after 100 cycles 20–70°C (24 hours at each temperature) and 50 days recovery (a total of 250 days). Under the same conditions the 125V types are better than 0·5%.

Care should be taken when soldering these capacitors that undue heat is not used. Melting of the polystyrene will result in the wires becoming loose and in a shift of capacitance. The smaller sizes are suitable for mounting by means of the terminal wires but the larger sizes should be supported. Where a clamp is used for this purpose, care should be taken to ensure that the unit is not under pressure as this will affect the stability of capacitance.

Standard Telephones and Cables Limited
Capacitor Division, Brixham Road, Paignton, Devon
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London Sales Office, Telephone: Footscray 3333 Telex: 21836
C O M P O N E N T S G R O U P

STC

Codes 455–LWA–103 to 111
455–LWA–303 to 311

CONTINUED

ELECTRICAL CHARACTERISTICS

Limits

(Reference temperature 20°C)

Capacitance tolerance	Close tolerance types	Wide tolerance types
10 to 49pF	±20%	±25%
50 to 149pF	±10%	±25%
150 to 500pF	± 5%	±25%
501 to 2 000pF	± 2%	±10% or 125pF
above 2 000pF	± 1%	± 5% or 200pF whichever is greater
Power factor (900 c/s)		Less than 0·0005
Insulance (300 volts 1 min)	Up to 10 000pF	More than 2×10^6 MΩ
	10 001pF to 20 000pF	,, ,, $1{\cdot}5 \times 10^6$,,
	20 001pF to 50 000pF	,, ,, $1{\cdot}0 \times 10^6$,,
	above 50 000pF	250 000 ΩF or 750 000 MΩ whichever is lower

Typical Performance

Temperature coefficient of capacitance	−150 ± 60 parts per million per °C.
Stability of capacitance 500V types	Better than 0·1%
350V types	Better than 0·3%
125V types	Better than 0·5%

Power Factor at Various Frequencies

Frequency (c/s)	Nominal Capacitance (pF)			
	Up to 1 000	1 000 to 10 000	10 000 to 100 000	Above 100 000
800	0·0003	0·0003	0·0003	0·0003
10 000	0·0003	0·0003	0·0003	0·001
100 000	0·0003	0·005	0·001–0·003	—
1 Mc/s	0·001	0·002	0·005–0·02	—

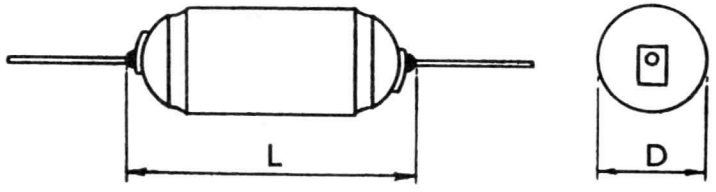
TEMPERATURE AND CLIMATIC GRADE

The 500V types meet the requirements of classification H5 of draft British Standard 2137 over the temperature range −40°C to +70°C.

Codes 455–LWA–103 to 111
455–LWA–303 to 311

CONTINUED

DIMENSIONS AND RATINGS



Length of terminal wires 38 mm (1·5 in) minimum

D.C. Working Voltage at 70°C	Capacitance Range (pF)		Dimensions						Terminal Wire Diameter nominal		STC Code	
			L max		D* min		D* max				Close tolerance 455–LWA–	Wide tolerance 455–LWA–
	min	max	mm	in	mm	in	mm	in	mm	in		
125	10	10 000	14,3	0·56	6,6	0·26	10,9	0·43	0,61	0·024	–105	–305
	5 000	25 000	27,0	1·06	7,4	0·29	13,7	0·53	0,91	0·036	–104	–304
	10 000	70 000	39,7	1·56	8,4	0·33	16,5	0·65	,,	,,	–103	–303
350	10	2 000	14,3	0·56	8,1	0·32	10,4	0·41	0,61	0·024	–111	–311
	1 000	10 000	27,0	1·06	9,9	0·39	15,5	0·61	0,91	0·036	–109	–309
	10 000	30 000	39,7	1·56	14,0	0·55	20,3	0·80	,,	,,	–108	–308
500	10	4 700	14,3	0·56	8,4	0·33	18,5	0·73	0,61	0·024	–110	–310

* Diameter varies according to capacitance.

N.B.—Metric dimensions are derived from original inch dimensions.

STC

PREFERRED VALUE CODES

Code 455-LWA-103

125 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
10000	DA	8,3	0·325	19100	ES	10,2	0·400	37900	GK	13,4	0·525
10200	DB	8,3	0·325	19400	ET	10,2	0·400	38600	GL	13,5	0·530
10400	DC	8,4	0·330	19700	EV	10,3	0·405	39000	HZ	13,5	0·530
10600	DD	8,4	0·330	20000	EW	10,3	0·405	39300	GM	13,6	0·535
10800	DE	8,4	0·330	20300	EX	10,4	0·410	40000	GN	13,7	0·540
11000	DF	8,5	0·335	20600	EY	10,4	0·410	40700	GP	13,7	0·540
11200	DG	8,5	0·335	21000	EZ	10,4	0·410	41500	GQ	13,9	0·545
11400	DH	8,6	0·340	21400	FA	10,6	0·415	42300	GR	14,0	0·550
11600	DJ	8,6	0·340	21800	FB	10,7	0·420	43100	GS	14,1	0·555
11800	DK	8,6	0·340	22200	FC	10,7	0·420	43900	GT	14,2	0·560
12000	DL	8,8	0·345	22600	FD	10,8	0·425	44000	JC	14,4	0·560
12200	DM	8,8	0·345	23000	FE	10,8	0·425	44700	GV	14,4	0·565
12400	DN	8,9	0·350	23400	FF	11,0	0·430	45500	GW	14,5	0·570
12600	DP	8,9	0·350	23800	FG	11,0	0·430	46400	GX	14,6	0·575
12800	DQ	8,9	0·350	24200	FH	11,1	0·435	47000	JA	14,8	0·580
13000	DR	9,0	0·355	24600	FJ	11,1	0·435	47300	GY	14,8	0·580
13200	DS	9,0	0·355	25000	FK	11,2	0·440	48000	JD	14,9	0·585
13400	DT	9,0	0·355	25500	FL	11,3	0·445	48200	GZ	14,9	0·585
13600	DV	9,0	0·355	26000	FM	11,3	0·445	49100	HA	15,0	0·590
13800	DW	9,2	0·360	26500	FN	11,4	0·450	50000	HB	15,1	0·595
14000	DX	9,2	0·360	27000	FP	11,4	0·450	51000	HC	15,3	0·600
14200	DY	9,2	0·360	27500	FQ	11,5	0·455	52000	HD	15,3	0·600
14400	DZ	9,3	0·365	28000	FR	11,7	0·460	53000	HE	15,4	0·605
14600	EA	9,3	0·365	28500	FS	11,8	0·465	54000	HF	15,5	0·610
14800	EB	9,3	0·365	29000	FT	11,8	0·465	55000	HG	15,6	0·615
15000	EC	9,4	0·370	29500	FV	12,0	0·470	56000	HH	15,8	0·620
15200	ED	9,4	0·370	30000	FW	12,1	0·475	57000	HJ	15,8	0·620
15500	EE	9,4	0·370	30500	FX	12,1	0·475	58000	HK	15,9	0·625
15800	EF	9,5	0·375	31000	FY	12,2	0·480	59000	HL	16,0	0·630
16100	EG	9,7	0·380	31600	FZ	12,3	0·485	60000	HM	16,0	0·630
16400	EH	9,7	0·380	32200	GA	12,3	0·485	61200	HN	16,1	0·635
16700	EJ	9,7	0·380	32800	GB	12,5	0·490	62400	HP	16,1	0·635
17000	EK	9,8	0·385	33000	HY	12,6	0·495	63600	HQ	16,3	0·640
17300	EL	9,8	0·385	33400	GC	12,6	0·495	64000	JE	16,3	0·640
17600	EM	9,9	0·390	34000	GD	12,7	0·500	64800	HR	16,3	0·640
17900	EN	9,9	0·390	34600	GE	12,7	0·500	66100	HS	16,4	0·645
18000	HX	9,9	0·390	35200	GF	12,8	0·505	67400	HT	16,4	0·645
18200	EP	10,0	0·395	35800	GG	12,9	0·510	68000	JB	16,5	0·650
18500	EQ	10,0	0·395	36500	GH	13,1	0·515	68700	HV	16,5	0·650
18800	ER	10,2	0·400	37200	GJ	13,2	0·520	70000	HW	16,5	0·650

PREFERRED VALUE CODES

Code 455-LWA-104

125 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
4750	JY	7,5	0·295	8490	CF	9,0	0·355	15000	DS	11,3	0·445
4800	JZ	7,5	0·295	8660	CG	9,0	0·355	15200	DT	11,3	0·445
4850	KA	7,5	0·295	8830	CH	9,2	0·360	15500	DV	11,4	0·450
4900	KB	7,5	0·295	9000	CJ	9,3	0·365	15800	DW	11,4	0·450
5000	BA	7,5	0·295	9160	CK	9,3	0·365	16100	DX	11,6	0·455
5100	BB	7,6	0·300	9320	CL	9,3	0·365	16400	DY	11,7	0·460
5200	BC	7,6	0·300	9480	CM	9,4	0·370	16700	DZ	11,8	0·465
5300	BD	7,6	0·300	9640	CN	9,4	0·370	17000	EA	11,8	0·465
5400	BE	7,6	0·300	9820	CP	9,5	0·375	17300	EB	11,9	0·470
5500	BF	7,7	0·305	10000	CQ	9,6	0·380	17600	EC	11,9	0·470
5600	BG	7,7	0·305	10200	CR	9,6	0·380	17900	ED	12,1	0·475
5700	BH	7,9	0·310	10400	CS	9,6	0·380	18000	FE	12,1	0·475
5800	BJ	7,9	0·310	10600	CT	9,8	0·385	18200	EE	12,2	0·480
5900	BK	7,9	0·310	10800	CV	9,9	0·390	18500	EF	12,2	0·480
6000	BL	8,0	0·315	11000	CW	9,9	0·390	18800	EG	12,3	0·485
6120	BM	8,0	0·315	11200	CX	10,0	0·395	19100	EH	12,3	0·485
6240	BN	8,0	0·315	11400	CY	10,0	0·395	19400	EJ	12,3	0·485
6360	BP	8,1	0·320	11600	CZ	10,2	0·400	19700	EK	12,5	0·490
6480	BQ	8,1	0·320	11800	DA	10,2	0·400	20000	EL	12,6	0·495
6610	BR	8,3	0·325	12000	DB	10,3	0·405	20300	EM	12,6	0·495
6740	BS	8,3	0·325	12200	DC	10,3	0·405	20600	EN	12,7	0·500
6800	FC	8,4	0·330	12400	DD	10,4	0·410	21000	EP	12,7	0·500
6870	BT	8,4	0·330	12600	DE	10,5	0·415	21400	EQ	12,8	0·505
7000	BV	8,4	0·330	12800	DF	10,5	0·415	21800	ER	12,9	0·510
7140	BW	8,5	0·335	13000	DG	10,7	0·420	22000	FF	12,9	0·510
7280	BX	8,5	0·335	13200	DH	10,7	0·420	22200	ES	12,9	0·510
7420	BY	8,6	0·340	13400	DJ	10,8	0·425	22600	ET	13,1	0·515
7560	BZ	8,6	0.340	13600	DK	10,8	0·425	23000	EV	13,1	0·515
7700	CA	8,8	0·345	13800	DL	10,9	0·430	23400	EW	13,2	0·520
7850	CB	8,8	0·345	14000	DM	10,9	0·430	23800	EX	13,2	0·520
8000	CC	8,9	0·350	14200	DN	11,0	0·435	24200	EY	13,4	0·525
8160	CD	8,9	0·350	14400	DP	11,0	0·435	24600	EZ	13,4	0·525
8200	FD	8,9	0·350	14600	DQ	11,2	0·440	25000	FA	13,5	0·530
8320	CE	8,9	0·350	14800	DR	11,2	0·440				

STC

PREFERRED VALUE CODES

Code 455-LWA-105

125 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
10	DA	6,5	0·255	210	ET	6,5	0·255	386	GD	6,5	0·255
15	DB	6,5	0·255	215	EV	6,5	0·255	390	QC	6,5	0·255
20	DC	6,5	0·255	220	EW	6,5	0·255	393	GE	6,5	0·255
25	DD	6,5	0·255	225	EX	6,5	0·255	395	SY	6,5	0·255
30	DE	6,5	0·255	230	EY	6,5	0·255	400	GF	6,5	0·255
35	DF	6,5	0·255	235	EZ	6,5	0·255	405	SZ	6,5	0·255
40	DG	6,5	0·255	240	FA	6,5	0·255	407	GG	6,5	0·255
45	DH	6,5	0·255	245	FB	6,5	0·255	410	ZL	6,5	0·255
50	DJ	6,5	0·255	250	FC	6,5	0·255	415	GH	6,5	0·255
55	DK	6,5	0·255	255	FD	6,5	0·255	420	ZM	6,5	0·255
60	DL	6,5	0·255	260	FE	6,5	0·255	425	GJ	6,5	0·255
65	DM	6,5	0·255	265	FF	6,5	0·255	430	ZN	6,5	0·255
70	DN	6,5	0·255	270	FG	6,5	0·255	431	GK	6,5	0·255
75	DP	6,5	0·255	275	FH	6,5	0·255	435	TD	6,5	0·255
80	DQ	6,5	0·255	280	FJ	6,5	0·255	439	GL	6,5	0·255
85	DR	6,5	0·255	285	FK	6,5	0·255	440	TE	6,5	0·255
90	DS	6,5	0·255	290	FL	6,5	0·255	445	TF	6,5	0·255
91	QR	6,5	0·255	295	FM	6,5	0·255	447	GM	6,5	0·255
95	DT	6,5	0·255	300	FN	6,5	0·255	450	TG	6,5	0·255
100	DV	6,5	0·255	305	FP	6,5	0·255	455	GN	6,5	0·255
105	DW	6,5	0·255	310	FQ	6,5	0·255	460	TH	6,5	0·255
110	DX	6,5	0·255	315	QX	6,5	0·255	464	GP	6,5	0·255
115	DY	6,5	0·255	316	FR	6,5	0·255	465	TJ	6,5	0·255
120	DZ	6,5	0·255	320	QY	6,5	0·255	470	QD	6,5	0·255
124	QS	6,5	0·255	322	FS	6,5	0·255	473	GQ	6,5	0·255
125	EA	6,5	0·255	325	QZ	6,5	0·255	475	TK	6,5	0·255
130	EB	6,5	0·255	328	FT	6,5	0·255	480	TL	6,5	0·255
134	QT	6,5	0·255	330	QB	6,5	0·255	482	GR	6,5	0·255
135	EC	6,5	0·255	334	FV	6,5	0·255	485	TM	6,5	0·255
140	ED	6,5	0·255	335	SN	6,5	0·255	490	TN	6,5	0·255
144	QV	6,5	0·255	340	FW	6,5	0·255	491	GS	6,5	0·255
145	EE	6,5	0·255	345	SP	6,5	0·255	495	TP	6,5	0·255
150	EF	6,5	0·255	346	FX	6,5	0·255	500	GT	6,5	0·255
154	QW	6,5	0·255	350	SQ	6,5	0·255	510	GV	6,5	0·255
155	EG	6,5	0·255	352	FY	6,5	0·255	520	GW	6,5	0·255
160	EH	6,5	0·255	355	SR	6,5	0·255	530	GX	6,5	0·255
165	EJ	6,5	0·255	358	FZ	6,5	0·255	540	GY	6,5	0·255
170	EK	6,5	0·255	360	SS	6.5	0·255	550	GZ	6,5	0·255
175	EL	6,5	0·255	365	GA	6,5	0·255	560	HA	6,5	0·255
180	EM	6,5	0·255	370	ST	6,5	0·255	570	HB	6,5	0·255
185	EN	6,5	0·255	372	GB	6,5	0·255	580	HC	6,5	0·255
190	EP	6,5	0·255	375	SV	6,5	0·255	590	HD	6,5	0·255
195	EQ	6,5	0·255	379	GC	6,5	0·255	600	HE	6,5	0·255
200	ER	6,5	0·255	380	SW	6,5	0·255	610	TQ	6,5	0·255
205	ES	6,5	0·255	385	SX	6,5	0·255	612	HF	6,5	0·255

Continued on next page

PREFERRED VALUE CODES

Code 455-LWA-105

CONTINUED

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
620	TR	6,5	0·255	920	VT	6,5	0·255	1440	KH	6,5	0·255
624	HG	6,5	0·255	930	VV	6,5	0·255	1455	WG	6,5	0·255
630	TS	6,5	0·255	932	JE	6,5	0·255	1460	KJ	6,5	0·255
636	HH	6,5	0·255	940	VW	6,5	0·255	1470	WR	6,5	0·255
640	TT	6,5	0·255	948	JF	6,5	0·255	1480	KK	6,5	0·255
648	HJ	6,5	0·255	950	VX	6,5	0·255	1485	WS	6,5	0·255
660	TW	6,5	0·255	960	VY	6,5	0·255	1500	KL	6,5	0·255
661	HK	6,5	0·255	964	JG	6,5	0·255	1520	KM	6,5	0·255
670	TX	6,5	0·255	970	VZ	6,5	0·255	1540	WT	6,5	0·255
674	HL	6,5	0·255	980	WA	6,5	0·255	1550	KN	6,5	0·255
680	QE	6,5	0·255	982	JH	6,5	0·255	1555	WV	6,5	0·255
687	HM	6,5	0·255	990	WB	6,5	0·255	1570	WW	6,5	0·255
690	TZ	6,5	0·255	1000	JJ	6,5	0·255	1580	KP	6,5	0·255
700	HN	6,5	0·255	1020	JK	6,5	0·255	1585	WX	6,5	0·255
710	VA	6,5	0·255	1035	WC	6,5	0·255	1600	WY	6,5	0·255
714	HP	6,5	0·255	1040	JL	6,5	0·255	1610	KQ	6,5	0·255
720	VB	6,5	0·255	1050	WD	6,5	0·255	1625	WZ	6,5	0·255
728	HQ	6,5	0·255	1060	JM	6,5	0·255	1640	KR	6,5	0·255
730	VC	6,5	0·255	1065	WE	6,5	0·255	1650	XA	6,5	0·255
740	VD	6,5	0·255	1080	JN	6,5	0·255	1670	KS	6,5	0·255
742	HR	6,5	0·255	1100	JP	6,5	0·255	1675	XB	6,5	0·255
750	VE	6,5	0·255	1120	JQ	6,5	0·255	1700	KT	6,5	0·255
756	HS	6,5	0·255	1135	WF	6,5	0·255	1725	XC	6,5	0·255
760	VF	6,5	0·255	1140	JR	6,5	0·255	1730	KV	6,5	0·255
770	HT	6,5	0·255	1150	WG	6,5	0·255	1750	XD	6,5	0·255
780	VG	6,5	0·255	1160	JS	6,5	0·255	1760	KW	6,5	0·255
785	HV	6,5	0·255	1165	WH	6,5	0·255	1775	XE	6,5	0·255
790	VH	6,5	0·255	1180	JT	6,5	0·255	1790	KX	6,5	0·255
800	HW	6,5	0·255	1200	JV	6,5	0·255	1800	QH	6,5	0·255
810	VJ	6,5	0·255	1220	JW	6,5	0·255	1820	KY	6,5	0·255
816	HX	6,5	0·255	1240	JX	6,5	0·255	1825	XF	6,5	0·255
820	QF	6,5	0·255	1255	WJ	6,5	0·255	1850	KZ	6,5	0·255
830	VK	6,5	0·255	1260	JY	6,5	0·255	1875	XG	6,5	0·255
832	HY	6,5	0·255	1270	WK	6,5	0·255	1880	LA	6,5	0·255
840	VL	6,5	0·255	1280	JZ	6,5	0·255	1900	XH	6,5	0·255
849	HZ	6,5	0·255	1285	WL	6,5	0·255	1910	LB	6,5	0·255
850	VM	6,5	0·255	1300	KA	6,5	0·255	1925	XJ	6,5	0·255
860	VN	6,5	0·255	1320	KB	6,5	0·255	1940	LC	6,5	0·255
866	JA	6,5	0·255	1340	KC	6,5	0·255	1950	XK	6,5	0·255
870	VP	6,5	0·255	1355	WM	6,5	0·255	1970	LD	6,5	0·255
880	VQ	6,5	0·255	1360	KD	6,5	0·255	1975	XL	6,5	0·255
883	JB	6,5	0·255	1370	WN	6,5	0·255	2000	LE	6,5	0·255
890	VR	6,5	0·255	1380	KE	6,5	0·255	2025	XM	6,5	0·255
900	JC	6,5	0·255	1385	WP	6,5	0·255	2030	LF	6,5	0·255
910	VS	6,5	0·255	1400	KF	6,5	0·255	2050	XN	6,5	0·255
916	JD	6,5	0·255	1420	KG	6,5	0·255	2060	LG	6,5	0·255

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PREFERRED VALUE CODES

STC

Code 455-LWA-105

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Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
2075	XP	6,5	0·255	3300	QK	7,4	0·290	4800	ZH	8,1	0·320
2100	LH	6,5	0·255	3340	ML	7,4	0·290	4820	NH	8,1	0·320
2125	XQ	6,6	0·260	3350	YJ	7,4	0·290	4850	ZJ	8,3	0·325
2140	LJ	6,6	0·260	3400	MM	7,4	0·290	4900	ZK	8,3	0·325
2150	XR	6,6	0·260	3450	YK	7,4	0·290	4910	NJ	8,3	0·325
2175	XS	6,6	0·260	3460	MN	7,4	0·290	5000	NK	8,3	0·325
2180	LK	6,6	0·260	3500	YL	7,5	0·295	5100	NL	8,3	0·325
2200	QJ	6,6	0·260	3520	MP	7,5	0·295	5200	NM	8,3	0·325
2220	LL	6,6	0·260	3550	YM	7,5	0·295	5300	NN	8,4	0·330
2225	XT	6,6	0·260	3580	MQ	7,5	0·295	5400	NP	8,5	0·335
2250	XV	6,6	0·260	3600	YN	7,5	0·295	5500	NQ	8,5	0·335
2260	LM	6,6	0·260	3650	MR	7,5	0·295	5600	NR	8,7	0·340
2275	XW	6,6	0·260	3700	YP	7,6	0·300	5700	NS	8,7	0·340
2300	LN	6,6	0·260	3720	MS	7,6	0·300	5800	NT	8,8	0·345
2325	XX	6,7	0·265	3750	YQ	7,6	0·300	5900	NV	8,9	0·350
2340	LP	6,7	0·265	3790	MT	7,6	0·300	6000	NW	8,9	0·350
2350	XY	6,7	0·265	3800	YR	7,6	0·300	6120	NX	8,9	0·350
2375	XZ	6,7	0·265	3850	YS	7,6	0·300	6240	NY	9,0	0·355
2380	LQ	6,7	0·265	3860	MV	7,6	0·300	6360	NZ	9,0	0·355
2400	YA	6,7	0·265	3900	QL	7,6	0·300	6480	PA	9,2	0·360
2420	LR	6,7	0·265	3930	MW	7,6	0·300	6610	PB	9,3	0·365
2425	YB	6,7	0·265	3950	YT	7,8	0·305	6740	PC	9,3	0·365
2450	YC	6,7	0·265	4000	MX	7,8	0·305	6800	QN	9,3	0·365
2460	LS	6,7	0·265	4050	YV	7,8	0·305	6870	PD	9,4	0·370
2475	YD	6,9	0·270	4070	MY	7,8	0·305	7000	PE	9,4	0·370
2500	LT	6,9	0·270	4100	YW	7,8	0·305	7140	PF	9,5	0·375
2525	YE	6,9	0·270	4150	MZ	7,8	0·305	7280	PG	9,7	0·380
2550	LV	6,9	0·270	4200	YX	7,9	0·310	7420	PH	9,7	0·380
2600	LW	6,9	0·270	4230	NA	7,9	0·310	7560	PJ	9,8	0·385
2650	LX	6,9	0·270	4250	YY	7,9	0·310	7700	PK	9,9	0·390
2700	LY	7,0	0·275	4300	YZ	7,9	0·310	7850	PL	9,9	0·390
2750	LZ	7,0	0·275	4310	NB	7,9	0·310	8000	PM	10,0	0·395
2800	MA	7,0	0·275	4350	ZA	7,9	0·310	8160	PN	10,0	0·395
2850	MB	7,1	0·280	4390	NC	7,9	0·310	8200	QP	10,2	0·400
2900	MC	7,1	0·280	4400	ZB	8,0	0·315	8320	PP	10,2	0·400
2950	MD	7,1	0·280	4450	ZC	8,0	0·315	8490	PQ	10,3	0·405
3000	ME	7,1	0·280	4470	ND	8,0	0·315	8660	PR	10,3	0·405
3050	MF	7,1	0·280	4500	ZD	8,0	0·315	8830	PS	10,4	0·410
3100	MG	7,3	0·285	4550	NE	8,0	0·315	9000	PT	10,4	0·410
3150	YF	7,3	0·285	4600	ZE	8,0	0·315	9160	PV	10,6	0·415
3160	MH	7,3	0·285	4640	NF	8,0	0·315	9320	PW	10,7	0·420
3200	YG	7,3	0·285	4650	ZF	8,1	0·320	9480	PX	10,7	0·420
3220	MJ	7,3	0·285	4700	QM	8,1	0·320	9640	PY	10,8	0·425
3250	YH	7,3	0·285	4730	NG	8,1	0·320	9820	PZ	10,8	0·425
3280	MK	7,3	0·285	4750	ZG	8,1	0·320	10000	QA	11,0	0·430

PREFERRED VALUE CODES

Code 455-LWA-108

350 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
10000	AA	14,0	0·550	14400	AZ	15,9	0·625	20600	BY	17,8	0·700
10200	AB	14,1	0·555	14600	BA	15,9	0·625	21000	BZ	17,9	0·705
10400	AC	14,2	0·560	14800	BB	16,0	0·630	21400	CA	18,0	0·710
10600	AD	14,4	0·565	15000	BC	16,0	0·630	21800	CB	18,2	0·715
10800	AE	14,5	0·570	15200	BD	16,1	0·635	22200	CC	18,3	0·720
11000	AF	14,6	0·575	15500	BE	16,1	0·635	22600	CD	18,4	0·725
11200	AG	14,6	0·575	15800	BF	16,3	0·640	23000	CE	18,5	0·730
11400	AH	14,8	0·580	16100	BG	16,4	0·645	23400	CF	18,7	0·735
11600	AJ	14,9	0·585	16400	BH	16,4	0·645	23800	CG	18,8	0·740
11800	AK	14,9	0·585	16700	BJ	16,5	0·650	24200	CH	18,8	0·740
12000	AL	15,0	0·590	17000	BK	16,7	0·655	24600	CJ	18,9	0·745
12200	AM	15,0	0·590	17300	BL	16,8	0·660	25000	CK	19,1	0·750
12400	AN	15,1	0·595	17600	BM	16,8	0·660	25500	CL	19,2	0·755
12600	AP	15,3	0·600	17900	BN	16,9	0·665	26000	CM	19,3	0·760
12800	AQ	15,3	0·600	18200	BP	17,0	0·670	26500	CN	19,5	0·765
13000	AR	15,4	0·605	18500	BQ	17,2	0·675	27000	CP	19,6	0·770
13200	AS	15,4	0·605	18800	BR	17,2	0·675	27500	CQ	19,7	0·775
13400	AT	15,5	0·610	19100	BS	17,3	0·680	28000	CR	19,8	0·780
13600	AV	15,5	0·610	19400	BT	17,4	0·685	28500	CS	20,0	0·785
13800	AW	15,6	0·615	19700	BV	17,4	0·685	29000	CT	20,1	0·790
14000	AX	15,8	0·620	20000	BW	17,5	0·690	29500	CV	20,2	0·795
14200	AY	15,8	0·620	20300	BX	17,7	0·695	30000	CW	20,3	0·800

PREFERRED VALUE CODES

STC

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350 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
1000	AA	9,8	0·385	1555	GL	9,8	0·385	2250	HL	10,3	0·405
1020	AB	9,8	0·385	1570	GM	9,8	0·385	2260	CD	10,3	0·405
1035	FS	9,8	0·385	1580	BF	9,8	0·385	2275	HM	10,4	0·410
1040	AC	9,8	0·385	1585	GN	9,8	0·385	2300	CE	10,4	0·410
1050	FT	9,8	0·385	1600	GP	9,8	0·385	2325	HN	10,4	0·410
1060	AD	9,8	0·385	1610	BG	9,8	0·385	2340	CF	10,4	0·410
1065	FV	9,8	0·385	1625	GQ	9,8	0·385	2350	HP	10,4	0·410
1080	AE	9,8	0·385	1640	BH	9,8	0·385	2375	HQ	10,4	0·410
1100	AF	9,8	0·385	1650	GR	9,8	0·385	2380	CG	10,4	0·410
1120	AG	9,8	0·385	1670	BJ	9,8	0·385	2400	HR	10,4	0·410
1135	FW	9,8	0·385	1675	GS	9,8	0·385	2420	CH	10,4	0·410
1140	AH	9,8	0·385	1700	BK	9,8	0·385	2425	HS	10,6	0·415
1150	FX	9,8	0·385	1725	GT	9,8	0·385	2450	HT	10,6	0·415
1160	AJ	9,8	0·385	1730	BL	9,8	0·385	2460	CJ	10,6	0·415
1165	FY	9,8	0·385	1750	GV	9,8	0·385	2475	HV	10,6	0·415
1180	AK	9,8	0·385	1760	BM	9,8	0·385	2500	CK	10,6	0·415
1200	AL	9,8	0·385	1775	GW	9,8	0·385	2525	HW	10,6	0·415
1220	AM	9,8	0·385	1790	BN	9,8	0·385	2550	CL	10,6	0·415
1240	AN	9,8	0·385	1820	BP	9,8	0·385	2600	CM	10,6	0·415
1255	FZ	9,8	0·385	1825	GX	9,9	0·390	2650	CN	10,7	0·420
1260	AP	9,8	0·385	1850	BQ	9,9	0·390	2700	CP	10,7	0·420
1275	GB	9,8	0·385	1870	GY	9,9	0·390	2750	CQ	10,7	0·420
1280	AQ	9,8	0·385	1880	BR	9,9	0·390	2800	CR	10,8	0·425
1285	GC	9,8	0·385	1900	GZ	10,1	0·395	2850	CS	10,8	0·425
1300	AR	9,8	0·385	1910	BS	10,1	0·395	2900	CT	10,8	0·425
1320	AS	9,8	0·385	1925	HA	10,1	0·395	2950	CV	10,8	0·425
1340	AT	9,8	0·385	1940	BT	10,1	0·395	3000	CW	11,0	0·430
1355	GD	9,8	0·385	1950	HB	10,1	0·395	3050	CX	11,0	0·430
1360	AV	9,8	0·385	1970	BV	10,1	0·395	3100	CY	11,0	0·430
1370	GE	9,8	0·385	1975	HC	10,1	0·395	3150	HX	11,1	0·435
1380	AW	9,8	0·385	2000	BW	10,1	0·395	3160	CZ	11,1	0·435
1385	GF	9,8	0·385	2025	HD	10,1	0·395	3200	HY	11,1	0·435
1400	AX	9,8	0·385	2030	BX	10,1	0·395	3220	DA	11,1	0·435
1420	AY	9,8	0·385	2050	HE	10,2	0·400	3250	HZ	11,1	0·435
1440	AZ	9,8	0·385	2060	BY	10,2	0·400	3280	DB	11,1	0·435
1455	GG	9,8	0·385	2070	HF	10,2	0·400	3340	DC	11,1	0·435
1460	BA	9,8	0·385	2100	BZ	10,2	0·400	3350	JA	11,2	0·440
1470	GH	9,8	0·385	2125	HG	10,2	0·400	3400	DD	11,2	0·440
1480	BB	9,8	0·385	2140	CA	10,2	0·400	3450	JB	11,2	0·440
1485	GJ	9,8	0·385	2150	HH	10,2	0·400	3460	DE	11,2	0·440
1500	BC	9,8	0·385	2175	HJ	10,2	0·400	3500	JC	11,2	0·440
1520	BD	9,8	0·385	2180	CB	10,2	0·400	3520	DF	11,2	0·440
1540	GK	9,8	0·385	2220	CC	10,3	0·405	3550	JD	11,3	0·445
1550	BE	9,8	0·385	2225	HK	10,3	0·405	3580	DG	11,3	0·445

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PREFERRED VALUE CODES

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Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
3600	JE	11,3	0·445	4500	JV	11,8	0·465	6480	ER	13,1	0·515
3650	DH	11,3	0·445	4550	DW	11,8	0·465	6610	ES	13,2	0·520
3700	JF	11,3	0·445	4600	JW	11,8	0·465	6740	ET	13,2	0·520
3720	DJ	11,3	0·445	4640	DX	12,0	0·470	6870	EV	13,4	0·525
3750	JG	11,4	0·450	4650	JX	12,0	0·470	7000	EW	13,5	0·530
3790	DK	11,4	0·450	4730	DY	12,0	0·470	7140	EX	13,5	0·530
3800	JH	11,4	0·450	4750	JY	12,0	0·470	7280	EY	13,6	0·535
3850	JJ	11,4	0·450	4800	JZ	12,1	0·475	7420	EZ	13,7	0·540
3860	DL	11,4	0·450	4820	DZ	12,1	0·475	7560	FA	13,7	0·540
3930	DM	11,6	0·455	4850	KA	12,1	0·475	7700	FB	13,9	0·545
3950	JK	11,6	0·455	4900	KB	12,1	0·475	7850	FC	14,0	0·550
4000	DN	11,6	0·455	4910	EA	12,1	0·475	8000	FD	14,1	0·555
4050	JL	11,6	0·455	5000	EB	12,2	0·480	8160	FE	14,2	0·560
4070	DP	11,6	0·455	5100	EC	12,2	0·480	8320	FF	14,2	0·560
4100	JM	11,6	0·455	5200	ED	12,2	0·480	8490	FG	14,4	0·565
4150	DQ	11,6	0·455	5300	EE	12,3	0·485	8660	FH	14,5	0·570
4200	JN	11,7	0·460	5400	EF	12,3	0·485	8830	FJ	14,6	0·575
4230	DR	11,7	0·460	5500	EG	12,5	0·490	9000	FK	14,7	0·580
4250	JP	11,7	0·460	5600	EH	12,5	0·490	9160	FL	14,7	0·580
4300	JQ	11,7	0·460	5700	EJ	12,6	0·495	9320	FM	14,9	0·585
4310	DS	11,7	0·460	5800	EK	12,6	0·495	9480	FN	15,0	0·590
4350	JR	11,8	0·465	5900	EL	12,7	0·500	9640	FP	15,1	0·595
4390	DT	11,8	0·465	6000	EM	12,7	0·500	9820	FQ	15,3	0·600
4400	JS	11,8	0·465	6120	EN	12,8	0·505	10000	FR	15,4	0·605
4450	JT	11,8	0·465	6240	EP	13,0	0·510				
4470	DV	11,8	0·465	6360	EQ	13,0	0·510				

STC

PREFERRED VALUE CODES

Code 455-LWA-110

500 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
10	AA	8,4	0·330	165	BJ	8,8	0·345	346	CX	9,4	0·370
15	AB	8,4	0·330	170	BK	8,8	0·345	350	LT	9,4	0·370
20	AC	8,4	0·330	175	BL	8,8	0·345	352	CY	9,4	0·370
22	LA	8,4	0·330	180	BM	8,8	0·345	355	LV	9,4	0·370
25	AD	8,4	0·330	185	BN	8,9	0·350	358	CZ	9,4	0·370
30	AE	8,4	0·330	190	BP	8,9	0·350	360	LW	9,4	0·370
33	LB	8,4	0·330	195	BQ	8,9	0·350	365	DA	9,4	0·370
35	AF	8,4	0·330	200	BR	8,9	0·350	370	LX	9,4	0·370
40	AG	8,4	0·330	205	BS	8,9	0·350	372	DB	9,4	0·370
45	AH	8,4	0·330	210	BT	8,9	0·350	375	LY	9,4	0·370
47	LC	8,4	0·330	215	BV	8,9	0·350	379	DC	9,4	0·370
50	AJ	8,4	0·330	220	BW	9,0	0·355	380	LZ	9,4	0·370
55	AK	8,4	0·330	225	BX	9,0	0·355	385	MA	9,4	0·370
60	AL	8,4	0·330	230	BY	9,0	0·355	386	DD	9,4	0·370
65	AM	8,4	0·330	235	BZ	9,0	0·355	393	DE	9,5	0·375
68	LD	8,4	0·330	240	CA	9,0	0·355	395	MB	9,5	0·375
70	AN	8,4	0·330	245	CB	9,0	0·355	400	DF	9,5	0·375
75	AP	8,4	0·330	250	CC	9,2	0·360	405	MC	9,5	0·375
80	AQ	8,4	0·330	255	CD	9,2	0·360	407	DG	9,5	0·375
85	AR	8,4	0·330	260	CE	9,2	0·360	410	MD	9,5	0·375
90	AS	8,4	0·330	265	CF	9,2	0·360	415	DH	9,5	0·375
91	LH	8,4	0·330	270	CG	9,2	0·360	420	ME	9,5	0·375
95	AT	8,4	0·330	275	CH	9,2	0·360	425	DJ	9,5	0·375
100	AV	8,4	0·330	280	CJ	9,2	0·360	430	MF	9,7	0·380
105	AW	8,4	0·330	285	CK	9,2	0·360	431	DK	9,7	0·380
110	AX	8,4	0·330	290	CL	9,2	0·360	435	MG	9,7	0·380
115	AY	8,5	0·335	295	CM	9,2	0·360	439	DL	9,7	0·380
120	AZ	8,5	0·335	300	CN	9,3	0·365	440	MH	9,7	0·380
124	LJ	8,5	0·335	305	CP	9,3	0·365	445	MJ	9,7	0·380
125	BA	8,5	0·335	310	CQ	9,3	0·365	447	DM	9,7	0·380
130	BB	8,5	0·335	315	LN	9,3	0·365	450	MK	9,7	0·380
134	LK	8,5	0·335	316	CR	9,3	0·365	455	DN	9,7	0·380
135	BC	8,5	0·335	320	LP	9,3	0·365	460	ML	9,7	0·380
140	BD	8,7	0·340	322	CS	9,3	0·365	464	DP	9,7	0·380
144	LL	8,7	0·340	325	LQ	9,3	0·365	465	MN	9,7	0·380
145	BE	8,7	0·340	328	CT	9,3	0·365	473	DQ	9,7	0·380
150	BF	8,7	0·340	334	CV	9,3	0·365	475	MP	9,8	0·385
154	LM	8,7	0·340	335	LR	9,4	0·370	480	MQ	9,8	0·385
155	BG	8,7	0·340	340	CW	9,4	0·370	482	DR	9,8	0·385
160	BH	8,8	0·345	345	LS	9,4	0·370	485	MR	9,8	0·385

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PREFERRED VALUE CODES

Code 455-LWA-110

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Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
490	MS	9,8	0·385	760	NK	10,3	0·405	1065	PJ	11,0	0·430
491	DS	9,8	0·385	770	ET	10,3	0·405	1080	FN	11,0	0·430
495	MT	9,8	0·385	780	NL	10,4	0·410	1100	FP	11,1	0·435
500	DT	9,8	0·385	785	EV	10,4	0·410	1120	FQ	11,1	0·435
510	DV	9,8	0·385	790	NM	10,4	0·410	1135	PK	11,1	0·435
520	DW	9,8	0·385	800	EW	10,4	0·410	1140	FR	11,1	0·435
530	DX	9,8	0·385	810	NN	10,4	0·410	1150	PL	11,2	0·440
540	DY	9,9	0·390	816	EX	10,4	0·410	1160	FS	11,2	0·440
550	DZ	9,9	0·390	830	NP	10,4	0·410	1165	PM	11,2	0·440
560	EA	9,9	0·390	832	EY	10,4	0·410	1180	FT	11,2	0·440
570	EB	9,9	0·390	840	NQ	10,4	0·410	1200	FV	11,2	0·440
580	EC	9,9	0·390	849	EZ	10,4	0·410	1220	FW	11,3	0·445
590	ED	9,9	0·390	850	NR	10,6	0·415	1240	FX	11,3	0·445
600	EE	9,9	0·390	860	NS	10,6	0·415	1255	PN	11,3	0·445
610	MV	9,9	0·390	866	FA	10,6	0·415	1260	FY	11,3	0·445
612	EF	9,9	0·390	870	NT	10,6	0·415	1270	PP	11,5	0·450
620	MW	10,1	0·395	880	NV	10,6	0·415	1280	FZ	11,5	0·450
624	EG	10,1	0·395	883	FB	10,6	0·415	1285	PQ	11,5	0·450
630	MX	10,1	0·395	890	NW	10,7	0·420	1300	GA	11,5	0·450
636	EH	10,1	0·395	900	FC	10,7	0·420	1320	GB	11,5	0·450
640	MY	10,1	0·395	910	NX	10,7	0·420	1340	GC	11,5	0·450
648	EJ	10,1	0·395	916	FD	10,7	0·420	1355	PR	11,6	0·455
650	MZ	10,1	0·395	920	NY	10,7	0·420	1360	GD	11,6	0·455
660	NA	10,1	0·395	930	NZ	10,7	0·420	1370	PS	11,6	0·455
661	EK	10,1	0·395	932	FE	10,7	0·420	1380	GE	11,6	0·455
670	NB	10,1	0·395	940	PA	10,7	0·420	1385	PT	11,6	0·455
674	EL	10,1	0·395	948	FF	10,7	0·420	1400	GF	11,6	0·455
680	NC	10,2	0·400	950	PB	10,8	0·425	1420	GG	11,7	0·460
687	EM	10,2	0·400	960	PC	10,8	0·425	1440	GH	11,7	0·460
690	ND	10,2	0·400	964	FG	10,8	0·425	1455	PV	11,8	0·465
700	EN	10,2	0·400	970	PD	10,8	0·425	1460	GJ	11,8	0·465
710	NE	10,2	0·400	980	PE	10,8	0·425	1470	PW	11,8	0·465
714	EP	10,2	0·400	982	FH	10,8	0·425	1480	GK	11,8	0·465
720	NF	10,2	0·400	990	PF	10,8	0·425	1485	PX	11,8	0·465
728	EQ	10,2	0·400	1000	FJ	10,8	0·425	1500	GL	11,8	0·465
730	NG	10,3	0·405	1020	FK	11,0	0·430	1520	GM	12,0	0·470
740	NH	10,3	0·405	1035	PG	11,0	0·430	1540	PY	12,0	0·470
742	ER	10,3	0·405	1040	FL	11,0	0·430	1550	GN	12,0	0·470
750	NJ	10,3	0·405	1050	PH	11,0	0·430	1555	PZ	12,1	0·475
756	ES	10,3	0·405	1060	FM	11,0	0·430	1570	QA	12,1	0·475

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PREFERRED VALUE CODES

Code 455-LWA-110

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Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximam Diameter mm	Maximam Diameter in
1580	GP	12,1	0·475	2220	HL	13,5	0·530	3450	RP	16,0	0·630
1585	QB	12,1	0·475	2225	QY	13,5	0·530	3460	JN	16,0	0·630
1600	QC	12,1	0·475	2250	QZ	13,5	0·530	3500	RQ	16,1	0·635
1616	GQ	12,1	0·475	2260	HM	13,5	0·530	3520	JP	16,1	0·635
1625	QD	12,2	0·480	2275	RA	13,6	0·535	3550	RR	16,3	0·640
1640	GR	12,2	0·480	2300	HN	13,6	0·535	3580	JQ	16,3	0·640
1650	QE	12,2	0·480	2325	RB	13,6	0·535	3600	RS	16,4	0·645
1670	GS	12,2	0·480	2340	HP	13,6	0·535	3650	JR	16,4	0·645
1675	QF	12,3	0·485	2350	RC	13,7	0·540	3700	RT	16,5	0·650
1700	GT	12,3	0·485	2375	RD	13,7	0·540	3720	JS	16,5	0·650
1725	QG	12,3	0·485	2380	HQ	13,7	0·540	3750	RV	16,7	0·655
1730	GV	12,3	0·485	2400	RE	13,9	0·545	3790	JT	16,7	0·655
1750	QH	12,5	0·490	2420	HR	13,9	0·545	3800	RW	16,8	0·660
1760	GW	12,5	0·490	2425	RF	13,9	0·545	3850	RX	16,8	0·660
1775	QJ	12,5	0·490	2450	RG	13,9	0·545	3860	JV	16,8	0·660
1790	GX	12,5	0·490	2460	HS	13,9	0·545	3930	JW	16,9	0·665
1820	GY	12,5	0·490	2475	RH	14,0	0·550	3950	RY	17,2	0·675
1825	QK	12,6	0·495	2500	HT	14,0	0·550	4000	JX	17,2	0·675
1850	GZ	12,6	0·495	2525	RJ	14,1	0·555	4050	RZ	17,3	0·680
1875	QL	12,7	0·500	2550	HV	14,1	0·555	4070	JY	17,3	0·680
1880	HA	12,7	0·500	2600	HW	14,1	0·555	4100	SA	17,4	0·685
1900	QM	12,7	0·500	2650	HX	14,2	0·560	4150	JZ	17,4	0·685
1910	HB	12,7	0·500	2700	HY	14,4	0·565	4200	SB	17,7	0·695
1925	QN	12,7	0·500	2750	HZ	14,5	0·570	4230	KA	17,7	0·695
1940	HC	12,7	0·500	2800	JA	14,6	0·575	4250	SC	17,8	0·700
1950	QP	12,8	0·505	2850	JB	14,6	0·575	4300	SD	17,8	0·700
1970	HD	12,8	0·505	2900	JC	14,7	0·580	4310	KB	17,8	0·700
1975	QQ	13,0	0·510	2950	JD	14,9	0·585	4350	SE	17,9	0·705
2000	HE	13,0	0·510	3000	JE	15,0	0·590	4390	KC	17,9	0·705
2025	QR	13,0	0·510	3050	JF	15,1	0·595	4400	SF	18,0	0·710
2030	HF	13,0	0·510	3100	JG	15,2	0·600	4450	SG	18,0	0·710
2050	QS	13,1	0·515	3150	RK	15,4	0·605	4470	KD	18,0	0·710
2060	HG	13,1	0·515	3160	JH	15,4	0·605	4500	SH	18,3	0·720
2075	QT	13,2	0·520	3200	RL	15,5	0·610	4550	KE	18,3	0·720
2100	HH	13,2	0·520	3220	JJ	15,5	0·610	4600	SJ	18,6	0·730
2125	QV	13,2	0·520	3250	RM	15,6	0·615	4640	KF	18,6	0·730
2140	HJ	13,2	0·520	3280	JK	15,6	0·615	4650	SK	18,6	0·730
2150	QW	13,2	0·520	3340	JL	15,8	0·620	4700	KG	18,6	0·730
2175	QX	13,2	0·520	3350	RN	15,9	0·625				
2180	HK	13,2	0·520	3400	JM	15,9	0·625				

PREFERRED VALUE CODES

Code 455-LWA-111

350 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
10	AA	8,1	0·320	185	BN	8,1	0·320	355	JQ	8,3	0·325
15	AB	8,1	0·320	190	BP	8,1	0·320	358	CZ	8,3	0·325
20	AC	8,1	0·320	195	BQ	8,1	0·320	360	JR	8,3	0·325
25	AD	8,1	0·320	200	BR	8,1	0·320	365	DA	8,3	0·325
30	AE	8,1	0·320	205	BS	8,1	0·320	370	JS	8,3	0·325
35	AF	8,1	0·320	210	BT	8,1	0·320	372	DB	8,3	0·325
40	AG	8,1	0·320	215	BV	8,1	0·320	375	JT	8,3	0·325
45	AH	8,1	0·320	220	BW	8,1	0·320	379	DC	8,3	0·325
50	AJ	8,1	0·320	225	BX	8,1	0·320	380	JV	8,3	0·325
55	AK	8,1	0·320	230	BY	8,1	0·320	385	JW	8,3	0·325
60	AL	8,1	0·320	235	BZ	8,1	0·320	386	DD	8,3	0·325
65	AM	8,1	0·320	240	CA	8,1	0·320	393	DE	8,3	0·325
70	AN	8,1	0·320	245	CB	8,1	0·320	395	JX	8,3	0·325
75	AP	8,1	0·320	250	CC	8,1	0·320	400	DF	8,3	0·325
80	AQ	8,1	0·320	255	CD	8,1	0·320	405	JY	8,3	0·325
85	AR	8,1	0·320	260	CE	8,1	0·320	407	DG	8,3	0·325
90	AS	8,1	0·320	265	CF	8,1	0·320	410	JZ	8,3	0·325
91	JD	8,1	0·320	270	CG	8,1	0·320	415	DH	8,3	0·325
95	AT	8,1	0·320	275	CH	8,1	0·320	420	KA	8,3	0·325
100	AV	8,1	0·320	280	CJ	8,1	0·320	425	DJ	8,3	0·325
105	AW	8,1	0·320	285	CK	8,1	0·320	430	KB	8,3	0·325
110	AX	8,1	0·320	290	CL	8,1	0·320	431	DK	8,3	0·325
115	AY	8,1	0·320	295	CM	8,1	0·320	435	KC	8,3	0·325
120	AZ	8,1	0·320	300	CN	8,1	0·320	439	DL	8,3	0·325
124	JE	8,1	0·320	305	CP	8,1	0·320	440	KD	8,3	0·325
125	BA	8,1	0·320	310	CQ	8,1	0·320	445	KE	8,3	0·325
130	BB	8,1	0·320	315	JJ	8,1	0·320	447	DM	8,3	0·325
134	JF	8,1	0·320	316	CR	8,1	0·320	450	KF	8,3	0·325
135	BC	8,1	0·320	320	JK	8,1	0·320	455	DN	8,3	0·325
140	BD	8,1	0·320	322	CS	8,1	0·320	460	KG	8,3	0·325
144	JG	8,1	0·320	325	JL	8,1	0·320	464	DP	8,3	0·325
145	BE	8,1	0·320	328	CT	8,1	0·320	465	KH	8,3	0·325
150	BF	8,1	0·320	330	JA	8,1	0·320	470	JB	8,3	0·325
154	JH	8,1	0·320	334	CV	8,1	0·320	473	DQ	8,3	0·325
155	BG	8,1	0·320	335	JM	8,1	0·320	475	KJ	8,3	0·325
160	BH	8,1	0·320	340	CW	8,1	0·320	480	KK	8,3	0·325
165	BJ	8,1	0·320	345	JN	8,3	0·325	482	DR	8,3	0·325
170	BK	8,1	0·320	346	CX	8,3	0·325	485	KL	8,3	0·325
175	BL	8,1	0·320	350	JP	8,3	0·325	490	KM	8,3	0·325
180	BM	8,1	0·320	352	CY	8,3	0·325	491	DS	8,3	0·325

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PREFERRED VALUE CODES

Code 455-LWA-111

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Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
495	KN	8,3	0·325	770	ET	8,3	0·325	1065	MD	8,7	0·340
500	DT	8,3	0·325	780	LF	8,3	0·325	1080	FN	8,7	0·340
510	DV	8,3	0·325	785	EV	8,3	0·325	1100	FP	8,7	0·340
520	DW	8,3	0·325	790	LG	8,3	0·325	1120	FQ	8,7	0·340
530	DX	8,3	0·325	800	EW	8,3	0·325	1135	ME	8,7	0·340
540	DY	8,3	0·325	810	LH	8,4	0·330	1140	FR	8,7	0·340
550	DZ	8,3	0·325	816	EX	8,4	0·330	1150	MF	8,8	0·345
560	EA	8,3	0·325	830	LJ	8,4	0·330	1160	FS	8,8	0·345
570	EB	8,3	0·325	832	EY	8,4	0·330	1165	MG	8,8	0·345
580	EC	8,3	0·325	840	LK	8,4	0·330	1180	FT	8,8	0·345
590	ED	8,3	0·325	849	EZ	8,4	0·330	1200	FV	8,8	0·345
600	EE	8,3	0·325	850	LL	8,4	0·330	1220	FW	8,8	0·345
610	KP	8,3	0·325	860	LM	8,4	0·330	1240	FX	8,9	0·350
612	EF	8,3	0·325	866	FA	8,4	0·330	1255	MH	8,9	0·350
620	KQ	8,3	0·325	870	LN	8,4	0·330	1260	FY	8,9	0·350
624	EG	8,3	0·325	880	LP	8,4	0·330	1270	MJ	8,9	0·350
630	KR	8,3	0·325	883	FB	8,4	0·330	1280	FZ	8,9	0·350
636	EH	8,3	0·325	890	LQ	8,4	0·330	1285	MK	8,9	0·350
640	KS	8,3	0·325	900	FC	8,4	0·330	1300	GA	8,9	0·350
648	EJ	8,3	0·325	910	LR	8,4	0·330	1320	GB	9,0	0·355
650	KT	8,3	0·325	916	FD	8,4	0·330	1340	GC	9,0	0·355
660	KV	8,3	0·325	920	LS	8,4	0·330	1355	ML	9,0	0·355
661	EK	8,3	0·325	930	LT	8,4	0·330	1360	GD	9,0	0·355
670	KW	8,3	0·325	932	FE	8,4	0·330	1370	MM	9,2	0·360
674	EL	8,3	0·325	940	LV	8,4	0·330	1380	GE	9,2	0·360
680	JC	8,3	0·325	948	FF	8,4	0·330	1385	MN	9,2	0·360
687	EM	8,3	0·325	950	LW	8,5	0·335	1400	GF	9,2	0·360
690	KY	8,3	0·325	960	LX	8,5	0·335	1420	GG	9,2	0·360
700	EN	8,3	0·325	964	FG	8,5	0·335	1440	GH	9,2	0·360
710	KZ	8,3	0·325	970	LY	8,5	0·335	1455	MP	9,3	0·365
714	EP	8,3	0·325	980	LZ	8,5	0·335	1460	GJ	9,3	0·365
720	LA	8,3	0·325	982	FH	8,5	0·335	1470	MQ	9,3	0·365
728	EQ	8,3	0·325	990	MA	8,5	0·335	1480	GK	9,3	0·365
730	LB	8,3	0·325	1000	FJ	8,5	0·335	1485	MR	9,4	0·370
740	LC	8,3	0·325	1020	FK	8,5	0·335	1500	GL	9,4	0·370
742	ER	8,3	0·325	1035	MB	8,5	0·335	1520	GM	9,4	0·370
750	LD	8,3	0·325	1040	FL	8,5	0·335	1540	MS	9,4	0·370
756	ES	8,3	0·325	1050	MC	8,5	0·335	1550	GN	9,4	0·370
760	LE	8,3	0·325	1060	FM	8,7	0·340	1555	MT	9,5	0·375

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PREFERRED VALUE CODES

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Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
1570	MV	9,5	0·375	1700	GT	9,7	0·380	1875	NF	10,2	0·400
1580	GP	9,5	0·375	1725	NB	9,8	0·385	1880	HA	10,2	0·400
1585	MW	9,5	0·375	1730	GV	9,8	0·385	1900	NG	10,2	0·400
1600	MX	9,5	0·375	1750	NC	9,8	0·385	1910	HB	10,2	0·400
1616	GQ	9,5	0·375	1760	GW	9,8	0·385	1925	NH	10,2	0·400
1625	MY	9,5	0·375	1775	ND	9,9	0·390	1940	HC	10,2	0·400
1640	GR	9,5	0·375	1790	GX	9,9	0·390	1950	NJ	10,3	0·405
1650	MZ	9,7	0·380	1820	GY	9,9	0·390	1970	HD	10,3	0·405
1670	GS	9,7	0·380	1825	NE	10,1	0·395	2000	HE	10,4	0·410
1675	NA	9,7	0·380	1850	GZ	10,1	0·395				

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PREFERRED VALUE CODES

Code 455-LWA-303–304–305

Code 455-LWA-303

125 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
10000	A	8,3	0·325	20000	H	10,4	0·410	39000	Q	13,6	0·535
11000	B	8,5	0·335	22000	J	10,7	0·420	43000	R	14,2	0·560
12000	C	8,8	0·345	24000	K	11,1	0·435	47000	S	14,9	0·585
13000	D	8,9	0·350	27000	L	11,7	0·460	51000	T	15,3	0·600
15000	E	9,3	0·365	30000	M	12,1	0·475	56000	V	15,8	0·620
16000	F	9,7	0·380	33000	N	12,6	0·495	62000	W	16,3	0·640
18000	G	10,1	0·395	36000	P	13,1	0·515	68000	X	16,5	0·650

Code 455-LWA-304

125 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
4700	A	7,4	0·290	8200	G	8,9	0·350	15000	N	11,3	0·445
5100	B	7,6	0·300	9100	H	9,3	0·365	16000	P	11,7	0·460
5600	C	7,8	0·305	10000	J	9,7	0·380	18000	Q	11,7	0·460
6200	D	8,0	0·315	11000	K	10,1	0·395	20000	R	12,7	0·500
6800	E	8,3	0·325	12000	L	10,3	0·405	22000	S	13,1	0·515
7500	F	8,6	0·340	13000	M	10,7	0·420	24000	T	13,4	0·525

Code 455-LWA-305

125 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
47	A	6,5	0·255	1200	M	6,5	0·255	4700	AA	8,1	0·320
68	B	6,5	0·255	1500	N	6,5	0·255	5100	AB	8,4	0·330
100	C	6,5	0·255	1800	P	6,5	0·255	5600	AC	8,6	0·340
150	D	6,5	0·255	2200	R	6,6	0·260	6200	AD	9,0	0·355
220	E	6,5	0·255	2400	S	6,7	0·265	6800	AE	9,4	0·370
330	F	6,5	0·255	2700	T	7,0	0·275	7500	AF	9,8	0·385
470	G	6,5	0·255	3000	V	7,1	0·280	8200	AG	10,4	0·410
560	H	6,5	0·255	3300	W	7,4	0·290	9100	AH	10,6	0·415
680	J	6,5	0·255	3600	X	7,5	0·295	10000	AJ	10,9	0·430
820	K	6,5	0·255	3900	Y	7,6	0·300				
1000	L	6,5	0·255	4300	Z	7,9	0·310				

PREFERRED VALUE CODES

Code 455-LWA-308–309–311

Code 455-LWA-308

350 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
10000	A	14,0	0·550	15000	D	16,0	0·630	22000	H	18,2	0·715
11000	M	14,6	0·575	16000	E	16,3	0·640	24000	J	18,8	0·740
12000	B	15,0	0·590	18000	F	16,9	0·665	27000	K	19,6	0·770
13000	C	15,4	0·605	20000	G	17,5	0·690	30000	L	20,3	0·800

Code 455-LWA-309

350 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
1000	A	9,8	0·385	3000	H	10,9	0·430	5600	P	12,5	0·490
1200	B	9,8	0·385	3300	J	11,1	0·435	6200	X	13,0	0·510
1500	C	9,8	0·385	3600	K	11,4	0·450	6800	Q	13,4	0·525
1800	D	9,8	0·385	3900	L	11,4	0·450	7500	R	13,7	0·540
2200	E	10,3	0·405	4300	M	11,7	0·460	8200	S	14,2	0·560
2400	F	10,4	0·410	4700	N	11,9	0·470	9100	T	14,7	0·580
2700	G	10,7	0·420	5100	W	12,2	0·480	10000	V	15,4	0·605

Code 455-LWA-311

350 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
10	A	8,2	0·320	150	H	8,2	0·320	1000	Q	8,5	0·335
15	B	8,2	0·320	220	J	8,2	0·320	1200	R	8,7	0·340
22	C	8,2	0·320	330	K	8,2	0·320	1500	S	9,3	0·365
33	D	8,2	0·320	470	L	8,2	0·320	1800	T	9,9	0·390
47	E	8,2	0·320	560	M	8,3	0·325	2000	V	10,4	0·410
68	F	8,2	0·320	680	N	8,3	0·325	2200	W	10,5	0·415
100	G	8,2	0·320	820	P	8,3	0·325				

STC

PREFERRED VALUE CODES

Code 455-LWA-310

Code 455-LWA-310
500 V. D.C. WORKING

Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in	Capacitance (pF)	Code Suffix	Maximum Diameter mm	Maximum Diameter in
10	A	8,4	0·330	330	K	9,4	0·370	2200	W	13,2	0·520
15	B	8,4	0·330	470	L	9,6	0·380	2400	X	13,7	0·540
22	C	8,4	0·330	560	M	9,9	0·390	2700	Y	14,4	0·565
33	D	8,4	0·330	680	N	10,2	0·400	3000	Z	15,1	0·595
47	E	8,4	0·330	820	P	10,4	0·410	3300	AA	15,6	0·615
68	F	8,4	0·330	1000	Q	10,8	0·425	3600	AB	16,4	0·645
100	G	8,4	0·330	1200	R	11,2	0·440	3900	AC	16,9	0·665
150	H	8,7	0·340	1500	S	11,8	0·465	4300	AD	17,8	0·700
220	J	9,0	0·355	1800	T	12,5	0·490	4700	AE	18,6	0·730

Polystyrene and Foil Capacitors

Codes: CA41-003, 007 and 005—With Grade H5 Humidity Protection

This range of protected polystyrene capacitors will meet the requirements of draft specification DEF 5138A-4 for operation at 160V d.c.

Sealing the ends of the wound units with thermosetting resin gives environmental protection to grade H5 (21 days) DEF 5011, grade 40/070/21 B.S.2401 (1966) and grade 565 I.E.C. 68. The capacitors will also meet the requirements of robustness classification SP1 DEF 5011.

Attributes of polystyrene capacitors are:

STABILITY—After temperature cycling, typically better than 0·5 per cent after 100 cycles 20°C to 70°C (24 hours at each temperature) and 50 days recovery (a total of 250 days).

With time, after 3 years under normal atmospheric conditions
<1 000pF—0·13 per cent drift from nominal
>1 000pF—0·05 per cent drift from nominal

NEGATIVE TEMPERATURE COEFFICIENT

HIGH INSULATION RESISTANCE

HIGH RELIABILITY—All stages of manufacture are subject to Quality Assurance testing to ensure that the capacitors will be of a uniformly high standard.

Standard Telephones and Cables Limited
Capacitor Division, Brixham Road, Paignton, Devon
Telephone: Paignton 50762 Telex: 42951
An Associate of ITT

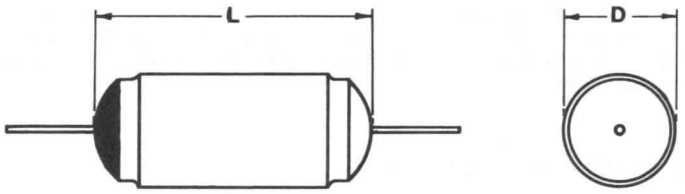
STC

Codes: CA41-003, 007 and 005—With Grade H5 Humidity Protection

CONTINUED

DIMENSIONS AND RATINGS

Black seal indicates outer foil.



STC CODE	Capacitance Range (pF)	MAXIMUM DIMENSIONS			
		L		D*	
		mm	in	mm	in
CA 41.003	10– 680	15,2	0·60	5,1	0·20
CA 41.007	680– 8 200	,,	,,	10,2	0·40
CA 41.005	4 700–43 000	32,5	1·28	13,7	0·54

* Diameter varies according to capacitance.

TERMINAL WIRES

Length 32mm (1·25in) minimum

Diameter

Codes 003 and 007 0,5mm (0·020in) nominal

Code 005 0,9mm (0·036in) nominal

N.B.—Metric dimensions are derived from inch dimensions.

Codes: CA41-003, 007 and 005—With Grade H5 Humidity Protection

CONTINUED

ELECTRICAL CHARACTERISTICS

		LIMITS
	(Reference temperature 20°C)	
Working voltage at 70°C		160V d.c.
Capacitance tolerance		
(<1 000pF measured at 20kHz	10pF to 500pF	±5% or ±1pF whichever is
>1 000pF measured at 1 000Hz)	501pF to 2 000pF	±2% the greater.
	above 2 000pF	±1%
Temperature coefficient of capacitance		−150 ± 50 p.p.m./deg. C.
Power Factor		
measured at 1MHz up to and including 1 000pF		<0·001
,, ,, 900Hz over 1 000pF		<0·0005
Insulation resistance after 1 minute at 300V d.c.		
up to 10 000pF		$>2 \times 10^6$ MΩ
10 001pF to 20 000pF		$>1{\cdot}5 \times 10^6$ MΩ
20 001pF and over		$>1{\cdot}0 \times 10^6$ MΩ
Proof test voltage		3 times rated voltage
Surge voltage		1·5 times rated voltage

Codes: CA41-003, 007 and 005—With Grade H5 Humidity Protection

CONTINUED

TYPICAL PERFORMANCE

Power factor at various frequencies.

Capacitance pF	Frequency			
	1kHz	10kHz	100kHz	1MHz
220	0·00005	0·00007	0·00018	0·0002
4 700	0·00004	0·00004	0·00033	0·0073
10 000	0·00005	0·00005	0·00087	0·0096

ENVIRONMENTAL

In accordance with DEF 5011

Humidity Classification	H5 (2 cycles accelerated and 21 days L.T.D.H.)
Temperature range	−40°C to +70°C
Vibration test	V1 (5 to 500Hz, short endurance)
Acceleration	A3 (100g)
Shock test	S2 (75g)
Low air density	D1 (0·370, mean altitude 30 000 ft)

SOLDERABILITY

The solder coated copper terminal wires meet the requirements of B.S. 2011 pt 2 T (1966) in the aged condition.

CAPACITORS

Metallized Polyester Capacitor

(CA43 Range)

BRIEF DATA

Capacitance range	0·032 μF to 10·0 μF
D.C. working voltages	100, 160, 250, 400 and 630V

The capacitors described in this data sheet are general purpose metallized polyester types which are capable of reliable performance under continuous use, at temperatures up to +125°C. Although similar in performance, they are considerably smaller than foil and paper capacitors and in most cases can be used as replacements. STC Polyester capacitors are ideal for use in communication, control and measuring equipment, in coupling, filter and timing circuits and for any application where reliable performance, higher operating temperatures and small physical size are important factors.

CONSTRUCTION

Metallized electrodes are formed by depositing fine grain aluminium on to the dielectric film. An advanced condensation technique is employed which ensures a highly uniform layer. In addition to considerable reduction in physical size resulting from the use of metallized electrodes, the capacitors have the added reliability of self-healing. Contact to the electrodes is made by metal end-spraying and soldering to the metal spray. This makes contact over the whole length of each electrode and results in an exceptionally low self-inductance.

The completed units, which have axial terminal wires, are wrapped in plastic film and sealed at each end with thermosetting resin.

SELF-HEALING

Self-healing is used primarily during the manufacturing process to eliminate the effect of faults (mainly pin holes) which are inevitably present in dielectric materials. Where a defect occurs part of the energy stored in the capacitor is used to burn away the surrounding metallizing, and isolate the fault. The area involved is so minute that the properties of the capacitor are not affected.

This clearing procedure gives rise to a small pulse in the external circuit and for this reason all STC metallized polyester capacitors are subjected to a stringent burn-out process during manufacture. This ensures that the number of self-healing pulses during service is kept to a minimum.

These capacitors are manufactured by our Italian Associates ITT Standard, Milan.

Standard Telephones and Cables Limited
Capacitor Division, Brixham Road, Paignton, Devon
Telephone: Paignton 50762 Telex: 4251
London Sales Office, Telephone: Footscray 3333 Telex: 21836
C O M P O N E N T S G R O U P

(CA43 Range)

CONTINUED

TEMPERATURE AND CLIMATIC GRADE

STC Polyester capacitors meet the requirements of Humidity Severity H5 of DEF-5011. The range described here is suitable for continuous use over the temperature range −55°C to +125°C when derated as shown below.

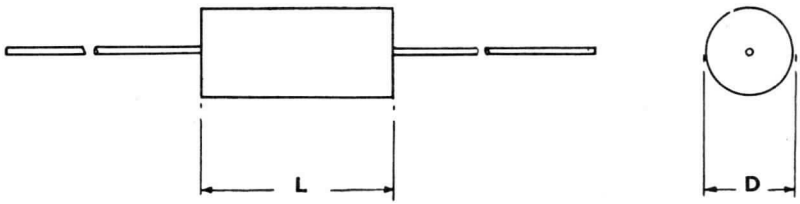
ELECTRICAL CHARACTERISTICS

	Limits (Reference temperature 20°C)
Capacitance tolerance	
Standard <1 μF	±20%
⩾1 μF	±10%
To special order <1 μF	±10% and ±5%
⩾1 μF	±5%
Working voltages up to 85°C (derate by 50% for 125°C)	
D.C.	100V, 160V, 250V, 400V and 630V
A.C. up to 120 Hz	
(*a*) communications equipment	40V, 65V, 120V and 150V
(*b*) industrial equipment	75V, 115V, 175V, 220V and 250V
Proof test voltage (applied for 1 min)	2 times working voltage
Surge voltage (max 2 min per hour)	1·5 times d.c. working voltage
Ambient temperature range	−55°C to +125°C
Insulance after 1 minute at 100V d.c.	>0·1 μF = 5 000 ΩF ⩽0·1 μF = 50 000 MΩ
Power factor at 1 000 Hz	<0·008
at 50 Hz	<0·0025
Temperature coefficient of capacitance	400 p.p.m/deg C between 20°C and 80°C
Stability of capacitance with time	Under normal operating conditions it is estimated that capacitance drift over a 10-year period will not exceed 1%.

(CA43 Range)

CONTINUED

DIMENSIONS AND RATINGS



Terminal Wires

Length 32 mm (1·25 in) minimum
Diameter 0,8 mm (0·032 in) nominal

N.B.—Manufacturing dimensions are metric.

Rated Working Voltage		Capacitance	Tolerance	MAXIMUM DIMENSIONS		STC CODE
D.C. at 85°C	D.C. at 125°C	μF	%	L mm in	D mm in	
100	50	0·1	±20	18 0·71	6,5 0·26	CA43 001 BGA
		0·15		18 0·71	7,0 0·28	,, 001 BHA
		0·22		18 0·71	8,0 0·32	,, 001 BJA
		0·33		18 0·71	8,5 0·34	,, 001 BKA
		0·47		18 0·71	10,0 0·39	,, 001 BLA
		0·68		23 0·91	9,0 0·35	,, 001 BMA
		1·0	±10	23 0·91	10,5 0·41	CA43 001 BNB
		1·5		23 0·91	13,5 0·53	,, 001 BPB
		2·2		23 0·91	15,5 0·61	,, 001 BQB
		3·3		33 1·30	14,5 0·57	,, 001 BRB
		4·7		33 1·30	16,5 0·65	,, 001 BSB
		6·8		33 1·30	19,0 0·77	,, 001 BTB
		10·0		33 1·30	22,5 0·89	,, 001 BVB
160	80	0·1	±20	18 0·71	9 0·35	CA43 001 CGA
		0·15		18 0·71	10 0·39	,, 001 CHA
		0·22		18 0·71	11 0·43	,, 001 CJA
		0·33		23 0·91	10 0·39	,, 001 CKA
		0·47		23 0·91	12 0·47	,, 001 CLA
		0·68		23 0·91	16 0·63	,, 001 CMA
		1·0	±10	23 0·91	17 0·67	CA43 001 CNB
		1·5		33 1·30	16 0·63	,, 001 CPB
		2·2		33 1·30	19 0·75	,, 001 CQB
		3·3		33 1·30	22 0·87	,, 001 CRB
		4·7		46 1·81	21 0·83	,, 001 CSB
		6·8		46 1·81	25 0·98	,, 001 CTB
		10·0		46 1·81	29 1·14	,, 001 CVB

STC

(CA43 Range)

CONTINUED

Rated Working Voltage		Capacitance	Tolerance	MAXIMUM DIMENSIONS				STC CODE
				L		D		
D.C. at 85°C	D.C. at 125°C	μF	%	mm	in	mm	in	
250	125	0·1	±20	29	1·14	8	0·32	CA43 001 EGA
		0·15		29	1·14	10	0·39	,, 001 EHA
		0·22		29	1·14	11	0·43	,, 001 EJA
		0·33		29	1·14	14	0·55	,, 001 EKA
		0·47		29	1·14	16	0·63	,, 001 ELA
		0·68		29	1·14	17	0·67	,, 001 EMA
		1·0	±10	39	1·54	18	0·71	CA43 001 ENB
		1·5		39	1·54	20	0·79	,, 001 EPB
		2·2		39	1·54	22	0·87	,, 001 EQB
		3·3		46	1·81	25	0·98	,, 001 ERB
		4·7		46	1·81	29	1·14	,, 001 ESB
		6·8		46	1·81	32	1·26	,, 001 ETB
		10·0		46	1·81	37	1·46	,, 001 EVB
400	200	0·033	±20	18	0·71	8,5	0·34	CA43 001 HDA
		0·047		18	0·71	9,5	0·37	,, 001 HEA
		0·068		18	0·71	10,5	0·41	,, 001 HFA
		0·1		23	0·91	10	0·39	,, 001 HGA
		0·15		23	0·91	12	0·47	,, 001 HHA
		0·22		23	0·91	15	0·59	,, 001 HJA
		0·33		23	0·91	17,5	0·69	,, 001 HKA
		0·47		33	1·30	16	0·63	,, 001 HLA
		0·68		33	1·30	18,5	0·73	,, 001 HMA
		1·0	±10	33	1·30	21,5	0·85	CA43 001 HNB
		1·5		46	1·81	21	0·83	,, 001 HPB
		2·2		46	1·81	25	0·98	,, 001 HQB
		3·3		46	1·81	29	1·14	,, 001 HRB
630	315	0·033	±20	23	0·91	10	0·39	CA43 001 LDA
		0·047		23	0·91	11	0·43	,, 001 LEA
		0·068		23	0·91	14	0·55	,, 001 LFA
		0·1		33	1·30	13	0·51	,, 001 LGA
		0·15		33	1·30	15	0·59	,, 001 LHA
		0·22		33	1·30	17	0·67	,, 001 LJA
		0·33		33	1·30	20,5	0·81	,, 001 LKA
		0·47		46	1·81	20	0·79	,, 001 LLA
		0·68		46	1·81	23	0·91	,, 001 LMA
		1·0	±10	46	1·81	27	1·06	CA43 001 LNB

The final letter in each of the above codes is for the standard capacitance tolerance which is the widest available.
Capacitors with closer tolerances are indicated by altering the final letter as follows:

B for ±10% e.g. CA43 001 CGB = 0·1 μF ±10% at 160V

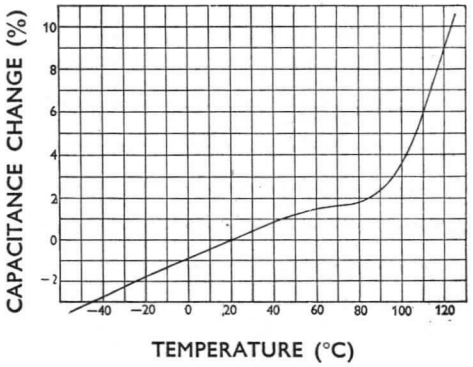
C for ± 5% e.g. CA43 001 CGC = 0·1 μF ± 5% at 160V

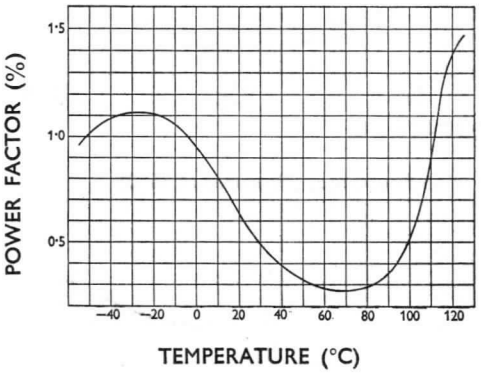
(CA43 Range)

CONTINUED

TYPICAL PERFORMANCE

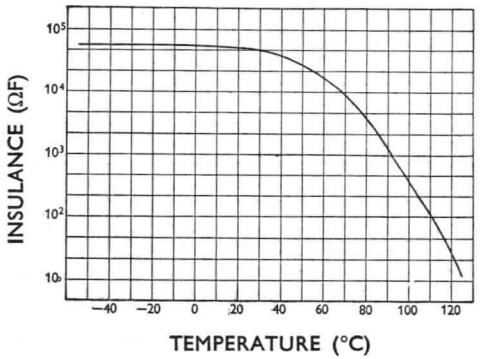
Capacitance change with Temperature
(Referred to 20°C)





Variation of Power Factor with Temperature
(Measured at 1 000 Hz)

Variation of Insulance with Temperature
(Measured at 100V)

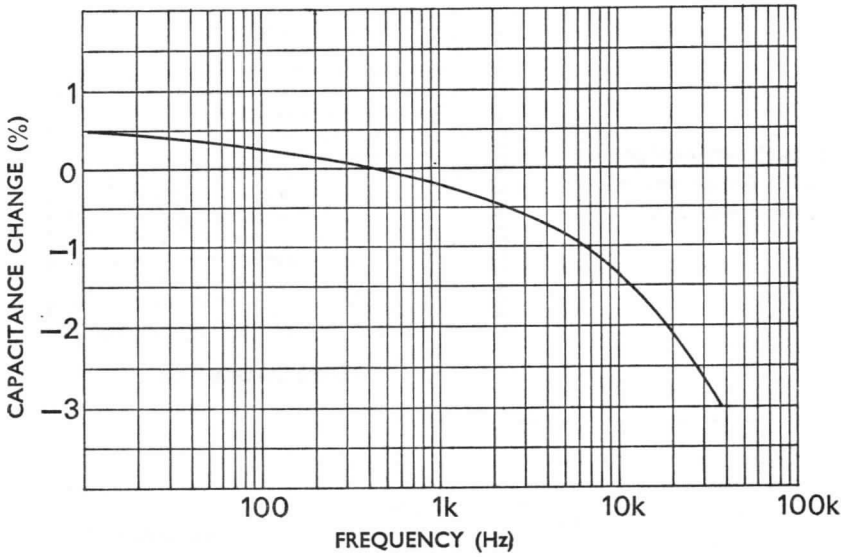


(CA43 Range)

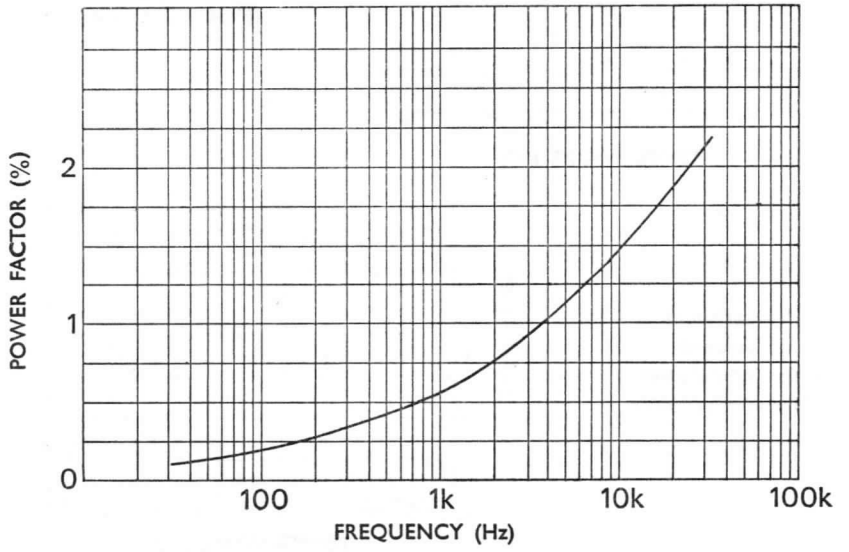
CONTINUED

TYPICAL PERFORMANCE—*continued*

Variation of Capacitance with Frequency (Measured at 25°C)

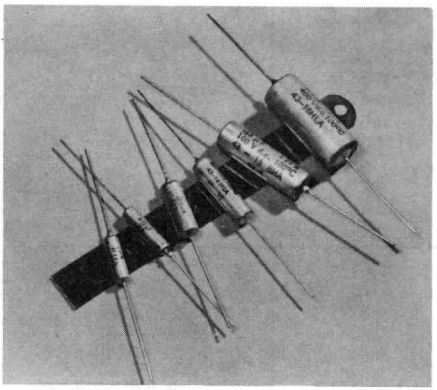


Variation of Power Factor with Frequency (Measured at 25°C)



Metal Cased Metallised Polycarbonate Capacitors

Codes: 43–11 to 43–16



BRIEF DATA

Capacitance range	Working Voltage
0·10μF to 4·7μF	63V d.c. (40V a.c.)
0·01μF to 2·2μF	100V d.c. (63V a.c.)
0·01μF to 1·0μF	250V d.c. (160V a.c.)
0·01μF to 0·47μF	400V d.c. (250V a.c.)

A range of tubular, hermetically sealed, metallised polycarbonate capacitors for professional grade applications.

Polycarbonate is a thermoplastic polyester of high tensile strength which, by using special techniques, can be processed and wound in films down to 2 micron thickness. The dielectric constant of polycarbonate is 2·8 and its electrical and physical characteristics remain excellent over a wide temperature range.

FEATURES

High insulation resistance which is stable over a wide temperature range and with time.

Low temperature coefficient of capacitance.

Low and stable loss angle.

Small size. An hermetically sealed capacitor, which for a given rating, is smaller than any comparable unit.

USE IN RADIO INTERFERENCE SUPPRESSION

The 250V d.c. range is suitable for general 115V a.c. 400 Hz aircraft applications. For radio interference suppression purposes where derating in accordance with CP 1012 is obligatory to 400V d.c. range should be specified for use across 115V a.c. 400 Hz supply lines.

ITT Components Group Europe
Standard Telephones and Cables Limited

Capacitor Product Division, Brixham Road, Paignton, Devon
Telephone: Paignton 50762 (STD Code 0803) Telex: 42951

ITT
COMPONENTS

CAPACITANCE RANGE

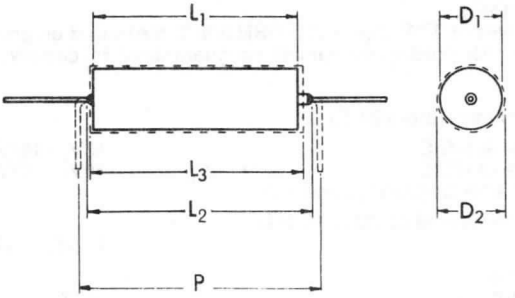
CODE	WORKING VOLTAGE AT 100°C d.c.	a.c.	CAPACITANCE (μF)	NATO STOCK NUMBER
43–11–AGA	63	40	0·10	
43–12–AHA			0·15	
43–12–AJA			0·22	
43–13–AKA			0·33	
43–13–ALA			0·47	
43–14–AMA			0·68	
43–14–ANA			1·0	
43–15–APA			1·5	
43–15–AQA			2·2	
43–16–ARA			3·3	
43–16–ASA			4·7	
43–11–BAA	100	63	0·01	
43–11–BBA			0·015	
43–11–BCA			0·022	
43–11–BDA			0·033	
43–11–BEA			0·047	5910–99–519–6816
43–12–BFA			0·068	
43–12–BGA			0·10	5910–99–956–1086
43–13–BHA			0·15	
43–13–BJA			0·22	5910–99–519–6814
43–14–BKA			0·33	5910–99–519–6637
43–14–BLA			0·47	5910–99–519–6638
43–15–BMA			0·68	
43–15–BNA			1·0	5910–99–519–6815
43–16–BPA			1·5	
43–16–BQA			2·2	5910–99–519–6821
43–11–EAA	250	160	0·01	
43–11–EBA			0·015	
43–11–ECA			0·022	
43–12–EDA			0·033	
43–12–EEA			0·047	
43–13–EFA			0·068	
43–13–EGA			0·10	
43–14–EHA			0·15	
43–14–EJA			0·22	
43–15–EKA			0·33	
43–15–ELA			0·47	
43–16–EMA			0·68	
43–16–ENA			1·0	
43–11–HAA	400	250	0·01	
43–12–HBA			0·015	
43–12–HCA			0·022	
43–13–HDA			0·033	
43–13–HEA			0·047	
43–14–HFA			0·068	
43–14–HGA			0·10	
43–15–HHA			0·15	
43–15–HJA			0·22	
43–16–HKA			0·33	
43–16–HLA			0·47	

The final letter in each of the above codes is for the standard capacitance tolerance of ±20% which is the widest available. Capacitors with closer tolerances are indicated by altering the final letter as follows:

B for ±10%, e.g. 43–11–BEB 0·047μF ±10% at 100V

C for ± 5%, e.g. 42–11–BEC 0·047μF ± 5% at 100V

DIMENSIONS



L_1 – Case length
L_2 – Overall length
L_3 – Sleeve length
P – Pitch for printed circuit mounting
D_1 – Case diameter
D_2 – Diameter over sleeve

The sleeve projects a minimum of 1,3mm (0·05in) over each end of the case.

CASE SIZE	MAXIMUM DIMENSIONS									
	L_1		L_2		L_3		D_1		D_2	
	mm	in	mm	in	mm	in	mm	in	mm	in
43–11	15,5	0·61	20,3	0·80	20,3	0·80	4,6	0·18	5,1	0·20
43–12	18,0	0·71	22,9	0·90	22,9	0·90	4,6	0·18	5,1	0·20
43–13	18,0	0·71	22,9	0·90	22,9	0·90	6,6	0·26	7,1	0·28
43–14	23,9	0·94	30,5	1·20	30,5	1·20	6,6	0·26	7,1	0·28
43–15	30,5	1·20	35,6	1·40	35,6	1·40	9,7	0·38	10,7	0·42
43–16	30,5	1·20	35,6	1·40	35,6	1·40	13,2	0·52	14,2	0·56

TERMINAL WIRES

Diameter types 11 to 14	0,7mm (0·028in) nominal
types 15 and 16	0,9mm (0·036in) nominal
Tolerance	+10% – 0,05mm (0·002in)
Length	32mm (1·25in) minimum

PRINTED CIRCUIT MOUNTING

For printed circuit board mounting, the terminal centres should not be less than dimension P above.

$$P = L_2 + 3{,}5\text{mm } (0{\cdot}14\text{in})$$

N.B. Manufacturing dimensions are inches.

CAPACITOR PERFORMANCE

The data below including Figs. 1, 2, 3 and 4 are design limits within which the capacitors will perform satisfactorily.

Figs. 5 to 9 are curves of TYPICAL PERFORMANCE measured on production capacitors selected at random. All production cannot be guaranteed to comply exactly with these curves.

LIMITS (Reference temperature 20°C)

D.C. working voltage at 100°C	63V, 100V, 250V, 400V
A.C. working voltage at 100°C (see Figs. 1, 2, 3 and 4 for frequency derating)	40V, 63V, 160V, 250V
Capacitance range (measured at 800 to 1000Hz) 0·01μF to	4·7μF, 2·2μF, 1·0μF, 0·47μF
Capacitance tolerance	
Standard	±20%
Special order	±10% and ±5%
Proof test voltage (applied for 1 minute)	1·6 times working voltage
Surge voltage (max. 1 min/hour)	1·5 times working voltage
Pulse rise time (i.e. max. rate of change of volts)	$\leqslant$10V/μs
Minimum insulation resistance at working voltage	10000ΩF or 25000MΩ whichever is the less
Power factor (tan δ) at 1000Hz	0·003 max.
Temperature coefficient of capacitance	
−55°C to +100°C	+130 p.p.m/°C
−50°C to +25°C	+150 to +200 p.p.m/°C
+20°C to +100°C	+50 to +100 p.p.m/°C

These capacitors meet the following test requirements in accordance with DEF 5011.

Temperature	T4	(−55°C to +100°C)
Humidity*	H6	(6 cycles accelerated and 56 days L.T.D.H.)
Vibration	V3	(5 to 5000 Hz)
Acceleration	A3	(100g)
Shock	S3	(100g duration 6ms)
Low air density	D3	(0·003: mean altitude 130000ft)

*This is equivalent to:
B.S. 2401 (1966) grade 55/100/56
IEC 68 class 444

SOLDERABILITY

The terminal wires of these capacitors comply with the requirements of B.S. 2011 part 2T (1966).

LIMITS – continued

Fig. 1.—Maximum rms Working Voltage as a Function of Frequency—63V d.c. Range

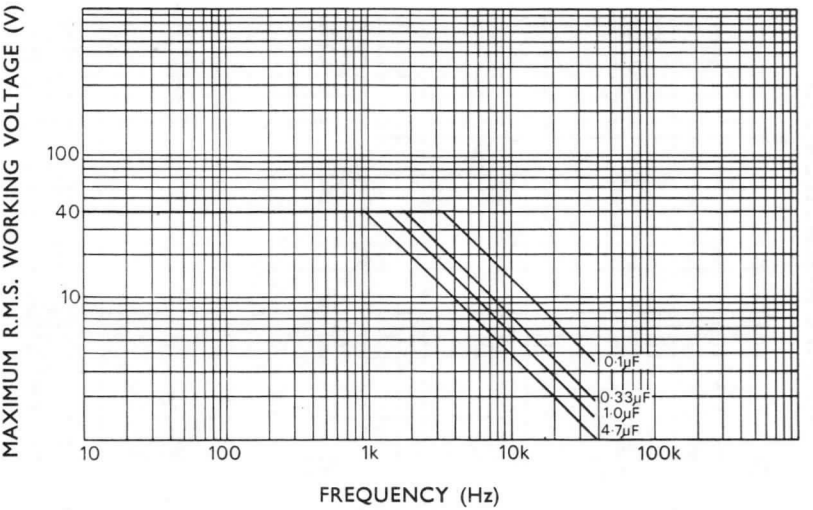
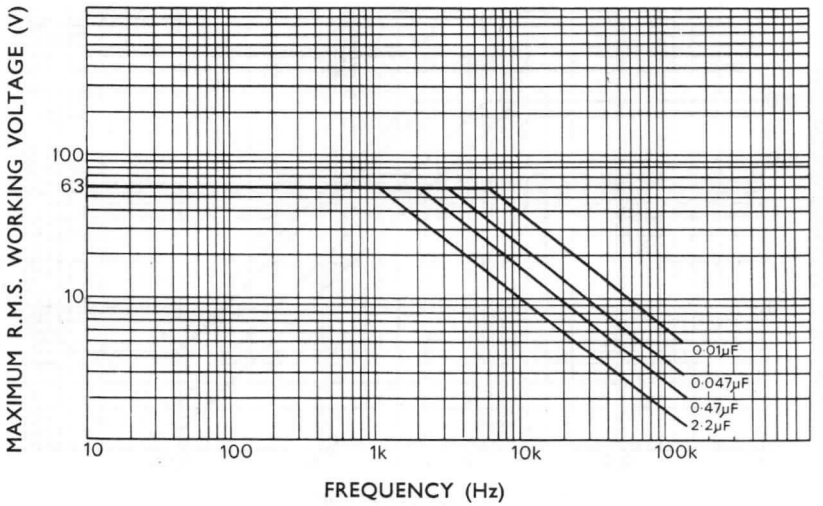


Fig. 2.—Maximum rms Working Voltage as a Function of Frequency—100V d.c. Range



LIMITS – continued

Fig. 3.—Maximum rms Working Voltage as a Function of Frequency—250V d.c. Range

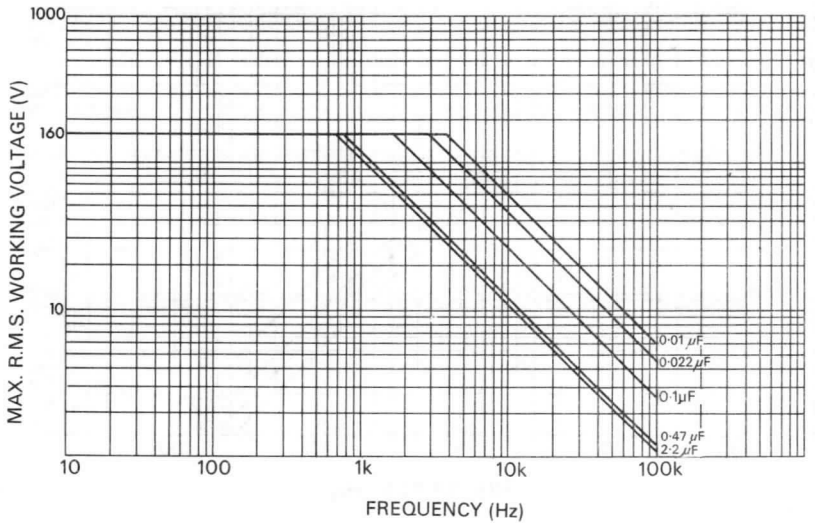
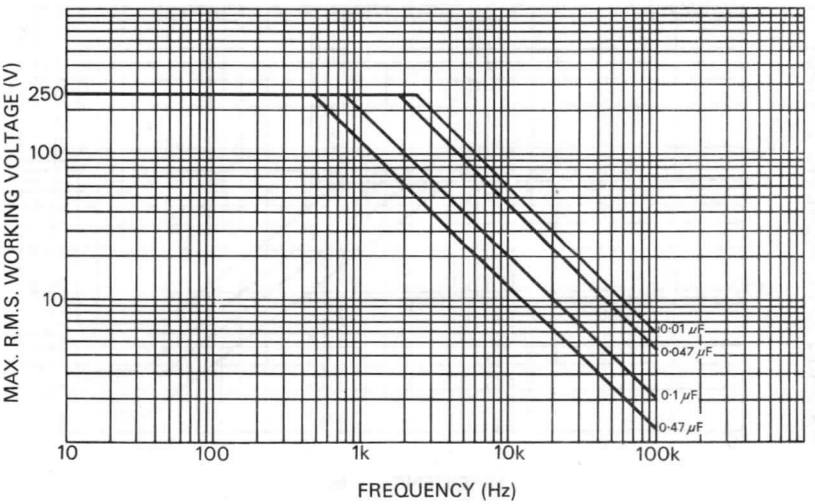


Fig. 4.—Maximum rms Working Voltage as a Function of Frequency—400V d.c. Range



GRAPHS OF TYPICAL PERFORMANCE

Fig. 5.—Variation of Capacitance with Frequency (measured at 20°C)

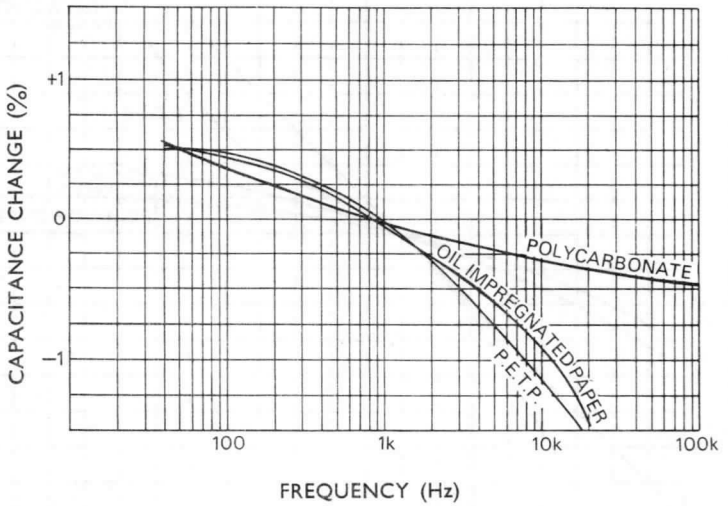
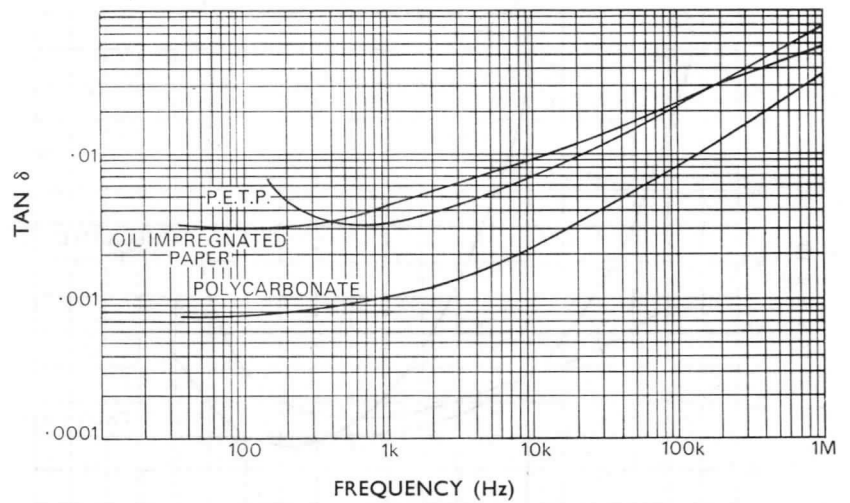


Fig. 6.—Variation of Tan δ with Frequency (measured at 20°C)



TYPICAL PERFORMANCE – continued

Fig. 7.—Variation of Capacitance with Temperature (referred to 20°C measured at 1000 Hz)

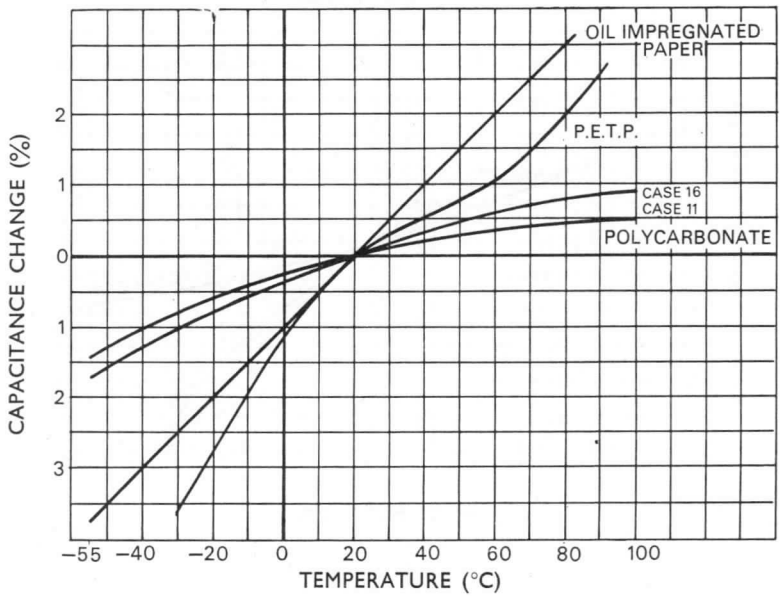
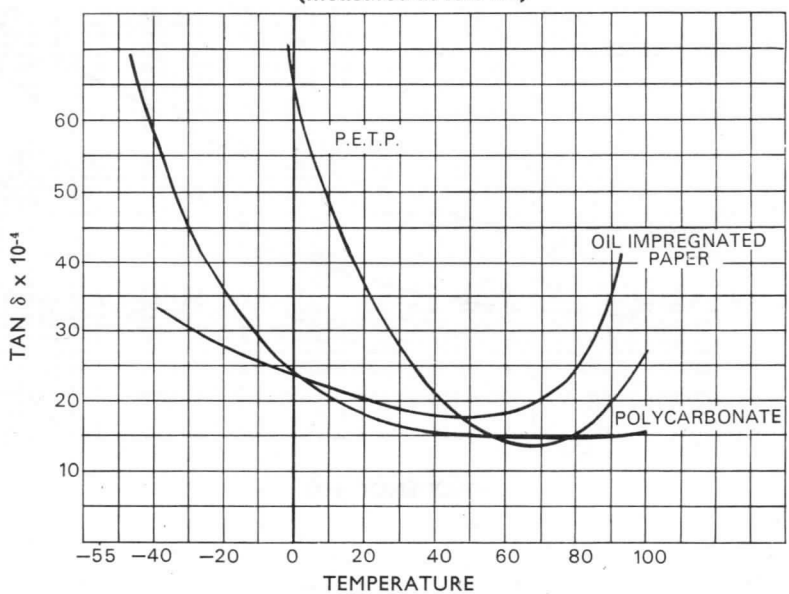
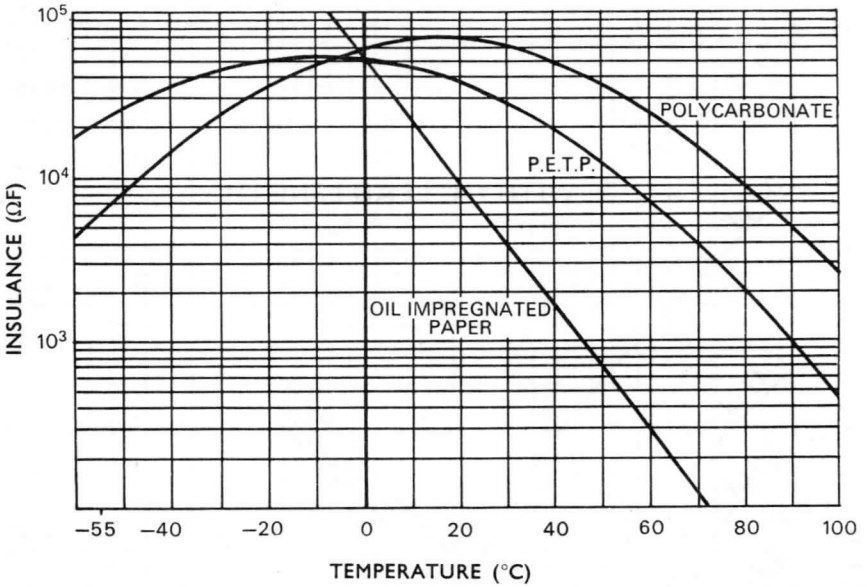


Fig. 8.—Variation of Tan δ with Temperature (measured at 1000 Hz)



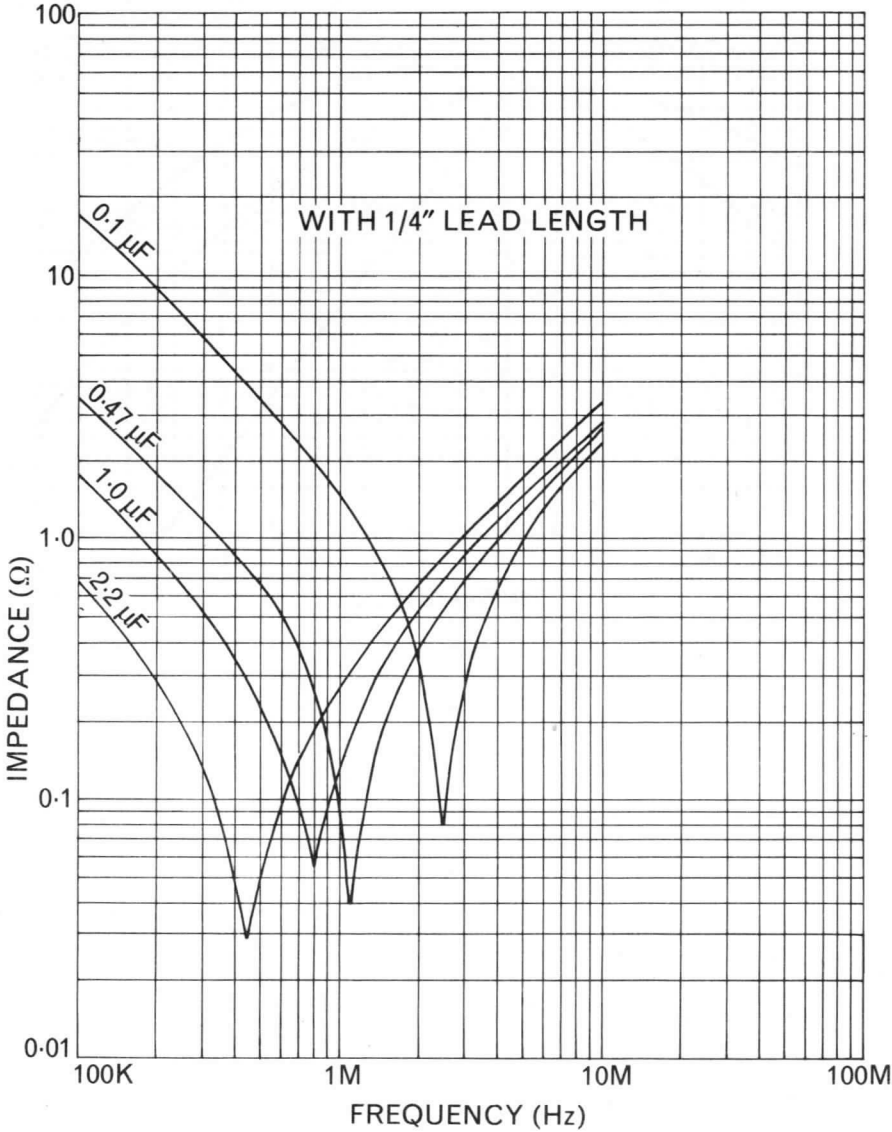
TYPICAL PERFORMANCE – continued

Fig. 9.—Variation of Insulation Resistance with Temperature



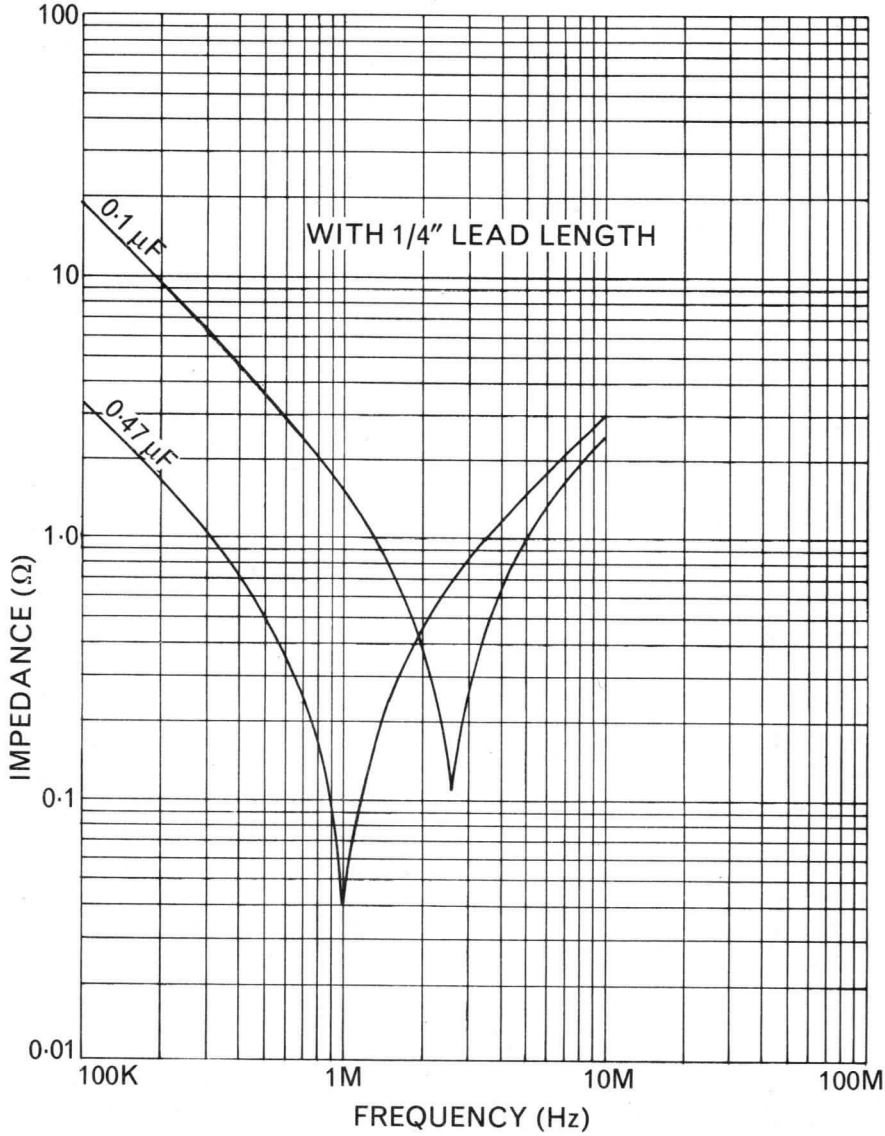
TYPICAL PERFORMANCE – continued

Fig. 10.—Variation of Impedance with Frequency (63V d.c. Capacitors)



TYPICAL PERFORMANCE – continued

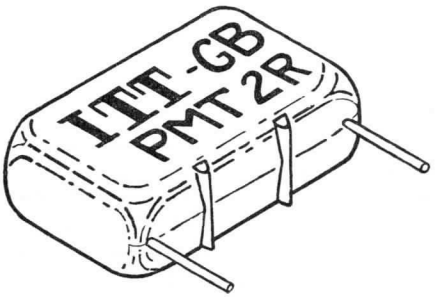
Fig. 11.—Variation of Impedance with Frequency (400V dc. Capacitors)



MOULDED METALLISED PLASTIC FILM CAPACITORS

CODES: PMC and PMT

(Previously Coded PMA, PMF and PMP)



BRIEF DATA

Capacitor ranges 0,068μF to 4,7μF 100V d.c.
0,033μF to 2,2μF 250V d.c.
0,01μF to 1,0μF 400V d.c.

Capacitance tolerances
PMT ±20% ±10% ±5%
PMC ±20% ±10% ±5% ±2%

Rated Temperature range −40°C to +100°C

Climatic category
PMC1R 40/100/4 (H3)
PMC2R, PMT2R 40/100/21 (H5)

This data sheet replaces data sheets Poly 6, 7 and 8 covering the PMA, PMF and PMP ranges.

The capacitors have been recoded and uprated as follows.

PMA	Polycarbonate	Superseded by	PMC1R
PMF	Polycarbonate	Superseded by	PMC2R
PMP	Polyester	Superseded by	PMT2R

Capacitors in these recoded ranges provide the equipment designer with an accepted Europe wide standard range of low cost, high performance metallised plastic film capacitors housed in rugged mouldings. The encapsulation is stable, uniform, non-flammable, thermosetting resin and is moulded with footed projections to give stability when mounting on printed circuit boards. The lead wires are solder coated copper wire for ease of soldering even after long storage periods.

These capacitors are produced in a highly mechanised factory with advanced Quality Control techniques applied from the base materials through to the finished product, to ensure a consistently reliable product standard.

POLYESTER DIELECTRIC TYPES

The PMT2R range has 21 day humidity classification (BS 9000) and is approved by the Post Office for CD 2247 styles 8025, 8026 and 8027 A and B, with additional special approved codes 8019A, 8021A and 8022A.

POLYCARBONATE DIELECTRIC TYPES

The PMC2R range also has a 21 day humidity rating and has Post Office approval for CD 2247 styles 8025 A, B and C, 8026 A, B and C, and 8027 A, B and C. This range also has approval by SRDE (certificate No. NS 3163).

The standard capacitance tolerance is ±20% with ±10% and ±5% available on all types. Tolerances of ±2% are available on the PMC range only, either as a fully stabilised unit or as a selection at final test without stabilisation. All tolerance grades of a code are supplied in the same basic case size.

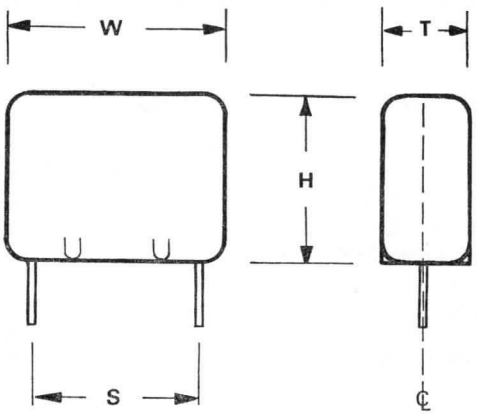
SEPT. 1971

ITT COMPONENTS GROUP EUROPE
Standard Telephones and Cables Limited
Capacitor Product Division
Brixham Road, Paignton, Devon.

Telephone: Paignton 50762
(STD Code 0803) Telex: 42951

ITT
COMPONENTS

	Dimensions are in mm. The inch equivalents are shown in parentheses											
Capacitance µF	100V d.c. WORKING W max.	H max.	T max.	S nom.	250V d.c. WORKING W max.	H max.	T max.	S nom.	400V d.c. WORKING W max.	H max.	T max.	S nom.
0,010									13,5 (0,53)	9,0 (0,35)	5,0 (0,20)	10,2 (0,40)
0,015									13,5 (0,53)	9,0 (0,35)	5,0 (0,20)	10,2 (0,40)
0,022									13,5 (0,53)	9,0 (0,35)	5,0 (0,20)	10,2 (0,40)
0,033					13,5 (0,53)	9,0 (0,35)	5,0 (0,20)	10,2 (0,40)	13,5 (0,53)	11,0 (0,43)	6,0 (0,24)	10,2 (0,40)
0,047					13,5 (0,53)	9,0 (0,35)	5,0 (0,20)	10,2 (0,40)	13,5 (0,53)	11,0 (0,43)	6,0 (0,24)	10,2 (0,40)
0,068	13,5 (0,53)	9,0 (0,35)	5,0 (0,20)	10,2 (0,40)	13,5 (0,53)	11,0 (0,43)	6,0 (0,24)	10,2 (0,40)	19,0 (0,75)	12,0 (0,47)	7,0 (0,28)	15,2 (0,60)
0,10	13,5 (0,53)	9,0 (0,35)	5,0 (0,20)	10,2 (0,40)	13,5 (0,53)	11,0 (0,43)	6,0 (0,24)	10,2 (0,40)	19,0 (0,75)	12,0 (0,47)	7,0 (0,28)	15,2 (0,60)
0,15	13,5 (0,53)	11,0 (0,43)	6,0 (0,24)	10,2 (0,40)	19,0 (0,75)	12,0 (0,47)	7,0 (0,28)	15,2 (0,60)	19,0 (0,75)	15,0 (0,59)	9,0 (0,35)	15,2 (0,60)
0,22	13,5 (0,53)	11,0 (0,43)	6,0 (0,24)	10,2 (0,40)	19,0 (0,75)	12,0 (0,47)	7,0 (0,28)	15,2 (0,60)	26,0 (1,02)	20,0 (0,79)	10,0 (0,39)	22,9 (0,90)
0,33	19,0 (0,75)	12,0 (0,47)	7,0 (0,28)	15,2 (0,60)	19,0 (0,75)	15,0 (0,59)	9,0 (0,35)	15,2 (0,60)	26,0 (1,02)	20,0 (0,79)	10,0 (0,39)	22,9 (0,90)
0,47	19,0 (0,75)	12,0 (0,47)	7,0 (0,28)	15,2 (0,60)	19,0 (0,75)	15,0 (0,59)	9,0 (0,35)	15,2 (0,60)	26,0 (1,02)	20,0 (0,79)	10,0 (0,39)	22,9 (0,90)
0,68	19,0 (0,75)	15,0 (0,59)	9,0 (0,35)	15,2 (0,60)	26,0 (1,02)	20,0 (0,79)	10,0 (0,39)	22,9 (0,90)	32,0 (1,26)	23,0 (0,91)	13,0 (0,51)	27,9 (1,10)
1,0	19,0 (0,75)	15,0 (0,59)	9,0 (0,35)	15,2 (0,60)	26,0 (1,02)	20,0 (0,79)	10,0 (0,39)	22,9 (0,90)	32,0 (1,26)	23,0 (0,91)	13,0 (0,51)	27,9 (1,10)
1,5	26,0 (1,02)	20,0 (0,79)	10,0 (0,39)	22,9 (0,90)	32,0 (1,26)	23,0 (0,91)	13,0 (0,51)	27,9 (1,10)				
2,2	26,0 (1,02)	20,0 (0,79)	10,0 (0,39)	22,9 (0,90)	32,0 (1,26)	23,0 (0,91)	13,0 (0,51)	27,9 (1,10)				
3,3	32,0 (1,26)	23,0 (0,91)	13,0 (0,51)	27,9 (1,10)								
4,7	32,0 (1,26)	23,0 (0,91)	13,0 (0,51)	27,9 (1,10)								



NOTE 1—The manufacturing dimensions are metric.

NOTE 2—The tolerance on the terminal wire spacing (S) is ±0,25mm (0,01in.)

NOTE 3—The terminal wire dimensions are standard to IEC 301 :—
Length 4mm (0,16in.) minimum.
Diameter 0,8mm (0,032in.) Tolerance +10% −0,05mm (0,002in.)

NOTE 4—The case has moulded feet for stability on printed circuit mounting.

ORDERING CODE

Example	PM	T	2	R	0,1	M	100

Plastic Metallised Film.
Dielectric. T—Polyethelyneterephthalate (P.E.T.P. film).
C—Polycarbonate film.
Humidity classification. 1.—4 day.
2.—21 day.
Terminals. R—Radial.
Capacitance value. μF.
Capacitance tolerance. M±20%, K±10%, J±5%,
G±2% Fully stabilised.*
Gu±2% Without stabilisation.*
* PMC range only.
Rated voltage (d.c.). 100V, 250V, 400V.

CAPACITOR MARKING

The code shown on the capacitor is moulded in the resin encapsulation. The series, capacitance and voltage are indicated. Standard ±20% tolerance capacitors carry no additional marking, the appropriate letter is overprinted on closer tolerance units. This additional marking may appear on either face of the capacitor.

All tolerance grades of a code are housed in the same basic case size.

RATINGS (including limiting conditions of use) and characteristics.

Reference Temperature 20 °C unless otherwise stated.

Capacitance range	0,01 μF to 4,7 μF	2,2 μF	1,0 μF
D.C. Working voltage at 100 °C	100V	250V	400V
A.C. Working voltage at 100 °C (f—50Hz, minimum source impedance=1k Ω)	63V	160V	200V

Capacitance tolerance

Standard	±20%
Special order	±10% and ±5%
PMC range only	±2% fully stabilised or selected at final test without stabilisation

Rated temperature range — 40 °C to +100 °C

	PMC1R	PMC2R	PMT2R
Climatic category	40/100/4	40/100/21	40/100/21
Power factor (tan δ) at 1 000Hz	0,005 max.	0,005 max.	0,01 max.
Minimum insulation resistance at working voltage	5 000 ΩF or 25 000M Ω whichever is less.	10 000 ΩF	5 000 ΩF

Vibration severity	5Hz to 5 000Hz 0,75mm or 98m/s²
Acceleration	981m/s²
Shock	Trapezoidal pulse 100g for 6ms 390m/s² (40g)
Low air density	200 N/m² (mean altitude 130 000ft)
Solderability	BS 2011 part 2T (1966)
Proof test-initial	2 x working voltage for 1 min.
subsequently	1,6 x working voltage for 2,5 s
Surge voltage (max. 1 min/hour)	1,5 times working voltage

Long term capacitance stability

d.c. at 1,5 x rated voltage < 2%

a.c. at rated voltage. (63, 160, or 200V r.m.s.).

Case size 1 & 2	< 25%
Case size 3 & 4	< 20%
Case size 5	< 15%
Case size 6	< 10%

RATINGS—Continued

Maximum rate of change of voltage. (Pulse rise time.).

RATED d.c. VOLTAGE	CASE SIZE			
	1 & 2	3 & 4	5	6
100	20V/μs	10V/μs	6V/μs	5V/μs
250	30V/μs	15V/μs	7V/μs	6V/μs
400	40V/μs	20V/μs	13V/μs	10V/μs

Typical capacitance change as a function of temperature. (ref. Fig. 5).

Polycarbonate.

Type PMC	−40 °C to +20 °C	−0 to +200 p.p.m./ °C
	+20 °C to +100 °C	−50 to +150 p.p.m./ °C

P.E.T.P.

Type PMT	−40 °C to +20 °C	+200 to +850 p.p.m./ °C
	+20 °C to +85 °C	−100 to +300 p.p.m./ °C
	+85 °C to +100 °C	−100 to +3 000 p.p.m./ °C

RIPPLE VOLTAGE RATING

Figs. 1, 2 and 3 give the maximum r.m.s. voltages which may be applied to the capacitors.

APPLICATION NOTES

The ITT range of metallised plastic capacitors have been designed for wide general application in electrical and electronic circuits and are therefore suitable for domestic, electronic or commercial service as well as for high grade professional use. They are employed by the communication and computer industries in instrumentation and control equipment as well as telephone systems and instruments. British Post Office approval is held for the series in both the Polycarbonate (PM-2R) and Polyester (PMT-2R) ranges.

ITT metallised plastic film capacitors have proven reliability both in the field and in-house testing. During tests of over 5 million component hours duration a catastrophic failure rate of less than 0,25% per 1 000 hours at maximum temperature and stress was confirmed. (60% confidence level). At 50 °C with 50% of rated voltage applied, a failure rate of 0,03 per million component hours can be expected.

The ITT series of metallised plastic film capacitors are suitable for any application requiring components with excellent characteristics, and good long term reliability.

Performance figures and data quoted in this document are typical and must be specifically confirmed in writing by Standard Telephones and Cables Limited, before they become applicable to any particular tender, order or contract.

RATINGS—Continued

Fig. 1 Maximum r.m.s. Working Voltage: 100V d.c. Capacitors.

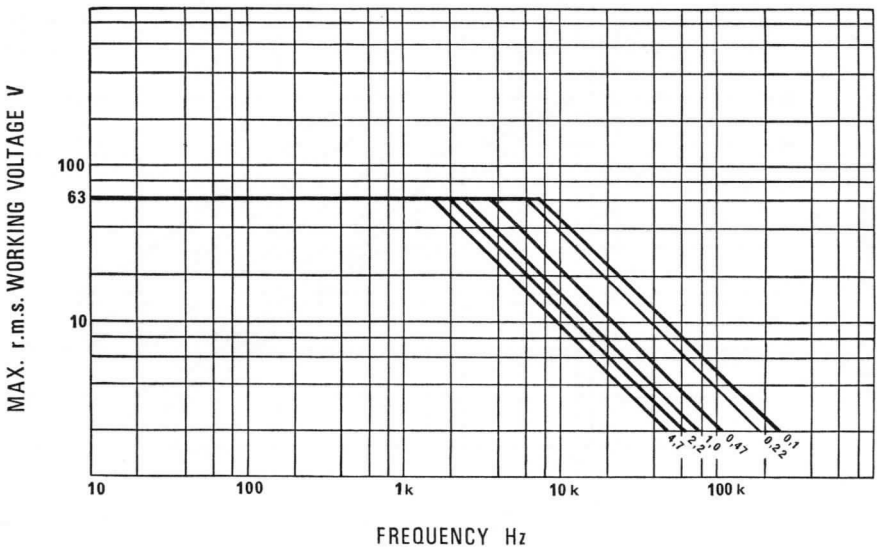
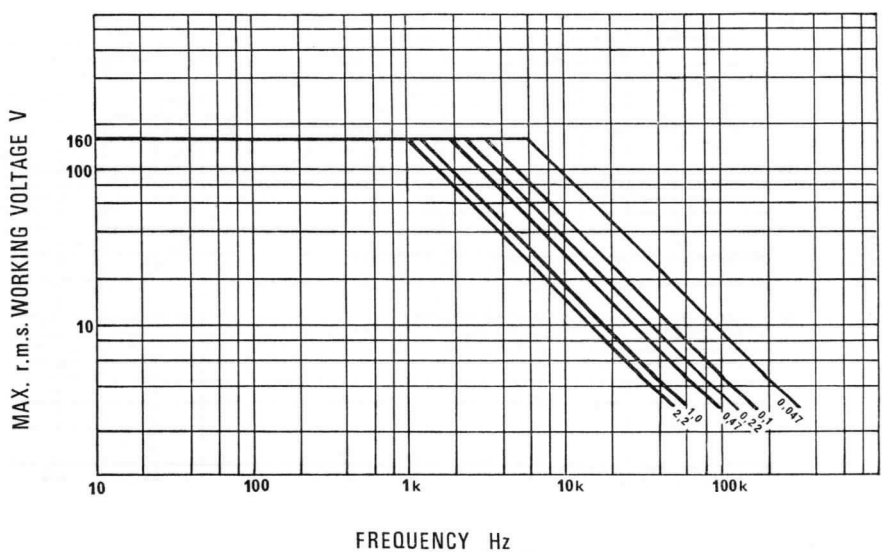
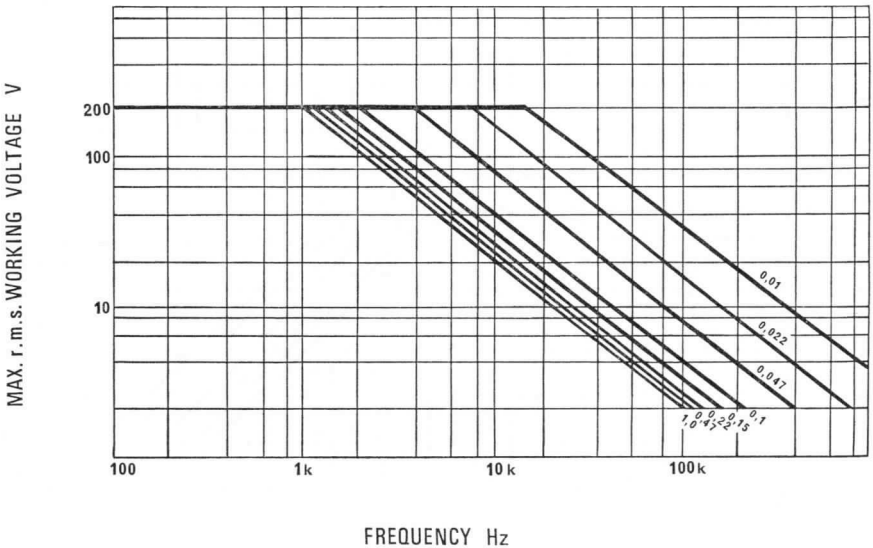


Fig. 2 Maximum r.m.s. Working Voltage: 250V d.c. Capacitors.



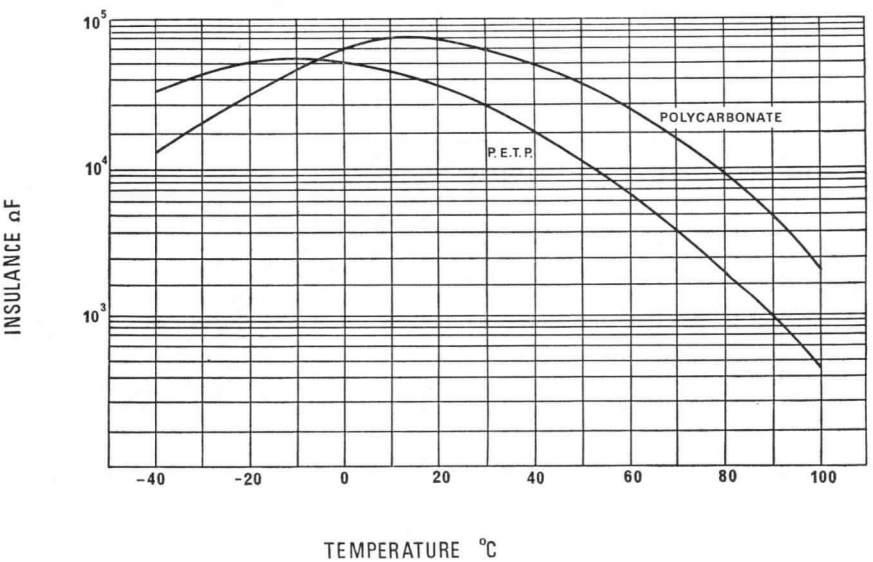
RATINGS—Continued

Fig. 3 Maximum r.m.s. Working Voltage: 400V d.c. Capacitors.



GRAPHS OF TYPICAL PERFORMANCE

Fig. 4 Variation of Insulance with Temperature.



TYPICAL PERFORMANCE—continued

Fig. 5 Variation of Capacitance with Temperature (referred to 20 °C).

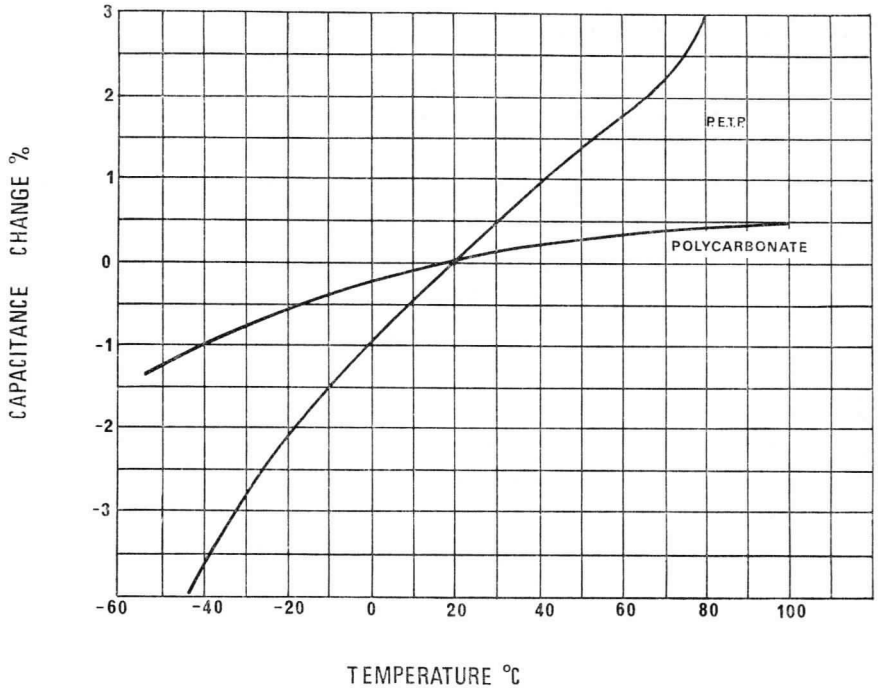
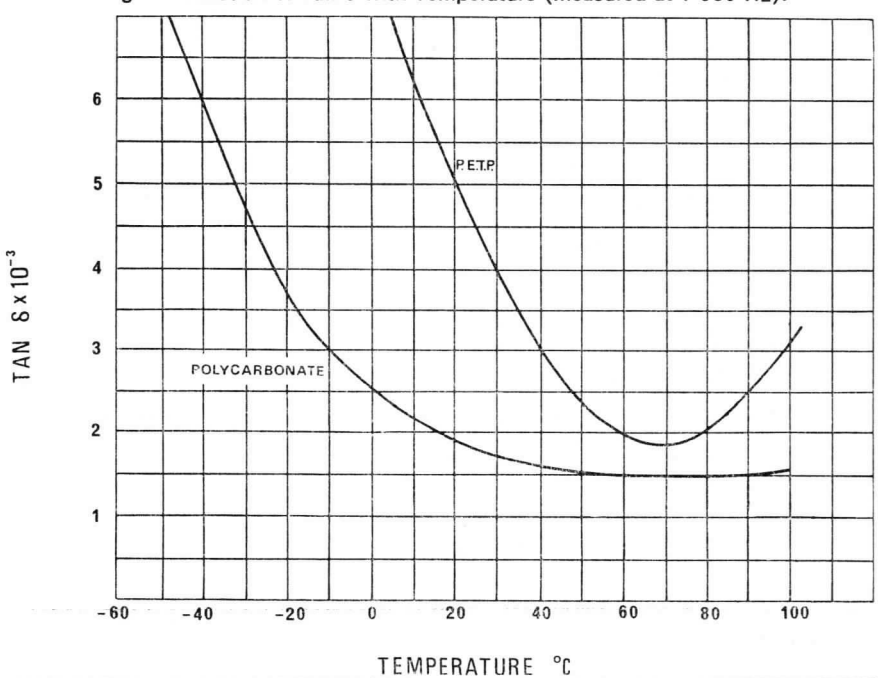


Fig. 6 Variation of Tan δ with Temperature (measured at 1 000 Hz).



TYPICAL PERFORMANCE—continued

Fig. 7 Variation of Capacitance with Frequency (measured at 20 °C).

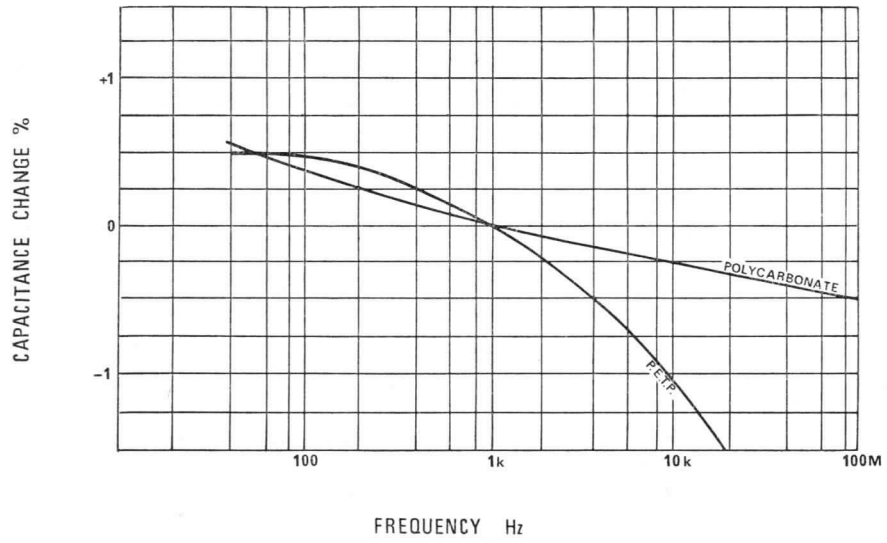


Fig. 8 Variation of Tan δ with Frequency (measured at 20 °C).

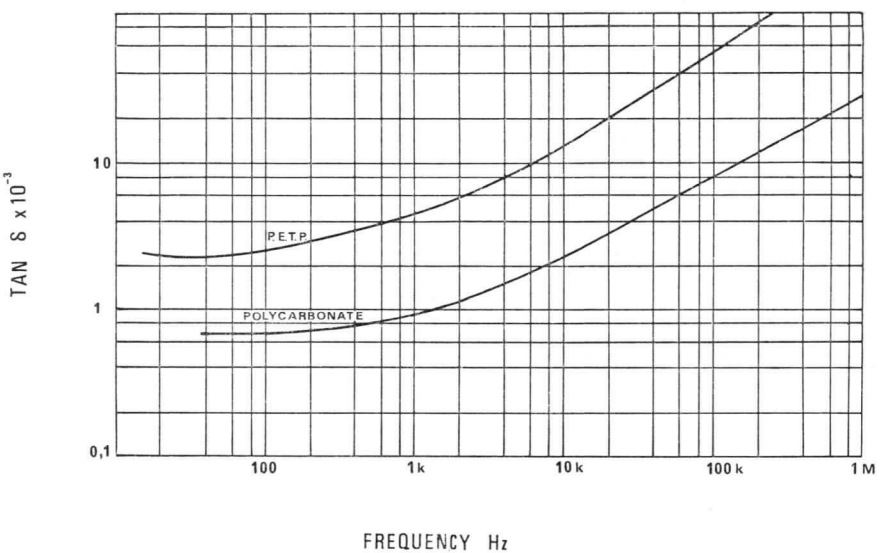
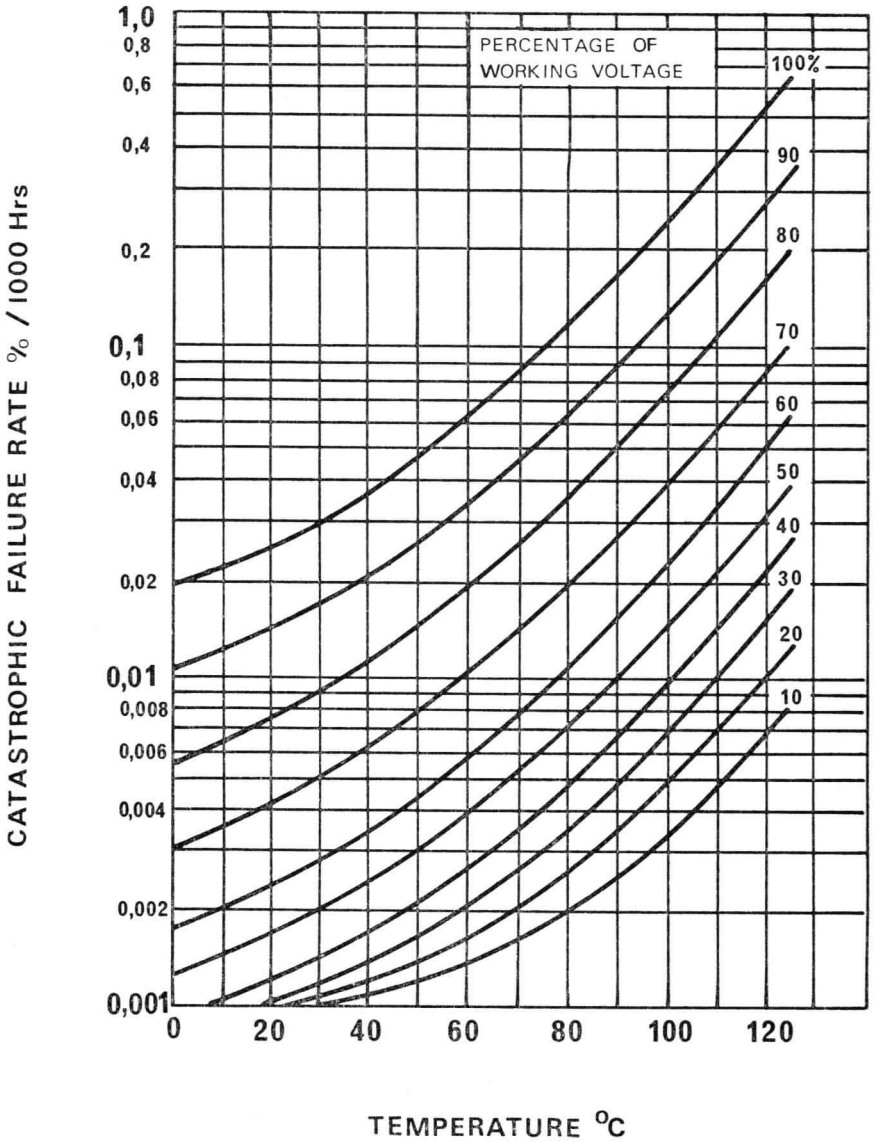


Fig. 9 Variation of Reliability with Temperature and stress ratio.



POWER

MAINTENANCE TYPE.

CAPACITORS

STC

POWER 1

PROVISIONAL DATA

Low Voltage Oil-Impregnated Unit Capacitor System for Power Factor Correction

INTRODUCTION

The Oil-Impregnated Unit Capacitor System offers a compact, simple and adaptable assembly of Power Factor Correction Capacitors based upon the use of three basic units. The units are rated at $1\frac{1}{2}$ to 9 kVAr at 415, 440 or 550 volts, 50 c/s, three or single phase, and may be assembled into complete capacitors rated from $10\frac{1}{2}$ to 108 kVAr. Tables of rating are given on page 3.

The banks are of such compact design that the plan area, together with very low weight, makes the assembly suitable for wall or stanchion mounting, with consequent saving of valuable floor space. Should plant conditions change, a multi-unit capacitor can easily be modified by simply adding or reducing the number of units.

BASIC UNITS

Each basic unit consists of an all welded, mild steel, hermetically sealed case* containing "flat" type elements, carbon discharge resistances, and filled with an impregnating compound comprising of refined hydro-carbon mineral oils and resin, blended to obtain optimum stability and viscosity.

The "flat" type elements are wound, with several layers of high quality capacitor tissue interleaved with pure aluminium foil electrodes, on modern precision winding machines. The elements, which are individually fused, are rigidly supported in mechanical clamps and electrically connected to the capacitor terminals.

The assembled unit is vacuum dried and impregnated with compound and the whole assembly packed into a suitable case which is filled with the same type of compound.

The basic units can be coupled together to form stacks and only four set screws per unit are required to fix the parts together. The P.V.C. wiring is concealed in the side channels and under the top cover. The terminal box can be fitted with either plain conduit entry or a cable sealing chamber.

Basic units without lid and feet can be supplied separately for assembly into customer's own control cubicles or racks.

Standard Telephones and Cables Limited

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COMPONENTS GROUP

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MAINTENANCE TYPE.

STC

PROVISIONAL DATA

POWER 1

Low Voltage Oil-Impregnated Unit Capacitor System for Power Factor Correction

BANKED ASSEMBLIES

These stacks can be built up into banks, the stacks being interconnected electrically by fully protected wires, and mechanically by means of mild steel spacing pieces. The completed banks are fitted with fixing feet, name plate and an earth stud. Contactors can be fitted to all sizes from 19½ upwards or can be supplied for separate wall or floor mounting.

Switchgear for the control of capacitors is supplied where specified. Due to the severe conditions which can be imposed on switchgear only equipment of adequate rating, sound construction and quality suitable for the control of capacitor installations is offered.

MAINTENANCE TYPE.

PROVISIONAL DATA

STC

POWER 1

Low Voltage Oil-Impregnated Unit Capacitor System for Power Factor Correction

NOMINAL kVAr RATINGS OF BASIC UNITS AND BANKED ASSEMBLIES (50 c/s SINGLE PHASE OR THREE PHASE DELTA CONNECTED)

SIZE REF.	200 Volts	210 Volts	220 Volts	230 Volts	240 Volts	250 Volts	380 Volts	400 Volts	415 Volts	420 Volts	440 Volts	500 Volts	550 Volts
¾	***0·21***	***0·23***	***0·25***	***0·28***	***0·31***	***0·33***	***0·63***	***0·70***	***0·75***	***0·77***	***0·75***	***0·62***	***0·75***
1½	0·43	0·47	0·51	0·56	0·61	0·67	1·26	1·40	1·50	1·54	1·50	1·24	1·50
2¼	***0·64***	***0·71***	***0·77***	***0·85***	***0·92***	***1·00***	***1·89***	***2·10***	***2·25***	***2·31***	***2·25***	***1·86***	***2·25***
3	0·85	0·94	1·03	1·13	1·23	1·33	2·52	2·80	3·00	3·08	3·00	2·48	3·00
3¾	***1·07***	***1·18***	***1·29***	***1·41***	***1·54***	***1·66***	***3·15***	***3·50***	***3·75***	***3·85***	***3·75***	***3·10***	***3·75***
4½	1·28	1·42	1·55	1·69	1·85	2·00	3·78	4·20	4·50	4·62	4·50	3·72	4·50
5¼	***1·50***	***1·65***	***1·80***	***1·97***	***2·15***	***2·33***	***4·41***	***4·90***	***5·25***	***5·39***	***5·25***	***4·34***	***5·25***
6	1·71	1·89	2·06	2·25	2·46	2·66	5·04	5·60	6·00	6·16	6·00	4·96	6·00
6¾	***1·92***	***2·12***	***2·32***	***2·54***	***2·77***	***3·00***	***5·67***	***6·30***	***6·75***	***6·93***	***6·75***	***5·58***	***6·75***
7½	2·14	2·36	2·58	2·82	3·08	3·33	6·30	7·00	7·50	7·70	7·50	6·20	7·50
8¼	***2·35***	***2·59***	***2·83***	***3·10***	***3·39***	***3·66***	***6·93***	***7·70***	***8·25***	***8·47***	***8·25***	***6·82***	***8·25***
9	2·57	2·83	3·10	3·38	3·69	4·00	7·56	8·40	9·00	9·24	9·00	7·44	9·00
10½	3·00	3·30	3·35	3·94	4·30	4·67	8·72	9·80	10·5	10·8	10·5	8·68	10·5
12	3·42	3·77	4·13	4·51	4·92	5·33	10·1	11·2	12·0	12·3	12·0	9·92	12·0
13½	3·85	4·25	4·65	5·07	5·54	6·00	11·3	12·6	13·5	13·8	13·5	11·2	13·5
15	4·28	4·72	5·16	5·63	6·15	6·66	12·6	14·0	15·0	15·4	15·0	12·4	15·0
16½	4·71	5·19	5·68	6·20	6·77	7·33	13·8	15·4	16·5	16·9	16·5	13·6	16·5
18	5·14	5·66	6·20	6·76	7·38	8·00	15·1	16·8	18·0	18·5	18·0	14·9	18·0
19½	5·57	6·13	6·71	7·32	7·99	8·67	16·4	18·2	19·5	20·0	19·5	16·1	19·5
21	5·99	6·60	7·23	7·89	8·61	9·33	17·6	19·6	21·0	21·6	21·0	17·4	21·0
22½	6·42	7·08	7·75	8·45	9·23	10·0	18·9	21·0	22·5	23·1	22·5	18·6	22·5
24	6·85	7·55	8·26	9·01	9·84	10·6	20·1	22·4	24·0	24·6	24·0	19·7	24·0
25½	7·28	8·02	8·78	9·58	10·4	11·3	21·4	23·8	25·5	26·3	25·5	21·1	25·5
27	7·71	8·49	9·30	10·1	11·0	12·0	22·7	25·2	27·0	27·7	27·0	22·3	27·0
30	8·56	9·44	10·3	11·2	12·3	13·3	25·2	28·0	30·0	30·8	30·0	24·8	30·0
33	9·42	10·4	11·3	12·4	13·5	14·6	27·6	30·8	33·0	33·8	33·0	27·2	33·0
36	10·3	11·3	12·4	13·5	14·7	16·0	30·2	33·6	36·0	37·0	36·0	29·8	36·0
39	11·1	12·2	13·4	14·6	15·9	17·3	32·8	36·4	39·0	40·0	39·0	32·2	39·0
42	11·9	13·2	14·4	15·8	17·2	18·6	35·2	39·2	42·0	43·4	42·0	34·8	42·0
45	12·8	14·1	15·5	16·9	18·4	20·0	37·8	42·0	45·0	46·2	45·0	37·2	45·0
48	13·7	15·1	16·5	18·0	19·7	21·3	40·2	44·8	48·0	49·2	48·0	39·4	48·0
51	14·5	16·0	17·5	19·1	20·9	22·6	42·8	47·6	51·0	52·6	51·0	42·2	51·0
54	15·4	16·9	18·6	20·3	22·1	24·0	45·4	50·4	54·0	55·4	54·0	44·6	54·0
58½	16·7	18·4	20·1	21·9	23·9	26·0	49·2	54·6	58·5	60·0	58·5	48·3	58·5
63	17·9	19·8	21·7	23·7	25·8	27·9	52·8	58·8	63·0	64·8	63·0	52·2	63·0
67½	19·2	21·2	23·2	25·3	27·7	30·0	56·7	63·0	67·5	69·3	67·5	55·8	67·5
72	20·2	22·6	24·8	27·0	29·5	31·9	60·3	67·2	72·0	73·8	72·0	59·1	72·0
76½	21·8	24·0	26·3	28·7	31·4	33·9	64·2	71·4	76·5	78·9	76·5	63·3	76·5
81	23·1	25·5	27·9	30·4	33·2	36·0	68·0	75·6	81·0	83·2	81·0	66·9	81·0
84	23·9	26·4	28·9	31·5	34·4	37·3	70·4	78·4	84·0	86·4	84·0	69·6	84·0
90	25·7	28·3	31·0	33·8	36·9	40·0	75·6	84·0	90·0	92·9	90·0	74·4	90·0
96	27·4	30·2	33·0	36·0	39·3	42·6	80·4	89·6	96·0	98·4	96·0	78·8	96·0
102	29·1	32·1	35·1	38·3	41·8	45·3	85·6	95·2	102	105	102	84·4	102
108	30·8	33·9	37·2	40·5	44·3	48·0	90·7	100	108	110	108	89·3	108

Sizes shown in bold italics are used for individual correction of equipment and are **not** normally used in banked assemblies.

Further Sizes: Sizes not shown in the above table can be supplied to suit specific requirements.

CAPACITORS

STC

POWER 2

PROVISIONAL DATA

Oil Impregnated

Codes 335-LWA-160 to 169

INTRODUCTION

This range of capacitors, designed in line with British Standard 1650, is primarily intended for the individual correction of small size motors and recommended capacitor ratings for various motors are given in page 5. Their compact design permits the capacitors to be unobtrusively mounted in restricted areas adjacent to the motor or control Switchgear. They are suitable for a number of other applications such as motor start/run, use with welding sets, etc.

The range is housed in five case sizes which have common base dimension and vary only in height to accommodate the various ratings.

CONSTRUCTION

The elements are wound with high grade capacitor tissue and aluminium foil and are rigidly supported in clamps to maintain capacitance stability. They are vacuum dried and impregnated in a high stability mineral oil.

The rolled seam rectangular case is made from tinned iron sheets and all seams are fully soldered. Electrical connection is made through silvered ceramic seals, which are soldered to the case. This gives hermetic sealing and there are no gaskets to leak or deteriorate. These units do not require maintenance or attention throughout their life. Connection to the equipment is made to a moulded bakelite terminal block, shrouded by a metal cover having a rubber grommeted cable entry.

For safety and protection, discharge resistors are connected inside the terminal block cover, which are capable of discharging the capacitor from peak alternating voltage to a voltage not exceeding 50 volts measured at the terminal of the capacitor, within one minute of disconnection from the supply.

All capacitor cases are fitted with integral mounting brackets.

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LONDON SALES OFFICE, FOOTSCRAY, SIDCUP, KENT Tel.: Footscray 3333 Telex: 21836

Codes 335–LWA–160 to 169

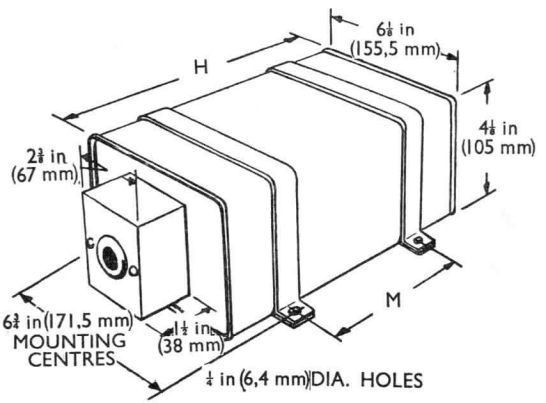
CONTINUED

SPECIFICATION

The capacitors are designed and tested in accordance with draft British Standard 1650 which gives the following temperature categories:

Temperature Category	Ambient Temperature			Maximum Permissible Container Temperature
	Peak	Mean over 24 hours	Mean over 1 year	
Temperate	40°C	30°C	20°C	55°C
Tropical	45°C	40°C	30°C	60°C
Super-tropical	50°C	45°C	35°C	60°C

DIMENSIONS



STC Code		Overall Dimensions				Approx. Weight	
Single Phase	Three Phase	H		M			
		in	mm	in	mm	lb	kg
335–LWA–160	335–LWA–165	3⅜	98	2⅜	60	5½	2,49
,, 161	,, 166	5¼	133	3	76	8	3,63
,, 162	,, 167	7¼	184	4	102	10	4,54
,, 163	,, 168	9¼	235	5	127	12	5,44
,, 164	,, 169	11¼	286	6½	165	14½	6,58

Codes 335–LWA–160 to 169

CONTINUED

RATINGS

Rated frequency 50 c/s

Capacity Tolerance — 0%
+10%

kVAr at Nominal Voltage	Single Phase Code	Single Phase Nominal Capacity (μF)	Three Phase Code	Three◆ Phase Nominal Capacity (μF)
	250 Volts—Nominal*			
0·5	335–LWA–160AB	25·5	—	—
0·75	,, 160AA	38·3	—	—
1·0	,, 161AB	51·0	—	—
1·25	,, 161AA	63·7	—	—
1·50	,, 162AB	76·4	—	—
1·75	,, 162AA	89·2	—	—
2·0	,, 163AC	102·0	—	—
2·25	,, 163AB	114·5	—	—
2·5	,, 163AA	127·4	—	—
2·75	,, 164AC	140·0	—	—
3·0	,, 164AB	152·8	—	—
3·25	,, 164AA	165·5	—	—
	385 Volts—Nominal*			
0·5	335–LWA–160BC	10·85	335–LWA–165BC	5·43
0·75	,, 160BB	16·1	,, 165BB	8·05
1·0	,, 160BA	21·7	,, 165BA	10·85
1·25	,, 161BC	26·85	,, 166BC	13·43
1·5	,, 161BB	32·2	,, 166BB	16·1
1·75	,, 161BA	37·6	,, 166BA	18·8
2·0	,, 162BC	42·9	,, 167BC	21·45
2·25	,, 162BB	48·4	,, 167BB	24·2
2·5	,, 162BA	53·7	,, 167BA	26·85
2·75	,, 163BC	59·1	,, 168BC	29·55
3·0	,, 163BB	64·4	,, 168BB	32·2
3·5	,, 163BA	75·2	,, 168BA	37·6
4·0	,, 164BB	85·9	,, 169BB	42·75
4·5	,, 164BA	96·6	,, 169BA	48·3

* Intermittent rated capacitors can be operated at a voltage 33 per cent above their rated value.

◆Three phase capacitors are delta connected, capacity measured between any two of three terminals.

NOTE: The standard range of capacitors in this table is designed for "Temperate" and "Tropical" temperature conditions only. For "Super-tropical" capacitors inquiries should be forwarded to the Capacitor Division.

Codes 335–LWA–160 to 169

CONTINUED

kVAr at Nominal Voltage	Single Phase Code	Single Phase Nominal Capacity (μF)	Three Phase Code	Three♦ Phase Nominal Capacity (μF)
		415 Volts—Nominal*		
0·5	335–LWA–160CD	9·25	335–LWA–165CD	4·63
0·75	,, 160CC	13·85	,, 165CC	6·93
1·0	,, 160CB	18·5	,, 165CB	9·25
1·25	,, 160CA	23·1	,, 166CD	11·55
1·5	,, 161CC	27·7	,, 166CC	13·8
1·75	,, 161CB	32·35	,, 166CB	16·18
2·0	,, 162CE	37·0	,, 167CE	18·5
2·25	,, 162CD	41·7	,, 167CD	20·85
2·5	,, 162CC	46·2	,, 167CC	23·1
2·75	,, 162CB	50·8	,, 167CB	25·4
3·0	,, 163CB	55·5	,, 168CB	27·75
3·5	,, 163CA	64·6	,, 168CA	32·3
4·0	,, 164CB	73·9	,, 169CB	36·95
4·5	,, 164CA	83·2	,, 169CA	41·6
		440 Volts—Nominal*		
0·5	335–LWA–160DE	8·22	335–LWA–165DE	4·11
0·75	,, 160DD	12·32	,, 165DD	6·16
1·0	,, 160DC	16·44	,, 165DC	8·27
1·25	,, 160DB	20·55	,, 166DE	10·28
1·5	,, 161DD	24·65	,, 166DD	12·33
1·75	,, 161DC	28·8	,, 166DC	14·4
2·0	,, 161DB	32·9	,, 166DB	16·45
2·25	,, 162DD	37·0	,, 167DD	18·5
2·5	,, 162DC	41·0	,, 167DA	20·55
2·75	,, 162DB	45·2	,, 167DB	22·6
3·0	,, 162DA	49·4	,, 167DC	24·7
3·5	,, 163DA	57·5	,, 168DA	28·75
4·0	,, 164DB	65·8	,, 169DB	32·9
4·5	,, 164DA	74·0	,, 169DA	37·0

* Intermittent rated capacitors can be operated at a voltage 33 per cent above their rated value.

♦Three phase capacitors are delta connected, capacity measured between any two of three terminals.

NOTE: The standard range of capacitors in this table is designed for "Temperate" and "Tropical" temperature conditions only. For "Super-tropical" capacitors inquiries should be forwarded to the Capacitor Division.

Codes 335-LWA-160 to 169

CONTINUED

PERMISSIBLE OVERLOADS

Capacitors will withstand the overload conditions as specified in Draft British Standard 1650.

Where the circuit conditions are such that these figures would be exceeded, it will be necessary to use a capacitor designed for an appropriately increased rating.

RECOMMENDED kVAr RATING OF CAPACITOR FOR INDIVIDUAL CORRECTION OF VARIOUS MOTORS

Motor h.p.	2 Pole 2 830–3 000 rev/min	4 Pole 1 420–1 500 rev/min	6 Pole 940–1 000 rev/min	8 Pole 700–750 rev/min	10 Pole 540–600 rev/min	12 Pole 470–500 rev/min
1	0·5	0·5	0·75	1·75	1·0	1·25
1½	0·5	0·5	0·75	1·0	1·0	2·0
2	0·75	0·75	1·0	1·25	1·5	2·5
2½	1·0	1·0	1·25	2·0	2·5	2·75
3	1·0	1·0	1·5	2·0	2·5	3·0
3½	1·25	1·25	1·75	2·25	3·0	3·75
4	1·5	1·5	1·75	2·5	3·0	4·0
4½	1·5	1·5	2·0	3·0	3·75	4·5
5	1·5	1·75	2·25	3·0	4·0	4·5
5½	1·5	2·0	2·5	3·0	4·0	5·0
6	1·5	2·0	2·5	3·5	4·0	5·0
6½	1·75	2·25	2·75	3·75	4·5	5·5
7	1·75	2·5	3·0	4·0	4·5	6·0
7½	1·75	2·5	3·0	4·0	5·0	6·0
8	2·0	2·75	3·0	4·5	5·25	6·0
8½	2·0	2·75	3·0	4·5	5·25	6·0
9	2·25	3·0	3·5	4·5	5·25	6·0
9½	2·25	3·0	3·75	4·5	5·25	6·0
10	2·5	3·0	4·0	5·0	5·25	6·0
10½	2·75	3·0	4·0	5·25	6·0	6·0
11	3·0	3·0	4·0	5·25	6·0	6·0
11½	3·0	3·5	4·0	5·25	6·0	6·75
12	3·25	3·5	4·0	6·0	6·75	6·75
12½	3·5	3·75	4·0	6·0	6·75	7·5
13	3·5	3·75	4·0	6·0	6·75	7·5
13½	3·75	4·0	4·5	6·0	7·5	7·5
14	3·75	4·0	4·5	6·75	7·5	8·25
14½	4·0	4·0	4·5	6·75	7·5	8·25
15	4·0	4·0	5·0	6·75	7·5	8·25

The above calculations are based upon motors having average characteristics, and are corrected to 0·98 power factor at three quarter load.

Ratings above 4·5 kVAr are available from the STC range of unit-constructed power capacitors described in POWER 1.

CAPACITORS

PROVISIONAL DATA

UNIT-CONSTRUCTED POWER CAPACITORS

(AROCLOR * IMPREGNATED)

INTRODUCTION

STC unit constructed capacitors offer a simple, compact and adaptable method of power factor correction. The system is based on a number of units housed in three standard case sizes. These basic units interlock vertically to form stacks and a number of stacks can be coupled together to give a wide selection of ratings. Side trunking and a top cover protect the P.V.C. covered interconnecting wires and terminals and also give a neat finish to the completed assembly.

The design is a simple one using a small number of components but resulting in a low-cost capacitor bank of rigid construction. Another advantage of the STC design is that existing banks can be readily enlarged or subdivided to meet changing plant requirements with the minimum of expense. Due to their slim end view and low weight the capacitor banks are suitable for wall or stanchion mounting and valuable floor space can thus be saved.

IMPREGNANT

The impregnant used in this range of capacitors is *Aroclor*, one of the chlorinated diphenyl synthetic dielectric fluids. It is non-inflammable, chemically inert and has excellent electrical properties. *Aroclor* has a higher permittivity than mineral oil which means that, for a given kVAr rating, a capacitor using *Aroclor* as the impregnant will be smaller.

The use of *Aroclor* in conjunction with the STC unitised construction is a significant advance in power capacitor design.

* *Aroclor is a registered trade mark of Monsanto Chemicals Ltd.*

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, W.C.2

COMPONENTS GROUP

CAPACITOR DIVISION, PAIGNTON, DEVON Tel.: Paignton 58685 Telex: 4251

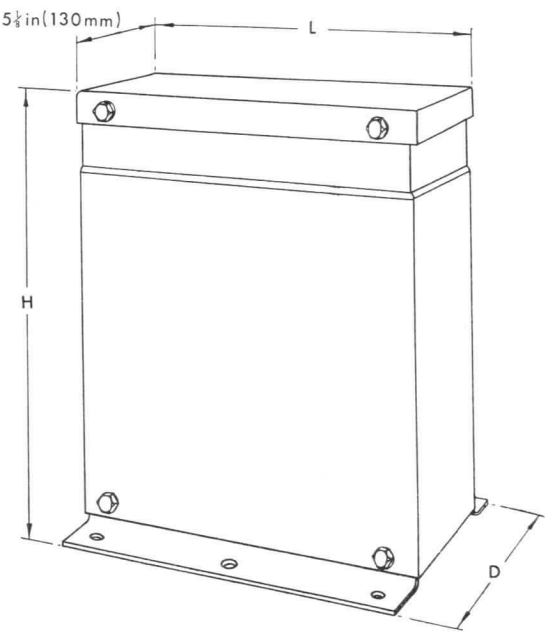
LONDON SALES OFFICE, FOOTSCRAY, SIDCUP, KENT Tel.: Footscray 3333 Telex: 21836

UNIT-CONSTRUCTED POWER CAPACITORS

CONTINUED

BASIC UNITS

Flat type elements wound with layers of high quality capacitor tissue and pure aluminium foil electrodes are used to build the basic units. These elements are separately fused and rigidly supported in mechanical clamps. After vacuum drying they are impregnated in *Aroclor* and hermetically sealed. *



BASIC UNIT

The cases are made from heavy gauge mild steel and the construction is an all-welded one. The terminals are bonded to the metal, consequently there are no gaskets to leak or deteriorate.

Basic ratings are 2, 4, 6, 8, 10, 12 kVAr (at 415V, 440V and 550V–50c/s) but intermediate ratings of 3, 5, 7, 9 and 11 kVAr, at these voltages, are also available. Basic units can be supplied separately (with or without lids and feet) or built into banked assemblies. All basic units are fitted with internal discharge resistors capable of discharging the entire capacitor from peak alternating voltage to a voltage not exceeding 50 volts (measured at the terminals of the capacitor) within one minute of disconnection from the supply.

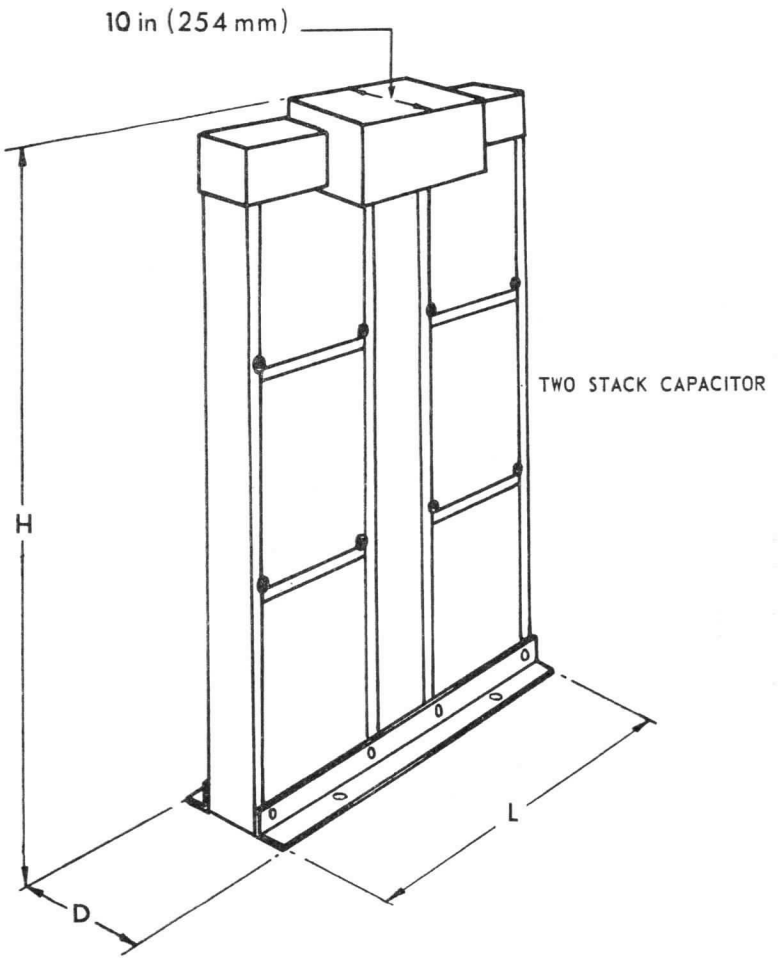
* *British Standard 2817 states that a hermetically sealed enclosure shall be air-tight, all joints being permanently sealed, e.g. by fusion.*

PROVISIONAL DATA

UNIT-CONSTRUCTED POWER CAPACITORS

CONTINUED

BANKED ASSEMBLIES



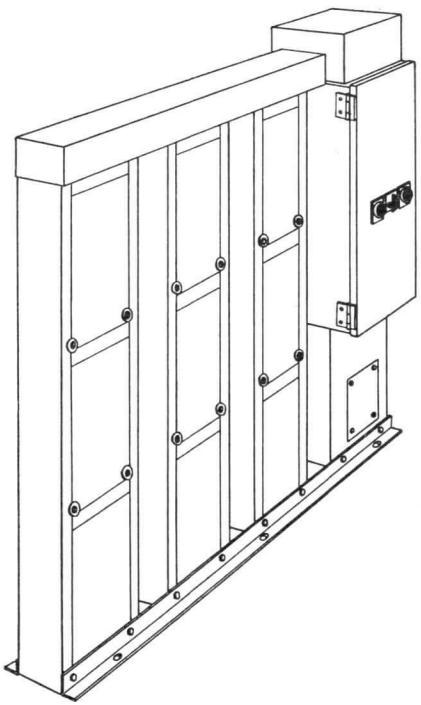
The basic units are designed to interlock on top of one another and rigid mechanical coupling only entails four bolts. Two or three units can be joined in one stack and up to three stacks linked together to give ratings up to 102 kVAr at 415V, 440V and 550V–50 c/s. The completed banks are fitted with a top cover, fixing feet and an earth stud.

UNIT-CONSTRUCTED POWER CAPACITORS

CONTINUED

BANKED ASSEMBLIES *(contd.)*

Control switch gear is supplied where specified and double pole contactors can be fitted as an integral part of the capacitor assembly to all sizes from 26 to 102 for use with automatic power factor correction schemes. Relays to operate the capacitors are also supplied.



THREE STACK CAPACITOR FITTED WITH CONTACTOR

Allow approximately 4 in (102 mm) to operate contactor handle

Overall clearance from back to front of contactor 11 in (279 mm)

These capacitors meet the requirements of the TEMPERATE and TROPICAL categories of British Standard 1650 (see Table).

For SUPER-TROPICAL conditions de-rating is necessary and details are available on request.

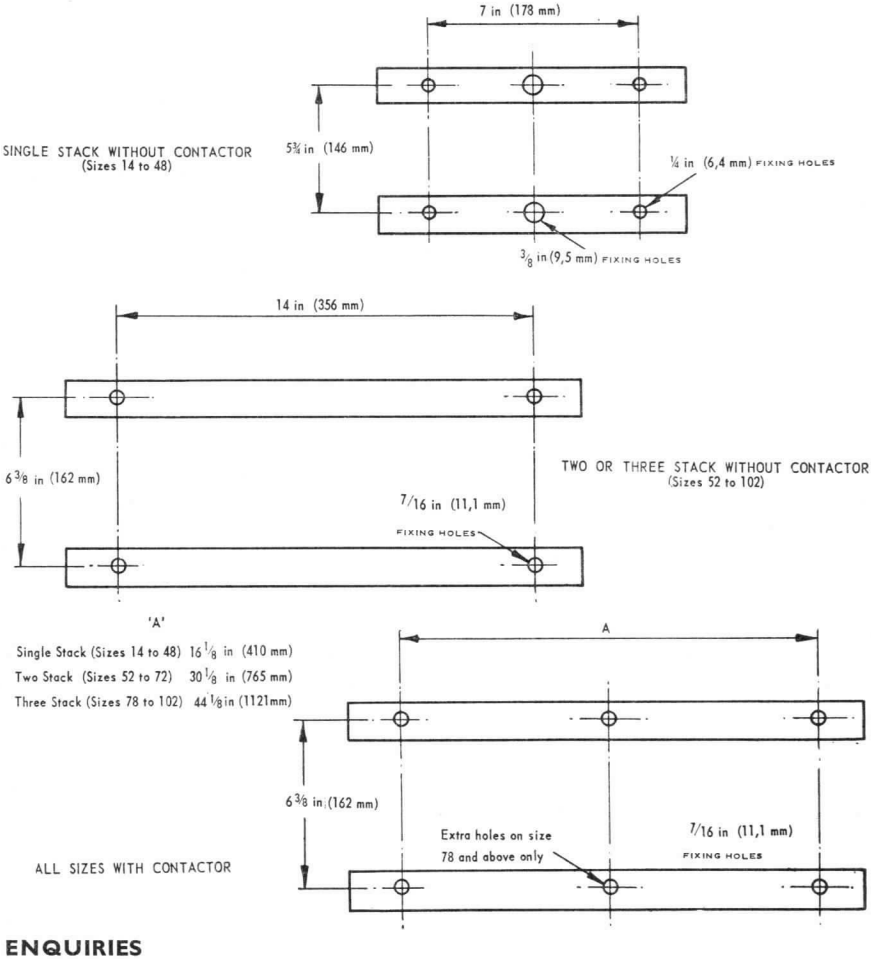
TEMPERATURE CATEGORY	AMBIENT TEMPERATURE		
	PEAK	MEAN OVER 24 HOURS	MEAN OVER 1 YEAR
Temperate	40°C	30°C	20°C
Tropical	45°C	40°C	30°C
Super-tropical	50°C	45°C	35°C

PROVISIONAL DATA

UNIT-CONSTRUCTED POWER CAPACITORS

CONTINUED

FIXING CENTRES



ENQUIRIES

STC capacitors are available for most applications and special types can be produced to meet specific requirements. The company is always pleased to answer queries on all matters involving the use of power capacitors, not only for power factor correction but for all applications.

The services of the company's technical staff are freely available to carry out surveys of electrical plant to ascertain if power factor correction is required. These surveys do not interfere with the normal running of plant, do not place enquirers under any obligation whatsoever and are conducted free of charge. The surveys enable STC engineers to submit details of a recommended scheme and to advise the initial cost and anticipated savings.

PROVISIONAL DATA

STC

UNIT-CONSTRUCTED POWER CAPACITORS

CONTINUED

NOMINAL kVAr RATINGS OF BASIC UNITS AND BANKED ASSEMBLIES

50 c/s – Single-phase or Three-phase Delta Connected

(Physical dimensions are given on Page 3–8)

Size Ref.	200 Volts	210 Volts	220 Volts	230 Volts	240 Volts	250 Volts
1	*0·29*	*0·32*	*0·36*	*0·39*	*0·42*	*0·46*
2	0·59	0·65	0·71	0·78	0·85	0·92
3	*0·88*	*0·97*	*1·07*	*1·16*	*1·27*	*1·37*
4	1·18	1·30	1·42	1·55	1·69	1·83
5	*1·47*	*1·62*	*1·78*	*1·94*	*2·12*	*2·29*
6	1·76	1·95	2·13	2·33	2·54	2·75
7	*2·06*	*2·27*	*2·49*	*2·72*	*2·97*	*3·21*
8	2·35	2·60	2·84	3·10	3·39	3·67
9	*2·65*	*2·92*	*3·20*	*3·49*	*3·81*	*4·12*
10	2·94	3·25	3·56	3·88	4·24	4·59
11	*3·24*	*3·57*	*3·91*	*4·27*	*4·66*	*5·05*
12	3·53	3·90	4·27	4·66	5·08	5·50
14	4·12	4·55	4,98	5·44	5·93	6·42
16	4·71	5·20	5·69	6·21	6·77	7·33
18	5·29	5·87	6·40	6·99	7·62	8·25
20	5·88	6·50	7·11	7·76	8·47	9·17
22	6·47	7·15	7·81	8·54	9·32	10·1
24	7·06	7·80	8·54	9·32	10·1	11·0
26	7·65	8·45	9·25	10·1	11·1	11·9
28	8·24	9·10	9·96	10·9	11·8	12·8
30	8·82	9·75	10·7	11·6	12·7	13·7
32	9·41	10·4	11·4	12·4	13·5	14·7
34	10·0	11·0	12·1	13·2	14·4	15·6
36	10·6	11·7	12·8	14·0	15·2	16·5
40	11·7	13·0	14·2	15·5	17·0	18·3
44	12·9	14·3	15·6	17·1	18·6	20·2
48	14·1	15·6	17·1	18·6	20·2	22·0
52	15·3	16·9	18·5	20·2	22·0	23·8
56	16·5	18·2	19·9	21·8	23·6	25·6
60	17·6	19·5	21·4	23·2	25·4	27·5
64	18·8	20·8	22·8	24·8	27·0	29·4
68	20·0	22·1	24·2	26·4	28·8	31·2
72	21·2	23·4	25·6	28·0	30·4	33·0
78	22·9	25·3	27·7	30·3	33·6	35·7
84	24·7	27·3	29·9	32·7	35·4	38·4
90	26·5	28·2	32·1	34·8	38·1	41·1
96	28·2	31·2	34·2	37·2	40·5	44·1
102	30·0	33·1	36·3	39·6	43·2	46·8

Sizes shown in italics are used for individual correction and are not normally used in banked assemblies.

PROVISIONAL DATA

UNIT-CONSTRUCTED POWER CAPACITORS

CONTINUED

NOMINAL kVAr RATINGS OF BASIC UNITS AND BANKED ASSEMBLIES

50 c/s – Single-phase or Three-phase Delta Connected

(Physical dimensions are given on page 3–8)

380 Volts	400 Volts	415 Volts	420 Volts	440 Volts	500 Volts	550 Volts	Size Ref.
0·84	*0·93*	*1·00*	*1·02*	*1·00*	*0·83*	*1·00*	1
1·68	1·86	2·00	2·05	2·00	1·65	2·00	2
2·52	*2·80*	*3·00*	*3·08*	*3·00*	*2·48*	*3·00*	3
3·36	3·72	4·00	4·10	4·00	3·31	4·00	4
4·20	*4·65*	*5·00*	*5·13*	*5·00*	*4·14*	*5·00*	5
5·04	5·60	6·00	6·16	6·00	4·96	6·00	6
5·88	*6·50*	*7·00*	*7·18*	*7·00*	*5·80*	*7·00*	7
6·72	7·43	8·00	8·21	8·00	6·63	8·00	8
7·56	*8·40*	*9·00*	*9·24*	*9·00*	*7·44*	*9·00*	9
8·40	9·30	10·0	10·2	10·0	8·28	10·0	10
9·24	*10·2*	*11·0*	*11·3*	*11·0*	*9·11*	*11·0*	11
10·1	11·2	12·0	12·3	12·0	9·92	12·0	12
11·8	13·0	14·0	14·3	14·0	11·6	14·0	14
13·4	14·9	16·0	16·4	16·0	13·2	16·0	16
15·1	16·8	18·0	18·5	18·0	14·9	18·0	18
16·8	18·6	20·0	20·5	20·0	16·5	20·0	20
18·5	20·5	22·0	22·5	22·0	18·2	22·0	22
20·2	22·4	24·0	24·6	24·0	19·8	24·0	24
21·9	24·2	26·0	26·6	26·0	21·5	26·0	26
23·5	26·1	28·0	28·7	28·0	23·1	28·0	28
25·2	28·0	30·0	30·8	30·0	24·8	30·0	30
26·9	29·8	32·0	32·8	32·0	26·5	32·0	32
28·6	31·7	34·0	34·8	34·0	28·1	34·0	34
30·3	33·6	36·0	37·0	36·0	29·8	36·0	36
33·6	37·2	40·0	41·0	40·0	33·0	40·0	40
37·0	41·0	44·0	45·0	44·0	36·4	44·0	44
40·4	44·8	48·0	49·2	48·0	39·6	48·0	48
43·8	48·4	52·0	53·2	52·0	43·0	52·0	52
47·0	52·2	56·0	57·4	56·0	46·2	56·0	56
50·4	56·0	60·0	61·6	60·0	49·6	60·0	60
53·8	59·6	64·0	65·6	64·0	53·0	64·0	64
57·2	63·4	68·0	69·6	68·0	56·2	68·0	68
60·6	67·2	72·0	74·0	72·0	59·6	72·0	72
65·7	72·6	78·0	79·8	78·0	64·5	78·0	78
70·4	78·4	84·0	86·1	84·0	69·3	84·0	84
75·6	84·0	90·0	92·6	90·0	74·4	90·0	90
80·8	89·6	96·0	98·4	96·0	79·5	96·0	96
85·6	95·2	102	105	102	84·3	102	102

FURTHER SIZES: Sizes not shown in the above table can be supplied to suit special requirements.

PROVISIONAL DATA

STC

UNIT-CONSTRUCTED POWER CAPACITORS

CONTINUED

DIMENSIONS AND WEIGHTS

BASIC UNITS

Size Reference		Approximate Weight		Overall Dimensions (See Page 3–2)					
				H		L		D	
		lb	kg	in	mm	in	mm	in	mm
2	A	16½	7,48	8¼	210	8¾	223	7⅛	181
4	B	,,	,,	,,	,,	,,	,,	,,	,,
6	C	23½	10,66	11¼	286	,,	,,	,,	,,
8	D	,,	,,	,,	,,	,,	,,	,,	,,
10	E	30½	13,83	14⅛	359	,,	,,	,,	,,
12	F	,,	,,	,,	,,	,,	,,	,,	,,

ASSEMBLIES

Size Ref.	Units per Stack	No. of Stacks	Approximate Weight *		Overall Dimensions (See Page 3–3)				
					H		L *		D
			lb	kg	in	mm	in	mm	
14	1F+1A		49	22	21	533	9¼	235	
16	1F+1B		51	23	,,	,,	,,	,,	
18	1F+1C		55	25	24	610	,,	,,	
20	1F+1D		58	26	,,	,,	,,	,,	
22	1F+1E		61	28	26⅞	683	,,	,,	
24	2F		64	29	,,	,,	,,	,,	
26	2F+1A	1	90	41	37½	953	9⅞	251	7⅛ in (181 mm)
28	2F+1B		92	42	,,	,,	,,	,,	
30	2F+1C		96	44	40½	1029	,,	,,	
32	2F+1D		99	45	,,	,,	,,	,,	
34	2F+1E		103	47	43½	1105	,,	,,	
36	3F		106	48	,,	,,	,,	,,	
40	2F+2D		126	57	53⅛	1349	,,	,,	
44	2F+2E		146	66	56⅛	1426	,,	,,	
48	4F		152	69	,,	,,	,,	,,	
52	2F+1A		177	80	37½	953	23 13/16	605	
56	2F+1B		181	82	,,	,,	,,	,,	
60	2F+1C	2	189	86	40½	1029	,,	,,	
64	2F+1D		195	88	,,	,,	,,	,,	
68	2F+1E		203	92	43½	1105	,,	,,	7⅝ in (194 mm)
72	3F		209	95	,,	,,	,,	,,	
78	2F+1A		241	109	37½	953	37¾	959	
84	2F+1B		247	112	,,	,,	,,	,,	
90	2F+1C	3	258	117	40½	1029	,,	,,	
96	2F+1D		267	121	,,	,,	,,	,,	
102	2F+1E		305	138	43½	1105	,,	,,	

NOTES: Up to size reference 24 available with Conduit Entry only.

*When contactor fitted add 90 lb (41 kg) to weight and 18 in (457 mm) to dimension L.

TANTALUM

CAPACITORS

Plain Tantalum Foil

Codes 472–LWA–1 to 6 Polarised
472–LWA–101 to 106 Non-Polarised

INTRODUCTION

STC plain tantalum foil capacitors have proved their reliability over many years, as shown by their universal adoption in military equipment during this period. They have been in production for over 15 years and Qualification Approval was received as long ago as 1954.

The capacitors will satisfy the most stringent requirements of environmental test specifications DEF5011 and IEC69–1 (1960) when operated over the range −55°C to +85°C (see ENVIRONMENTAL SPECIFICATION).

FEATURES

Long shelf life—reforming is never required.
Long working life—estimated to be in excess of 20 years.
Low leakage current.

CONSTRUCTION

The wound capacitor element consists of two tantalum foils interleaved with a spacing tissue which is impregnated with a non-corrosive electrolyte. The dielectric is a pentoxide layer, formed electrochemically on the anode foil.

Burying the terminal wire/tantalum stub weld in the resin end seal of the silver case gives high vibration resistance and robustness in excess of the requirements of DEF5134–2 and DEF5011 (see page 3).

All units are aged at the surge voltage and reforming is never required.

COMMUNICATION EQUIPMENT APPLICATIONS

For long life performance a reduction of operating temperature and working voltage is recommended to eliminate field crystallisation and to minimise diffusion of electrolyte vapour. Temperatures up to a maximum of 85°C can be tolerated but the average over the year should not exceed 50°C. When operated at 85°C the voltage must be derated as shown in the rating table.

Standard Telephones and Cables Limited
Capacitor Division, Brixham Road, Paignton, Devon
Telephone: Paignton 50762 Telex: 42951
C O M P O N E N T S G R O U P

Codes 472–LWA–1 to 6
472–LWA–101 to 106

CONTINUED

ELECTRICAL LIMITS (Reference temperature 20°C)

Capacitance tolerance, 0·25μF and above	±20%
<0·25μF	+30% −10%
Temperature range	−55°C to +85°C
Rated working voltages at 50°C	6, 12, 25, 50, 100 and 150V d.c.
at 85°C	4, 8, 16, 32, 64 and 100V d.c.
Surge voltage at 85°C (Must not exceed 30 seconds in any 6-minute period)	15% above rated.
Maximum dissipation factor at 120Hz, up to 25V	15%
25V and above	10%
Insulation resistance of sleeve	<100MΩ at 100V d.c.
Breakdown voltage of sleeve	>500V d.c.
Leakage current after 3 minutes at rated voltage	
Polar	0·02μA/μF V
Non-Polar	0·04μA/μF V

ENVIRONMENTAL SPECIFICATION

These capacitors meet the requirements of the following tests:

DEF5011		IEC 69—1 (1960)
Humidity classification	H6	Specification test A — IV
Temperature range	T3	,, ,, B — V
Vibration test	V3	,, ,, C — IV
Acceleration test	A3	,, ,, D — IV
Shock test	S3	,, ,, F — IV
Low air density test	D3	

ROBUSTNESS OF TERMINATIONS

Tensile strength test	5lb*
Bending test	2½lb through two bends at 90°

* Specification limit, actual average tensile pull at fracture 10lb.

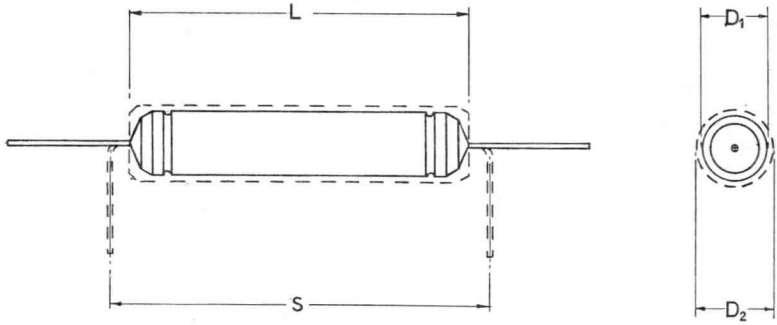
SOLDERABILITY

The terminal wires comply with the requirements of B.S.2011 part 2T (1966) in the aged condition.

Codes 472–LWA–1 to 6
472–LWA–101 to 106

CONTINUED

DIMENSIONS



Type	Maximum Dimensions					
	L		D_1		D_2	
	mm	in	mm	in	mm	in
472–LWA–1 101	25,1	0·99	3,94	0·155	4,45	0·175
472–LWA–2 102	25,1	0·99	4,70	0·185	5,21	0·205
472–LWA–3 103	25,1	0·99	6,22	0·245	6,73	0·265
472–LWA–4 104	30,2	1·19	6,22	0·245	6,73	0·265
472–LWA–5 105	46,0	1·81	6,22	0·245	6,73	0·265
472–LWA–6 106	46,0	1·81	8,99	0·354	9,50	0·374

TERMINAL WIRES

Length 32 mm (1·25 in) minimum
Diameter 0,6 mm (0·024 in) nominal

PRINTED CIRCUIT MOUNTING

For mounting on printed circuit boards the minimum recommended hole centres are dimension S.

$S = L + 3{,}5$ mm (0·14 in).

When bending terminals, the wire adjacent to the end seal should be gripped firmly to prevent possible damage to the resin.

N.B.—Manufacturing dimensions are inches.

Codes 472–LWA–1 to 6
472–LWA–101 to 106

CONTINUED

RATINGS AND CODES

The following tables show the maximum capacitance, measured at 120Hz, that can be housed in the given case size for the rated working voltages.

Polarised Type

Working Voltage (V)		Capacitance (μF)	STC Code	Joint Services Ref. No.
at 50°C	at 85°C			
6	4	5·0	472–LWA–1AA	5910–99–014–5266
		10·0	,, 2AA	,, –5267
		20·0	,, 3AA	,, –5268
		40·0	,, 4AA	,, –5269
		80·0	,, 5AA	,, –5270
		200·0	,, 6AA	,, –5271
12	8	2·5	472–LWA–1BA	5910–99–014–5272
		5·0	,, 2BA	,, –5273
		10·0	,, 3BA	,, –5274
		20·0	,, 4BA	,, –5275
		40·0	,, 5BA	,, –5276
		100·0	,, 6BA	,, –5277
25	16	1·5	472–LWA–1CA	5910–99–014–5285
		2·5	,, 2CA	,, –5286
		6·0	,, 3CA	,, –5287
		10·0	,, 4CA	,, –5288
		20·0	,, 5CA	,, –5289
		50·0	,, 6CA	,, –5290
50	32	0·75	472–LWA–1DA	5910–99–014–5291
		1·5	,, 2DA	,, –5292
		3·0	,, 3DA	,, –5293
		5·0	,, 4DA	,, –5295
		10·0	,, 5DA	,, –5296
		25·0	,, 6DA	,, –5297
100	64	0·4	472–LWA–1EA	5910–99–014–5323
		0·75	,, 2EA	,, –5324
		1·5	,, 3EA	,, –5325
		2·5	,, 4EA	,, –5326
		5·0	,, 5EA	,, –5327
		15·0	,, 6EA	,, –5328
150	100	0·3	472–LWA–1FA	5910–99–014–5329
		0·5	,, 2FA	,, –5330
		1·0	,, 3FA	,, –5331
		2·0	,, 4FA	,, –5332
		4·0	,, 5FA	,, –5333
		10·0	,, 6FA	,, –5334

POLAR TYPE CAPACITORS ARE FULLY TYPE APPROVED TO RCS 134B.

Codes 472–LWA–1 to 6
472–LWA–101 to 106

CONTINUED

RATINGS AND CODES—(*contd.*)

Non-Polarised Type

Working Voltage (V)		Capacitance (μF)	STC Code	Joint Services Ref. No.
at 50°C	at 85°C			
6	4	2·5	472–LWA–101AA	5910–99–914–9355
		5·0	,, 102AA	5910–99–945–3467
		10·0	,, 103AA	5910–99–945–3468
		20·0	,, 104AA	5910–99–932–0964
		40·0	,, 105AA	5910–99–580–0954
		100·0	,, 106AA	5910–99–580–0369
12	8	1·25	472–LWA–101BA	5910–99–940–9226
		2·5	,, 102BA	5910–99–914–7809
		5·0	,, 103BA	5910–99–914–1385
		10·0	,, 104BA	5910–99–940–8488
		20·0	,, 105BA	5910–99–101–1201
		50·0	,, 106BA	5910–99–580–0158
25	16	0·75	472–LWA–101CA	5910–99–914–9356
		1·25	,, 102CA	5910–99–110–2474
		3·0	,, 103CA	5910–99–914–7810
		5·0	,, 104CA	5910–99–100–7478
		10·0	,, 105CA	5910–99–914–8684
		25·0	,, 106CA	5910–99–940–8489
50	32	0·375	472–LWA–101DA	5910–99–940–9192
		0·75	,, 102DA	5910–99–900–9095
		1·5	,, 103DA	5910–99–914–6713
		2·5	,, 104DA	5910–99–914–8685
		5·0	,, 105DA	5910–99–913–2760
		12·5	,, 106DA	5910–99–932–0769
100	64	0·2	472–LWA–101EA	5910–99–940–8490
		0·375	,, 102EA	5910–99–952–5533
		0·75	,, 103EA	5910–99–932–2224
		1·25	,, 104EA	5910–99–945–5480
		2·5	,, 105EA	5910–99–913–6395
		7·5	,, 106EA	5910–99–940–9057
150	100	0·15	472–LWA–101FA	5910–99–580–0358
		0·25	,, 102FA	5910–99–932–0963
		0·50	,, 103FA	5910–99–932–4547
		1·0	,, 104FA	5910–99–932–2225
		2·0	,, 105FA	5910–99–100–7419
		5·0	,, 106FA	5910–99–932–2394

NON-POLAR CAPACITORS HAVE RECEIVED FULL DEPARTMENTAL TYPE APPROVAL FROM SRDE.

Codes 472–LWA–1 to 6
472–LWA–101 to 106

CONTINUED

A.C. RATINGS

Volt-Ampere Rating

The following table shows the maximum volt-ampere ratings at various temperatures and frequencies for both polarised and non-polarised tantalum foil capacitors.

Temperature (°C)	Frequency (Hz)	Maximum Volt-Ampere Ratings					
		472–LWA –1 –101	472–LWA –2 –102	472–LWA –3 –103	472–LWA –4 –104	472–LWA –5 –105	472–LWA –6 –106
25	50	2·4	2·8	3·9	4·9	8·1	12·2
	400	1·76	2·06	2·87	3·6	6·0	9·0
	1 000	1·44	1·7	2·3	2·9	4·9	7·3
50	50	1·7	1·9	2·6	3·3	5·5	8·1
	400	1·25	1·4	1·9	2·4	4·0	6·0
	1 000	1·0	1·1	1·5	2·0	3·3	4·8
85	50	0·68	0·79	1·08	1·36	2·25	3·3
	400	0·5	0·58	0·80	1·00	1·65	2·42
	1 000	0·41	0·48	0·65	0·82	1·35	2·0

Ripple Current Rating

The maximum ripple currents which can be permitted in STC tantalum foil type electrolytic capacitors are determined by two factors.

1. At low frequencies the peak applied voltage must not exceed the rated d.c. voltage and with polarised type capacitors the applied voltage must not cause a reversal of polarity.
2. At high frequencies the heat generated must not cause excessive temperature rise. The permissible temperature rise decreases as the ambient temperature increases.

Codes 472-LWA-1 to 6
472-LWA-101 to 106

CONTINUED

Polarised Capacitors

It should be particularly noted that with polarised type capacitors the sum of the applied d.c. and the peak a.c. ripple voltage must not exceed the rated d.c. working voltage and there must be no reversal of polarity.

Maximum ripple currents and voltages and d.c. polarising voltages for polarised tantalum foil capacitors are given in Table 1.

Where d.c. polarising volts are shown as half of the rated d.c. working voltage the maximum ripple current and voltage can only be achieved with this value of d.c. polarising voltage. With lower values of ripple current and voltage a correspondingly wider range of d.c. polarising voltages may be employed.

Non-Polarised Capacitors

Due to the fact that this type of capacitor employs two formed electrodes, it normally has half the capacitance of the polarised type. Each electrode acts as its own rectifier to polarise itself in the correct direction. Thus this type of capacitor may be used either on a.c. or d.c. of either polarity.

Maximum ripple currents and voltages for non-polarised tantalum foil capacitors are given in Table II.

The $\pm$ d.c. polarising voltage given is the maximum permissible when full a.c. ripple voltage is present. Larger values of d.c. voltage must be compensated by decreasing a.c. ripple voltage correspondingly.

STC

Codes 472–LWA–1 to 6
472–LWA–101 to 106

CONTINUED

TABLE 1

MAXIMUM RIPPLE CURRENT RATINGS OF PLAIN FOIL TANTALUM CAPACITORS 472–LWA–1 to 6
(POLAR TYPE 85°C MAX.)

STC Code	Rated Volts (50°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY								
			25°C								
			50Hz			400Hz			1 000Hz		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)
472–LWA–1AA	6	5	3·3	2·1	3·0	26	2·1	3·0	67	2·1	3·0
,, –1BA	12	2·5	3·3	4·2	6·0	26	4·2	6·0	67	4·3	6·0
,, –1CA	25	1·5	4·2	8·8	12·5	33	8·8	12·5	84	8·9	12·5
,, –1DA	50	0·75	4·2	18·0	25·0	33	18·0	25·0	82	17·4	25·7
,, –1EA	100	0·4	4·4	35·0	50·0	35	35·0	50·0	60	24·0	66·4
,, –1FA	150	0·3	4·6	53·0	75·0	36	48·0	82·0	52	27·6	111·0
472–LWA–2AA	6	10	6·7	2·1	3·0	53	2·1	3·0	133	2·1	3·0
,, –2BA	12	5	6·7	4·2	6·0	53	4·2	6·0	133	4·3	6·0
,, –2CA	25	2·5	7·0	8·8	12·5	55	8·8	12·5	138	8·9	12·5
,, –2DA	50	1·5	8·3	18·0	25·0	66	18·0	25·0	126	13·4	31·3
,, –2EA	100	0·75	8·3	35·0	50·0	62	33·0	53·0	89	18·9	73·5
,, –2FA	150	0·5	8·3	53·0	75·0	51	41·0	92·0	73	23·2	117·2
472–LWA–3AA	6	20	13·0	2·1	3·0	110	2·1	3·0	264	2·1	3·0
,, –3BA	12	10	13·0	4·2	6·0	110	4·2	6·0	264	4·3	6·0
,, –3CA	25	6	17·0	8·8	12·5	130	8·8	12·5	293	7·9	14·0
,, –3DA	50	3	17·0	18·0	25·0	130	18·0	25·0	207	11·2	34·4
,, –3EA	100	1·5	17·0	35·0	50·0	100	27·0	62·0	146	15·8	78·0
,, –3FA	150	1·0	17·0	53·0	75·0	85	34·0	100·0	120	19·2	122·9
472–LWA–4AA	6	40	26·0	2·1	3·0	210	2·1	3·0	530	2·1	3·0
,, –4BA	12	20	26·0	4·2	6·0	210	4·2	6·0	530	4·3	6·0
,, –4CA	25	10	28·0	8·8	12·5	220	8·8	12·5	427	6·8	15·4
,, –4DA	50	5	28·0	18·0	25·0	210	17·0	26·0	300	9·6	35·6
,, –4EA	100	2·5	28·0	35·0	50·0	150	24·0	66·0	212	13·6	81·0
,, –4FA	150	2	33·0	53·0	75·0	130	26·0	110·0	190	15·2	128·5
472–LWA–5AA	6	80	53·0	2·1	3·0	420	2·1	3·0	1060	2·1	3·0
,, –5BA	12	40	53·0	4·2	6·0	420	4·2	6·0	1060	4·3	6·0
,, –5CA	25	20	55·0	8·8	12·5	440	8·8	12·5	785	6·3	16·2
,, –5DA	50	10	56·0	18·0	25·0	390	16·0	27·0	555	8·9	37·6
,, –5EA	100	5	56·0	35·0	50·0	270	22·0	69·0	390	12·5	82·5
,, –5FA	150	4	66·0	53·0	75·0	250	25·0	110·0	350	14·0	130·2
472–LWA–6AA	6	200	133	2·1	3·0	1100	2·1	3·0	2650	2·14	3·0
,, –6BA	12	100	133	4·2	6·0	1100	4·2	6·0	2130	3·4	7·2
,, –6CA	25	50	138	8·8	12·5	1100	8·8	12·0	1500	4·8	18·3
,, –6DA	50	25	139	18·0	25·0	750	12·0	33·0	1070	6·9	40·4
,, –6EA	100	15	167	35·0	50·0	580	16·0	77·0	830	8·8	87·7
,, –6FA	150	10	176	53·0	75·0	470	19.0	120·0	680	10·9	134·7

Codes 472–LWA–1 to 6
472–LWA–101 to 106

CONTINUED

TABLE 1

MAXIMUM RIPPLE CURRENT RATINGS OF PLAIN FOIL TANTALUM CAPACITORS 472–LWA–1 to 6
(POLAR TYPE 85°C MAX.)

STC Code	Rated Volts (50°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY 50°C 50Hz Max. ripple current (mA)	50Hz Max. ripple volts (rms)	50Hz Max. d.c. polarising volts (see note)	400Hz Max. ripple current (mA)	400Hz Max. ripple volts (rms)	400Hz Max. d.c. polarising volts (see note)	1 000Hz Max. ripple current (mA)	1 000Hz Max. ripple volts (rms)	1 000Hz Max. d.c. polarising volts (see note)
472–LWA–1AA	6	5	3·3	2·1	3·0	26	2·1	3·0	67	2·1	3·0
,, –1BA	12	2·5	3·3	4·2	6·0	26	4·2	6·0	67	4·3	6·0
,, –1CA	25	1·5	4·2	8·8	12·5	33	8·8	12·5	84	8·9	12·5
,, –1DA	50	0·75	4·2	18·0	25·0	33	18·0	25·0	69	14·5	29·6
,, –1EA	100	0·4	4·4	35	50·0	35	35·0	50·0	50	20·0	72·0
,, –1FA	150	0·3	4·6	53	75·0	31	41·0	92·0	44	23·0	117·4
472–LWA–2AA	6	10	6·7	2·1	3·0	53	2·1	3·0	133	2·1	3·0
,, –2BA	12	5	6·7	4·2	6·0	53	4·2	6·0	133	4·3	6·0
,, –2CA	25	2·5	7·0	8·8	12·5	55	8·8	12·5	131	8·4	13·1
,, –2DA	50	1·5	8·3	18·0	25·0	66	18·0	25·0	102	10·8	34·7
,, –2EA	100	0·75	8·3	35	50·0	51	27·0	62·0	72	15·3	78·4
,, –2FA	150	0·5	8·3	53	75·0	42	34·0	100·0	59	18·7	123·6
472–LWA–3AA	6	20	13	2·1	3·0	110	2·1	3·0	264	2·1	3·0
,, –3BA	12	10	13	4·2	6·0	110	4·2	6·0	264	4·3	6·0
,, –3CA	25	6	17	8·8	12·5	130	8·8	12·5	235	6·3	16·0
,, –3DA	50	3	17	18·0	25·0	120	16·0	29·0	166	9·0	37·3
,, –3EA	100	1·5	17	25·0	50·0	84	22·0	69·0	177	12·6	82·1
,, –3FA	150	1·0	17	53·0	75·0	69	28·0	110·0	96	15·4	128·2
472–LWA–4AA	6	40	26	2·1	3·0	210	2·1	3·0	530	2·1	3·0
,, –4BA	12	20	26	4·2	6·0	210	4·2	6·0	501	4·0	6·3
,, –4CA	25	10	28	8·8	12·5	220	8·8	12·5	354	5·7	17·0
,, –4DA	50	5	28	18·0	25·0	170	14·0	30·0	249	8·0	38·8
,, –4EA	100	2·5	28	35·0	50·0	120	19·0	73·0	176	11·3	85·9
,, –4FA	150	2	33	53·0	75·0	110	22·0	115·0	157	12·6	132·3
472–LWA–5AA	6	80	53	2·1	3·0	420	2·1	3·0	1060	2·1	3·0
,, –5BA	12	40	53	4·2	6·0	420	4·2	6·0	914	3·6	6·8
,, –5CA	25	20	55	8·8	12·5	440	8·8	12·5	647	5·2	17·7
,, –5DA	50	10	56	18·0	25·0	320	13·0	32·0	457	7·3	39·7
,, –5EA	100	5	56	35·0	50·0	220	18·0	75·0	322	10·3	85·5
,, –5FA	150	4	66	53·0	75·0	200	20·0	120·0	288	11·5	133·7
472–LWA–6AA	6	200	133	2·1	3·0	1100	2·1	3·0	2470	2·0	3·2
,, –6BA	12	100	133	4·2	6·0	1100	4·2	6·0	1730	2·8	8·1
,, –6CA	25	50	138	8·8	12·5	870	7·0	15·0	1215	3·9	19·5
,, –6DA	50	25	139	18·0	25·0	610	9·8	36·0	865	5·5	42·2
,, –6EA	100	15	167	35·0	50·0	470	13·0	82·0	673	7·1	90·0
,, –6FA	150	10	160	51·0	78·0	390	16·0	125·0	550	8·8	137·6

Codes 472–LWA–1 to 6
472–LWA–101 to 106

CONTINUED

TABLE

MAXIMUM RIPPLE CURRENT RATINGS OF PLAIN FOIL TANTALUM CAPACITORS 472–LWA–1 to 6
(POLAR TYPE 85°C MAX.)

STC Code	Rated Volts (50°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY 85°C								
			50Hz			400Hz			1 000Hz		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)
472–LWA–1AA	6	5	2·2	1·4	2·0	18	1·4	2·0	44	1·4	2·0
,, –1BA	12	2·5	2·2	2·8	4·0	18	2·8	4·0	44	2·8	4·0
,, –1CA	25	1·5	2·8	5·9	8·3	22	5·9	8·3	56	5·9	8·3
,, –1DA	50	0·75	2·8	11·8	16·6	22	11·8	16·6	44	9·3	20·1
,, –1EA	100	0·40	3·0	23·6	33·3	22	22·0	35·6	32	12·8	47·5
,, –1FA	150	0·30	3·0	35·6	50·0	19	25·3	64·2	27	14·3	80·0
472–LWA–2AA	6	10	4·4	1·4	2·0	35	1·4	2·0	88	1·4	2·0
,, –2BA	12	5	4·5	2·8	4·0	35	2·8	4·0	88	2·8	4·0
,, –2CA	25	2·5	4·6	5·9	8·3	37	5·9	8·3	86	5·5	8·8
,, –2DA	50	1·5	5·6	11·8	16·6	44	11·8	16·6	67	7·1	23·3
,, –2EA	100	0·75	5·6	23·6	33·3	33	17·6	41·7	47	10·0	52·4
,, –2FA	150	0·5	5·6	35·6	50·0	27	21·6	69·5	39	12·5	82·4
472–LWA–3AA	6	20	8·9	1·4	2·0	71	1·4	2·0	176	1·4	2·0
,, –3BA	12	10	8·9	2·8	4·0	71	2·8	4·0	176	2·8	4·0
,, –3CA	25	6	11·0	5·9	8·3	89	5·9	8·3	156	4·2	10·7
,, –3DA	50	3	11·0	11·8	16·6	77	10·2	18·8	110	5·9	25·0
,, –3EA	100	1·5	11·0	23·6	33·3	54	14·4	46·3	78	8·4	54·7
,, –3FA	150	1·0	11·0	35·6	50·0	45	18·0	74·6	64	10·2	85·6
472–LWA–4AA	6	40	18	1·4	2·0	140	1·4	2·0	353	1·4	2·0
,, –4BA	12	20	18	2·8	4·0	140	2·8	4·0	324	2·6	4·3
,, –4CA	25	10	19	5·9	8·3	150	5·9	8·3	228	3·6	11·1
,, –4DA	50	5	19	11·8	16·6	112	9·0	20·7	161	5·2	26·0
,, –4EA	100	2·5	19	23·6	33·3	79	12·6	48·6	114	7·3	56·3
,, –4FA	150	2	24	35·6	50·0	71	14·2	80·0	102	8·2	88·5
472–LWA–5AA	6	80	35	1·4	2·0	280	1·4	2·0	707	1·4	2·0
,, –5BA	12	40	35	2·8	4·0	280	2·8	4·0	583	2·3	4·7
,, –5CA	25	20	37	5·9	8·3	290	5·8	8·4	413	3·3	12·0
,, –5DA	50	10	37	11·8	16·6	200	8·0	22·0	293	4·7	26·7
,, –5EA	100	5	37	23·6	33·3	140	11·2	51·0	205	6·6	57·3
,, –5FA	150	4	44	35·6	50·0	130	13·0	81·6	183	7·3	89·7
472–LWA–6AA	6	200	88	1·4	2·0	710	1·4	2·0	1590	1·3	2·2
,, –6BA	12	100	88	2·8	4·0	710	2·8	4·0	1115	1·8	5·5
,, –6CA	25	50	92	5·9	8·3	550	4·4	10·4	783	2·5	13·1
,, –6DA	50	25	93	11·8	16·6	390	6·2	23·5	558	3·6	28·3
,, –6EA	100	15	110	23·6	33·3	300	8·1	55·2	443	4·7	60·0
,, –6FA	150	10	102	32·4	54·1	250	10·0	86·0	354	5·7	92·0

Codes 472–LWA–1 to 6
472–LWA–101 to 106

CONTINUED

TABLE II

MAXIMUM RIPPLE CURRENT RATINGS OF PLAIN FOIL TANTALUM CAPACITORS 472–LWA–101 to 106
(NON-POLAR TYPE 85°C MAX.)

STC Code	Rated Volts (50°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY								
			25°C								
			50Hz			400Hz			1 000Hz		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)
472–LWA–101AA	6	2·5	3·3	4·2	0	26	4·2	0	67	4·2	0
,, –101BA	12	1·25	3·3	8·5	0	26	8·5	0	67	8·5	0
,, –101CA	25	0·75	4·2	18·0	0	33	18·0	0	82	17·5	0·4
,, –101DA	50	0·375	4·2	35·0	0	33	35·0	0	58	24·6	15·4
,, –101EA	100	0·2	4·4	71·0	0	30	60·0	15	42	33·6	52·6
,, –101FA	150	0·15	4·6	106·0	0	26	69·0	52	37	39·0	95·0
472–LWA–102AA	6	5	6·7	4·2	0	53	4·2	0	133	4·2	0
,, –102BA	12	2·5	6·7	8·5	0	53	8·5	0	133	8·5	0
,, –102CA	25	1·25	7·0	18·0	0	55	18·0	0	115	14·7	4·2
,, –102DA	50	0·75	8·3	35·0	0	62	33·0	3·3	89	18·9	23·4
,, –102EA	100	0·375	8·3	71·0	0	44	47·0	34	63	26·6	62·3
,, –102FA	150	0·25	8·3	106·0	0	36	58·0	68	51	32·8	103·6
472–LWA–103AA	6	10	13	4·2	0	110	4·2	0	264	4·2	0
,, –103BA	12	5	13	8·5	0	110	8·5	0	264	8·5	0
,, –103CA	25	3	17	18·0	0	130	18·0	0	207	14·6	4·4
,, –103DA	50	1·5	17	35·0	0	100	27·0	12	146	15·8	27·7
,, –103EA	100	0·75	17	71·0	0	73	39·0	45	103	22·3	68·6
,, –103FA	150	0·5	17	106·0	0	60	48·0	82	85	27·2	111·7
472–LWA–104AA	6	20	26	4·2	0	210	4·2	0	530	4·2	0
,, –104BA	12	10	26	8·5	0	210	8·5	0	427	6·8	2·3
,, –104CA	25	5	28	18·0	0	210	17·0	0·96	301	9·6	11·4
,, –104DA	50	2·5	28	35·0	0	150	24·0	16·0	212	13·6	30·8
,, –104EA	100	1·25	28	71·0	0	110	35·0	51·0	150	19·2	73·0
,, –104FA	150	1·0	33	106·0	0	95	38·0	96·0	134	21·4	119·8
472–LWA–105AA	6	40	53	4·2	0	420	4·2	0	1060	4·2	0
,, –105BA	12	20	53	8·5	0	420	8·5	0	785	6·3	3·1
,, –105CA	25	10	55	18·0	0	390	16·0	2·4	555	8·9	12·5
,, –105DA	50	5	56	35·0	0	270	22·0	19·0	393	12·6	32·3
,, –105EA	100	2·5	56	71·0	0	190	30·0	58·0	275	17·6	75·2
,, –105FA	150	2·0	66	106·0	0	170	34·0	100·0	247	19·7	122·0
472–LWA–106AA	6	100	133	4·2	0	1100	4·2	0	2150	3·4	1·1
,, –106BA	12	50	133	8·5	0	1100	8·5	0	1510	4·8	5·2
,, –106CA	25	25	138	18·0	0	750	12·0	8·0	1050	6·7	15·4
,, –106DA	50	12·5	139	35·0	0	530	17·0	26·0	754	9·6	36·4
,, –106EA	100	7·5	167	71·0	0	410	22·0	69·0	586	12·4	82·5
,, –106FA	150	5·0	140	89·0	24	340	27·0	110·0	480	15·4	128·3

STC

Codes 472–LWA–1 to 6
472–LWA–101 to 106

CONTINUED

TABLE II

MAXIMUM RIPPLE CURRENT RATINGS OF PLAIN FOIL TANTALUM CAPACITORS 472–LWA–101 to 106
(NON-POLAR TYPE 85°C MAX.)

STC Code	Rated Volts (50°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY								
			50°C								
			50Hz			400Hz			1 000Hz		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)
472–LWA–101AA	6	2·5	3·3	4·2	0	26	4·2	0	67	4·2	0
,, –101BA	12	1·25	3·3	8·5	0	26	8·5	0	67	8·5	0
,, –101CA	25	0·75	4·2	18·0	0	33	18·0	0	68	14·5	4·5
,, –101DA	50	0·375	4·2	35·0	0	33	35·0	0	50	21·0	20·4
,, –101EA	100	0·2	4·4	71·0	0	25	50·0	29	34	27·5	61·1
,, –101FA	150	0·15	4·6	106·0	0	22	59·0	67	31	32·6	104·0
472–LWA–102AA	6	5	6·7	4·2	0	53	4·2	0	133	4·2	0
,, –102BA	12	2·5	6·7	8·5	0	53	8·5	0	133	8·5	0
,, –102CA	25	1·25	7·0	18·0	0	55	18·0	0	93	11·9	8·2
,, –102DA	50	0·75	8·3	35·0	0	51	27·0	12	72	15·3	28·4
,, –102EA	100	0·375	8·3	71·0	0	36	38·0	46	51	21·6	69·4
,, –102FA	150	0·25	8·3	106·0	0	30	48·0	82	42	27·2	111·6
472–LWA–103AA	6	10	13	4·2	0	110	4·2	0	264	4·2	0
,, –103BA	12	5	13	8·5	0	110	8·5	0	216	6·9	2·2
,, –103CA	25	3	17	18·0	0	120	16·0	2·4	166	9·0	12·3
,, –103DA	50	1·5	17	35·0	0	84	22·0	19·0	117	12·6	32·1
,, –103EA	100	0·75	17	71·0	0	60	32·0	55·0	83	17·9	74·8
,, –103FA	150	0·5	17	106·0	0	49	39·0	95·0	68	21·7	119·3
472–LWA–104AA	6	20	26	4·2	0	210	4·2	0	500	4·0	0·3
,, –104BA	12	10	26	8·5	0	210	8·5	0	354	5·7	4·0
,, –104CA	25	5	28	18·0	0	170	14·0	5·2	250	8·0	13·7
,, –104DA	50	2·5	28	35·0	0	120	19·0	23·0	176	11·3	34·1
,, –104EA	100	1·25	28	71·0	0	87	28·0	60·0	124	15·9	77·6
,, –104FA	150	1·0	32	102·0	5·8	77	31·0	105·0	111	17·8	124·9
472–LWA–105AA	6	40	53	4·2	0	420	4·2	0	900	3·6	0·9
,, –105BA	12	20	53	8·5	0	420	8·5	0	646	5·2	4·7
,, –105CA	25	10	55	18·0	0	320	13·0	6·6	457	7·3	14·7
,, –105DA	50	5	56	35·0	0	220	18·0	25·0	323	10·3	35·4
,, –105EA	100	2·5	56	71·0	0	160	26·0	63·0	226	14·5	79·6
,, –105FA	150	2·0	59	94·0	17	140	28·0	110·0	203	16·2	127·0
472–LWA–106AA	6	100	133	4·2	0	100	4·2	0	1750	2·8	2·0
,, –106BA	12	50	133	8·5	0	870	7·0	2·1	1220	3·9	6·5
,, –106CA	25	25	138	18·0	0	610	9·8	11·0	860	5·5	17·2
,, –106DA	50	12·5	139	35·0	0	430	14·0	30·0	611	7·8	39·0
,, –106EA	100	7·5	140	59·0	17·0	330	18·0	75·0	475	10·1	85·8
,, –106FA	150	5·0	110	70·0	51·0	270	22·0	115·0	388	12·4	132·5

Codes 472–LWA–1 to 6
472–LWA–101 to 106

CONTINUED

TABLE II

MAXIMUM RIPPLE CURRENT RATINGS OF PLAIN FOIL TANTALUM CAPACITORS 472–LWA–101 to 106
(NON-POLAR TYPE 85°C MAX.)

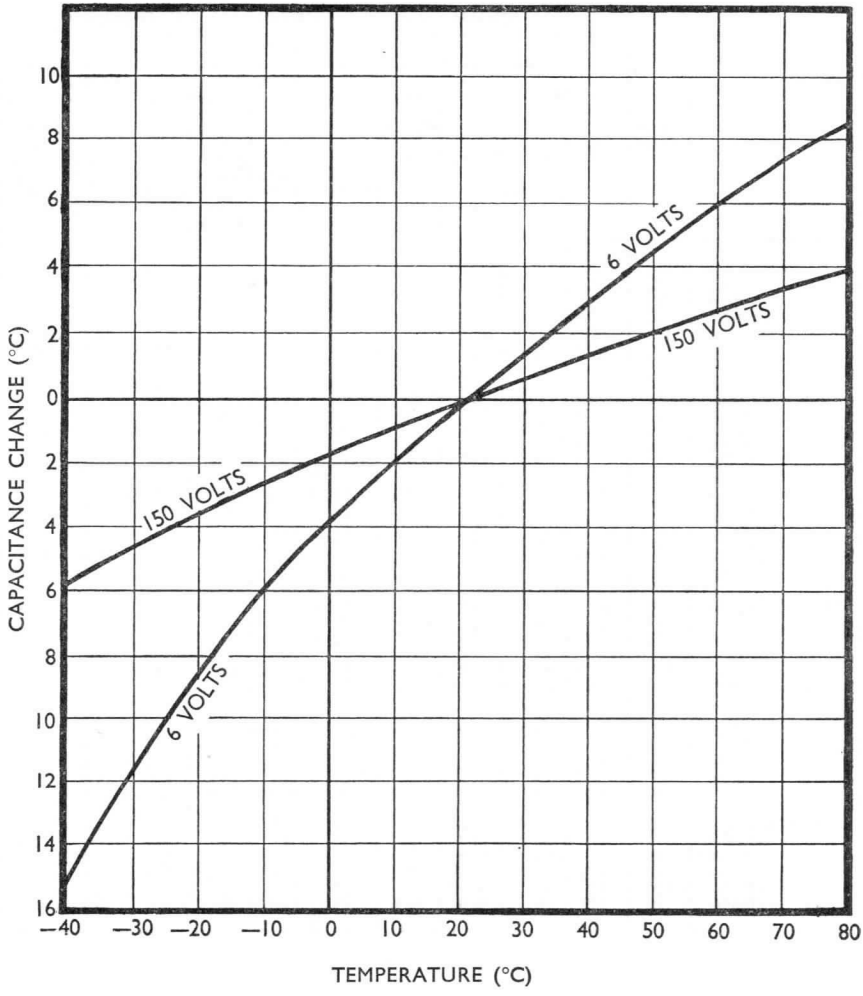
STC Code	Rated Volts (50°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY								
			85°C								
			50Hz			400Hz			1 000Hz		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)
472–LWA–101AA	6	2·5	2·2	2·8	0	18	2·8	0	44	2·8	0
,, –101BA	12	1·25	2·2	5·7	0	18	5·7	0	44	5·7	0
,, –101CA	25	0·75	2·8	11·8	0	22	11·8	0	44	9·3	3·4
,, –101DA	50	0·375	2·8	23·6	0	22	23·6	0	31	13·1	14·8
,, –101EA	100	0·2	3·0	47·0	0	16	32·0	21·4	23	18·1	41·0
,, –101FA	150	0·15	3·0	70·7	0	14	37·2	47·5	20	21·2	70·0
472–LWA–102AA	6	5	4·4	2·8	0	35	2·8	0	88	2·8	0
,, –102BA	12	2·5	4·5	5·7	0	35	5·7	0	88	5·7	0
,, –102CA	25	1·25	4·6	11·8	0	37	11·8	0	61	7·8	5·6
,, –102DA	50	0·75	5·6	23·6	0	33	17·6	8·5	48	10·2	19·0
,, –102EA	100	0·375	5·6	47·0	0	23	24·6	31·8	34	14·4	46·2
,, –102FA	150	0·25	5·6	70·7	0	19	30·4	57·0	27	17·3	75·7
472–LWA–103AA	6	10	8·9	2·8	0	71	2·8	0	176	2·8	0
,, –103BA	12	5	8·9	5·7	0	71	5·7	0	144	4·6	1·5
,, –103CA	25	3	11·0	11·8	0	77	10·3	2·1	110	5·9	8·2
,, –103DA	50	1·5	11·0	23·6	0	55	14·6	12·7	78	8·4	21·4
,, –103EA	100	0·75	11·0	47·0	0	38	20·3	38·0	55	11·9	50·0
,, –103FA	150	0·5	11·0	70·7	0	31	24·8	65·0	45	14·4	79·6
472–LWA–104AA	6	20	18	2·8	0	140	2·8	0	323	2·6	0·4
,, –104BA	12	10	18	5·7	0	140	5·7	0	228	3·6	2·8
,, –104CA	25	5	19	11·8	0	112	9·0	4·0	161	5·2	9·3
,, –104DA	50	2·5	19	23·6	0	79	12·6	15·5	114	7·3	23·0
,, –104EA	100	1·25	19	47·0	0	56	17·9	41·3	80	10·2	52·2
,, –104FA	150	1·0	21	66·1	6·5	50	20·0	72·0	72	11·5	83·7
472–LWA–105AA	6	40	35	2·8	0	280	2·8	0	576	2·3	0·7
,, –105BA	12	20	35	5·7	0	280	5·7	0	412	3·3	3·3
,, –105CA	25	10	37	11·8	0	202	8·1	5·2	291	4·7	10·0
,, –105DA	50	5	37	23·6	0	143	11·4	17·2	206	6·6	24·0
,, –105EA	100	2·5	37	47·0	0	101	16·2	43·8	145	9·3	53·5
,, –105FA	150	2·0	38	60·0	15	90	18·0	74·6	130	10·4	85·3
472–LWA–106AA	6	100	88	2·8	0	710	2·8	0	1120	1·8	1·5
,, –106BA	12	50	88	5·7	0	551	4·4	1·8	787	2·5	3·6
,, –106CA	25	25	92	11·8	0	390	6·2	7·8	552	3·5	11·6
,, –106DA	50	12·5	92	23·6	0	276	8·8	20·8	394	5·0	26·2
,, –106EA	100	7·5	88	37·2	14	212	11·4	50·4	306	6·5	57·4
,, –106FA	150	5·0	72	45·8	55·4	175	14·0	80·0	250	8·0	88·7

Codes 472-LWA-1 to 6
472-LWA-101 to 106

CONTINUED

GRAPHS OF TYPICAL PERFORMANCE

Fig. 1.—Variation of Capacitance with Temperature (referred to 20°C)

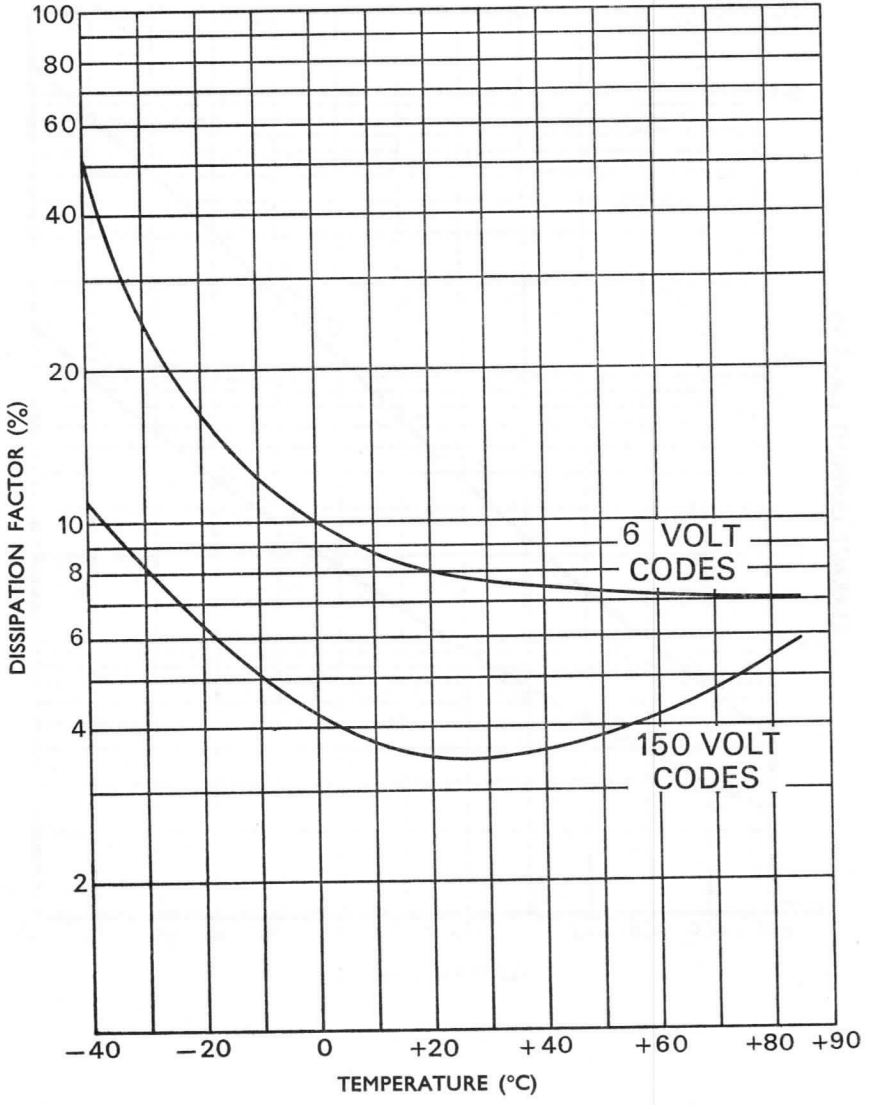


Codes 472–LWA–1 to 6
472–LWA–101 to 106

CONTINUED

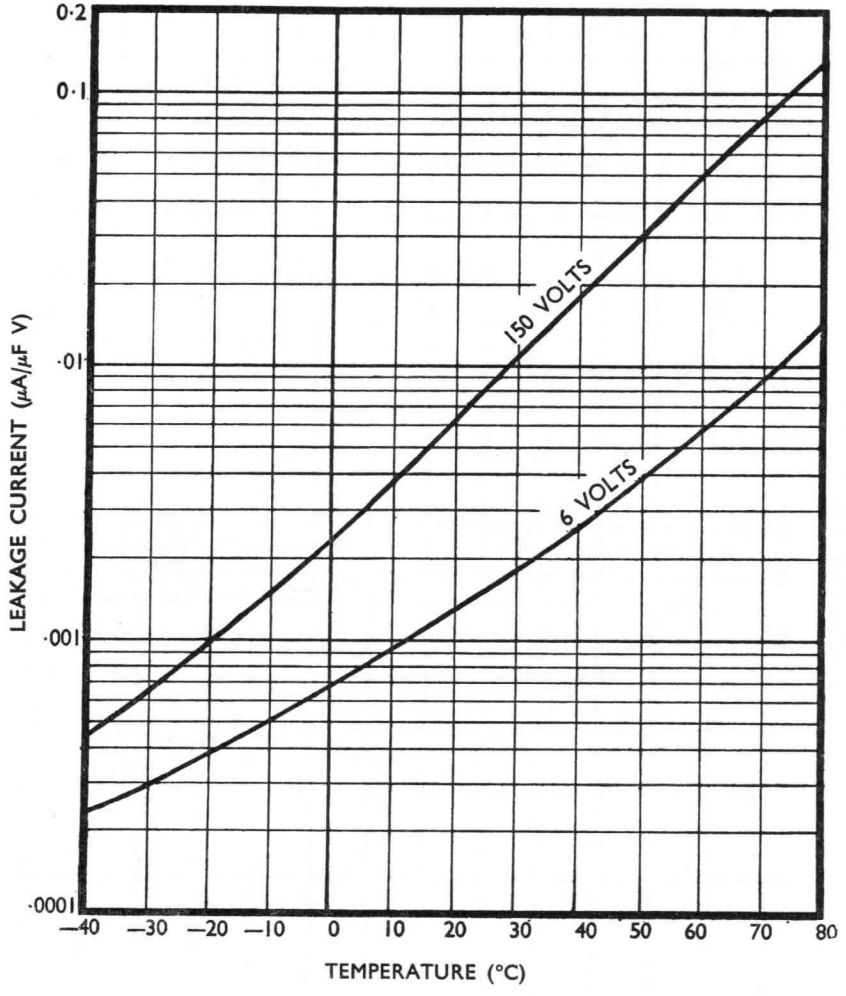
GRAPHS OF TYPICAL PERFORMANCE—(*continued*)

Fig. 2.—Variation of Dissipation Factor with Temperature (measured at 120Hz)



GRAPHS OF TYPICAL PERFORMANCE—(*continued*)

Fig. 3.—Leakage Current after 10 minutes Electrification

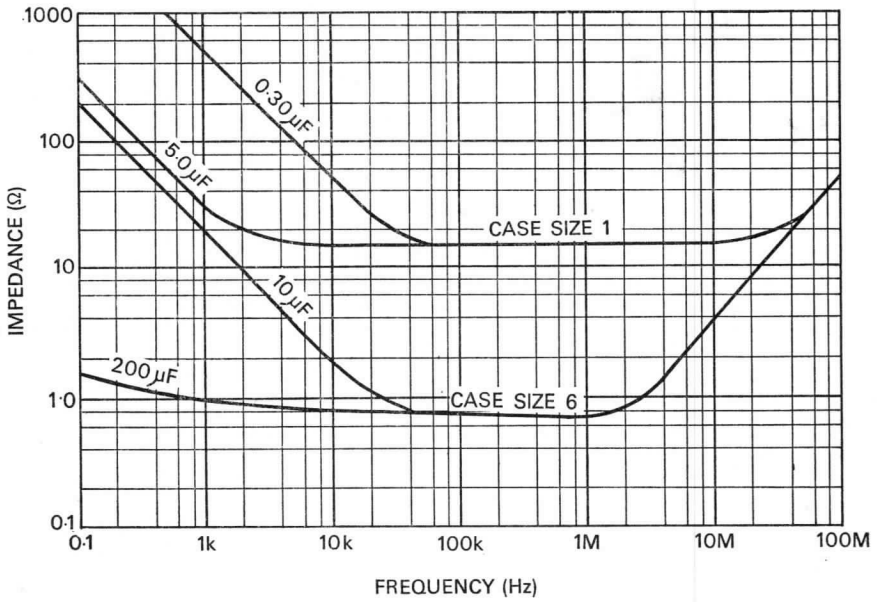


Codes 472-LWA-1 to 6
472-LWA-101 to 106

CONTINUED

GRAPHS OF TYPICAL PERFORMANCE—(*continued*)

Fig. 4.—Impedance/Frequency Characteristics



CAPACITORS

STC

PROVISIONAL DATA

TANTALUM 3

High Temperature Tantalum

(WET ELECTROLYTE FOIL TYPE)

Codes 472–LWA–41 to 46 Polarised
472–LWA–141 to 146 Non-Polarised

INTRODUCTION

The standard ranges of Stantelum electrolytic capacitors 472–LWA–1 to 6 and 472–LWA–101 to 106 are now well established and have received widespread acceptance as a highly reliable component for many communication and industrial applications. To meet new requirements STC have developed a range of tantalum foil wet-electrolyte capacitors for operation up to 125°C and to withstand vibration conditions far in excess of those specified in RCS 134B.

A low vapour-pressure electrolyte has been chosen to ensure that the seal efficiency remains unimpaired up to the maximum operating temperature, while the full electrical characteristics of the capacitor are maintained.

The improved performance under the more stringent conditions of vibration has been achieved by a revised mechanical assembly, which completely supports the unit and reduces internal resonances.

CONSTRUCTION

The construction of these capacitors is identical to that of the standard range of Stantelum Foil Type Electrolytic Capacitors with the following exceptions.

1. The electrolyte has been changed to allow an upper temperature of 125°C.
2. There is an improved mechanical assembly which permits the unit to be wound to the internal diameter of the case, thereby reducing movement under vibration conditions. When they are used under conditions of severe vibration it is essential that the capacitors are supported otherwise than by their terminal wires.
3. Instead of a separate insulating sleeve the case is totally encapsulated in a rigid plastic sleeve and sealed at each end by the further application of high-temperature thermo-setting resin.

These high temperature tantalum capacitors are suitable for use in circuits intended for total encapsulation, provided that the process temperature does not exceed 125°C.

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, W.C.2

COMPONENTS GROUP

CAPACITOR DIVISION, PAIGNTON, DEVON Tel.: Paignton 58685 Telex: 4251

LONDON SALES OFFICE, FOOTSCRAY, SIDCUP, KENT Tel.: Footscray 3333 Telex: 21836

TEMPERATURE AND CLIMATIC GRADE

These capacitors are designed to meet the requirements of Humidity Class H6 of DEF–5011 in the temperature range −55°C to +125°C and under conditions of high vibration, for a maximum period of 1 000 hours. They are suitable for storage at temperatures as low as −60°C.

TERMINATIONS

The leads are securely spot welded to the tantalum stub and this weld is encapsulated in the first resin seal.

Robustness

The terminations will withstand the robustness tests outlined in draft DEF 5134C and DEF 5011 as follows:

Tensile Strength Test	5 lb
Bending Test	2½ lb through two bends at 90°
Average performance	
Tensile Test; tensile pull at fracture	> 20 lb
Bending Test	> four bends through 90° with 2½ lb

Vibration Test

The terminations will withstand the vibration and bumping tests outlined in the above Service Specifications, provided that the body of the capacitor is supported otherwise than by the terminal wires.

Codes 472-LWA-41 to 46
472-LWA-141 to 146

CONTINUED

ELECTRICAL CHARACTERISTICS

Limits

(Reference temperature 20°C)

Capacitance tolerance	>0·25μF	±20%
	<0·25μF	+30% −10%

Power Factor	6 V	12 V	25 V	50 V	100 V
	12%	12%	8%	8%	6%

Leakage current after three minutes at working voltage	Polar Types	0·02μA/μF V
	Non-Polar Types	0·04μA/μF V

Typical Performance

		+125°C	−20°C	−40°C
Capacitance change (reference temperature 20°C)	100 V	+ 8%	− 4%	−10%
	50 V	+10%	− 6%	−20%
	25 V	+22%	−10%	−25%
	12 V	+28%	−12%	−30%
	6 V	+33%	−15%	−35%
Power Factor	100 V	2%	6%	36%
	50 V	3%	14%	56%
	25 V	4%	10%	30%
	12 V	5%	16%	50%
	6 V	7%	21%	75%

Leakage current/Time characteristics

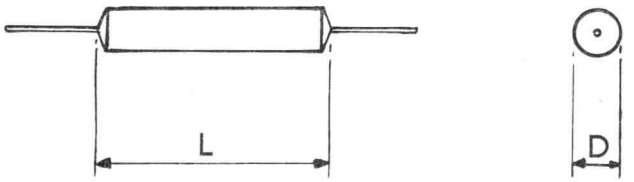
472-LWA-45EA

5μF 100 V Polarised	10 sec	0·014μA/μF V
	180 sec	0·002μA/μF V
	1 500 sec	0·0009μA/μF V

Conditions of measurement:

At 50 c/s and 20°C and in the case of polarised capacitors with d.c. working voltage applied.

DIMENSIONS



STC Code	Maximum Dimensions				Weight (Max)	
	L		D			
	in	mm	in	mm	oz	g
472–LWA–41 472–LWA–141	1·06	26,9	0·195	4,95	0·053	1,5
472–LWA–42 472–LWA–142	1·06	26,9	0·225	5,72	0·070	2,0
472–LWA–43 472–LWA–143	1·06	26,9	0·285	7,24	0·105	3,0
472–LWA–44 472–LWA–144	1·25	31,8	0·285	7,24	0·123	3,5
472–LWA–45 472–LWA–145	1·88	47,8	0·285	7,24	0·195	5,5
472–LWA–46 472–LWA–146	1·88	47,8	0·395	10,03	0·335	9,5

Terminal Wires

Diameter	0·024 in	(0,61 mm)
Length (minimum)	~~1·56~~ in	(~~39,7~~ mm)
	1·25.	32.

Codes 472–LWA–41 to 46
472–LWA–141 to 146

CONTINUED

RATINGS AND CODES

The following table shows the maximum capacitance, measured at 50 c/s, that can be housed in the given case size for the rated working voltages.

D.C. Working Voltage (125°C)	Polarised Type		Non-Polarised Type	
	Cap (μF)	Code No.	Cap (μF)	Code No.
6	5·0	472–LWA–41AA	2·5	472–LWA–141AA
	10·0	,, 42AA	5·0	,, 142AA
	20·0	,, 43AA	10·0	,, 143AA
	40·0	,, 44AA	20·0	,, 144AA
	80·0	,, 45AA	40·0	,, 145AA
	200·0	,, 46AA	100·0	,, 146AA
12	2·5	472–LWA–41BA	1·25	472–LWA–141BA
	5·0	,, 42BA	2·5	,, 142BA
	10·0	,, 43BA	5·0	,, 143BA
	20·0	,, 44BA	10·0	,, 144BA
	40·0	,, 45BA	20·0	,, 145BA
	100·0	,, 46BA	50·0	,, 146BA
25	1·5	472–LWA–41CA	0·75	472–LWA–141CA
	2·5	,, 42CA	1·25	,, 142CA
	6·0	,, 43CA	3·0	,, 143CA
	10·0	,, 44CA	5·0	,, 144CA
	20·0	,, 45CA	10·0	,, 145CA
	50·0	,, 46CA	25·0	,, 146CA
50	0·75	472–LWA–41DA	0·375	472–LWA–141DA
	1·5	,, 42DA	0·75	,, 142DA
	3·0	,, 43DA	1·5	,, 143DA
	5·0	,, 44DA	2·5	,, 144DA
	10·0	,, 45DA	5·0	,, 145DA
	25·0	,, 46DA	12·5	,, 146DA
100	0·40	472–LWA–41EA	0·20	472–LWA–141EA
	0·75	,, 42EA	0·375	,, 142EA
	1·5	,, 43EA	0·75	,, 143EA
	2·5	,, 44EA	1·25	,, 144EA
	5·0	,, 45EA	2·50	,, 145EA
	15·0	,, 46EA	7·50	,, 146EA

A.C. RATINGS

The following table shows the maximum volt-ampere ratings at various temperatures and frequencies for both polarised and non-polarised HIGH-TEMPERATURE TANTALUM foil capacitors.

Temperature (°C)	Frequency (c/s)	Maximum Volt-Ampere Ratings					
		472–LWA –41 –141	472–LWA –42 –142	472–LWA –43 –143	472–LWA –44 –144	472–LWA –45 –145	472–LWA –46 –146
25	50	2·4	2·8	3·9	4·9	8·1	12·2
	400	1·76	2·06	2·87	3·6	6·0	9·0
	1 000	1·44	1·7	2·3	2·9	4·9	7·3
50	50	1·7	1·9	2·6	3·3	5·5	8·1
	400	1·25	1·4	1·9	2·4	4·0	6·0
	1 000	1·0	1·1	1·5	2·0	3·3	4·8
85	50	0·68	0·79	1·08	1·36	2·25	3·3
	400	0·5	0·58	0·80	1·00	1·65	2·42
	1 000	0·41	0·48	0·65	0·82	1·35	2·0
125	50	0·34	0·40	0·54	0·68	1·13	1·65
	400	0·25	0·29	0·40	0·50	0·83	1·21
	1 000	0·21	0·24	0·33	0·41	0·68	1·00

RIPPLE CURRENT RATING

The maximum ripple currents which can be permitted in HIGH-TEMPERATURE TANTALUM foil type electrolytic capacitors are determined by two factors:

1. At low frequencies the peak applied voltage must not exceed the rated d.c. voltage and with polarised type capacitors the applied voltage must not cause a reversal of polarity.
2. At high frequencies the heat generated must not cause excessive temperature rise. The permissible temperature rise decreases as the ambient temperature increases.

Polarised Capacitors

It should be particularly noted that with polarised type capacitors the sum of the applied d.c. and the peak a.c. ripple voltage must not exceed the rated d.c. working voltage and there must be no reversal of polarity.

Maximum ripple currents and voltages and d.c. polarising voltages for polarised HIGH-TEMPERATURE TANTALUM capacitors are given in Table I.

Where d.c. polarising volts are shown as half of the rated d.c. working voltage the maximum ripple current and voltage can only be achieved with this value of d.c. polarising voltage. With lower values of ripple current and voltage a correspondingly wider range of d.c. polarising voltages may be employed.

Non-Polarised Capacitors

Due to the fact that this type of capacitor employs two formed electrodes, it normally has half the capacitance of the polarised type. Each electrode acts as its own rectifier to polarise itself in the correct direction. Thus this type of capacitor may be used either on a.c. or d.c. of either polarity.

Maximum ripple currents and voltages for non-polarised HIGH-TEMPERATURE TANTALUM capacitors are given in Table II.

The $\pm$ d.c. polarising voltage given is the maximum permissible when full a.c. ripple voltage is present. Larger values of d.c. voltage must be compensated by decreasing a.c. ripple voltage correspondingly.

TABLE I

MAXIMUM RIPPLE CURRENT RATINGS OF STC HIGH-TEMPERATURE TANTALUM ELECTROLYTIC CAPACITORS 472–LWA–41 TO 46 (POLAR TYPE 125°C MAX.)

STC Code	Rated Volts (125°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY								
			25°C								
			50 c/s			400 c/s			1 000 c/s		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)
472–LWA–41AA	6	5·0	3·3	2·1	3·0	26	2·1	3·0	67	2·1	3·0
,, –41BA	12	2·5	3·3	4·2	6·0	26	4·2	6·0	67	4·3	6·0
,, –41CA	25	1·5	4·2	8·8	12·5	33	8·8	12·5	84	8·9	12·5
,, –41DA	50	0·75	4·2	18·0	25·0	33	18·0	25·0	82	17·4	25·7
,, –41EA	100	0·40	4·4	35·0	50·0	35	35·0	50·0	60	24·0	66·4
472–LWA–42AA	6	10·0	6·7	2·1	3·0	53	2·1	3·0	133	2·1	3·0
,, –42BA	12	5·0	6·7	4·2	6·0	53	4·2	6·0	133	4·3	6·0
,, –42CA	25	2·5	7·0	8·8	12·5	55	8·8	12·5	138	8·9	12·5
,, –42DA	50	1·5	8·3	18·0	25·0	66	18·0	25·0	126	13·4	31·3
,, –42EA	100	0·75	8·3	35·0	50·0	62	33·0	53·0	89	18·9	73·5
472–LWA–43AA	6	20·0	13·0	2·1	3·0	110	2·1	3·0	264	2·1	3·0
,, –43BA	12	10·0	13·0	4·2	6·0	110	4·2	6·0	264	4·3	6·0
,, –43CA	25	6·0	17·0	8·8	12·5	130	8·8	12·5	293	7·9	14·0
,, –43DA	50	3·0	17·0	18·0	25·0	130	18·0	25·0	207	11·2	34·4
,, –43EA	100	1·5	17·0	35·0	50·0	100	27·0	62·0	146	15·8	78·0
472–LWA–44AA	6	40·0	26·0	2·1	3·0	210	2·1	3·0	530	2·1	3·0
,, –44BA	12	20·0	26·0	4·2	6·0	210	4·2	6·0	530	4·3	6·0
,, –44CA	25	10·0	28·0	8·8	12·5	220	8·8	12·5	427	6·8	15·4
,, –44DA	50	5·0	28·0	18·0	25·0	210	17·0	26.0	300	9·6	35·6
,, –44EA	100	2·5	28·0	35·0	50·0	150	24·0	66·0	212	13·6	81·0
472–LWA–45AA	6	80	53·0	2·1	3·0	420	2·1	3·0	1060	2·12	3·0
,, –45BA	12	40	53·0	4·2	6·0	420	4·2	6·0	1060	4·3	6·0
,, –45CA	25	20	55·0	8·8	12·5	440	8·8	12·5	785	6·3	16·2
,, –45DA	50	10	56·0	18·0	25·0	390	16·0	27·0	555	8·9	37·6
,, –45EA	100	5	56·0	35·0	50·0	270	22·0	69·0	390	12·5	82·5
472–LWA–46AA	6	200	133·0	2·1	3·0	1100	2·1	3·0	2650	2·1	3·0
,, –46BA	12	100	133·0	4·2	6·0	1100	4·2	6·0	2130	3·4	7·2
,, –46CA	25	50	138·0	8·8	12·5	1100	8·8	12·0	1500	4·8	18·3
,, –46DA	50	25	139·0	18·0	25·0	750	12·0	33·0	1070	6·9	40·4
,, –46EA	100	15	167·0	35·0	50·0	580	16·0	77·0	830	8·8	87·7

Codes 472–LWA–41 to 46
472–LWA–141 to 146

CONTINUED

TABLE I

MAXIMUM RIPPLE CURRENT RATINGS OF STC HIGH-TEMPERATURE TANTALUM ELECTROLYTIC CAPACITORS 472–LWA–41 TO 46 (POLAR TYPE 125°C MAX.)

STC Code	Rated Volts (125°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY								
			50°C								
			50 c/s			400 c/s			1 000 c/s		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)
472–LWA–41AA	6	5·0	3·3	2·1	3·0	26	2·1	3·0	67	2·1	3·0
,, –41BA	12	2·5	3·3	4·2	6·0	26	4·2	6·0	67	4·3	6·0
,, –41CA	25	1·5	4·2	8·8	12·5	33	8·8	12·5	84	8·9	12·5
,, –41DA	50	0·75	4·2	18·0	25·0	33	18·0	25·0	69	14·5	29·6
,, –41EA	100	0·40	4·4	35·0	50·0	35	35·0	50·0	50	20·0	72·0
472–LWA–42AA	6	10.0	6·7	2·1	3·0	53	2·1	3·0	133	2·1	3·0
,, –42BA	12	5·0	6·7	4·2	6·0	53	4·2	6·0	133	4·3	6·0
,, –42CA	25	2·5	7·0	8·8	12·5	55	8·8	12·5	131	8·4	13·1
,, –42DA	50	1·5	8·3	18·0	25·0	66	18·0	25·0	102	10·8	34·7
,, –42EA	100	0·75	8·3	35·0	50·0	51	27·0	62·0	72	15·3	78·4
472–LWA–43AA	6	20·0	13·0	2·1	3·0	110	2·1	3·0	264	2·1	3·0
,, –43BA	12	10·0	13·0	4·2	6·0	110	4·2	6·0	264	4·3	6·0
,, –43CA	25	6·0	17·0	8·8	12·5	130	8·8	12·5	235	6·3	16·0
,, –43DA	50	3·0	17·0	18·0	25·0	120	16·0	29·0	166	9·0	37·3
,, –43EA	100	1·5	17·0	35·0	50·0	84	22·0	69·0	117	12·6	82·1
472–LWA–44AA	6	40·0	26·0	2·1	3·0	210	2·1	3·0	530	2·1	3·0
,, –44BA	12	20·0	26·0	4·2	6·0	210	4·2	6·0	501	4·0	6·3
,, –44CA	25	10·0	28·0	8·8	12·5	220	8·8	12·5	354	5·7	17·0
,, –44DA	50	5·0	28·0	18·0	25·0	170	14·0	30·0	249	8·0	38·8
,, –44EA	100	2·5	28·0	35·0	50·0	120	19·0	73·0	176	11·3	85·9
472–LWA–45AA	6	80	53·0	2·1	3·0	420	2·1	3·0	1060	2·1	3·0
,, –45BA	12	40	53·0	4·2	6·0	420	4·2	6·0	914	3·6	6·8
,, –45CA	25	20	55·0	8·8	12·5	440	8·8	12·5	647	5·2	17·7
,, –45DA	50	10	56·0	18·0	25·0	320	13·0	32·0	457	7·3	39·7
,, –45EA	100	5	56·0	35·0	50·0	220	18·0	75·0	322	10·3	85·5
472–LWA–46AA	6	200	133·0	2·1	3·0	1100	2·1	3·0	2470	2·0	3·2
,, –46BA	12	100	133·0	4·2	6·0	1100	4·2	6·0	1730	2·8	8·1
,, –46CA	25	50	138·0	8·8	12·5	870	7·0	15·0	1215	3·9	19·5
,, –46DA	50	25	139·0	18·0	25·0	610	9·8	36·0	865	5·5	42·2
,, –46EA	100	15	167·0	35·0	50·0	470	13·0	82·0	673	7·1	90·0

TABLE I

MAXIMUM RIPPLE CURRENT RATINGS OF STC HIGH-TEMPERATURE TANTALUM ELECTROLYTIC CAPACITORS 472–LWA–41 TO 46 (POLAR TYPE 125°C MAX.)

STC Code	Rated Volts (125°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY								
			85°C								
			50 c/s			400 c/s			1 000 c/s		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)
472–LWA–41AA	6	5·0	3·3	2·1	3·0	26	2·1	3·0	67	2·1	3·0
,, –41BA	12	2·5	3·3	4·2	6·0	26	4·2	6·0	67	4·3	6·0
,, –41CA	25	1·5	4·2	8·8	12·5	33	8·8	12·5	62	6·6	15·8
,, –41DA	50	0·75	4·2	18·0	25·0	31	17·0	26·0	44	9·3	36·9
,, –41EA	100	0·40	4·4	35·0	50·0	22	22·0	69·0	32	12·8	81·9
472–LWA–42AA	6	10·0	6·7	2·1	3·0	53	2·1	3·0	133	2·1	3·0
,, –42BA	12	5·0	6·7	4·2	6·0	53	4·2	6·0	122	3·9	6·5
,, –42CA	25	2·5	7·0	8·8	12·5	55	8·8	12·5	86	5·5	17·2
,, –42DA	50	1·5	8·3	18·0	25·0	47	13·0	32·0	67	7·0	41·1
,, –42EA	100	0·75	8·3	35·0	50·0	33	18·0	75·0	47	10·1	85·7
472–LWA–43AA	6	20·0	13·0	2·1	3·0	110	2·1	3·0	264	2·1	3·0
,, –43BA	12	10·0	13·0	4·2	6·0	110	4·2	6·0	203	3·2	7·4
,, –43CA	25	6·0	17·0	8·8	12·5	110	7·4	15·0	156	4·2	19·0
,, –43DA	50	3·0	17·0	18·0	25·0	77	10·0	36·0	110	5·9	41·6
,, –43EA	100	1·5	17·0	35·0	50·0	54	14·0	80·0	78	8·4	88·1
472–LWA–44AA	6	40·0	26·0	2·1	3·0	210	2·1	3·0	457	1·9	3·3
,, –44BA	12	20·0	26·0	4·2	6·0	210	4·2	6·0	324	2·6	8·3
,, –44CA	25	10·0	28·0	8·8	12·5	160	6·4	16·0	228	3·7	19·8
,, –44DA	50	5·0	28·0	18·0	25·0	110	8·8	38·0	161	5·2	42·7
,, –44EA	100	2·5	28·0	35·0	50·0	79	13·0	82·0	114	7·3	89·7
472–LWA–45AA	6	80	53·0	2·1	3·0	420	2·1	3·0	815	1·6	3·7
,, –45BA	12	40	53·0	4·2	6·0	410	4·1	6·0	583	2·3	8·7
,, –45CA	25	20	55·0	8·8	12·5	290	5·8	17·0	413	3·3	20·3
,, –45DA	50	10	56·0	18·0	25·0	200	8·0	39·0	293	4·7	43·4
,, –45EA	100	5	56·0	35·0	50·0	140	11·0	84·0	205	6·6	90·7
472–LWA–46AA	6	200	133·0	2·1	3·0	1100	2·1	3·0	1590	1·3	4·2
,, –46BA	12	100	133·0	4·2	6·0	780	3·1	7·6	1115	1·8	9·4
,, –46CA	25	50	138·0	8·8	12·5	550	4·4	19·0	783	2·5	21·5
,, –46DA	50	25	139·0	18·0	25·0	390	6·2	41·0	558	3·6	44·9
,, –46EA	100	15	167·0	35·0	50·0	300	8·1	89·0	433	4·6	93·5

Codes 472–LWA–41 to 46
472–LWA–141 to 146

CONTINUED

TABLE 1

MAXIMUM RIPPLE CURRENT RATINGS OF STC HIGH-TEMPERATURE TANTALUM ELECTROLYTIC CAPACITORS 472–LWA–41 TO 46 (POLAR TYPE 125°C MAX.)

STC Code	Rated Volts (125°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY								
			125°C								
			50 c/s			400 c/s			1 000 c/s		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. d.c. polarising volts (see note)
472–LWA–41AA	6	5·0	3·3	2·1	3·0	26	2·1	3·0	67	2·1	3·0
,, –41BA	12	2·5	3·3	4·2	6·0	26	4·2	6·0	67	4·3	6·0
,, –41CA	25	1·5	4·2	8·8	12·5	33	8·8	12·5	59	6·3	16·2
,, –41DA	50	0·75	4·2	18·0	25·0	30	16·0	27·0	42	8·9	37·4
,, –41EA	100	0·40	4·4	35·0	50·0	22	22·0	31·0	33	31·2	81·4
472–LWA–42AA	6	10·0	6·7	2·1	3·0	53	2·1	3·0	133	2·1	3·0
,, –42BA	12	5·0	6·7	4·2	6·0	53	4·2	6·0	117	3·7	6·7
,, –42CA	25	2·5	7·0	8·8	12·5	55	8·8	12·5	83	5·3	17·5
,, –42DA	50	1·5	8·3	18·0	25·0	45	12·0	33·0	64	6·8	40·4
,, –42EA	100	0·75	8·3	35·0	50·0	32	17·0	76·0	46	9·7	86·2
472–LWA–43AA	6	20·0	13·0	2·1	3·0	110	2·1	3·0	264	2·1	3·0
,, –43BA	12	10·0	13·0	4·2	6·0	110	4·2	6·0	195	3·1	7·6
,, –43CA	25	6·0	17·0	8·8	12·5	100	6·7	16·0	150	4·1	19·3
,, –43DA	50	3·0	17·0	18·0	25·0	74	9·8	36·0	106	5·7	41·9
,, –43EA	100	1·5	17·0	35·0	50·0	52	14·0	80·0	74	8·0	88·7
472–LWA–44AA	6	40·0	26·0	2·1	3·0	210	2·1	3·0	439	1·7	3·5
,, –44BA	12	20·0	26·0	4·2	6·0	210	4·2	6·0	311	2·5	8·5
,, –44CA	25	10·0	28·0	8·8	12·5	150	6·0	17·0	218	3·5	20·1
,, –44DA	50	5·0	28·0	18·0	25·0	110	8·8	38·0	154	4·9	43·0
,, –44EA	100	2·5	28·0	35·0	50·0	76	12·0	83·0	109	7·0	90·1
472–LWA–45AA	6	80	53·0	2·1	3·0	420	2·1	3·0	782	1·6	3·8
,, –45BA	12	40	53·0	4·2	6·0	390	3·9	6·0	559	2·2	8·8
,, –45CA	25	20	55·0	8·8	12·5	270	5·4	17·0	397	3·2	20·5
,, –45DA	50	10	56·0	18·0	25·0	190	7·6	39·0	280	4·5	43·7
,, –45EA	100	5	56·0	35·0	50·0	140	11·0	84·0	196	6·3	91·2
472–LWA–46AA	6	200	133·0	2·1	3·0	1100	2·1	3·0	1522	1·2	4·3
,, –46BA	12	100	133·0	4·2	6·0	750	3·0	7·8	1070	1·7	9·6
,, –46CA	25	50	138·0	8·8	12·5	530	4·2	19·0	750	2·4	21·6
,, –46DA	50	25	139·0	18·0	25·0	370	5·9	42·0	535	3·4	45·2
,, –46EA	100	15	120·0	25·0	65·0	290	7·8	89·0	415	4·4	93·8

TABLE II

MAXIMUM RIPPLE CURRENT RATINGS OF STC HIGH-TEMPERATURE TANTALUM ELECTROLYTIC CAPACITORS 472–LWA–141 TO 146 (NON-POLAR TYPE 125°C MAX.)

STC Code	Rated Volts (125°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY								
			25°C								
			50 c/s			400 c/s			1 000 c/s		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)
472–LWA–141AA	6	2·5	3·3	4·2	0	26	4·2	0	67	4·2	0
,, –141BA	12	1·25	3·3	8·5	0	26	8·5	0	67	8·5	0
,, –141CA	25	0·75	4·2	18·0	0	33	18·0	0	82	17·5	0·4
,, –141DA	50	0·375	4·2	35·0	0	33	35·0	0	58	24·6	15·4
,, –141EA	100	0·2	4·4	71·0	0	30	60·0	15	42	33·6	52·6
472–LWA–142AA	6	5·0	6·7	4·2	0	53	4·2	0	133	4·2	0
,, –142BA	12	2·5	6·7	8·5	0	53	8·5	0	133	8·5	0
,, –142CA	25	1·25	7·0	18·0	0	55	18·0	0	115	14·7	4·2
,, –142DA	50	0·75	8·3	35·0	0	62	33·0	3·3	89	18·9	23·4
,, –142EA	100	0·375	8·3	71·0	0	44	47·0	34	63	26·6	62·3
472–LWA–143AA	6	10·0	13	4·2	0	110	4·2	0	264	4·2	0
,, –143BA	12	5·0	13	8·5	0	110	8·5	0	264	8·5	0
,, –143CA	25	3·0	17	18·0	0	130	18·0	0	207	14·6	4·4
,, –143DA	50	1·5	17	35·0	0	100	27·0	12	146	15·8	27·7
,, –143EA	100	0·75	17	71·0	0	73	39·0	45	103	22·3	68·6
472–LWA–144AA	6	20·0	26	4·2	0	210	4·2	0	530	4·2	0
,, –144BA	12	10·0	26	8·5	0	210	8·5	0	427	6·8	2·3
,, –144CA	25	5·0	28	18·0	0	210	17·0	0·96	301	9·6	11·4
,, –144DA	50	2·5	28	35·0	0	150	24·0	16·0	212	13·6	30·8
,, –144EA	100	1·25	28	71·0	0	110	35·0	51·0	150	19·2	73·0
472–LWA–145AA	6	40·0	53	4·2	0	420	4·2	0	1060	4·2	0
,, –145BA	12	20·0	53	8·5	0	420	8·5	0	785	6·3	3·1
,, –145CA	25	10·0	55	18·0	0	390	16·0	2·4	555	8·9	12·5
,, –145DA	50	5·0	56	35·0	0	270	22·0	19·0	393	12·6	32·3
,, –145EA	100	2·5	56	71·0	0	190	30·0	58·0	275	17·6	75·2
472–LWA–146AA	6	100·0	130	4·2	0	1100	4·2	0	2150	3·4	1·1
,, –146BA	12	50·0	130	8·5	0	1100	8·5	0	1510	4·8	5·2
,, –146CA	25	25·0	140	18·0	0	750	12·0	8·0	1050	6·7	15·4
,, –146DA	50	12·5	140	35·0	0	530	17·0	26·0	754	9·6	36·4
,, –146EA	100	7·5	170	71·0	0	410	22·0	69·0	586	12·4	82·5

Codes 472–LWA–41 to 46
472–LWA–141 to 146

CONTINUED

TABLE II

MAXIMUM RIPPLE CURRENT RATINGS OF STC HIGH-TEMPERATURE TANTALUM ELECTROLYTIC CAPACITORS 472–LWA–141 TO 146 (NON-POLAR TYPE 125°C MAX.)

STC Code	Rated Volts (125°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY								
			50°C								
			50 c/s			400 c/s			1 000 c/s		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)
472–LWA–141AA	6	2·5	3·3	4·2	0	26	4·2	0	67	4·2	0
,, –141BA	12	1·25	3·3	8·5	0	26	8·5	0	67	8·5	0
,, –141CA	25	0·75	4·2	18·0	0	33	18·0	0	68	14·5	4·5
,, –141DA	50	0·375	4·2	35·0	0	33	35·0	0	50	21·0	20·4
,, –141EA	100	0·2	4·4	71·0	0	25	50·0	29	34	27·5	61·1
472–LWA–142AA	6	5·0	6·7	4·2	0	53	4·2	0	133	4·2	0
,, –142BA	12	2·5	6·7	8·5	0	53	8·5	0	133	8·5	0
,, –142CA	25	1·25	7·0	18·0	0	55	18·0	0	93	11·9	8·2
,, –142DA	50	0·75	8·3	35·0	0	51	27·0	12	72	15·3	28·4
,, –142EA	100	0·375	8·3	71·0	0	36	38·0	46	51	21·6	69·4
472–LWA–143AA	6	10·0	13	4·2	0	110	4·2	0	264	4·2	0
,, –143BA	12	5·0	13	8·5	0	110	8·5	0	216	6·9	2·2
,, –143CA	25	3·0	17	18·0	0	120	16·0	2·4	166	9·0	12·3
,, –143DA	50	1·5	17	35·0	0	84	22·0	19·0	117	12·6	32·1
,, –143EA	100	0·75	17	71·0	0	60	32·0	55·0	83	17·9	74·8
472–LWA–144AA	6	20·0	26	4·2	0	210	4·2	0	500	4·0	0·3
,, –144BA	12	10·0	26	8·5	0	210	8·5	0	354	5·7	4·0
,, –144CA	25	5·0	28	18.0	0	170	14·0	5·2	250	8·0	13·7
,, –144DA	50	2·5	28	35·0	0	120	19·0	23·0	176	11·3	34·1
,, –144EA	100	1·25	28	71·0	0	87	28·0	60·0	124	15·9	77·6
472–LWA–145AA	6	40·0	53	4·2	0	420	4·2	0	900	3·6	0·9
,, –145BA	12	20·0	53	8·5	0	420	8·5	0	646	5·2	4·7
,, –145CA	25	10·0	55	18·0	0	320	13·0	6·6	457	7·3	14·7
,, –145DA	50	5·0	56	35·0	0	220	18·0	25·0	323	10·3	35·4
,, –145EA	100	2·5	56	71·0	0	160	26·0	63·0	226	14·5	79·6
472–LWA–146AA	6	100·0	130	4·2	0	1100	4·2	0	1750	2·8	2·0
,, –146BA	12	50·0	130	8·5	0	870	7·0	2·1	1220	3·9	6·5
,, –146CA	25	25·0	140	18·0	0	610	9·8	11·0	860	5·5	17·2
,, –146DA	50	12·5	140	35·0	0	430	14·0	30·0	611	7·8	39·0
,, –146EA	100	7·5	140	59·0	17·0	330	18·0	75·0	475	10·1	85·8

TABLE II

MAXIMUM RIPPLE CURRENT RATINGS OF STC HIGH-TEMPERATURE TANTALUM ELECTROLYTIC CAPACITORS 472–LWA–141 TO 146 (NON-POLAR TYPE 125°C MAX.)

STC Code	Rated Volts (125°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY								
			85°C								
			50 c/s			400 c/s			1 000 c/s		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)
472–LWA–141AA	6	2·5	3·3	4·2	0	26	4·2	0	67	4·2	0
,, –141BA	12	1·25	3·3	8·5	0	26	8·5	0	57	7·3	1·5
,, –141CA	25	0·75	4·2	18·0	0	31	17·0	0·96	44	9·3	11·8
,, –141DA	50	0·375	4·2	35·0	0	22	23·0	18·0	31	13·1	31·5
,, –141EA	100	0·2	4·4	71·0	0	16	32·0	55·0	23	18·1	74·4
472–LWA–142AA	6	5·0	6·7	4·2	0	53	4·2	0	122	3·9	0·5
,, –142BA	12	2·5	6·7	8·5	0	53	8·5	0	86	5·5	4·2
,, –142CA	25	1·25	7·0	18·0	0	43	14·0	5·2	61	7·8	14·0
,, –142DA	50	0·75	8·3	35·0	0	33	18·0	25·0	48	10·1	35·8
,, –142EA	100	0·375	8·3	71·0	0	23	25·0	65·0	34	14·2	80·0
472–LWA–143AA	6	10·0	13	4·2	0	110	4·2	0	204	3·3	1·4
,, –143BA	12	5·0	13	8·5	0	100	8·0	0·69	144	4·6	5·5
,, –143CA	25	3·0	17	18·0	0	77	10·0	11·0	110	5·9	16·6
,, –143DA	50	1·5	17	35·0	0	55	15·0	29·0	78	8·4	38·1
,, –143EA	100	0·75	16	68·0	3·8	38	20·0	72·0	55	11·9	83·2
472–LWA–144AA	6	20·0	26	4·2	0	210	4·2	0	323	2·6	2·4
,, –144BA	12	10·0	26	8·5	0	160	6·4	3·0	228	3·6	6·8
,, –144CA	25	5·0	28	18·0	0	110	8·8	13·0	161	5·2	17·7
,, –144DA	50	2·5	28	35·0	0	79	13·0	32·0	114	7·3	39·7
,, –144EA	100	1·25	23	58·0	18	56	18·0	75·0	80	10·3	85·5
472–LWA–145AA	6	40·0	53	4·2	0	390	3·9	0·49	576	2·3	2·7
,, –145BA	12	20·0	53	8·5	0	290	5·8	3·8	412	3·3	7·3
,, –145CA	25	10·0	55	18·0	0	200	8·0	14·0	291	4·7	18·4
,, –145DA	50	5·0	56	35·0	0	140	11·0	34·0	206	6·6	40·7
,, –145EA	100	2·5	42	53·0	25	100	16·0	77·0	145	9·3	86·9
472–LWA–146AA	6	100·0	130	4·2	0	780	3·1	1·6	1120	1·8	3·5
,, –146BA	12	50·0	130	8·5	0	550	4·4	5·8	787	2·5	8·4
,, –146CA	25	25·0	140	18·0	0	390	6·2	16·0	552	3·5	20·0
,, –146DA	50	12·5	110	28·0	10	280	9·0	37·0	394	5·0	42·9
,, –146EA	100	7·5	98	37·0	48	210	11·0	84·0	306	6·5	90·8

Codes 472–LWA–41 to 46
472–LWA–141 to 146

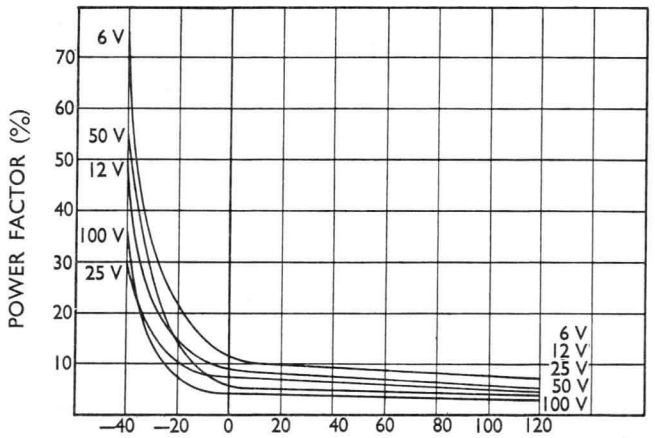
CONTINUED

TABLE II

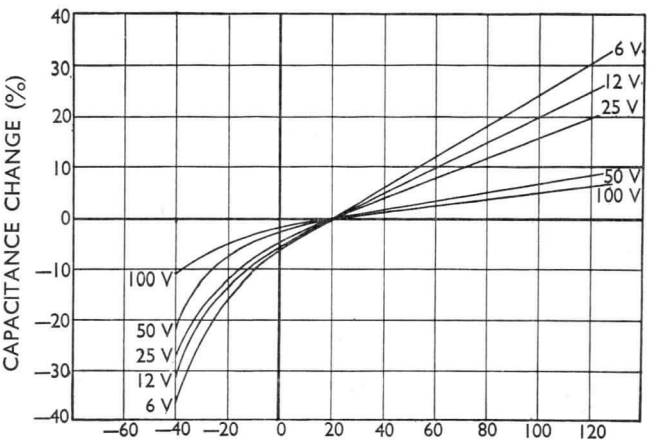
MAXIMUM RIPPLE CURRENT RATINGS OF STC HIGH-TEMPERATURE TANTALUM ELECTROLYTIC CAPACITORS 472–LWA–141 TO 146 (NON-POLAR TYPE 125°C MAX.)

STC Code	Rated Volts (125°C)	Cap. (μF)	ACTUAL OPERATING TEMPERATURE AND FREQUENCY								
			125°C								
			50 c/s			400 c/s			1 000 c/s		
			Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)	Max. ripple current (mA)	Max. ripple volts (rms)	Max. ± d.c. polarising volts (see note)
472–LWA–141AA	6	2·5	3·3	4·2	0	26	4·2	0	67	4·2	0
,, –141BA	12	1·25	3.3	8·5	0	26	8·5	0	54	7·0	2·2
,, –141CA	25	0·75	4·2	18·0	0	29	15·0	3·8	42	8·9	12·4
,, –141DA	50	0·375	4·2	35·0	0	21	22·0	19·0	30	12·6	32·2
,, –141EA	100	0·2	4·4	71·0	0	15	30·0	58·0	22	17·8	75·4
472–LWA–142AA	6	5·0	6·7	4·2	0	53	4·2	0	118	3·8	0·7
,, –142BA	12	2·5	6·7	8·5	0	53	8·5	0	83	5·3	4·5
,, –142CA	25	1·25	7·0	18·0	0	41	13·0	6·6	59	7·5	14·4
,, –142DA	50	0·75	8·3	35·0	0	32	17·0	26·0	47	9·9	36·0
,, –142EA	100	0·375	8·3	71·0	0	22	23·0	67·0	32	13·5	81·0
472–LWA–143AA	6	10·0	13	4·2	0	110	4·2	0	195	3·1	1·6
,, –143BA	12	5·0	13	8·5	0	96	7·7	1·1	138	4·4	5·8
,, –143CA	25	3·0	17	18·0	0	74	9·9	11·0	106	5·7	16·9
,, –143DA	50	1·5	17	35·0	0	52	14·0	30·0	75	8·1	38·6
,, –143EA	100	0·75	15	64·0	9·5	37	20·0	72·0	53	11·4	83·8
472–LWA–144AA	6	20·0	26	4·2	0	210	4·2	0	310	2·5	2·5
,, –144BA	12	10·0	26	8·5	0	150	6·0	3·5	219	3·5	7·0
,, –144CA	25	5·0	28	18·0	0	110	8·8	13·0	155	5·0	18·0
,, –144DA	50	2·5	28	35·0	0	76	12·0	33·0	109	7·0	40·1
,, –144EA	100	1·25	22	56·0	21	54	17·0	76·0	77	9·9	86·1
472–LWA–145AA	6	40·0	53	4·2	0	390	3·9	0·49	554	2·2	2·9
,, –145BA	12	20·0	53	8·5	0	280	5·6	4·1	396	3·2	7·5
,, –145CA	25	10·0	55	18·0	0	190	7·6	14·0	280	4·5	18·7
,, –145DA	50	5·0	56	35·0	0	140	11·0	34·0	198	6·3	41·0
,, –145EA	100	2·5	40	51·0	28	97	16·0	77·0	139	8·9	87·4
472–LWA–146AA	6	100·0	130	4·2	0	750	3·0	1·8	1080	1·7	3·6
,, –146BA	12	50·0	130	8·5	0	530	4·2	6·1	756	2·4	8·6
,, –146CA	25	25·0	140	18·0	0	370	5·9	17·0	530	3·4	20·2
,, –146DA	50	12·5	110	28·0	10	260	8·3	38·0	378	4·8	43·2
,, –146EA	100	7·5	85	36·0	49	240	13·0	82·0	293	6·2	91·2

TYPICAL CHARACTERISTICS



VARIATION OF POWER FACTOR WITH TEMPERATURE



VARIATION OF CAPACITANCE WITH TEMPERATURE

CAPACITORS

Etched Tantalum Foil
(85°C Range)

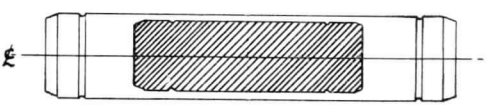
INTRODUCTION

The STC range of polar and non-polar etched tantalum foil capacitors has been granted full QUALIFICATION APPROVAL by R.C.S.C.

In addition to meeting the requirements of DEF and IEC specifications these capacitors comply with MIL–C–3965/2A with the exception of the voltage/capacitance ratings. STC capacitors give higher working voltages and more capacitance in a given case size.

ADVANTAGES

Good space factor.—The surface area of an etched tantalum foil electrode is up to seven times greater than the equivalent plain foil electrode. The mechanical limitations of the case reduce this advantage but the diagram below compares the outline of an STC etched tantalum foil capacitor with that of a plain tantalum foil unit of similar rating.



Low leakage current (see "Electrical Limits").

Long shelf life.—No reforming of these capacitors is required, even after long periods of storage.

CONSTRUCTION

The capacitor units consist of two etched tantalum foils wound with interleaving tissue, a dielectric layer of tantalum pentoxide having first been formed on the anode. After impregnation with a high conductivity non-corrosive electrolyte the units are hermetically sealed in silver cases. Terminal wires are axial. Ageing is carried out at a voltage which is slightly in excess of the rated voltage and no further formation is required—even after long periods of storage.

Polarised and non-polarised capacitors are included in the range, the non-polarised series being suitable for uses involving reversal of polarity and for certain a.c. low power applications.

STC etched tantalum foil capacitors are normally supplied fitted with an insulating sleeve.

Standard Telephones and Cables Limited

Capacitor Division, Brixham Road, Paignton, Devon

Telephone: Paignton 50762 Telex: 4251

London Sales Office, Telephone: Footscray 3333 Telex: 21836

C O M P O N E N T S G R O U P

85°C Etched Tantalum Foil

CONTINUED

ELECTRICAL LIMITS (Reference temperature 20°C)

Capacitance tolerance	+75% −15%
Temperature range	−55°C to +85°C
Rated working voltage at 85°C	6, 16, 25, 40, 63, 100 and 160V d.c.
Surge voltage at 85°C (must not exceed 30 seconds in any 6 minute period)	15% above rated
Maximum power factor at 120 Hz <16V 16V to 40V >40V	30% 20% 15%
Insulation resistance of sleeve	⩽1 000 MΩ at 100V d.c.
Breakdown voltage of sleeve	>500V d.c.

Leakage current after 3 minutes of rated voltage

	Case Size	μA/μFV
Polar	001	0·016
	002	0·010
	003	0·005
	004	0·005
	005	0·005
Non-Polar	011	0·032
	012	0·020
	013	0·010
	014	0·010
	015	0·010

These capacitors meet the requirements of the following tests:

DEF 5011		IEC 69–1 (1960)
Humidity classification	H6	Specification test A —IV
Temperature range	T3	,, ,, B — V
Vibration test	V3	,, ,, C —IV
Acceleration test	A3	,, ,, D —IV
Shock test	S3	,, ,, F —IV
Low air density test	D3	

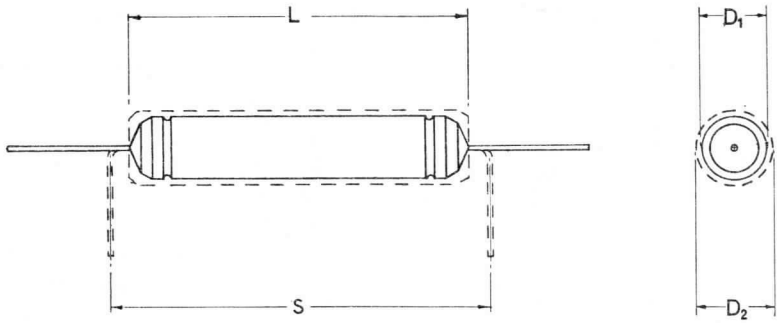
SOLDERABILITY

The terminal wires comply with the requirements of BS 2011 part 2T (1966).

85°C Etched Tantalum Foil

CONTINUED

DIMENSIONS—In accordance with DEF 5134A—5



CASE SIZE		MAXIMUM DIMENSIONS					
		L		D_1		D_2	
		mm	in	mm	in	mm	in
CA51	001 011	22,4	0·88	5,16	0·203	5,54	0·218
		,,		,,		,,	
CA51	002 012	26,9	1·06	7,54	0·297	7,93	0·312
		,,		,,		,,	
CA51	003 013	41,4	1·63	9,93	0·391	10,31	0·406
		,,		,,		,,	
CA51	004 014	58,7	2·31	9,93	0·391	10,31	0·406
		,,		,,		,,	
CA51	005 015	74,7	2·94	9,93	0·391	10,31	0·406
		,,		,,		,,	

TERMINAL WIRES

Length 32 mm (1·25 in) minimum
Diameter 0,6 mm (0·024 in) nominal

PRINTED CIRCUIT MOUNTING

For mounting on printed circuit boards the minimum recommended hole centres are dimension S.

$S = L + 3,5$ mm (0·14 in).

When bending terminals, the wire adjacent to the end seal should be gripped firmly to prevent possible damage to the resin.

The dimensions of STC etched tantalum foil capacitors conform to the requirements of MIL–C–3965/2A.

N.B.—Manufacturing dimensions are inches.

85°C Etched Tantalum Foil

CONTINUED

CAPACITANCE VALUES AND CODES

POLARISED TYPE CAPACITORS

RATED VOLTAGE at 85°C (V d.c.)	CAPACITANCE (μF)	STC CODE	NATO STOCK NUMBER
6	33	CA51. 001 ANA	
	47	,, 001 APA	
	150	,, 002 ASA	
	220	,, 002 ATA	
	330	,, 003 AVA	
	470	,, 003 AWA	
	680	,, 004 AXA	
	1 000	,, 004 AYA	
	1 500	,, 005 AZA	
16	22	CA51. 001 BMA	5910–99–014–2535
	68	,, 002 BQA	2536
	100	,, 002 BRA	2537
	220	,, 003 BTA	2538
	470	,, 004 BWA	2539
	680	,, 005 BXA	2540
25	15	CA51. 001 CLA	5910–99–014–2541
	47	,, 002 CPA	2542
	150	,, 003 CSA	2543
	220	,, 004 CTA	2544
	330	,, 004 CVA	2545
	470	,, 005 CWA	2546
40	6·8	CA51. 001 DJA	—
	10	,, 001 DKA	5910–99–014–2547
	22	,, 002 DMA	—
	33	,, 002 DNA	5910–99–014–2548
	68	,, 003 DQA	—
	100	,, 003 DRA	5910–99–014–2549
	150	,, 004 DSA	—
	220	,, 005 DTA	—
63	3·3	CA51. 001 EGA	—
	4·7	,, 001 EHA	5910–99–014–2555
	15	,, 002 ELA	—
	33	,, 003 ENA	—
	47	,, 003 EPA	5910–99–014–2556
	68	,, 004 EQA	—
	100	,, 004 ERA	5910–99–014–2557
	150	,, 005 ESA	2558
100	2·2	CA51. 001 FFA	5910–99–014–2564
	6·8	,, 002 FJA	2565
	10	,, 002 FKA	2566
	22	,, 003 FMA	2567
	47	,, 004 FPA	2568
	68	,, 005 FQA	2569
150	1·5	CA51. 001 GEA	5910–99–014–2574
	4·7	,, 002 GHA	2577
	15	,, 003 GLA	2580
	33	,, 004 GNA	2582
	47	,, 005 GPA	2583

85°C Etched Tantalum Foil

CONTINUED

NON-POLARISED TYPE CAPACITORS

RATED VOLTAGE at 85°C (V d.c.)	CAPACITANCE (μF)	STC CODE	NATO STOCK NUMBER
6	22	CA51. 011 AMA	
	33	,, 011 ANA	
	100	,, 012 ARA	
	220	,, 013 ATA	
	330	,, 013 AVA	
	470	,, 014 AWA	
	680	,, 014 AXA	
	1 000	,, 015 AYA	
16	15	CA51. 011 BLA	
	47	,, 012 BPA	
	68	,, 012 BQA	
	150	,, 013 BSA	
	220	,, 014 BTA	
	330	,, 014 BVA	
	470	,, 015 BWA	5910-99-519-4915
25	6·8	CA51. 011 CJA	
	10	,, 011 CKA	
	22	,, 012 CMA	
	33	,, 012 CNA	
	68	,, 013 CQA	
	100	,, 013 CRA	
	150	,, 014 CSA	
	220	,, 015 CTA	
40	3·3	CA51. 011 DGA	
	4·7	,, 011 DHA	
	10	,, 012 DKA	
	15	,, 012 DLA	
	33	,, 013 DNA	
	47	,, 013 DPA	
	68	,, 014 DQA	
	100	,, 014 DRA	
	150	,, 015 DSA	
63	1·5	CA41. 011 EEA	
	2·2	,, 011 EFA	
	6·8	,, 012 EJA	
	15	,, 013 ELA	
	22	,, 013 EMA	
	33	,, 014 ENA	
	47	,, 014 EPA	
	68	,, 015 EQA	
100	1·0	CA51. 011 FDA	
	3·3	,, 012 FGA	
	4·7	,, 012 FHA	
	10	,, 013 FKA	
	22	,, 014 FMA	
	33	,, 015 FNA	
160	0·68	CA51. 011 GCA	
	2·2	,, 012 GFA	
	6·8	,, 013 GJA	
	15	,, 014 GLA	
	22	,, 015 GMA	

85°C Etched Tantalum Foil

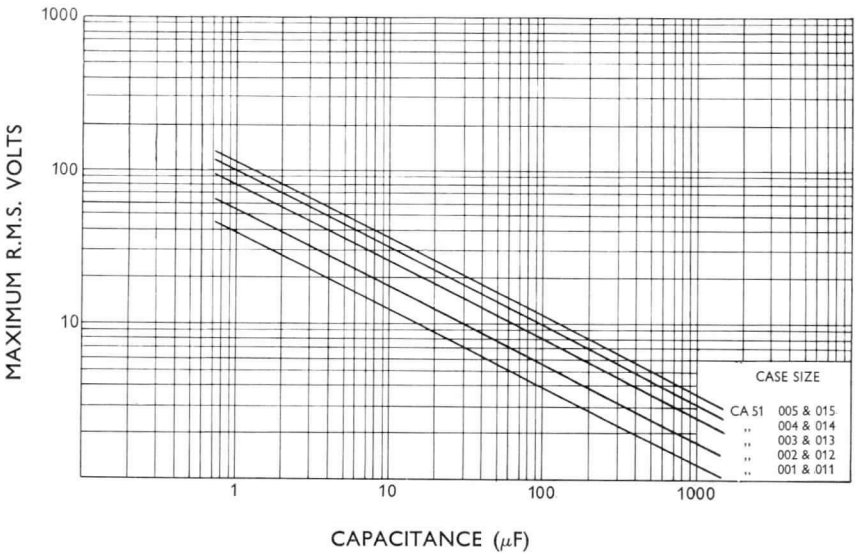
CONTINUED

A.C. RATINGS

The maximum ripple current permitted in these capacitors is determined as follows:

1. The peak applied voltage (d.c. + peak a.c.) must never exceed the rated voltage.
2. The maximum permissible a.c. voltage at 50 Hz and 20°C is given in Fig. 1.
3. For higher frequencies and temperatures the maximum a.c. voltage must be multiplied by the factors given in Fig. 2 and Fig. 3 respectively.

Fig. 1.—Maximum Ripple Voltages (50 Hz at 20°C)



85°C Etched Tantalum Foil

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Fig. 2.—Maximum Ripple Voltage—Frequency Derating Factor

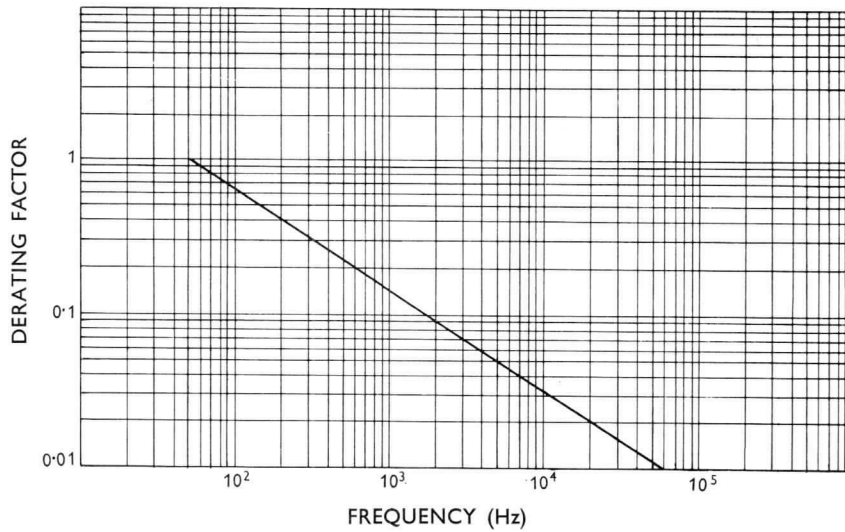
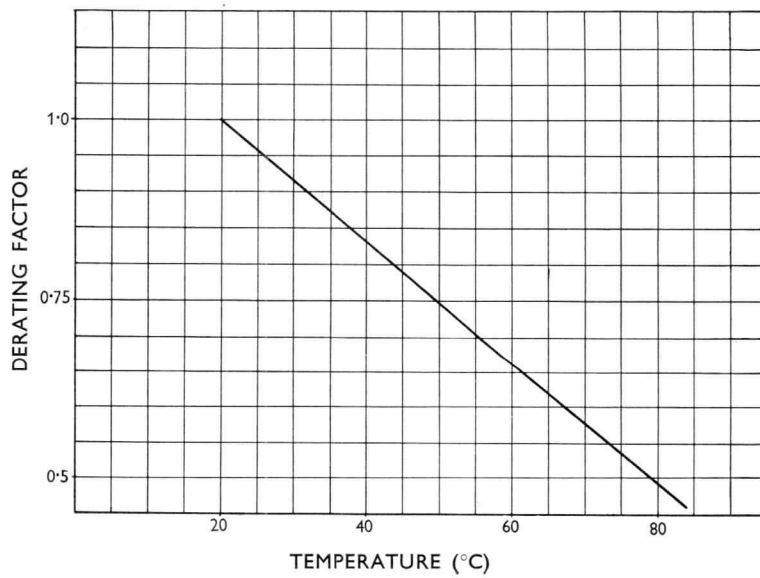


Fig. 3.—Maximum Ripple Voltage—Temperature Derating Factor



85°C Etched Tantalum Foil

CONTINUED

TYPICAL PERFORMANCE

Fig. 4.—Variation of Capacitance with Temperature (Referred to 20°C)

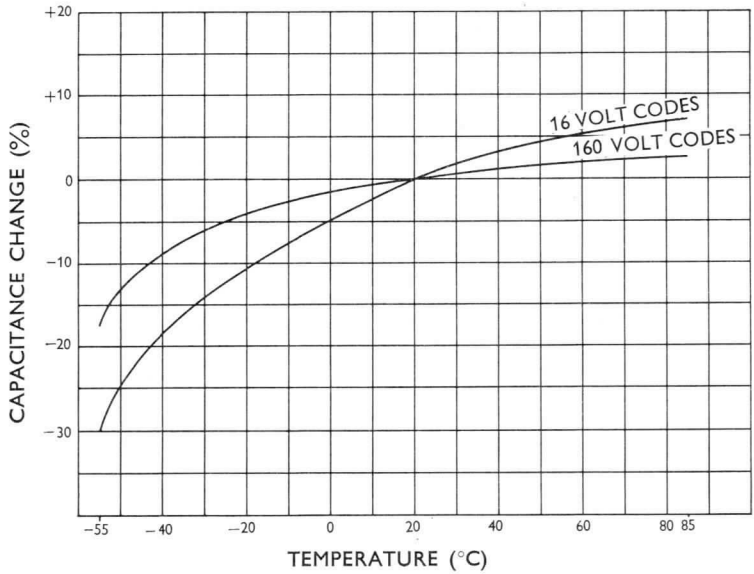
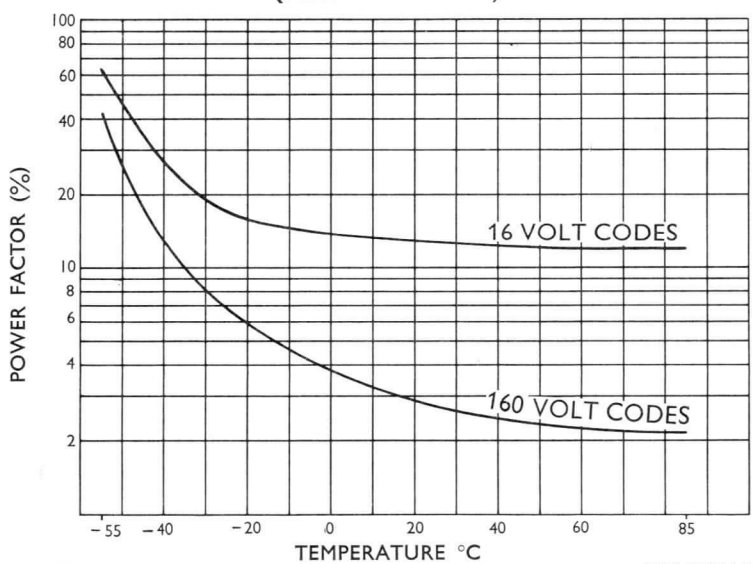


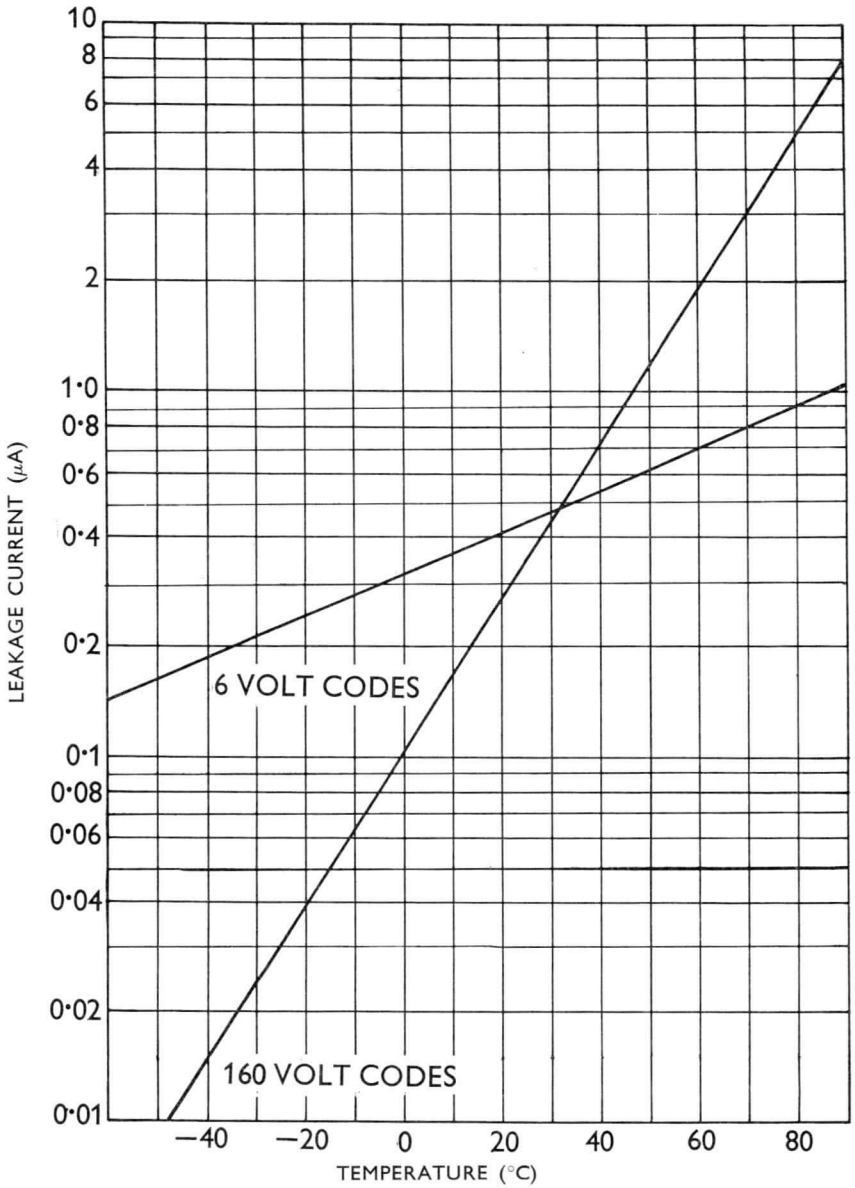
Fig. 5.—Variation of Power Factor with Temperature (Measured at 120 Hz)



85°C Etched Tantalum Foil

CONTINUED

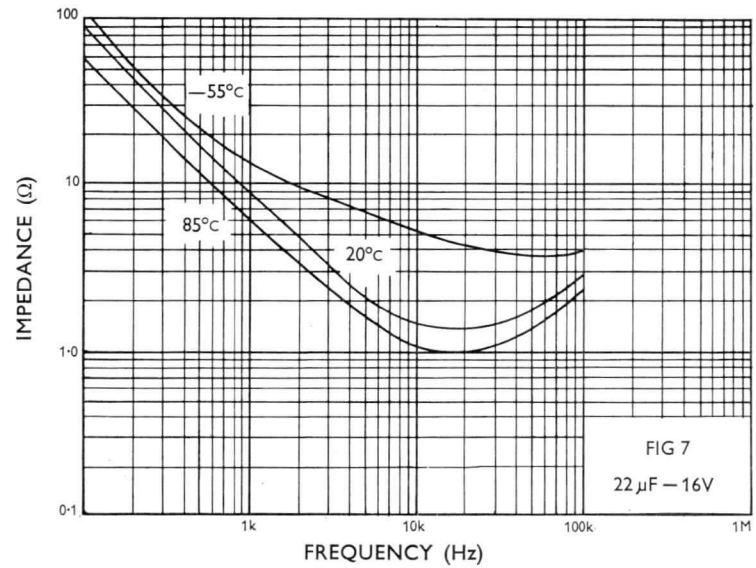
Fig. 6.—Variation of Leakage Current with Temperature

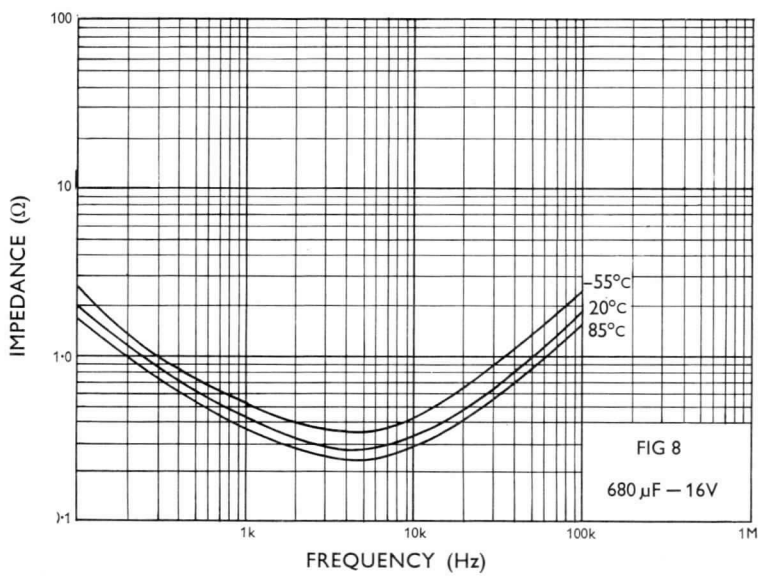


85°C Etched Tantalum Foil

CONTINUED

Figs. 7, 8, 9 and 10.—Typical Curves of Variation of Impedance with Frequency at various Temperatures

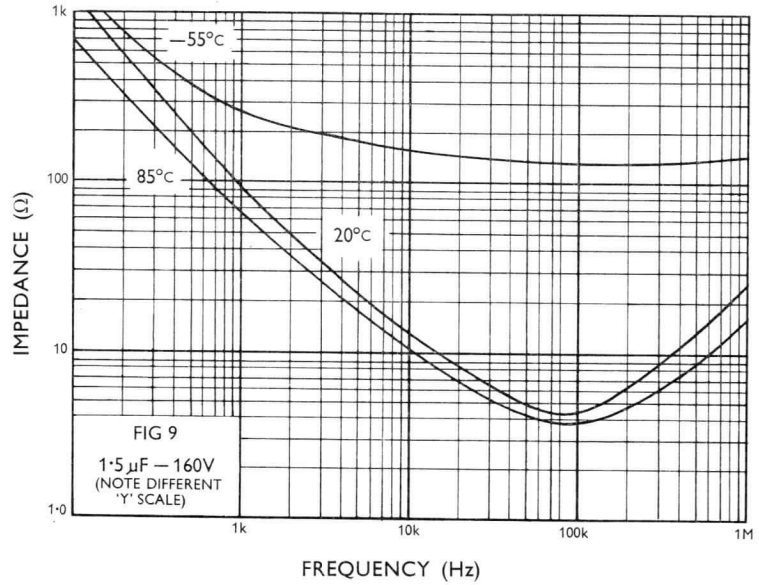


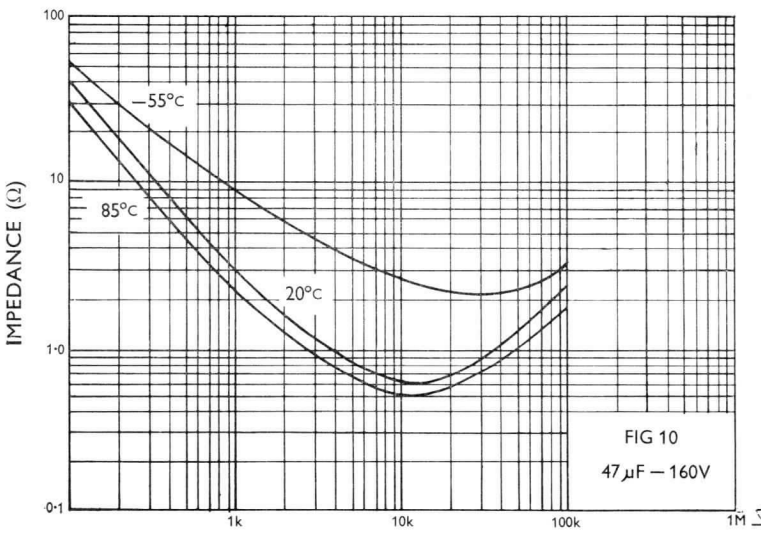


85°C Etched Tantalum Foil

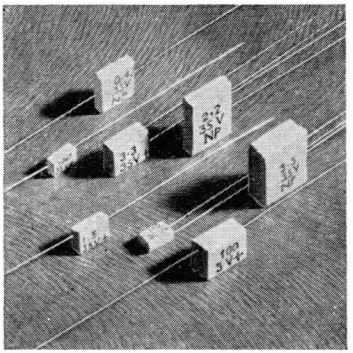
CONTINUED

Impedance/Frequency Characteristics—*continued*





Miniature Moulded Solid Tantalum Capacitors
Polar and Bi-Polar
Codes: Axial Leads - TAJ Radial Leads - TAK



Actual size

BRIEF DATA

CAPACITANCE

Polar 0,015μF to 100μF

Bi-Polar 0,0068μF to 68μF

CAPACITANCE TOLERANCE

±20%, ±10%, ±5%

WORKING VOLTAGES at 85°C

3, 6, 10, 15, 20 and 35V d.c.

TEMPERATURE RANGE

−40°C to +100°C

This extension to the ITT solid tantalum capacitor range has been developed for inclusion in film circuits and for general applications where space is limited. Possible uses include microphone amplifiers, medical devices, and hearing aids, in fact any circuit where performance must be maintained at high packing density.

The capacitors are rectangular and are moulded in thermosetting resin to controlled outlines. The Polar and Bi-polar units are offered with either axial or radial leads. Connection to these capacitors may be made by soldering or by welding.

ITT COMPONENTS GROUP EUROPE
Standard Telephones and Cables Limited
Capacitor Product Division, Brixham Road, Paignton, Devon
Telephone: Paignton 50762 (STD Code 0803) Telex: 42951

ITT
COMPONENTS

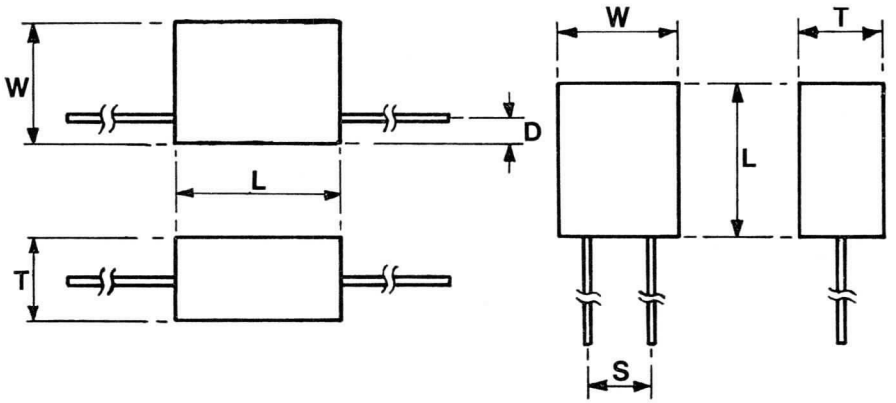
CAPACITANCE RANGE (letter denotes case size)

Capacitors are available with either axial or radial terminals.

CAPACITANCE (μF)	WORKING VOLTAGES (d.c.) POLAR 3	6	10	15	20	35	BI-POLAR 3	6	10	15	20	35	CAPACITANCE (μF)
												N	0,0068
												N	0,010
0,015						A						N	0,015
0,022						A						N	0,022
0,033						A						N	0,033
0,047						A						N	0,047
0,068						A						N	0,068
0,10						A						N	0,10
0,15						A						N	0,15
0,22						A					N	P	0,22
0,33						A					N	P	0,33
0,47						A – B				N	P	Q	0,47
0,68					A	B			N	P		Q	0,68
1,0				A	B	C		N	P		Q	R	1,0
1,5			A	B		C		N	P	Q		R	1,5
2,2		A	B		C	D			P	Q		R	2,2
3,3		A – B		C		D		P	Q		R	S	3,3
4,7		B	C			D		Q		R		S	4,7
6,8		B – C				D – E		Q	R		S		6,8
10,0		C			D	E			R			S	10,0
15		C	D		E			R	S				15
22			D		E			R – S					22
33		D		E				S					33
47		D – E						S					47
68			E					S					68
100		E											100

The case codes shown are the smallest for a given capacitance/voltage combination and, where no other code is indicated, should also be used for lower voltages.

DIMENSIONS



CASE CODE		Maximum Dimensions L mm	L in	W mm	W in	T mm	T in	S* (Radial only) Nominal mm	S* in	D* (Axial only) Nominal mm	D* in
POLAR	A	4,2	0,165	2,6	0,102	1,5	0,059	1,3	0,050	0,7	0,028
	B	4,2	0,165	2,6	0,102	2,0	0,079	1,3	0,050	0,6	0,024
	C	5,1	0,201	3,6	0,142	2,0	0,079	2,5	0,100	0,6	0,024
	D	6,3	0,248	4,8	0,189	2,5	0,100	2,5	0,100	0,6	0,024
	E	6,7	0,264	5,1	0,201	3,7	0,146	2,5	0,100	0,6	0,024
BI-POLAR	N	5,2	0,205	4,5	0,177	1,5	0,059	2,5	0,100	2,2	0,087
	P	5,2	0,205	4,5	0,177	2,0	0,079	2,5	0,100	2,2	0,087
	Q	5,9	0,232	6,4	0,252	2,0	0,079	2,5	0,100	3,2	0,126
	R	7,1	0,279	8,9	0,350	2,5	0,100	2,5	0,100	4,2	0,165
	S	7,5	0,295	9,6	0,378	3,7	0,146	2,5	0,100	4,8	0,189

*Tolerance ± 0,5mm (0,020in).

N.B. Manufacturing dimensions are metric.

TERMINAL WIRES

Length 32mm (1,25in) minimum

Diameter 0,25mm (0,01in) nominal

CODING

Ordering Code

Example	TA	J	0,47	M	35	B

Tantalum

Terminal Configuration
J: Axial K: Radial

Capacitance (μF)

Capacitance tolerance
Suffix M ±20%, K ±10%, J ±5%

Working voltage

Case and polarity code
A, B, C, D, E: Polar
N, P, Q, R, S: Bi-polar

CAPACITOR MARKING

Capacitors are marked as shown in the illustration below.

Polar capacitors

1st line Capacitance (μF)

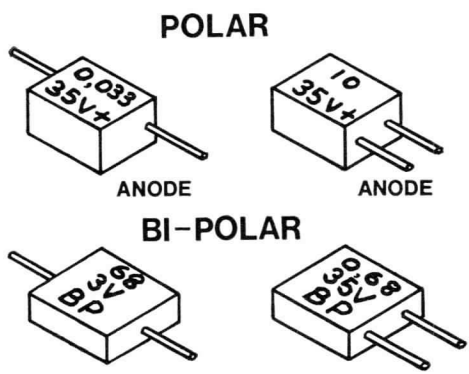
2nd line Voltage and anode indicator

Bi-polar capacitors

1st line Capacitance (μF)

2nd line Voltage

3rd line BP denoting bi-polar unit
(Previously coded NP)



Capacitance tolerance is indicated by the colour of ink used for the above markings.

Black ±20%
Blue ±10%
Red ±5%

CAPACITOR PERFORMANCE

The data below are design limits within which the capacitors will perform satisfactorily. Figs. 1 to 6 are curves of TYPICAL PERFORMANCE measured on production capacitors selected at random. All production cannot be guaranteed to comply exactly with these curves.

LIMITS

(Reference temperature 20°C unless otherwise specified)

Capacitance tolerance		±20%,	±10%.	±5%		
Working voltages at 85°C		3	6	10	15	20 and 35V d.c.
	at 100°C	2	4	7	10	14 and 24V d.c.

Surge voltage

85°C		100°C	
V d.c.		V d.c.	
Rated	Surge	Rated	Surge
3	4	2	3
6	8	4	5
10	12	7	9
15	17	10	12
20	23	14	16
35	41	24	28

Power factor at 120 Hz — 10% maximum

Maximum leakage current after 3 minutes at rated voltage.

Case Size	
A B C N P Q	0,5μA
D and R	1,5μA
E and S	4,0μA

Maximum reverse voltage – 0,5 Volt.

Ripple voltage rating – See Figs. 1 and 2.

Note 1. The use of lower ripple ratings will give a smaller temperature rise and some improvement in reliability.

Note 2. The curves, Figs. 1 and 2, are based on an ambient temperature of 20°C, for higher temperatures derate as follows:

at 50°C use figures above x 0,7
at 85°C use figures above x 0,3
at 100°C use figures above x 0,1

Note 3. The sum of peak a.c. voltage and d.c. voltage shall not exceed the d.c working voltage of the capacitor.

Note 4. The sum of negative peak a.c. voltage and applied d.c. voltage shall not allow a voltage reversal exceeding 0,5 Volt.

LIMITS—Continued

The capacitors will meet the following environmental test requirements in accordance with DEF 5011, BS 2011 and IEC 68.

Item	DEF 5011	IEC 68 BS 2011	Description	Conditions
Temperature		A & B	Category temperature range	−40°C to +100°C
Humidity	H3	C & D	Damp heat (cyclic)	1 cycle
			Damp heat (long term exposure)	4 days
Vibration	V3	Fc	Resonance search	5 – 5000 Hz
			Endurance	30 – 2000 Hz (0,03in/10g) 100 hours
Acceleration	A3	Ga	Acceleration steady state	100g
Shock	S3	Ea	Trapeziodal pulse	100g for 6ms
Low air density	D3	M		Rel. density 0,003 Mean alt. 130000ft
Robustness of terminations		u	Tensile	250gm
			Bending	100gm 3 bends ±90°
Solderability		Part 2T (aged condition)	Solder globule method	
Resistance to soldering heat			Solder bath method	350°C 3 to 4 secs.

LIMITS

Fig. 1.—Ripple voltage characteristics, Polar

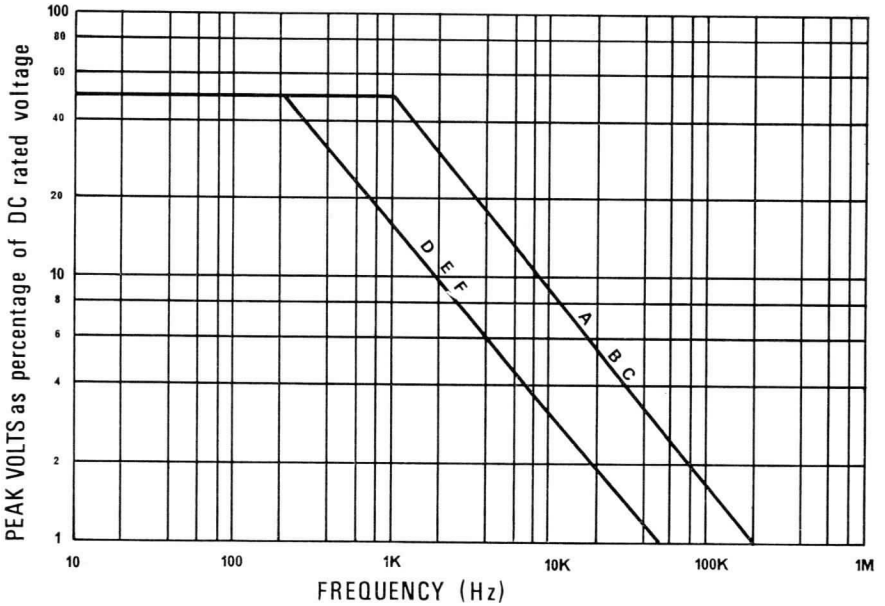
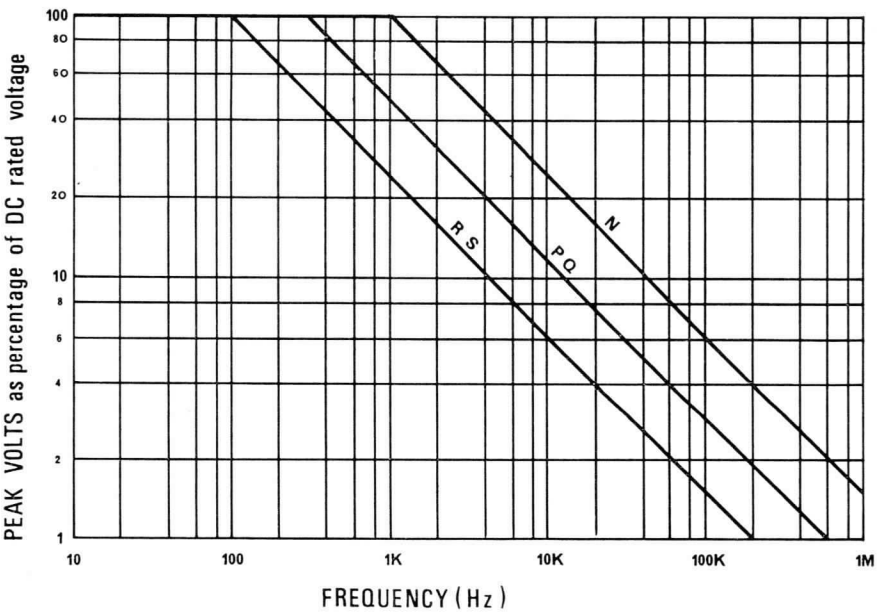


Fig. 2.—Ripple voltage characteristics, Bi-Polar



GRAPHS OF TYPICAL PERFORMANCE

Fig. 3.—Variation of Capacitance with Temperature (referred to 20°C)

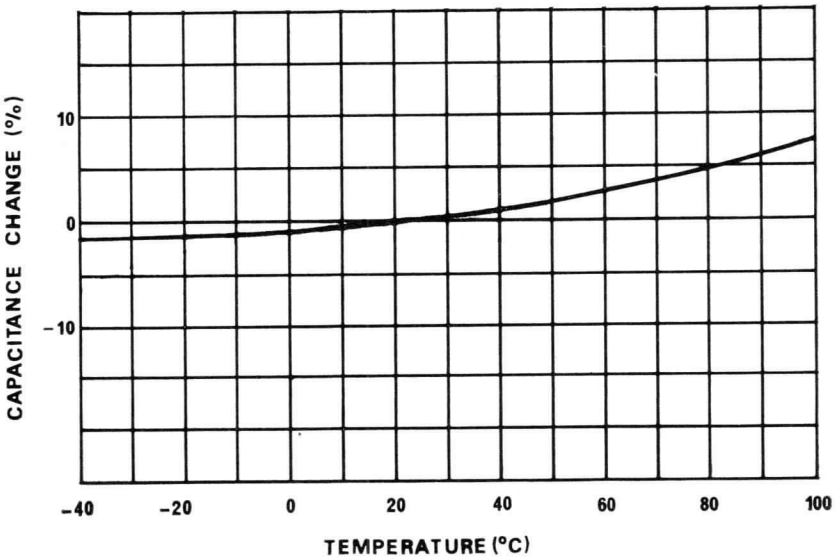
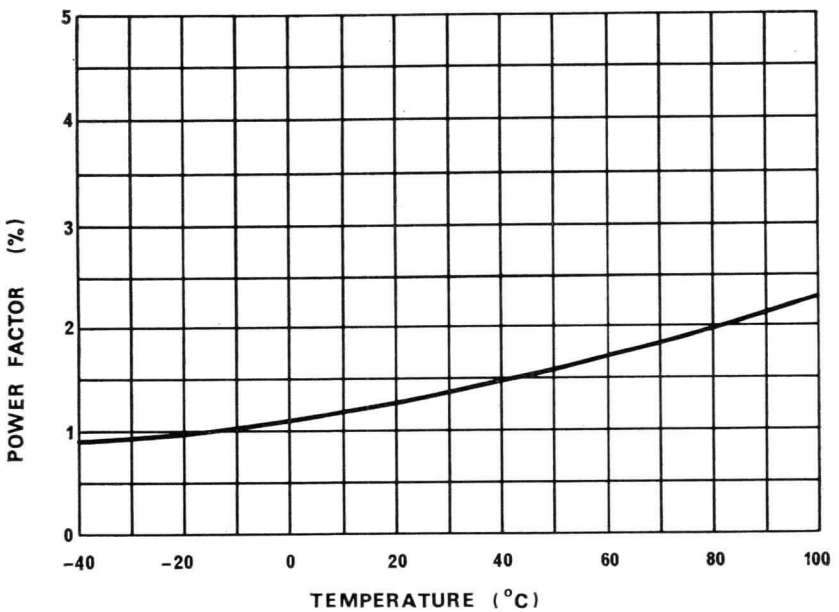
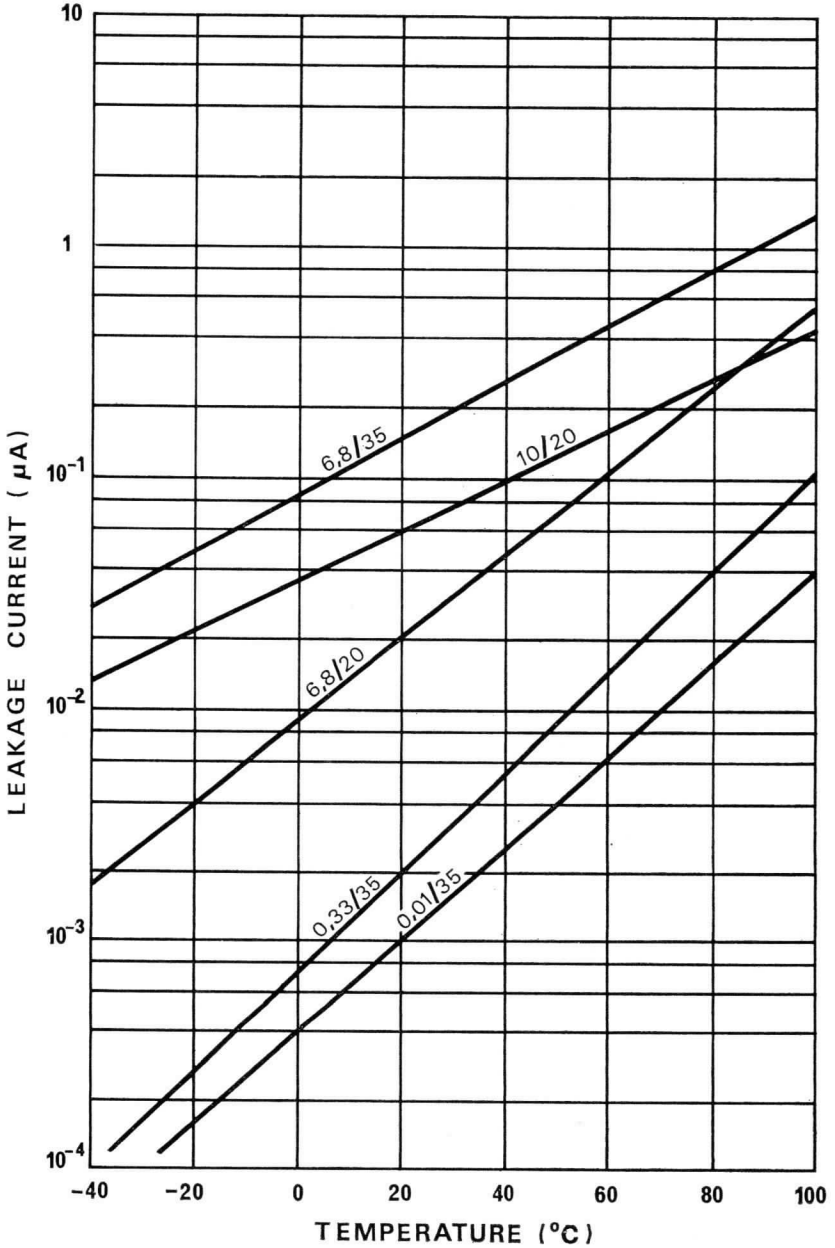


Fig. 4.—Variation of Power Factor with Temperature (measured at 120Hz with maximum working voltage applied)



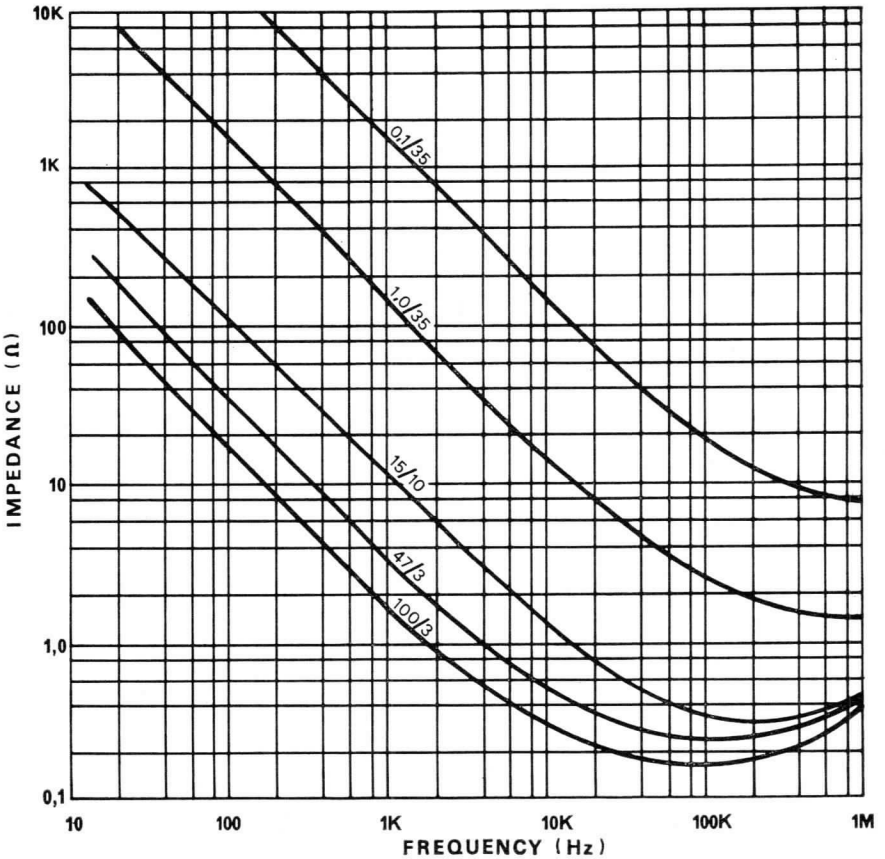
TYPICAL PERFORMANCE—Continued

Fig. 5.—Variation of Leakage Current with Temperature (measured at maximum working voltage after 3 minutes)



TYPICAL PERFORMANCE—Continued

Fig. 6.—Variation of Impedance with Frequency



METAL CASED SOLID TANTALUM CAPACITORS
CODE: TAA

FORMERLY CODED 472-400 to 403
and 472-420 to 423

BRIEF DATA

CAPACITANCE RANGE	0,01 μF to 330 μF
WORKING VOLTAGES AT 85 °C	6 10 15 20 35 50 and 75V d.c.
TEMPERATURE RANGE	−55 °C to +125 °C

Metal case encapsulation with hermetic seals give these rugged capacitors a 56 day humidity protection and ensures that their inherent reliability is maintained during service.

MINISTRY OF DEFENCE APPROVED	to DEF 5134–A–1 over the voltage range 6 to 75V
BS 9000 APPROVED	to BS 9070–N–001
POST OFFICE APPROVED	specification D2281 Electrolytic Capacitors Type 4501
MIL–C–39003A (styles CSR12 and CSR13).	Reliability performance equivalent to failure rate M and can be supplied to lower failure rates on request.
ESRO Space Application APPROVED	Capacitors screened to our specification CES 5133 used in the HEOS and other satellites.

ITT Components Group Europe
Standard Telephones and Cables Limited
Capacitor Product Division,
Brixham Road, Paignton, Devon.

Telephone: Paignton 50762 (STD Code 0803) Telex: 42951

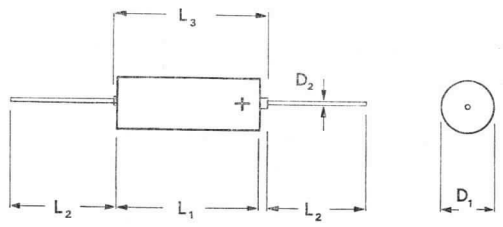
ITT
COMPONENTS

CAPACITANCE RANGE (letter denotes case size)

The values shown are the E12 series, in addition many values in the E24 series are available and are shown together with a full list of appropriate NATO stock numbers. at the back of this data sheet.

TABLE 1

Capacitance (μF)	WORKING VOLTAGE (d.c.)						
	6	10	15	20	35	50	75
0,01					A		
0,012							
0,015					A		
0,018							
0,022					A		
0,027					A		
0,033					A		
0,039							
0,047					A		A
0,056							
0,068					A		
0,082							
0,1					A	A	A
0,12					A		A
0,15					A		A
0,18					A		A
0,22					A		A
0,27							A
0,33					A		A
0,39					A		A
0,47					A		A
0,56					A		A
0,68					A		A
0,82					A		B
1,0					A	A	B
1,2				A	B	B	B
1,5				A	B	B	B
1,8				A	B	B	B
2,2				A	B	B	B
2,7			A		B	B	B
3,3			A		B	B	B
3,9		A			B	B	B
4,7		A			B	B	C
5,6	A				B	C	C
6,8	A				B	C	C
8,2				B	C	C	C
10				B	C	C	C
12				B	C	C	D
15				B	C	C	D
18			B		C	C	
22			B		C	D	
27		B		C	D		
33		B		C	D		
39		B		C	D		
47	B			C	D		
56	B		C	D	D		
68			C	D			
82		C		D			
100		C		D			
120		C	D				
150	C		D				
180	C	D					
220		D					
270	D						
330	D						



FIXED CAPACITOR

TANTALUM ELECTROLYTIC

Solid Electrolyte:
Porous Anode:
Polar:
Hermetically sealed
Metal Case:
Insulated and
Uninsulated Case:

Axial Terminations

General Application

DIMENSIONS uninsulated capacitors

Case Size ITT/ NATO	L_1 Nom. mm ±0,79	L_1 Nom. in ±0,031	L_8 Max. mm	L_8 Max. in	D_1 Nom. * mm	D_1 Nom. * in	D_2 Max. mm	D_2 Max. in	Capacitance Range and Rated Voltage Range	Typical Weight g	Typical Weight oz
A	6,35	0,250	10,72	0,422	3,18	0,125	0,5	0,020	6,8µF 6V to 0,01µF 35V to 0,047 75V	0,71	0,025
B	11,13	0,438	15,49	0,610	4,45	0,175	0,5	0,020	56µF 6V to 0,82µF 75V	1,28	0,045
	16,51	0,650	20,88	0,822	7,09	0,279	0,6	0,025	180µF 6V to 4,7µF 75V	4,71	0,166
	19,05	0,750	23,42	0,922	8,66	0,341	0,6	0,025	330µF 6V to 12µF 75V	7,40	0,261

NOTE 1 Length of terminations (L2) 32mm (1,25in.) minimum.

NOTE 2 Marking for polarity shall be indicated, as shown, near the positive terminal.

NOTE 3 Basic case dimensions for the insulated style shall be the same as for the uninsulated style.

NOTE 4 The case insulation shall extend beyond the ends of the capacitor body by the amounts shown below and shall lap over the ends of the body.

Case Size	Overlap each end of body	
	Min. mm	Max. mm
A	0,4	1,1
B C & D	0,4	1,5

NOTE 5* The increase in maximum diameter for insulated types shall not exceed 0,25mm.

Tolerance on diameter insulated +0,41mm +0,016in
−0,38mm −0,015in
uninsulated +0,41mm +0,016in
−0,25mm −0,010in

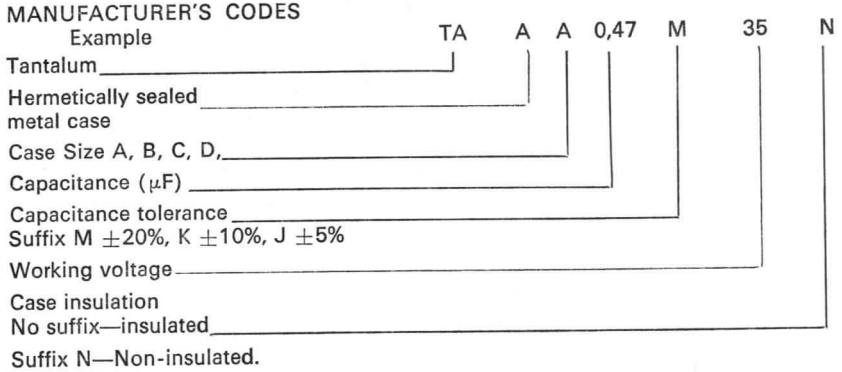
DIMENSIONS—*continued*

NOTE 6 The terminal wires must not be bent closer than 2,0mm to the body of the capacitor.

NOTE 7 The complete capacitance/rated voltage range is given in Tables 2 and 3.

NOTE 8 The tolerance on the wire diameter is +10% −0,05mm.

MANUFACTURER'S CODES



Capacitors below 0,1 μF are only available at ±20% and ±10% tolerance

RATINGS (including limiting conditions of use) and characteristics (reference BS 9070)

Reference temperature 20 °C unless otherwise stated.

Capacitance range	0,01 μF to 330 μF (E 12 range of BS 2488 IEC 68) In addition many values in the E24 series
Standard selection tolerance	±20% ±10% ±5% Below 0,1 μF ±20% and ±10% tolerance only
Climatic category	55/125/56
Rated temperature range	−55 °C to +125 °C
Power factor at 120Hz	< 150 μF Tan delta 0,06 max. ≥ 150 μF Tan delta 0,10 max.
Maximum leakage current after 3 minutes at rated voltage	0,02 μA/μFV or 1,0 μA whichever is the greater

RATINGS—*continued*

D.C. Working Voltage
at 85 °C — 6, 10, 15, 20, 35, 50 and 75V
at 125 °C — 4, 7, 10, 13, 23, 33 and 50V

Surge Voltage

85 °C		125 °C	
Rated/Surge V d.c.		Rated/Surge V d.c.	
6	8	4	5
10	13	7	9
15	20	10	12
20	26	13	16
35	46	23	28
50	65	33	40
75	98	50	64

Max reverse voltage — 10% at 125 °C, or 1V whichever is the lesser

Vibration severity — 5 to 5000Hz
0,75mm or 98m/s²

Acceleration — 981m/s²

Shock — Trapezoidal Pulse — 100g for 6ms
390m/s² (40g)

Low air pressure — 200 N/m²
(mean altitude 130,000 ft)

Robustness of terminations — Tensile 1kg
Bending ½kg
2 bends through 90°

Solderability — Solder globule method 2 s without ageing
3 s with ageing

Insulation of sleeve — >1000 M Ω at 500V d.c.

Breakdown voltage of sleeve — >2000 V d.c.

Stability of Capacitance with temperature.
Deviation at — −55 °C — −12%
+125 °C — +15%

RIPPLE VOLTAGE RATINGS — See Figs. 1 to 4

NOTE 1 The above curves are based on an ambient temperature of 20 °C.
For higher temperatures derate the 20 °C figures as follows:
at 50 °C derate to 70%
at 85 °C derate to 50%
at 125 °C derate to 30%

NOTE 2 The sum of the peak a.c. voltage and the d.c. voltage must not exceed the d.c. working voltage of the capacitor.

NOTE 3 The sum of the negative peak a.c. voltage and the applied d.c. voltage shall not allow a voltage reversal exceeding 10% of the d.c. working voltage or 1 volt whichever is the lesser.

NOTE 4 The use of lower ripple ratings will give a smaller temperature rise and some improvement in reliability.

RATINGS—*continued*

Fig. 1 Ripple voltage characteristics, case size A

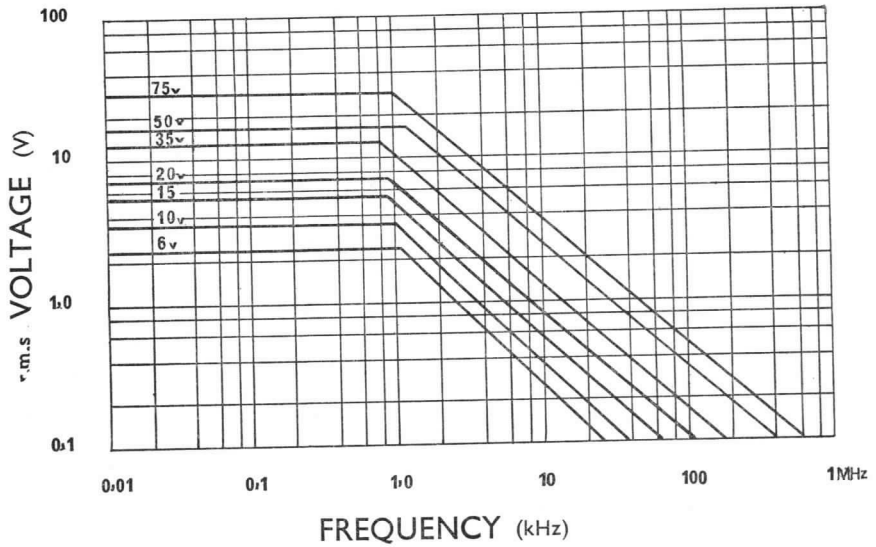
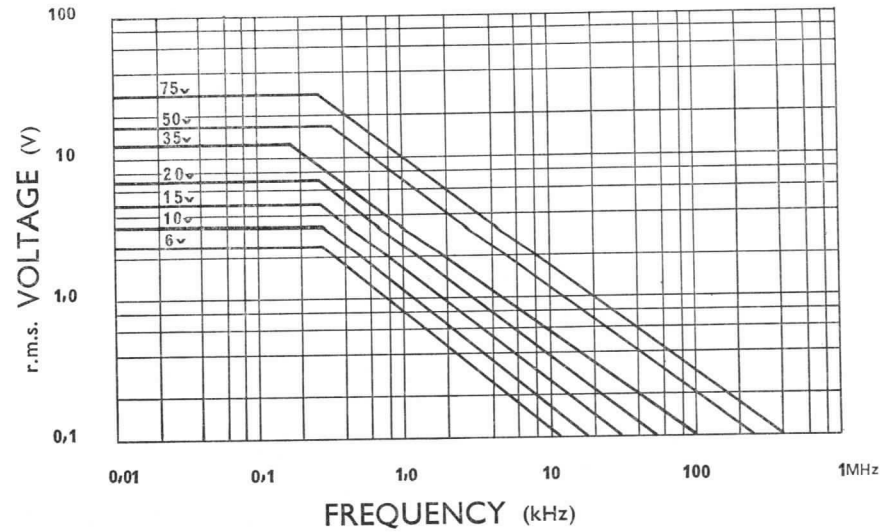


Fig. 2 Ripple voltage characteristics, case size B



RATINGS—*continued*

Fig. 3 Ripple voltage characteristics, case size C

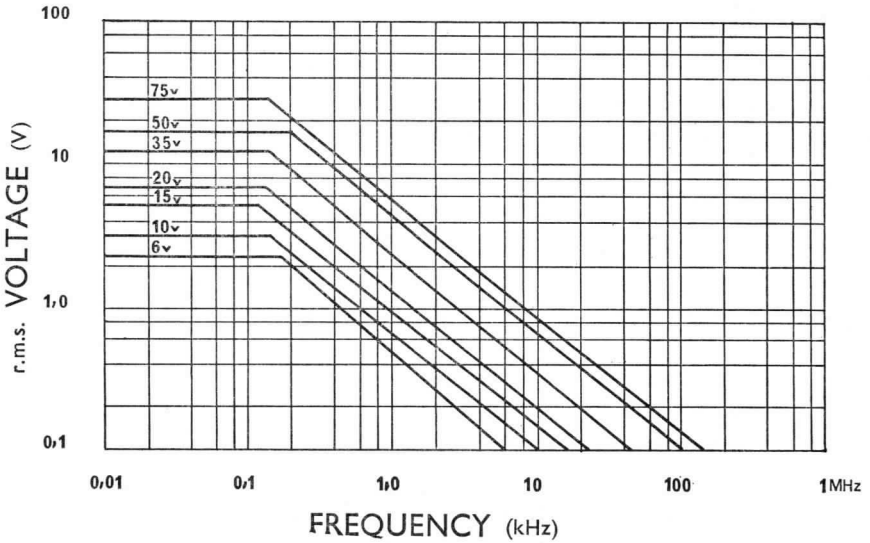
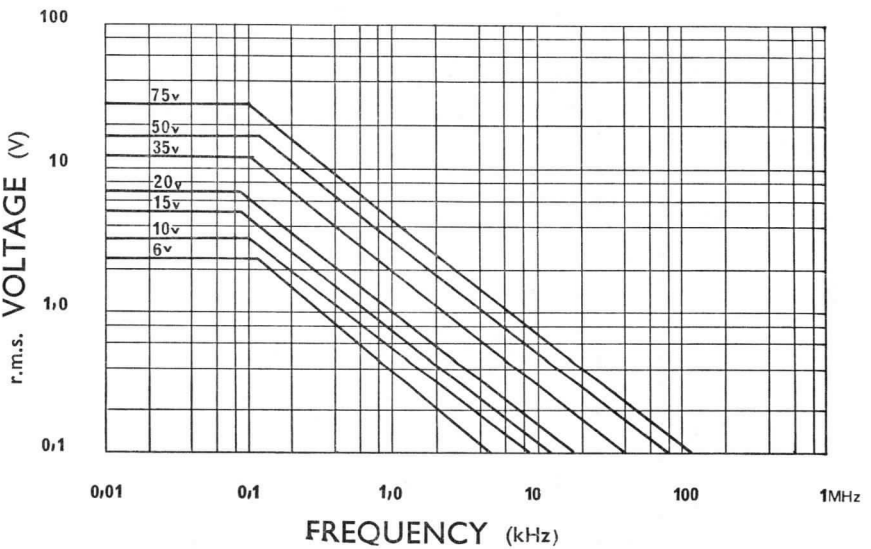


Fig. 4 Ripple voltage characteristics, case size D



GRAPHS OF TYPICAL PERFORMANCE

Fig. 5 Variation of capacitance with temperature (referred to 25 °C)

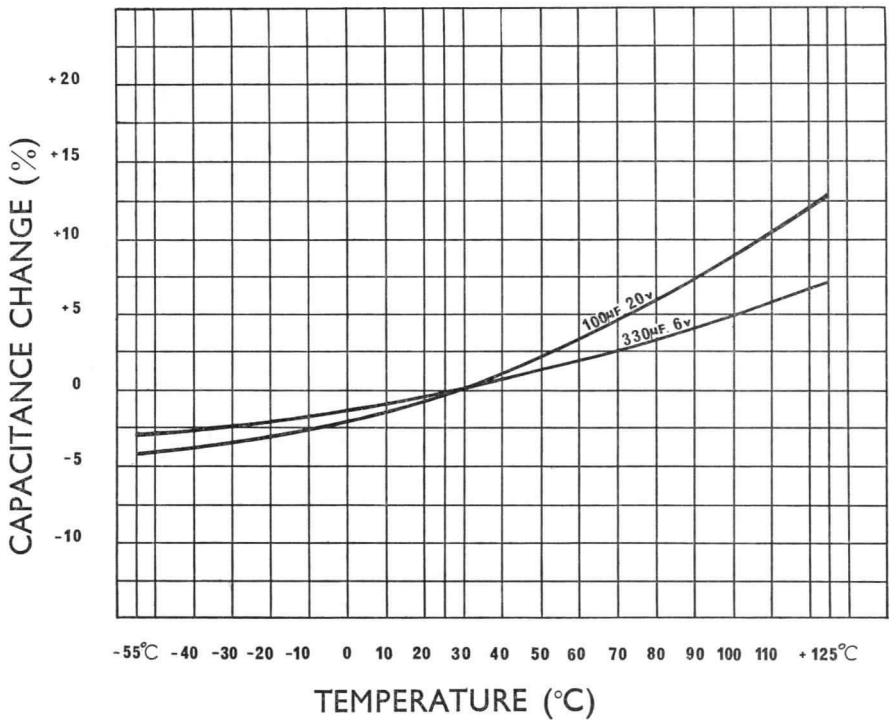
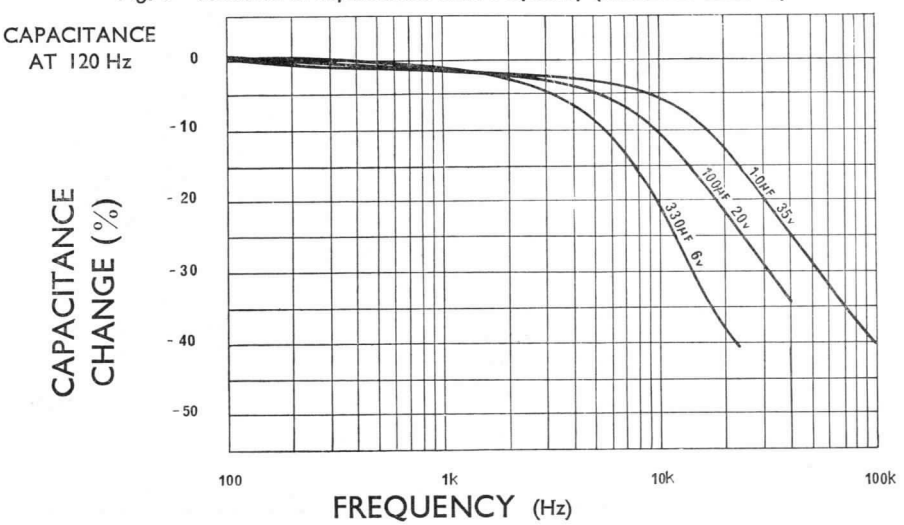


Fig. 6 Variation of capacitance with frequency (measured at 25 °C)



GRAPHS OF TYPICAL PERFORMANCE—*continued*

Fig. 7 Variation of impedance with frequency (20V capacitors)

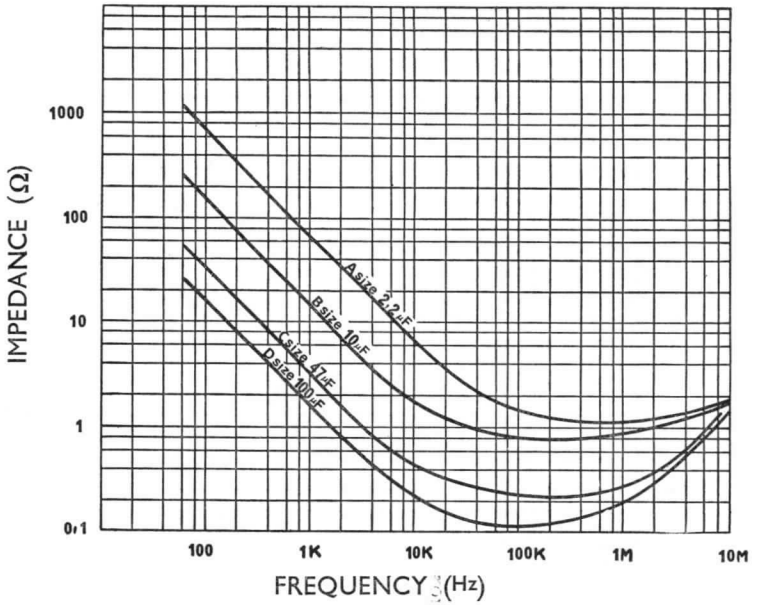
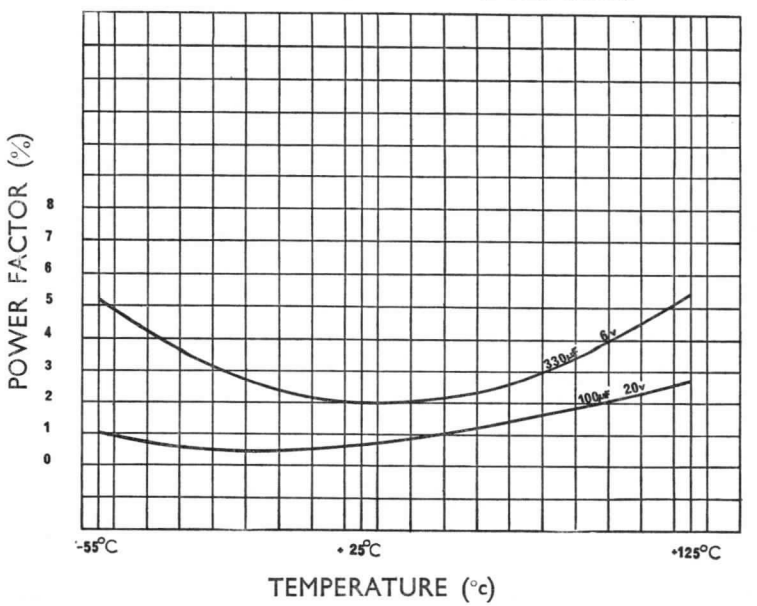
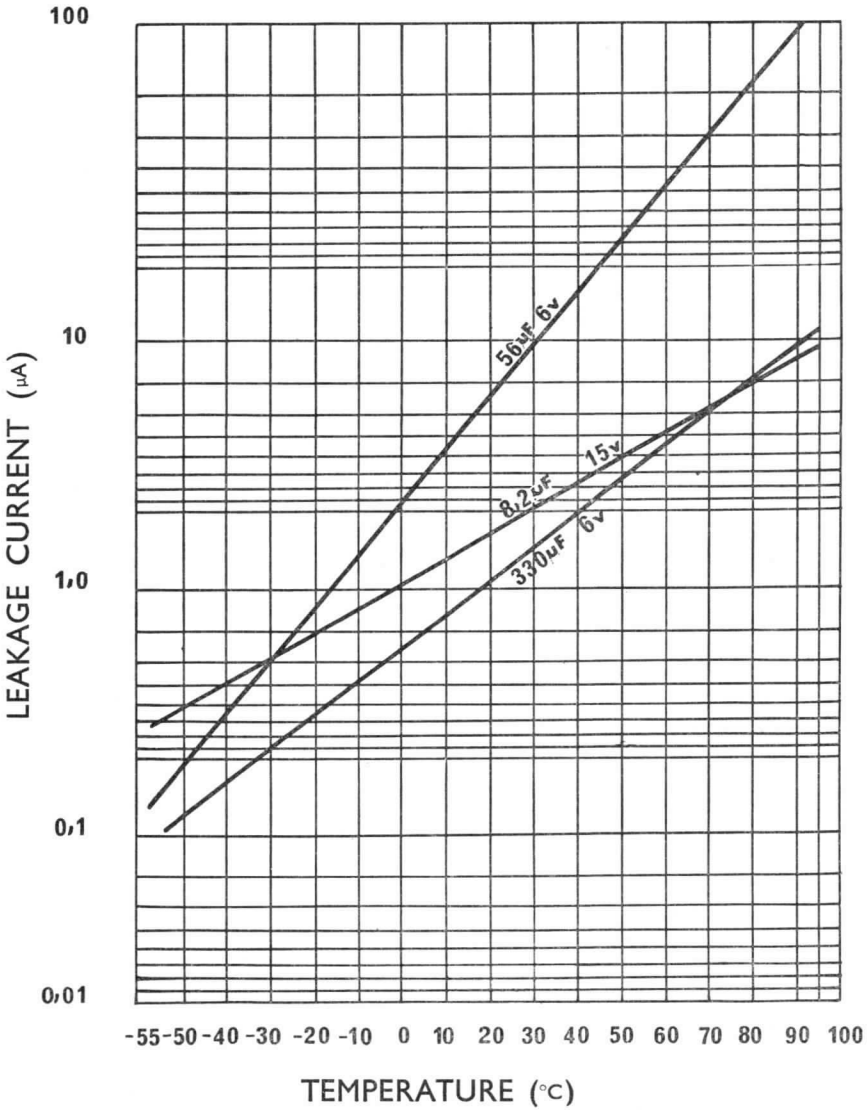


Fig. 8 Variation of Power Factor with temperature
(measured at 120 Hz with maximum working voltage applied)



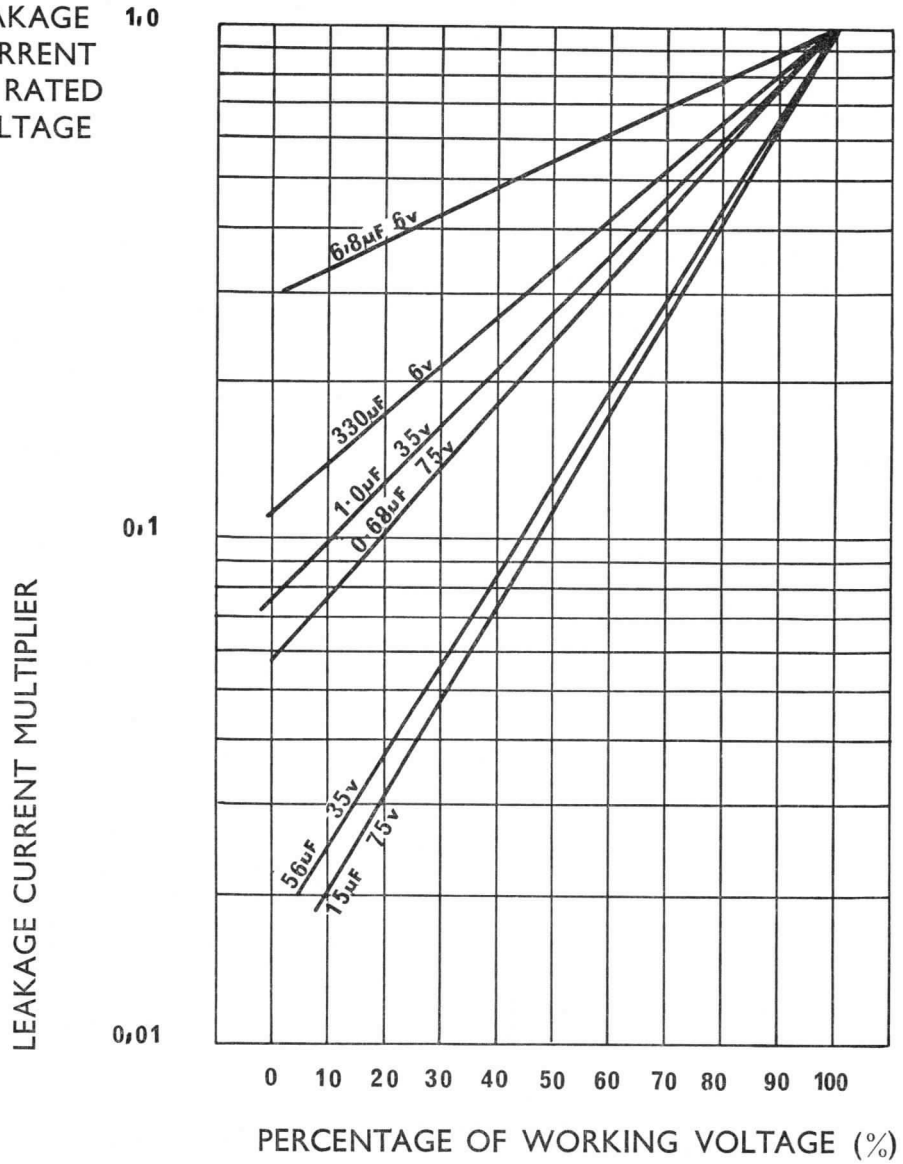
TYPICAL PERFORMANCE—*continued*

Fig. 9 Variation of leakage current with temperature
(measured at maximum working voltage after 3 minutes)



TYPICAL PERFORMANCE—*continued*

Fig. 10 Variation of leakage current with voltage



RELIABILITY

Continuous life testing of ITT solid tantalum capacitors is carried out at various temperatures from 70 °C to 150 °C and with application of various proportions of rated volts. These tests are carried out for three reasons:

1. 2,000 hr tests carried out as part of our regular Quality Assurance programme.
2. 10,000 hr continuation tests to obtain reliability data.
3. Other tests under derated conditions to obtain supplementary information to 1 and 2.

These data are kept under continuous review by means of an attributes analysis. In addition variables analyses are carried out as required. A general indication of the results obtained to date is given below and this is being continuously updated and augmented. It will, however, be appreciated that a substantial amount of data is necessary before a complete picture can be built up of the variations of failure rate with case size and voltage rating.

Results to date indicate the mean failure rate at 60% confidence varies from approximately 0,2 per cent/1,000 hrs for capacitors tested at 70 °C, $\frac{2}{3}$ rated volts, to approximately 0,7 per cent/1,000 hrs when tested at 125 °C, $\frac{2}{3}$ rated volts. These figures are total failure rates and include parametric and catastrophic failures; the former being the majority. (A parametric failure is any capacitor where one parameter exceeds the Q.A. test limits of DEF. 5134–A1). These results are obtained in circuits of impedance of < 3 ohms and under these conditions the higher voltage ratings have higher failure rates than the lower voltage ratings. It would be expected that in circuits of constant ohms per volt this difference would be eliminated. Figures for particular cases can be provided. Failure rate at the 60% confidence level is based on the upper one sided failure rate for the exponential failure distribution, 60% being chosen as the most representative true reliability figure related to a sampling procedure.

MIL Handbook 217A gives, in considerable detail, the failure rates for MIL–C–39003 solid tantalum capacitors. The evidence from the tests listed above, which accumulate currently about 30 million component hours per year, suggests that in general the failure rates of these ITT capacitors are of the same order as level M and corresponding variations can be expected with changes in voltage and temperature stress levels.

Analyses based on the Weibull distribution have shown that failure rate decreases with time. Values of β about 0,7 are normally obtained. The "early failures" are eliminated by an ageing period which is part of the manufacturing process.

EFFECT OF SURGES

The solid tantalum capacitor has a limited ability to withstand surges (15% to 30% of rated voltage). This is in common with all electrolytic capacitors and is due to the fact that these operate at very high electrical stress within the oxide layer. In the case of "solid" electrolytic capacitors this is further complicated by the limited self healing ability of the manganese dioxide semiconductor.

It is important to ensure that the voltage across the terminals of the capacitor does not exceed the surge voltage rating at any time. This is particularly so in low impedance circuits where the capacitor is likely to be subjected to the full impact of surges especially in even a slightly inductive circuit. Even an extremely short duration spike in likely to cause damage.

EFFECT OF CIRCUIT IMPEDANCE

As stated earlier, the reliability of solid tantalum capacitors depends on the applied voltage, both steady state and peak values of transient surges. An inductive low impedance circuit may apply voltage surges to the capacitor, and similarly a non-inductive low impedance circuit may apply current surges to the capacitors, causing localised overheating and failure. The recommended circuit impedance is 3 ohms per volt. Where this is not feasible, equivalent voltage derating should be used, see MIL–HANDBOOK–217A or Fig. 11.

MODE OF FAILURE

This is normally an increase of leakage current which ultimately becomes a short circuit.

Fig. 11 Effect of temperature and voltage derating on failure rate at 0,1 Ω/volt.
Compiled from MIL HDBK 217A, Figs. 7.6.34.A

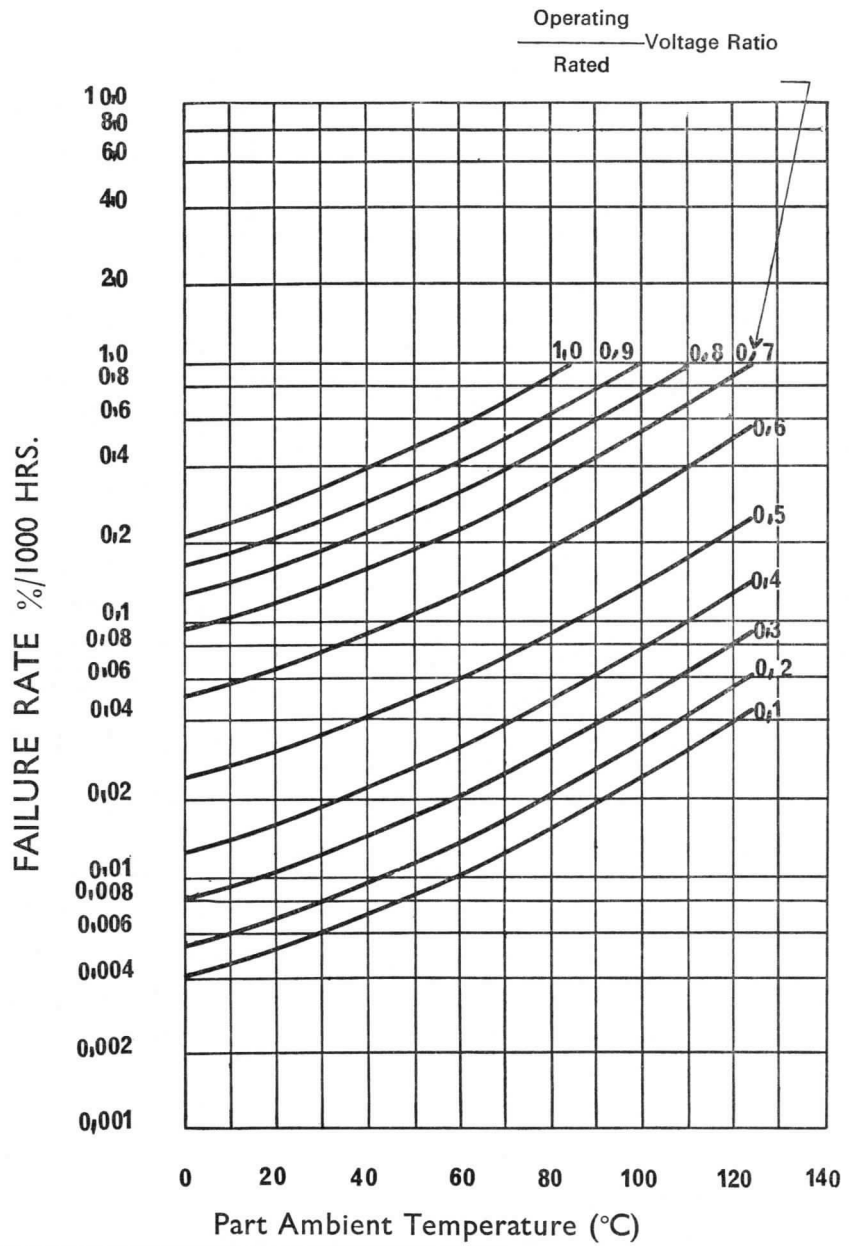
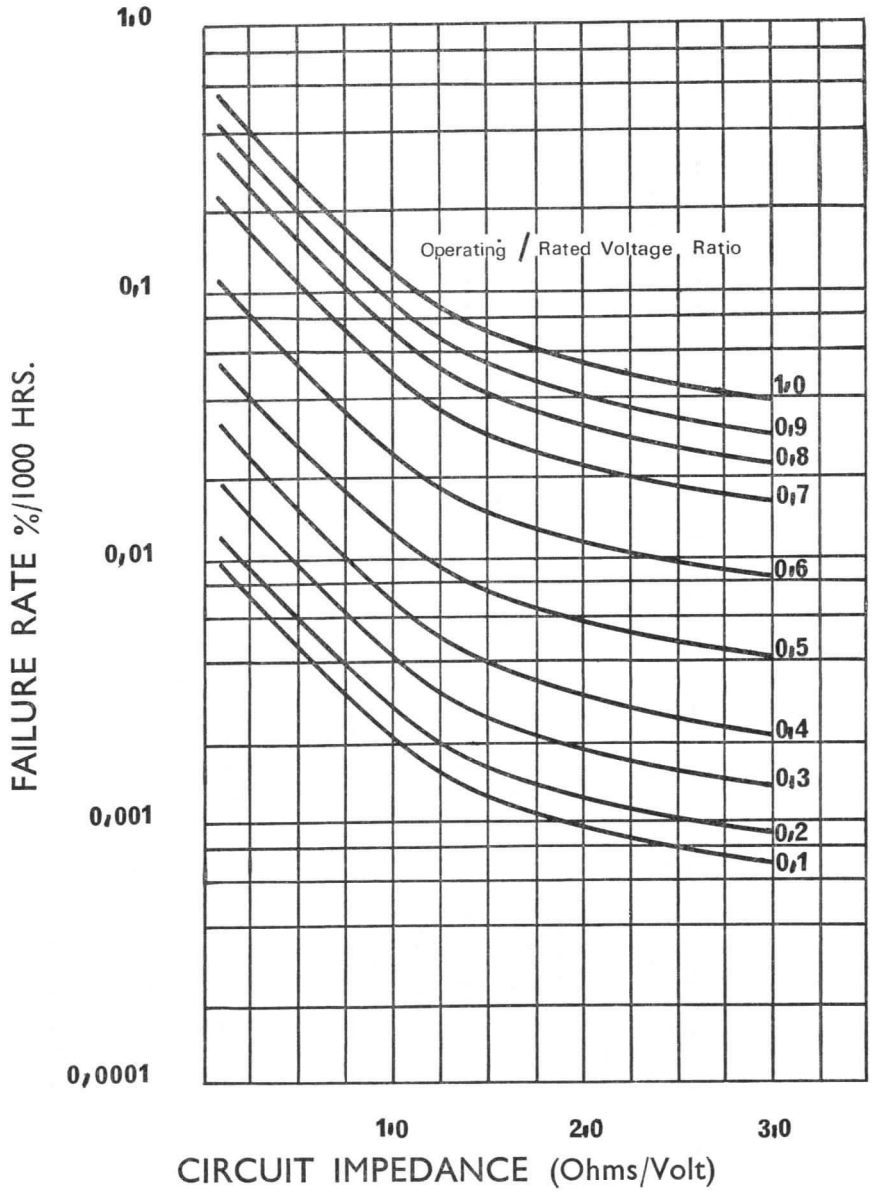


Fig. 12 Effect of circuit impedance and voltage derating on failure rate at 60°C
Compiled from MIL HDBK 217A, Fig. 7.6.34.A and 34.B.



FULL CODE LIST with applicable NATO stock numbers.

TABLE 2—INSULATED CAPACITORS

ITT/ NATO CASE SIZE	Capacitance (μF)	D.C. Working Voltage		NATO STOCK NUMBER		
		up to 85 °C	at 125 °C	5% Tolerance 5910–99–	10% Tolerance 5910–99–	20% Tolerance 5910–99–
A	5,1					
A	5,6				013–0366	
A	6,2					
A	6,8				013–0367	013–0484
B	43					
B	47				013–0368	013–0485
B	51					
B	56	6	4		013–0369	948–8473
C	130					
C	150				013–0370	013–0486
C	160					
C	180				013–0371	946–4298
D	240					
D	270				013–0372	
D	300					
D	330				013–0373	013–0487
A	3,6					
A	3,9				013–0374	
A	4,3					
A	4,7				013–0375	013–0488
B	24					
B	27				013–0376	
B	30					
B	33				013–0377	013–0489
B	36					
		10	7			
B	39				013–0378	970–6556
C	75					
C	82				013–0379	
C	91					
C	100				013 0380	013–0490
C	110					
C	120				013–0381	948–8471
D	160					
D	180				013–0382	
D	200					
D	220				013–0383	013–0491

TABLE 2—INSULATED CAPACITORS—continued

ITT/ NATO CASE SIZE	Capacitance (μF)	D.C. Working Voltage		NATO STOCK NUMBER		
		up to 85 °C	at 125 °C	5% Tolerance 5910–99–	10% Tolerance 5910–99–	20% Tolerance 5910–99–
A	2,4					
A	2,7				013–0384	
A	3,0					
A	3,3				013–0385	013–0492
B	16					
B	18				013–0386	
B	20					
B	22	15	10		013–0387	013–0493
C	51					
C	56				013–0388	
C	62					
C	68				013–0389	013–0494
D	110					
D	120				013–0390	
D	130					
D	150			972–4744	013–0391	013–0495
A	1,1					
A	1,2				013–0392	
A	1,3					
A	1,5			519–6168		953–4704
A	1,6					
A	1,8					
A	2,0	20	13			
A	2,2			954–4461	013–0393	013–0496
B	7,5					
B	8,2				013–0394	
B	9,1					
B	10			519–2560	013–0395	013–0497
B	11					
B	12				013–0396	
B	13					
B	15			519–2558	013–0397	013–0498

TABLE 2—INSULATED CAPACITORS—continued

ITT/ NATO CASE SIZE	Capacitance (μF)	D.C. Working Voltage		NATO STOCK NUMBER		
		up to 85 °C	at 125 °C	5% Tolerance 5910–99–	10% Tolerance 5910–99–	20% Tolerance 5910–99–
C	24					
C	27				013–0398	
C	30					
C	33				013–0399	013–0499
C	36					
C	39				013–0400	
C	43					
C	47				013–0401	013–0500
D	56				013–0402	
D	62					
D	68				013–0403	013–0501
D	75	20	13			
D	82				013–0404	
D	91					
D	100				013–0405	013–0502
A	0,01					
A	0,015					
A	0,022			Not available at ±5% tolerance		
A	0,027					
A	0,033					
A	0,047					
A	0,068					
A	0,1			519–6166	013–0406	
A	0,12					
A	0,15					
A	0,18	35	23		948–5696	
A	0,22			519–6167	013–0407	950–8983
A	0,33				013–0408	013–0503
A	0,36					
A	0,39					
A	0,43					
A	0,47			519–6170	013–0409	013–0504
A	0,51					
A	0,56					
A	0,62					

TABLE 2—INSULATED CAPACITORS—continued

ITT/ NATO CASE SIZE	Capacitance (μF)	D.C. Working Voltage		NATO STOCK NUMBER		
		up to 85 °C	at 125 °C	5% Tolerance 5910–99–	10% Tolerance 5910–99–	20% Tolerance 5910–99–
A	0,68				013–0410	013–0505
A	0,75					
A	0,82					
A	0,91					
A	1,0			954–4462	013–0411	013–0506
B	1,1					
B	1,2					
B	1,3					
B	1,5				013–0855	951–4390
B	1,6					
B	1,8				948–5697	
B	2,0					
B	2,2			956–8772	013–0412	013–0507
B	2,4					
B	2,7	35	23			
B	3,0					
B	3,3				013–0413	013–0508
B	3,6					
B	3,9					
B	4,3					
B	4,7				013–0414	013–0509
B	5,1					
B	5,6					
B	6,2					
B	6,8			955–5931	013–0415	013–0510
C	7,5					
C	8,2				013–0416	
C	9,1					
C	10				013–0417	013–0511
C	11					
C	12				013–0418	
C	13					
C	15				013–0419	013–0512
C	16					
C	18				013–0420	

TABLE 2—INSULATED CAPACITORS—continued

ITT/ NATO CASE SIZE	Capacitance (μF)	D.C. Working Voltage		NATO STOCK NUMBER		
		up to 85 °C	at 125 °C	5% Tolerance 5910–99–	10% Tolerance 5910–99–	20% Tolerance 5910–99–
C	20					
C	22			972–3170	013–0421	013–0513
D	24					
D	27				013–0422	
D	30					
D	33	35	23		013–0423	013–0514
D	36					
D	39				013–0424	
D	43					
D	47				013–0425	013–0515
D	51					
D	56			519–2557		102–1722
A	0,1					
A	1,0			972–1818	013–0426	013–0516
B	1,2				013–0427	
B	1,5				013–0428	013–0517
B	1,6					
B	1,8				013–0429	
B	2,0					
B	2,2				013–0430	013–0518
B	2,4					
B	2,7				013–0431	
B	3,0					
B	3,3			519–6169	013–0432	013–0519
B	3,6					
B	3,9	50	33		013–0433	
B	4,3					
B	4,7				013–0434	013–0520
C	5,6				013–0435	
C	6,8				013–0436	013–0521
C	7,5					
C	8,2				013–0437	
C	9,1					
C	10				013–0438	013–0522

TABLE 2—INSULATED CAPACITORS—continued

ITT/ NATO CASE SIZE	Capaci-tance (μF)	D.C. Working Voltage		NATO STOCK NUMBER		
		up to 85 °C	at 125 °C	5% Tolerance 5910–99–	10% Tolerance 5910–99–	20% Tolerance 5910–99–
C	11					
C	12				013–0439	
C	13					
C	15				013–0440	013–0523
C	16	50	33			
C	18				013–0441	953–4708
D	20					
D	22				013–0442	013–0524
A	0,047					
A	0,1				013–1647	013–1688
A	0,12				013–1648	
A	0,15				013–1649	013–1689
A	0,18				013–1650	
A	0,22				013–1651	013–1690
A	0,27				013–1652	
A	0,33				013–1653	013–1691
A	0,39				013–1654	
A	0,47				013–1655	013–1692
A	0,56				013–1656	
A	0,68				013–1657	013–1693
B	0,82				013–1658	
B	1,0	75	50		013–1659	013–1694
B	1,2				013–1660	
B	1,5				013–1661	013–1695
B	1,8				013–1662	
B	2,2				013–1663	013–1696
B	2,7				013–1664	
B	3,3				013–1665	013–1697
B	3,9				013–1666	
C	4,7				013–1667	013–1698
C	5,6				013–1668	
C	6,8				013–1669	013–1699
C	8,2				013–1670	
C	10				013–1671	013–1700
D	12				013–1672	
D	15				013–1673	013–1701

TABLE 3—UNINSULATED CAPACITORS

ITT/ NATO CASE SIZE	Capaci-tance (μF)	D.C. Working Voltage		NATO STOCK NUMBER	
		up to 85 °C	at 125 °C	10% Tolerance 5910–99–	20% Tolerance 5910–99–
A	5,6			013–0289	
A	6,8			013–0290	013–0443
B	47			013–0291	013–0444
B	56	6	4	013–0292	
C	150			013–0293	013–0445
C	180			013–0294	
D	270			013–0295	
D	330			013–0296	013–0446
A	3,9			013–0297	
A	4,7			013–0298	013–0447
B	27			013–0299	
B	33	10	7	013–0300	013–0448
B	39			013–0301	
C	82			013–0302	
C	100			013–0303	013–0449
C	120			013–0304	
D	180			013–0305	
D	220			013–0306	013–0450
A	2,7			013–0307	
A	3,3			013–0308	013–0451
B	18			013–0309	
B	22	15	10	013–0310	013–0452
C	56			013–0311	
C	68			013–0312	013–0453
D	120			013–0313	
D	150			013–0314	013–0454
A	1,2			013–0315	
A	2,2			013–0316	013–0455
B	8,2			013–0317	
B	10			013–0318	013–0456
B	12	20	13	013–0319	
B	15			013–0320	013–0457

TABLE 3—UNINSULATED CAPACITORS—continued

ITT/ NATO CASE SIZE	Capacitance (μF)	D.C. Working Voltage		NATO STOCK NUMBER	
		up to 85 °C	at 125 °C	10% Tolerance 5910–99–	20% Tolerance 5910–99–
C	27			013–0321	
C	33			013–0322	013–0458
C	39			013–0323	
C	47			013–0324	013–0459
D	56	20	13	013–0325	
D	68			013–0326	013–0460
D	82			013–0327	
D	100			013–0328	013–0461
A	0,1			013–0329	
A	0,22			013–0330	
A	0,33			013–0331	013–0462
A	0,47			013–0332	
A	0,63			013–0333	013–0464
A	1,0			013–0334	013–0465
B	2,2			013–0335	013–0466
B	3,3			013–0336	013–0467
B	4,7			013–0337	013–0468
B	6,8			013–0338	013–0469
C	8,2	35	23	013–0339	
C	10			013–0340	013–0470
C	12			013–0341	
C	15			013–0342	013–0471
C	18			013–0343	
C	22			013–0344	013–0472
D	27			013–0345	
D	33			013–0346	013–0473
D	39			013–0347	
D	47			013–0348	013–0474
A	1,0			013–0349	013–0475
B	1,2			013–0350	
B	1,5			013–0351	013–0476
B	1,8	50	33	013–0352	
B	2,2			013–0353	013–0477
B	2,7			013–0354	

TABLE 3—UNINSULATED CAPACITORS—continued

ITT/ NATO CASE SIZE	Capacitance (μF)	D.C. Working Voltage		NATO STOCK NUMBER	
		up to 85°C	at 125°C	10% Tolerance 5910–99–	20% Tolerance 5910–99–
B	3,3	50	33	013–0355	013–0478
B	3,9			013–0356	
B	4,7			013–0357	013–0479
C	5,6			013–0358	
C	6,8			013–0359	013–0480
C	8,2			013–0360	
C	10,0			013–0361	013–0481
C	12,0			013–0362	
C	15,0			013–0363	013–0482
C	18,0			013–0364	
D	22,0			013–0365	013–0483
A	0,047				
A	0,1			013–1620	013–1674
A	0,12			013–1621	
A	0,15			013–1622	013–1675
A	0,18			013–1623	
A	0,22			013–1624	013–1676
A	0,27			013–1625	
A	0,33			013–1626	013–1677
A	0,39			013–1627	
A	0,47			013–1628	013–1678
A	0,56			013–1629	
A	0,68			013–1630	013–1679
B	0,82			013–1631	
B	1,0	75	50	013–1632	013–1680
B	1,2			013–1633	
B	1,5			013–1634	013–1681
B	1,8			013–1635	
B	2,2			013–1636	013–1682
B	2,7			013–1637	
B	3,3			013–1638	013–1683
B	3,9			013–1639	

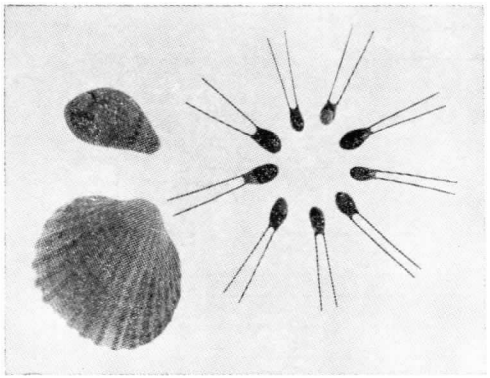
TABLE 3—UNINSULATED CAPACITORS—continued

ITT/ NATO CASE SIZE	Capaci-tance (μF)	D.C. Working Voltage		NATO STOCK NUMBER	
		up to 85 °C	at 125 °C	10% Tolerance 5910–99–	20% Tolerance 5910–99–
C	4,7			013–1640	013–1684
C	5,6			013–1641	
C	6,8			013–1642	013–1685
C	8,2			013–1643	
C	10			013–1644	013–1686
D	12			013–1645	
D	15			013–1646	013–1687

Although any capacitor listed in Table 2 is available without an insulating sleeve the list above covers uninsulated capacitors for which there are NATO STOCK NUMBERS.

Resin Dipped Solid Tantalum Capacitors

Code : TAG



BRIEF DATA

CAPACITANCE RANGE
0,1μF to 150μF

CAPACITANCE TOLERANCE
$\pm$20% $\pm$10%

WORKING VOLTAGES at 85°C
3 6,3 10 16 25 and 35V d.c.

RATED TEMPERATURE RANGE
$-$55°C to +85°C

The very popular TAG series has been extended in range and the performance specification has been tightened to give truly professional leakage current limits.

Note these points:—

* * CV ratings up—1,000μF/V now standard production.

* * Leakage current limits tightened—0,02μA/μFV. or 1μA, whichever greater.

* * Power factor limits tightened.

* * New snap-in terminals for P.C.B. applications.

* * 21 day humidity protection.

The newly introduced miniature TAM capacitors effectively extend the range down to 0,015μF at 35 volts. Four decades of capacitance are now covered by low cost resin dipped solid tantalum capacitors. (Send for separate data sheet on TAM resin dipped solid tantalum capacitors.)

ITT Components Group Europe
Standard Telephones and Cables Limited
Capacitor Product Division, Brixham Road, Paignton, Devon
Telephone : Paignton 50762 (STD Code 0803) Telex 42951

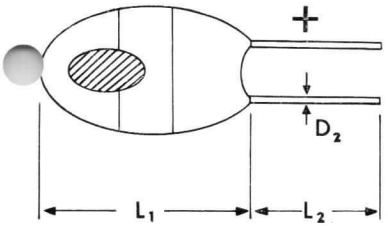
ITT
COMPONENTS

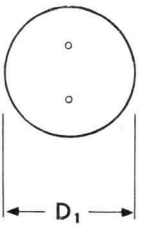
TABLE 1

CAPACITANCE RANGE (letter denotes case code)

Capacitance	Rated Voltage D.C.					
μF	3	6,3	10	16	25	35
0,1	—	—	—	—	—	A
0,15	—	—	—	—	—	A
0,22	—	—	—	—	—	A
0,33	—	—	—	—	—	A
0,47	—	—	—	—	—	A
0,68	—	—	—	—	—	A
1,0	—	—	—	—	—	A
1,5	—	—	—	—	—	A
2,2	—	—	—	A	—	A
3,3	—	—	—	A	B	B
4,7	—	—	A	A	B	C
6,8	—	A	A	B	C	D
10	A	A	B	C	D	D
15	A	B	C	D	E	E
22	A	C	D	D	E	
33	B	D	D	E	F	
47	C	D	E	F		
68	D	E	E	F		
100	D	E	F			
150	—	F				
	Surge Voltage D.C.					
	3,5	8	12	18	30	42

STANDARD TERMINATIONS





FIXED CAPACITOR

TANTALUM ELECTROLYTIC

Solid Electrolyte :
Porous Anode :
Polar :
Resin Dipped :

Radial Terminations

General Application

DIMENSIONS AND RATINGS

Case Size	L_1 Max. mm	L_1 Max. in	D_1 Max. mm	D_1 Max. in	D_2 Nom. mm	D_2 Nom. in	Capacitance Range and Rated Voltage Range	Typical Weight (g)
A	9,5	0,37	5,0	0,20	0,4	0,016	22μF 3V to 0,1μF 35V	0,23
B	10,0	0,39	5,5	0,22	0,4	0,016	33μF 3V to 3,3μF 35V	0,27
C	11,0	0,43	6,3	0,25	0,4	0,016	47μF 3V to 4,7μF 35V	0,31
D	11,5	0,45	7,5	0,30	0,4	0,016	100μF 3V to 6,8μF 35V	0,52
E	12,0	0,47	8,0	0,32	0,4	0,016	100μF 6,3V to 15μF 35V	0,55
F	13,0	0,51	9,0	0,35	0,4	0,016	150μF 6,3V to 33μF 25V	1,80

NOTE 1 Manufacturing dimensions are in millimetres.

NOTE 2 Length of terminations (L_2) 15mm (0,6in) minimum.

NOTE 3 Marking for polarity shall be indicated, as shown, by the position of the coloured spot relative to the positive terminal.

NOTE 4 The complete capacitance/rated voltage range is given in Table 1.

NOTE 5 The tolerance on the wire diameter is +10% −0,05mm (0,002in).

NOTE 6 The maximum length of resin along the terminal wires is 1,5mm (0,055in) and is contained within the maximum body length L_1.

MANUFACTURERS CODES

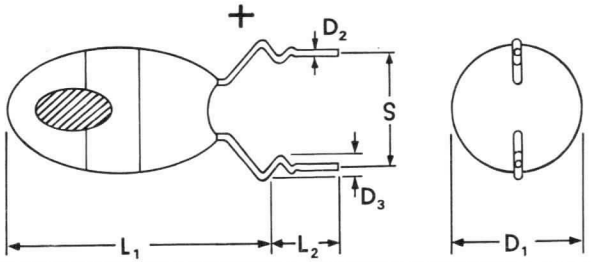
Example :

TA G 6,8 M 25

Tantalum
Resin Dipped Encapsulation
Capacitance (μF)
Capacitance Tolerance M ±20% K ±10%
Working Voltage

CODE : TAG

SNAP-IN P.C.B. TERMINATIONS



FIXED CAPACITOR

TANTALUM ELECTROLYTIC

Solid Electrolyte :
Porous Anode :
Polar :
Resin Dipped :

Radial Terminations

General Application

DIMENSIONS AND RATINGS

Case Size	L_1 Max. mm	L_1 Max. in	D_1 Max. mm	D_1 Max. in	D_2 Nom mm	D_2 Nom in	Capacitance Range and Rated Voltage Range	Typical Weight (g)
A	11,5	0,45	5,0	0,20	0,5	0,02	22μF 3V to 0,1μF 35V	0,23
B	12,0	0,47	5,5	0,22	0,5	0,02	33μF 3V to 3,3μF 35V	0,27
C	13,0	0,52	6,3	0,25	0,5	0,02	47μF 3V to 4,7μF 35V	0,31
D	13,5	0,54	7,5	0,30	0,5	0,02	100μF 3V to 6,8μF 35V	0,52
E	14,0	0,55	8,0	0,32	0,5	0,02	100μF 6,3V to 15μF 35V	0,55
F	15,0	0,59	9,0	0,35	0,5	0,02	150μF 6,3V to 33μF 25V	1,80

NOTE 1 Manufacturing dimensions are metric.

NOTE 2 Length of terminations through printed circuit board (L_2) 3mm $^{+3mm}_{-0mm}$ ($0,12in\ ^{+0,12}_{-0in}$).

NOTE 3 Hole clearance in printed circuit board for snap-in terminations (D_3) 1,1mm ±0,05mm (0,043in ±0,002in).

NOTE 4 Spacing between terminations, (S) 5mm ±0,5mm (0,20in ±0,02in).

NOTE 5 Marking for polarity shall be indicated, as shown, by the position of the coloured spot relative to the positive terminal.

NOTE 6 The complete capacitance/rated voltage range is given in Table 1.

NOTE 7 The tolerance on the wire diameter is +10% −0,05mm (0,002in).

MANUFACTURERS CODES

Example :

TA G f 6,8 M 25

- TA — Tantalum
- G — Resin Dipped Encapsulation
- f — Formed Terminal Wires
- 6,8 — Capacitance (μF)
- M — Capacitance Tolerance M ±20% K ±10%
- 25 — Working Voltage

1 **RATINGS** (including limiting conditions of use) **AND CHARACTERISTICS**

Reference temperature 20°C unless otherwise stated.

Capacitance range	0,1μF to 150μF (E6 range of BS 2488 (IEC68))
Standard selection tolerance	±20% ±10%
Climatic category	55/85/21
Rated temperature range	−55°C to +85°C
Power factor at 120 Hz	Capacitance $\leq$ 47μF, Tan Delta 0,1 max. Capacitance $>$ 47μF, Tan Delta 0,2 max.
Maximum leakage current (after 3 minutes at rated voltage with 1 kΩ series resistance)	0,02μA/μFV or 1μA whichever is greater

Working Voltage	3	6,3	10	16	25	35	V d.c.
Surge Voltage	3,5	8	12	18	30	42	V d.c.
Maximum Reverse Voltage	0,3	0,5	0,5	0,5	0,5	0,5	V d.c.

Robustness of terminations: Terminal wires will withstand a tension of 1 lb. Two bends of 90° are permissible

Ripple voltage ratings

Table 2 gives the maximum r.m.s. ripple voltage which may be applied at 100 Hz. The sum of the D.C. voltage and the peak value of the superimposed alternating voltage must not exceed the normal rated voltage and no inadmissable reverse polarity must occur.

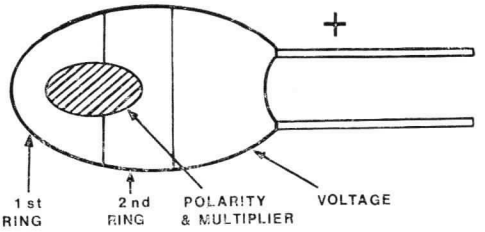
TABLE 2 RIPPLE VOLTAGE RATINGS (r.m.s.)

Capacitance	Rated D.C. Voltage					
μF	3	6,3	10	16	25	35
0,1						10
0,15						10
0,22						10
0,33						10
0,47						10
0,68						10
1,0						10
1,5						10
2,2				4,3		8,5
3,3				4,3	5,7	6,7
4,7			2,1	4,3	4,7	5,7
6,8		1,7	2,1	3,9	4,7	5,7
10	0,9	1,7	2,1	3,9	4,7	5,7
15	0,9	1,7	2,1	3,9	3,1	5,5
22	0,9	1,7	2,1	2,7	3,1	
33	0,9	1,7	2,1	2,7	3,1	
47	0,9	1,7	1,8	2,5		
68	0,9	1,5	1,8	2,5		
100	0,9	1,2	1,5			
150		1,2				

These conditions apply at all temperatures up to 85°C. Ripple voltage ratings at higher frequencies are obtained by multiplying the above 100 Hz values by the following factors:—

Frequency	Factor
1 kHz	0,5
10 kHz	0,1
100 kHz	0,02

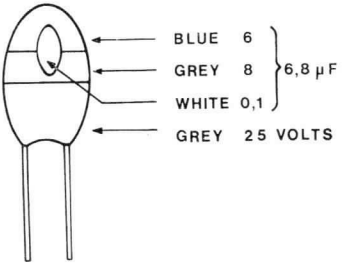
2 CODING



Capacitance in μF				D.C. Working Voltage	
Colour	1st Ring	2nd Ring	Polarity and Multiplier	Colour	Volts
Black	—	0	x 1	White	3
Brown	1	1	x 10	Yellow	6,3
Red	2	2		Black	10
Orange	3	3		Green	16
Yellow	4	4		Grey	25
Green	5	5		Pink	35
Blue	6	6			
Violet	7	7			
Grey	8	8	x 0,01		
White	9	9	x 0,1		

N.B.—The above sketch shows the position of the coloured spot which serves both as multiplier and anode indicator.

EXAMPLE : 6,8μF/25 volts



3 APPLICATION NOTES

These capacitors are suitable for coupling and decoupling and general applications in electronic circuits. The reliability of these capacitors depends on circuit impedance. In very low impedance (e.g. less than 3Ω/V) circuits, such as power supplies, particular care is necessary to ensure that the surge voltage rating is not exceeded. The main mode of failure is high leakage current or short circuit.

Performance figures and data quoted in this document are typical and must be specifically confirmed in writing by Standard Telephones and Cables Limited before they become applicable to any particular tender, order or contract.

GRAPHS OF TYPICAL PERMORMANCE

Fig. 1. Variation of capacitance with temperature (referred to 20°C)

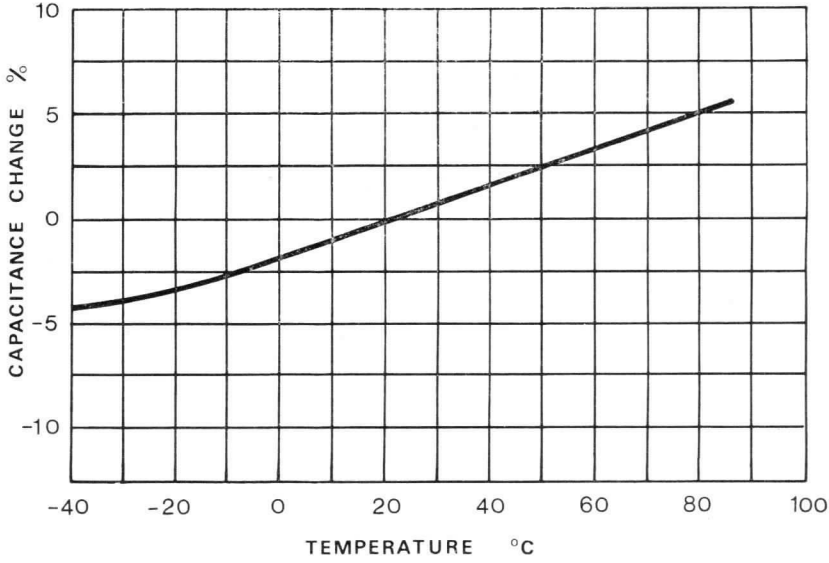
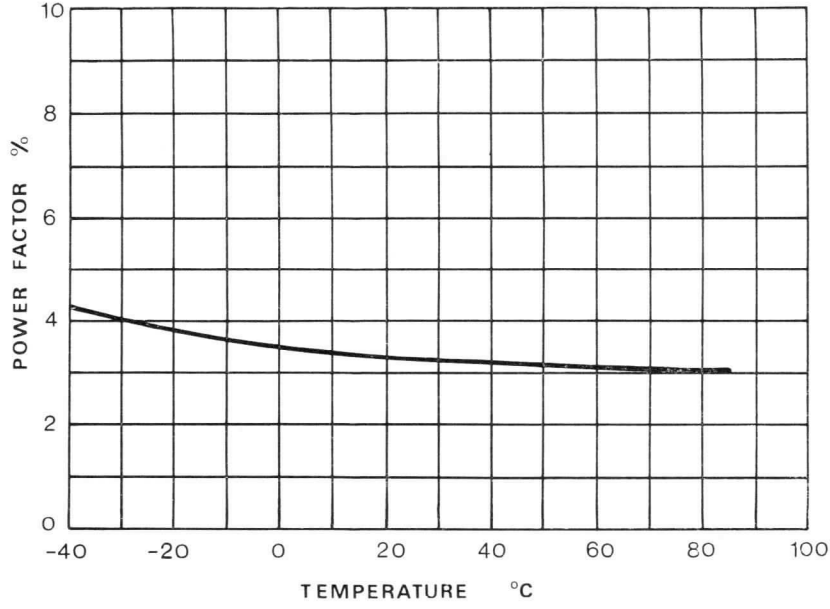


Fig. 2. Variation of power factor with temperature (measured at 120 Hz with maximum working voltage applied)



TYPICAL PERFORMANCE—continued

Fig. 3. Variation of leakage current with temperature (measured at maximum working voltage after 3 minutes)

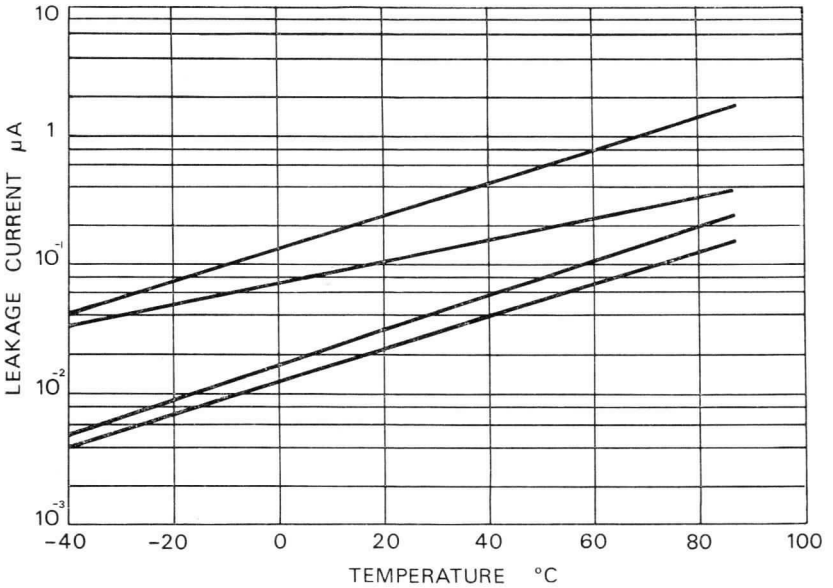
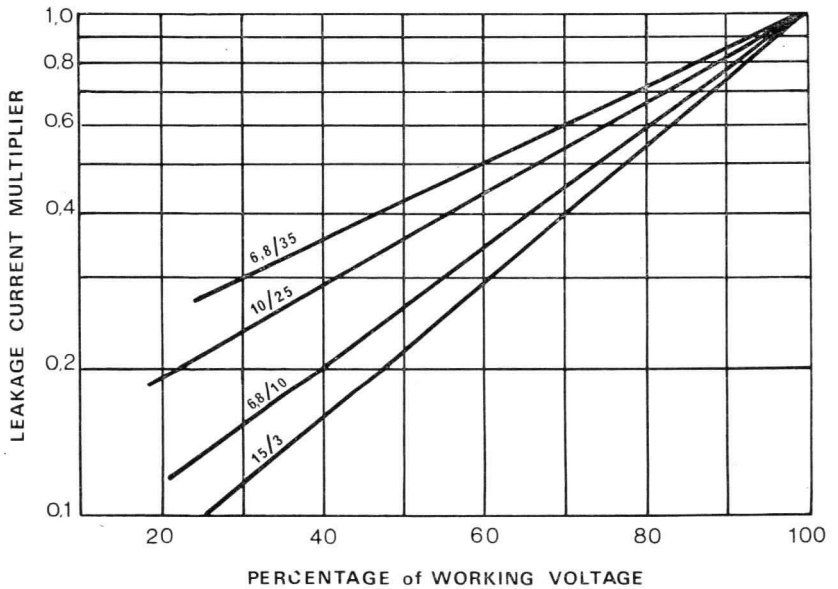
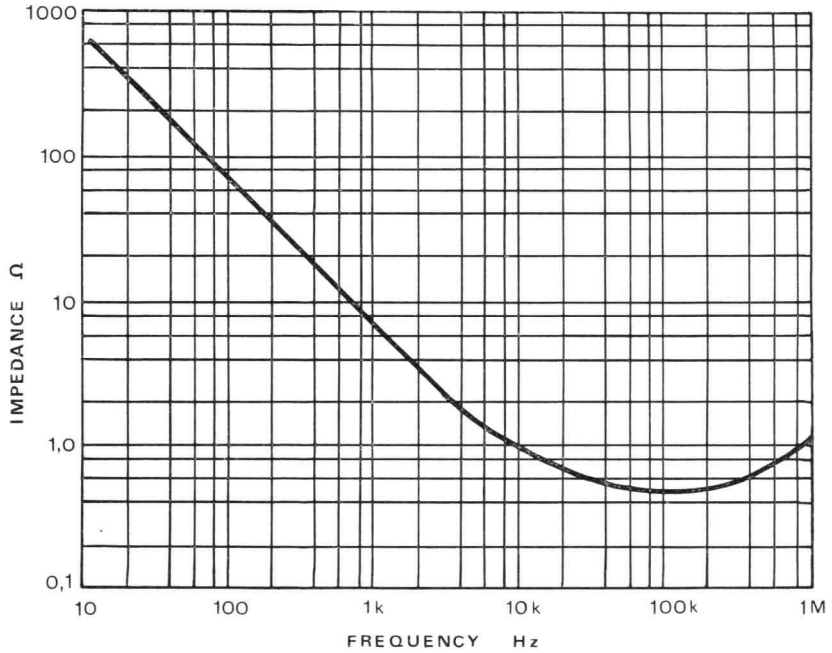


Fig. 4. Variation of leakage current with applied voltage



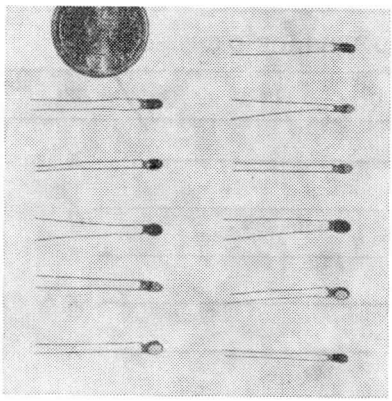
TYPICAL PERFORMANCE—continued

Fig. 5. Variation of impedance with frequency



MINIATURE RESIN DIPPED SOLID TANTALUM CAPACITORS

CODE: TAM



BRIEF DATA

Capacitance Range	0,015μF to 6,8μF
Capacitance Tolerance	±20%
Working Voltages	3 6,3 10 16 25 and 35V d.c.
Rated Temperature Range	−55°C to +85°C

This new range of capacitors has been specially developed by ITT to give high packing densities at low cost. These miniature capacitors are constructed to the same high standards of manufacture employed for ITT's other tantalum capacitors.

The TAM range has a conformal resin encapsulation giving mechanical protection together with a 21 day humidity classification. It has radial leads suitable for either soldering or welding.

These capacitors are suitable for hearing aid amplifiers, pocket paging equipment, and other miniature electronic circuits where performance is required at low cost.

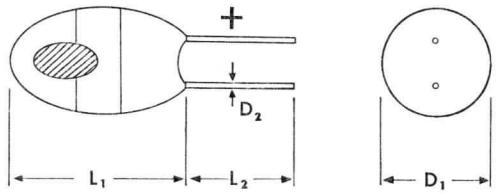
ITT COMPONENTS GROUP EUROPE
Standard Telephones and Cables Ltd
Capacitor Product Division,
Brixham Road, Paignton, Devon.
Telephone: Paignton 50762
(STD Code 0803) Telex: 42951

ITT
COMPONENTS

TABLE 1

CAPACITANCE RANGE (letter denotes case code)

CAPACITANCE µF	RATED VOLTAGE D.C.					
	3	6,3	10	16	25	35
0,015						X
0,022						X
0,033						X
0,047						X
0,068						X
0,10						X
0,15						X
0,22						X
0,33						X
0,47					X	
0,68				X		Y
1,0			X		Y	
1,5		X		Y		
2,2	X		Y			
3,3	X	Y				
4,7	Y					
6,8	Y					
SURGE VOLTAGE D.C.	3,5	7	12	18	30	40



Fixed Capacitor.
Tantalum Electrolytic.
Solid Electrolyte: Porous Anode: Polar: Resin Dipped:
Radial Terminations.
General Application.

DIMENSIONS AND RATINGS

CASE SIZE	L_1 mm	MAX. in.	D_1 mm	MAX. in.	D_2 mm	NOM. in.	CAPACITANCE RANGE AND RATED VOLTAGE RANGE	TYPICAL WEIGHT (g)
X	4,5	0,18	2,5	0,10	0,35	0,014	3,3μF 3V to 0,015μF 35V	0,064
Y	5,0	0,20	2,5	0,10	0,35	0,014	6,8μF 3V to 0,68μF 35V	0,073

NOTE 1 Manufacturing dimensions are in millimetres.

NOTE 2 Length of terminations (L_2) 15mm (0,6in.) minimum.

NOTE 3 Marking for polarity shall be indicated, as shown, by the position of the coloured spot relative to the positive terminal.

NOTE 4 The complete capacitance/rated voltage range is given in Table 1.

NOTE 5 The tolerance on the wire diameter is +10% −0,05mm (0,002in.).

NOTE 6 The maximum length of resin along the terminal wires is 1,5mm (0,055in.) and is contained within the maximum body length L_1.

MANUFACTURING CODES

Style reference TAM followed by the capacitance and rated voltage.

EXAMPLE TAM 6,8/3V

1. RATINGS (including limiting conditions of use) and CHARACTERISTICS.

Reference temperature 20 °C unless otherwise stated.

Capacitance Range	0,015 μF to 6,8 μF (E6 range of BS 2488 (IEC68))
Standard Selection Tolerance	±20%
Climatic Category	55/85/21
Rated Temperature Range	−55 °C to +85 °C
Power Factor at 120 Hz	10% Maximum
Maximum Leakage Current (after 3 minutes at rated voltage with 1 kΩ series resistance).	1 μA

WORKING VOLTAGE	3	6,3	10	16	25	35 V d.c.
SURGE VOLTAGE	3,5	7	12	18	30	40 V d.c.
MAXIMUM REVERSE VOLTAGE	0,3	0,5	0,5	0,5	0,5	0,5 V d.c.

Robustness of Terminations	Tensile 250 gm Bending 100 gm 3 bends ±90°
Solderability	BS 2011 Part 2T (aged condition)

Ripple voltage ratings

Table 2 gives the maximum r.m.s. ripple voltage which may be applied at 100 Hz. The sum of the D.C. voltage and the peak value of the superimposed alternating voltage must not exceed the normal rated voltage and no inadmissible reverse polarity must occur.

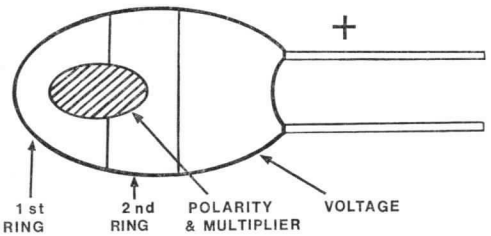
TABLE 2 RIPPLE VOLTAGE RATINGS (r.m.s.)

CAPACITANCE μF	RATED VOLTAGE D.C.					
	3	6,3	10	16	25	35
0,015						10
0,022						10
0,033						10
0,047						10
0,068						10
0,10						10
0,15						10
0,22						10
0,33						10
0,47					7,1	
0,68				4,3		10
1,0			2,8		5,7	
1,5		1,7		4,3		
2,2	0,9		2,8			
3,3	0,9	1,7				
4,7	0,9					
6,8	0,9					

These conditions apply at all temperatures up to 85 °C. Ripple voltage ratings at higher frequencies are obtained by multiplying the above 100 Hz values by the following factors :—

FREQUENCY	FACTOR
1 kHz	0,5
10 kHz	0,1
100 kHz	0,02

2. CODING

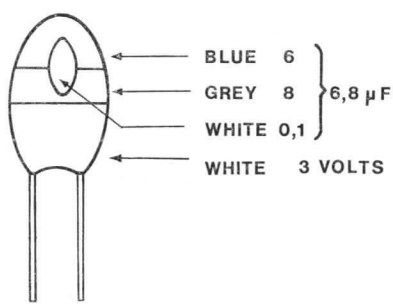


CAPACITANCE IN μF				D.C. WORKING VOLTAGE	
COLOUR	1st RING	2nd RING	POLARITY and MULTIPLIER	COLOUR	VOLTS
Black	–	0		White	3
Brown	1	1		Yellow	6,3
Red	2	2		Black	10
Orange	3	3		Green	16
Yellow	4	4		Grey	25
Green	5	5		Pink	35
Blue	6	6			
Violet	7	7	×0,001		
Grey	8	8	×0,01		
White	9	9	×0,1		

N.B.—The above sketch shows the position of the coloured spot which serves both as multiplier and anode indicator.

EXAMPLE

6,8μF/3 volts



3. APPLICATION NOTES

These capacitors are suitable for coupling and decoupling and general applications in electronic circuits. The reliability of these capacitors depends on circuit impedance. In very low impedance (e.g. less than 3 Ω/V) circuits, such as power supplies, particular care is necessary to ensure that the surge voltage rating is not exceeded. The main mode of failure is high leakage current or short circuit.

Performance figures and data quoted in this document are typical and must be specifically confirmed in writing by Standard Telephones and Cables Limited, before they become applicable to any particular tender, order or contract.

GRAPHS OF TYPICAL PERFORMANCE

Fig. 1 Variation of Capacitance with temperature (referred to 20 °C)

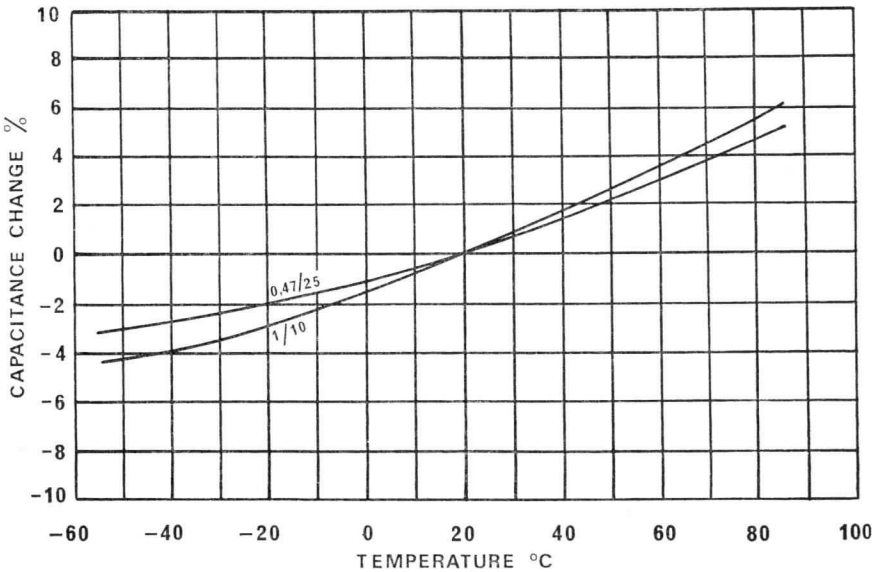
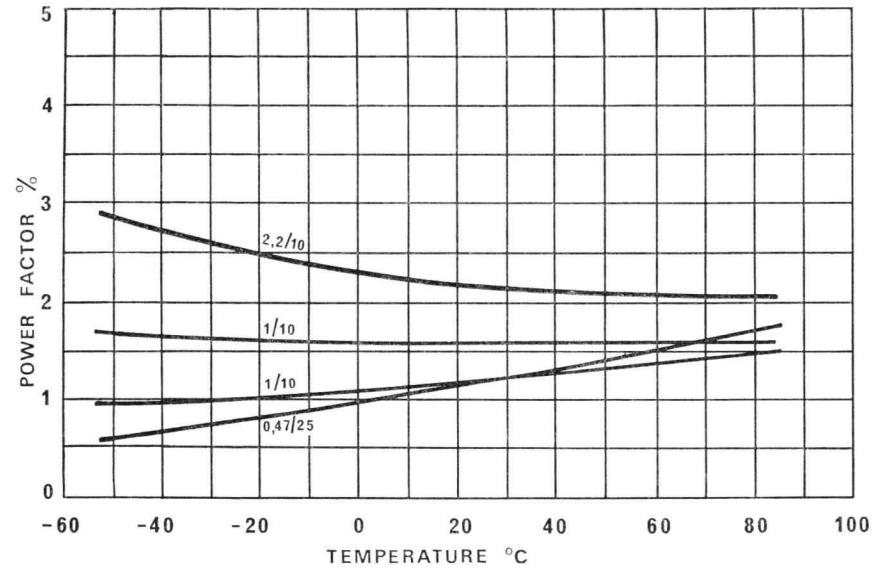
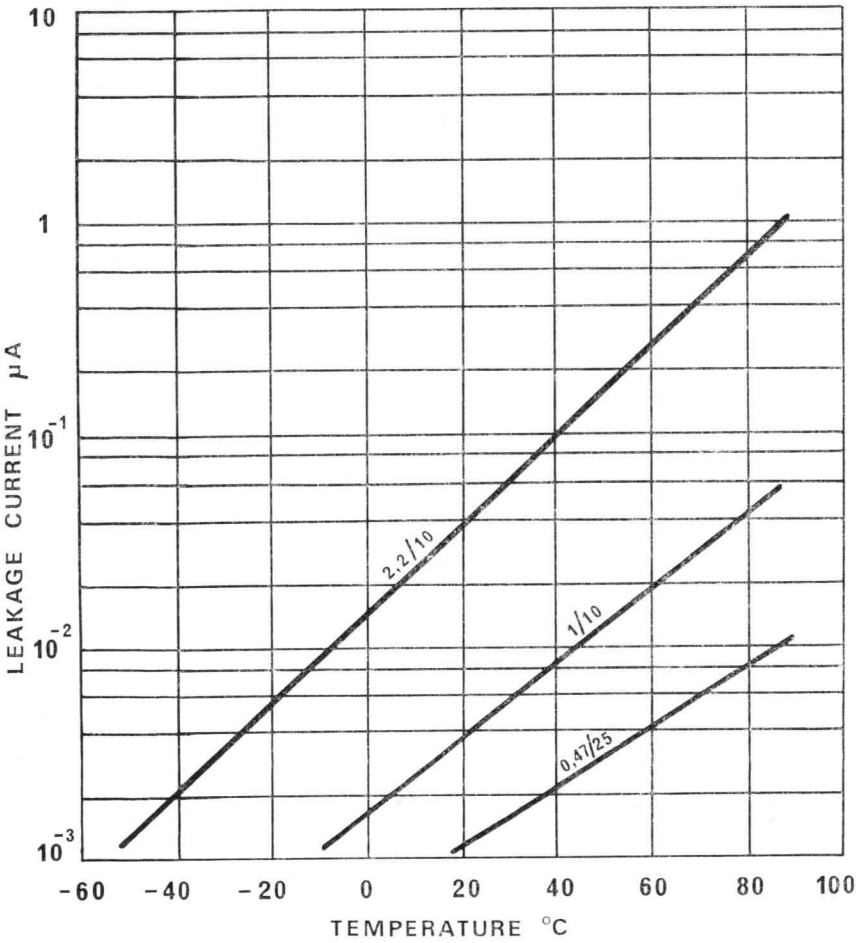


Fig. 2 Variation of Power Factor with temperature (measured at 120 Hz with maximum working voltage applied).



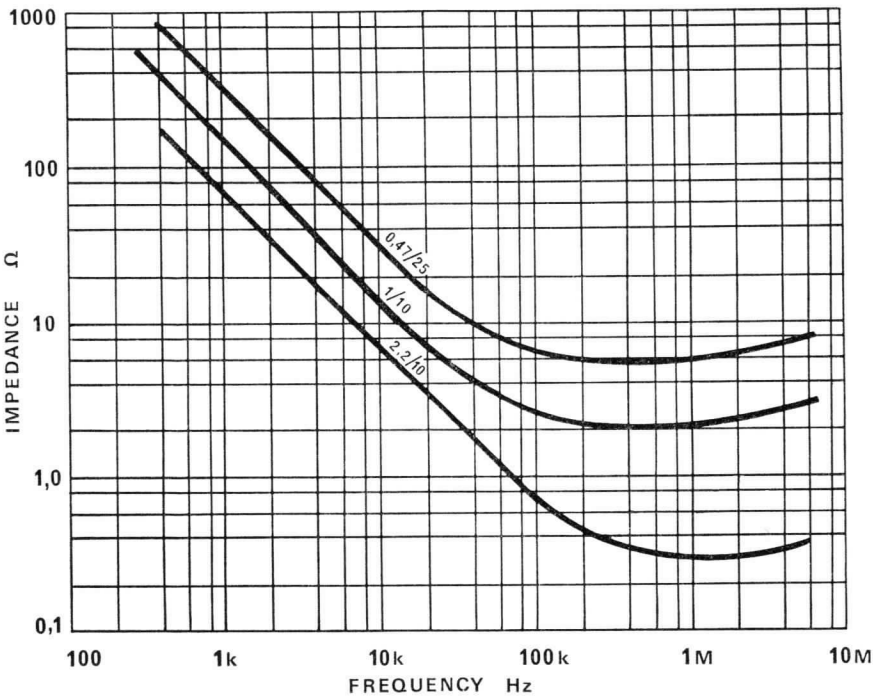
TYPICAL PERFORMANCE—continued

Fig. 3 Variation of leakage current with temperature (measured at maximum working voltage after 3 minutes).



TYPICAL PERFORMANCE—continued

Fig. 4 Variation of Impedance with Frequency.



Resin Dipped Solid Tantalum Capacitors
Code TAP

Provisional Data

Introduction

The TAP range of professional tantalum capacitors have a sintered anode and a solid electrolyte encapsulated in epoxy resin. They are drop shape with tinned nickel radial lead wires.

Each capacitor is marked with its capacitance, rated d.c. voltage and polarity.

Ratings and Characteristics (at 20°C unless otherwise stated)

Capacitance range C_N 0,1 µF to 680 µF
Capacitance tolerance ±10%
±20%

Voltage ratings (V)

d.c. (U_R)	3,0	6,3	10	16	25	35	50
surge	3,5	8	12	18	30	42	60
reverse	0,3	0,5	0,5	0,5	0,5	0,5	0,5

Climatic category 55/85/21
Rated temperature 85°C
Bump severity 390 m/s²; 1 000±10 bumps
Low air pressure 1 kN/m²
Solderability (method 3 solder globule) without ageing 2 s
with ageing 3 s
Resistance to soldering heat (Method 1 solder bath) 350°C
Power factor tan δ (at 100 Hz)
  $C < 100$ µF 0,08
  $C \geqslant 100$ µF 0,10
Maximum leakage current I_R (measured at 1 kΩ series resistance)
  after 3 mins at 20°C $0{,}02 \times C_N \times U_R$ or 1 µA whichever is the greater
  after 3 mins at 85°C $8 \times I_R$ at 20°C

Reliability — Failure rate 0,1%/1 000 hours, related to 85°C, U_R and 3 Ω per volt series resistance

Max. impedance at 100 kHz

<0,68 µF	Not applicable
⩾0,68 µF but <75 µFV	10 Ω
⩾75 µFV but < 360 µFV	5 Ω
⩾360 µFV but <1 000 µFV	2 Ω
⩾1 000 µFV	1 Ω

Minimum circuit resistance 3 Ω/V (see notes below)

Application Notes

These capacitors are suitable for coupling, decoupling and general applications in electronic circuits. Change of capacitance and tangent of loss angle are relatively small over the temperature range and in environmental tests.

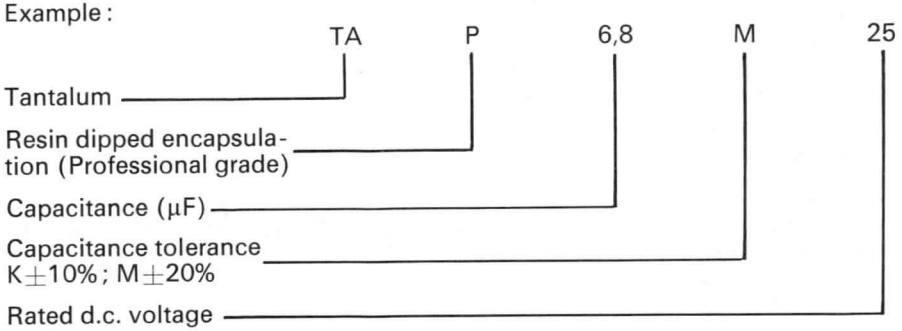
The reliability of these capacitors depends on circuit impedance. In very low impedance (e.g. less than 3 Ω/V) circuits, such as power supplies, particular care is necessary to ensure that the surge voltage rating is not exceeded and derating of up to 50% is recommended.

If failure does occur it is normally to the high leakage or short circuit mode.

Ordering Procedure

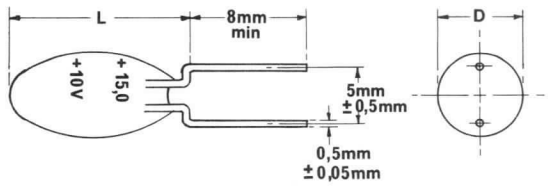
TAP capacitors should be ordered as in the following example:

Example:



Colour

The colour of the capacitor body is blue.



Fixed Capacitor
Tantalum Electrolytic
Solid Electrolyte:
Porous Anode:
Polar:
Bead-coated Case:
Radial Terminations
Commercial Application

Dimensions

C_N (μF)	Max. Dimensions L × D (mm)						
	3V	6,3V	10V	16V	25V	35V	50V
0,1						9×5,0	9×5,0
0,15						9×5,0	9×5,0
0,22						9×5,0	9×5,0
0,33						9×5,0	9×5,0
0,47						9×5,0	9×5,0
0,68						9×5,0	9×5,0
1,0						9×5,0	10×5,5
1,5					9×5,0	9×5,5	11×6,0
2,2				9×5,0	10×5,5	10×5,5	11×6,0
3,3				9×5,5	10×5,5	11×6,0	12×7,0
4,7			9×5,5	10×5,5	11×6,0	11×6,0	12×7,5
6,8		9×5,5	10×5,5	11×6,0	11×6,0	12×7,0	12×7,5
10	9×5,0	10×5,5	11×6,0	11×6,0	12×7,5	12×7,5	13×8,0
15	9×5,5	11×6,0	11×6,0	12×7,0	12×7,5	13×8,0	14×8,5
22	10×5,5	11×6,0	12×7,0	12×7,5	13×8,0	14×8,5	14×9,0
33	11×6,0	12×7,0	12×7,5	13×8,0	14×8,5	17×9,0	
47	11×6,0	12×7,5	13×8,0	14×8,5	17×9,0	17×9,0	
68	12×7,0	13×8,0	14×8,5	17×9,0	17×9,0		
100	12×7,5	14×8,5	17×9,0	17×9,0			
150	13×8,0	17×9,0	17×9,0	17×9,0			
220	14×8,5	17×9,0	17×11	21×11			
330	14×9,0	17×11	21×11				
470	17×9,0	21×11					
680	17×11	21×11					

Weights

Body size 'L'×'D'	Typical wt (g)	Body size 'L'×'D'	Typical wt (g)
9,0× 5,0	0,22	13,0× 8,0	0,5
9,0× 5,5	0,25	14,0× 8,5	0,6
10,0× 5,5	0,28	14,0× 9,0	1,0
11,0× 6,0	0,3	17,0× 9,0	1,5
12,0× 7,0	0,4	17,0×11,0	3,0
12,0× 7,5	0,5	21,0×11,0	4,5

Graphs of Typical Performance

Fig. 1. Variation of Capacitance with Temperature

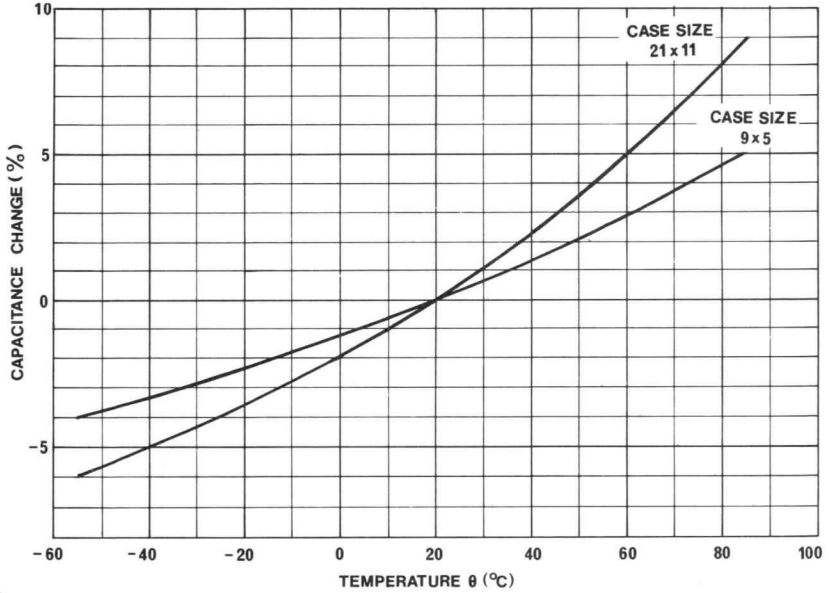
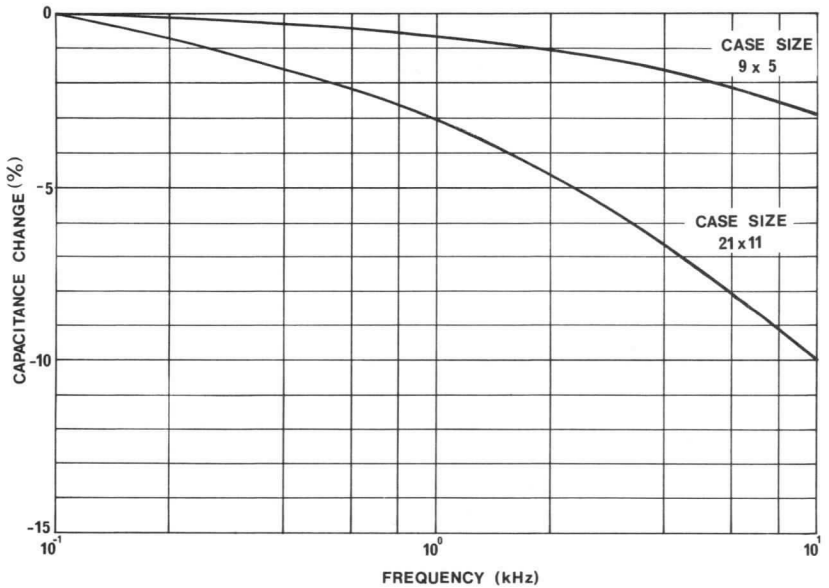


Fig. 2. Variation of Capacitance with Frequency



Graphs of Typical Performance – Cont'd

Fig. 3. Variation of Tan δ with Temperature

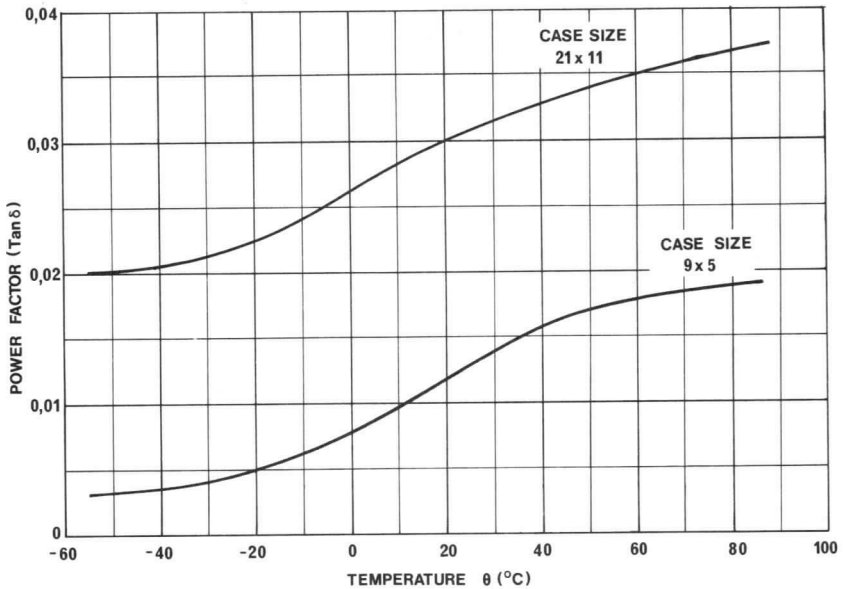
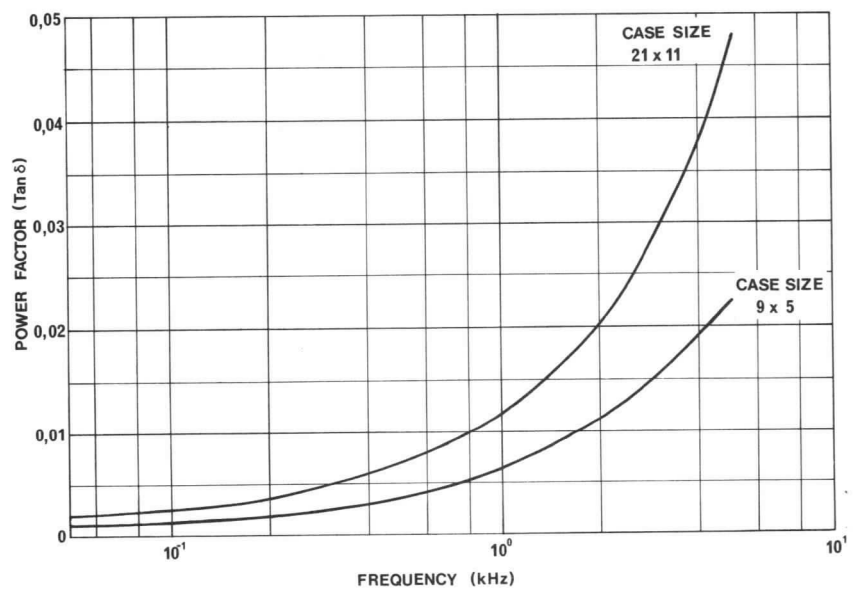


Fig. 4. Variation of Tan δ with Frequency



Graphs of Typical Performance – Cont'd

Fig. 5. Variation of Impedance with Temperature, at 10kHz

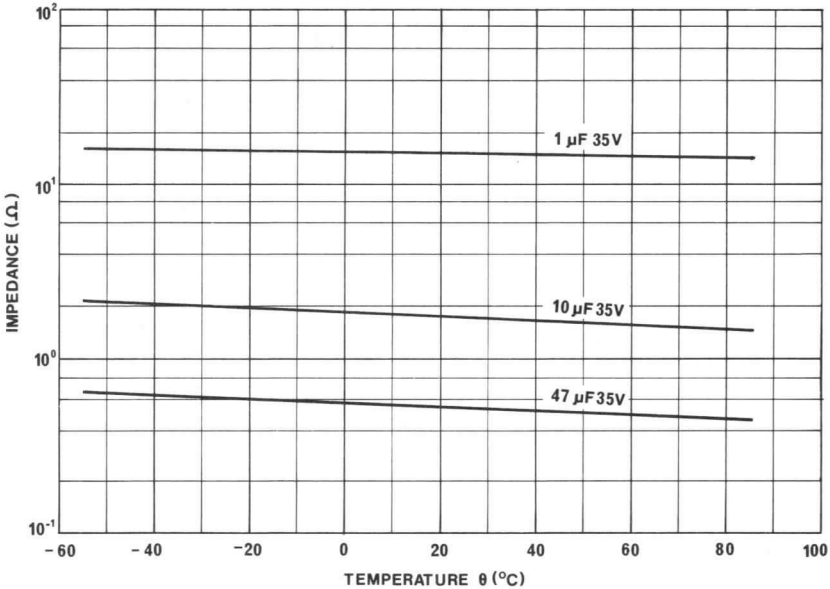
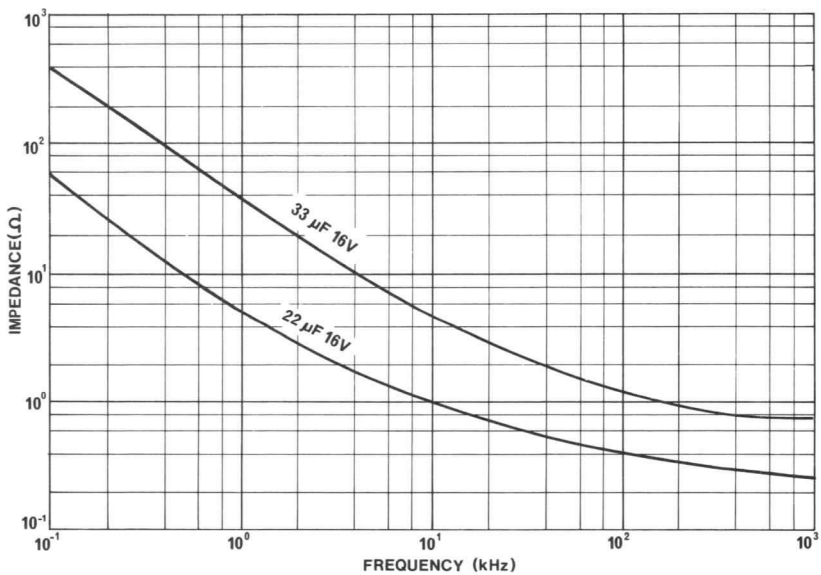
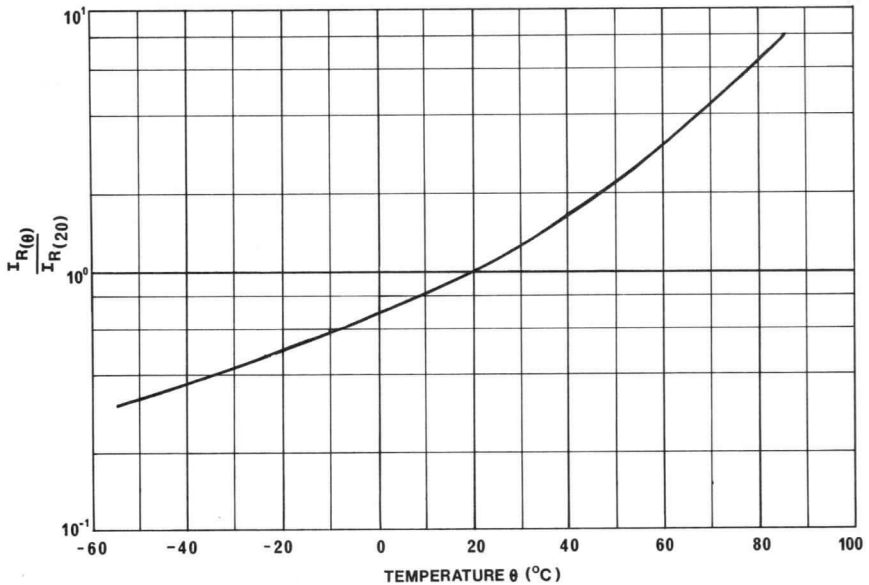


Fig. 6. Variation of Impedance with Frequency



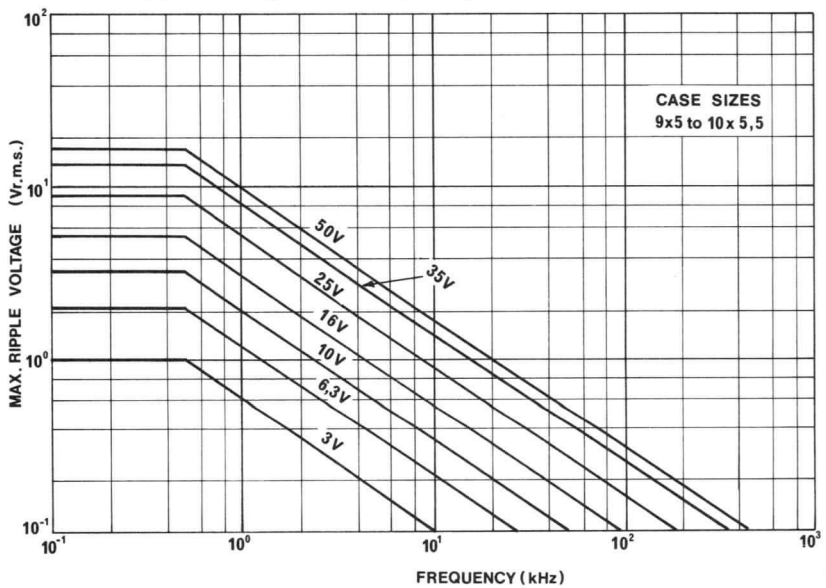
Graphs of Typical Performance – Cont'd

Fig. 7. Variation of Leakage Current with Temperature



Limits

Fig. 8. Variation of Ripple Voltage with Frequency



Limits – Cont'd

Fig. 9. Variation of Ripple Voltage with Frequency

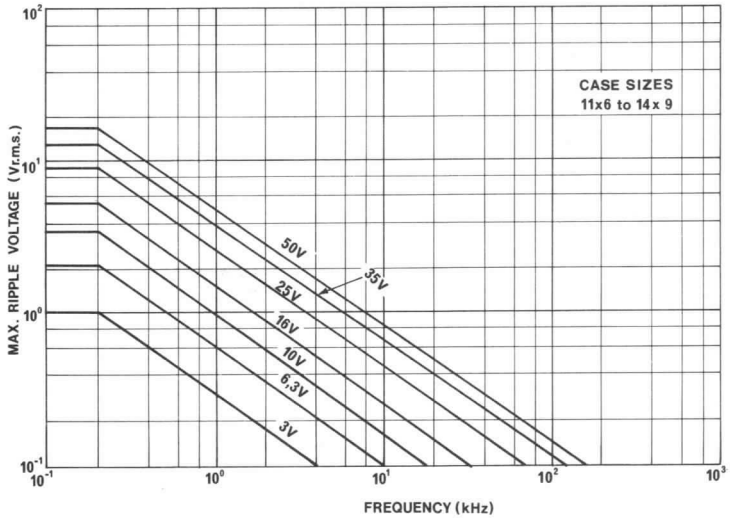
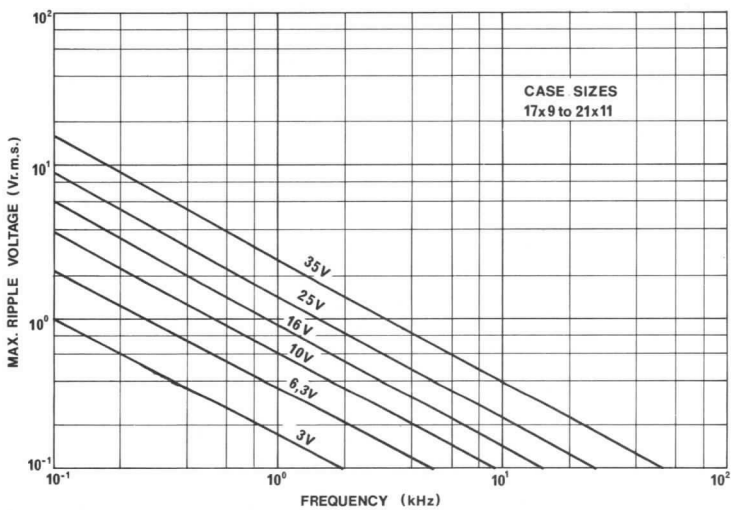


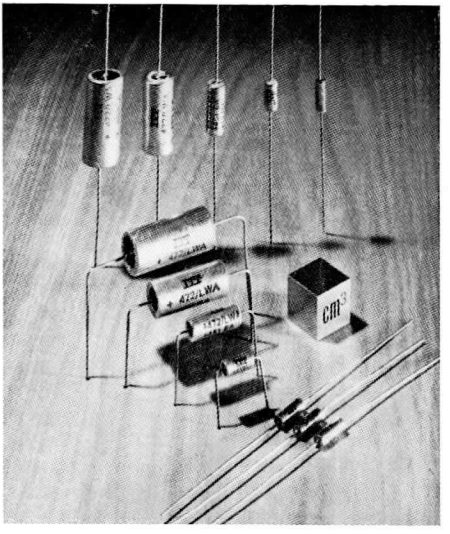
Fig. 10. Variation of Ripple Voltage with Frequency



These components are available from

ITT Components Group Europe
Standard Telephones and Cables Limited
Capacitor Division
Brixham Road, PAIGNTON, Devon
Tel : Paignton (0803) 50762
Telex : 42951

Resin End Sealed Solid Tantalum Capacitors
Code : TAR



BRIEF DATA

CAPACITANCE RANGE
0,1μF to 680μF

CAPACITANCE TOLERANCE
$\pm$20% standard
($\pm$10% special selection)

WORKING VOLTAGES
6 10 15 20 and 35V d.c.

RATED TEMPERATURE RANGE
$-$40°C to +85°C

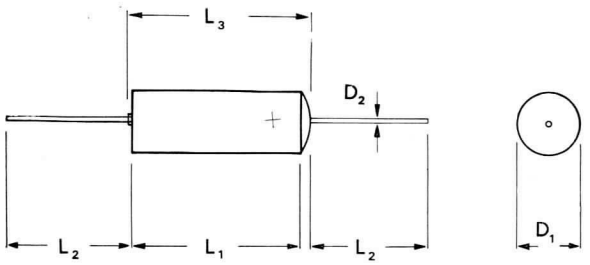
This new series of axial capacitors offers a wide range of capacitance values in the E12 series. Nearly four decades of capacitance values are covered by five case sizes, the four largest of which offer approximately twice the CV of the comparable case sizes in the standard glass-to-metal sealed TAA range (previously coded 472-400 and 472-420 etc.). The TAR range has the high performance and reliability associated with ITT tantalum capacitors together with an encapsulation that provides a 21 day humidity rating and a high resistance to damage from mechanical vibration and shock. The capacitors are encapsulated in a metal case with a resin end seal. The metal case is supplied either uninsulated or insulated.

ITT Components Group Europe
Standard Telephones and Cables Limited
Capacitor Product Division, Brixham Road, Paignton, Devon
Telephone : Paignton 50762 (STD Code 0803) Telex 42951

ITT
COMPONENTS

TABLE 1

Capacitance	Working Voltage D.C.				
μF	6	10	15	20	35
0,10					1
0,12					1
0,15					1
0,18					1
0,22					1
0,27					1
0,33					1
0,39					1
0,47					1
0,56					1
0,68					1
0,82					1
1,0					1
1,2					1
1,5					1
1,8					2
2,2				1	2
2,7				1	3
3,3				1	3
3,9				2	3
4,7			1	2	3
5,6			2		3
6,8		1			3
8,2		2			3
10	1				3
12	1				3
15	2			3	4
18				3	4
22				3	4
27				3	4
33			3		4
39		3			4
47		3			4
56	3				4
68	3			4	
82	3			4	
100				4	
120			4		
150			4	5	
180		4		5	
220		4		5	
270	4		5		
330	4	5			
390	4	5			
470	5				
560	5				
680	5				
	Surge Voltage D.C.				
	8	13	20	26	46



FIXED CAPACITOR

TANTALUM ELECTROLYTIC

Solid Electrolyte :
Porous Anode :
Polar :
Resin Filled Cylindrical
Metal Case :
Insulated and
Uninsulated Case :

Axial Terminations

General Application

Case Size	L_1 Nom. mm ±0,79	L_3 Max. mm	D_1 Nom. mm ±0,38	D_2 Max. mm	Capacitance Range and Rated Voltage Range	Typical Weight g
1	7,06	9,0	2,57	0,56	12μF 6V to 0,1μF 35V	0,32
2	6,35	8,2	3,18	0,56	15μF 6V to 1,8μF 35V	0,44
3	11,13	13,0	4,45	0,56	82μF 6V to 2,7μF 35V	1,2
4	16,51	18,3	7,09	0,69	390μF 6V to 15μF 35V	4,0
5	19,05	20,9	8,66	0,69	680μF 6V to 150μF 20V	6,8

NOTE 1 Length of terminations (L_2) 32mm minimum.

NOTE 2 Marking for polarity shall be indicated, as shown, near the positive terminal.

NOTE 3 Basic case dimensions for the insulated style shall be the same as for the uninsulated style.

NOTE 4 The case insulation shall extend beyond the ends of the capacitor body by the amounts shown below and shall lap over the ends of the body.

Case Size	Overlap each end of body	
	Min. mm	Max. mm
1 & 2	0,4	1,1
3 4 & 5	0,4	1,5

NOTE 5 The increase in maximum diameter for insulated types shall not exceed 0,25mm.

NOTE 6 The terminal wires must not be bent closer than 2,0mm to the body of the capacitor.

NOTE 7 The complete capacitance/rated voltage range is given in Table 1.

NOTE 8 The tolerance on the wire diameter is +10% −0,05mm.

MANUFACTURER'S CODES

Style reference TAR followed by the capacitance, rated voltage and tolerance. EXAMPLE : TAR 33μF/35V ±20% insulated case.

Note.—The unsleeved style is standard. If an insulated case is required it must be specified.

1 **RATINGS** (including limiting conditions of use) and characteristics (reference BS 9070)

Reference temperature 20°C unless otherwise stated.

Capacitance range	0,1μF to 680μF (E 12 range of BS 2488 IEC 68)
Standard selection tolerance	±20% (±10% available on request)
Climatic category	40/85/21
Rated temperature range	−40°C to +85°C
Power factor at 120 Hz	$\leq$150μF Tan delta 0,06 max. $>$ 150μF$\geq$330μF Tan delta 0,10 max. $>$330μF Tan delta 0,20 max.
Maximum leakage current after 3 minutes at rated voltage	0,02μA/μFV or 1,0μA whichever is the greater

Working Voltage	6	10	15	20	35	V d.c.
Surge Voltage	8	13	20	26	46	V d.c.

Maximum reverse voltage	0,5 volts
Vibration severity	5 to 5000 Hz 0,75mm or 98 m/s^2
Acceleration	98lm/s^2
Low air pressure	200 N/m^2 (mean altitude 130 000ft)
Robustness of terminations	Tensile 1kg Bending $\frac{1}{2}$kg 2 bends through 90°
Solderability	Solder globule method 2 s without ageing 3 s with ageing
Insulation of sleeve	$>$1000 MΩ at 500V d.c.
Breakdown voltage of sleeve	$>$2000V d.c.
Ripple voltage ratings	See Figs. 1 to 4

NOTE 1 The above curves are based on an ambient temperature of 20°C. For higher temperatures derate the 20°C figures as follows:—
at 50°C derate to 70%
at 85°C derate to 50%

NOTE 2 The sum of the peak a.c. voltage and the d.c. voltage must not exceed the d.c. working voltage of the capacitor.

NOTE 3 The sum of the negative peak a.c. voltage and the applied d.c. voltage shall not allow a voltage reversal exceeding 0,5 volt.

2 APPLICATION NOTES

These capacitors are suitable for coupling and decoupling and general applications in electronic circuits. The reliability of these capacitors depends on circuit impedance. In very low impedance circuits (i.e. less than 3Ω/volt), such as power supplies, particular care is necessary to ensure that the surge voltage rating is not exceeded. The main mode of failure is high leakage current and short circuit.

Performance figures and data quoted in this document are typical and must be specifically confirmed in writing by Standard Telephones and Cables Limited before they become applicable to any particular tender, order or contract.

GRAPHS OF TYPICAL PERFORMANCE

Fig. 1. Ripple voltage characteristics, case sizes 1 and 2

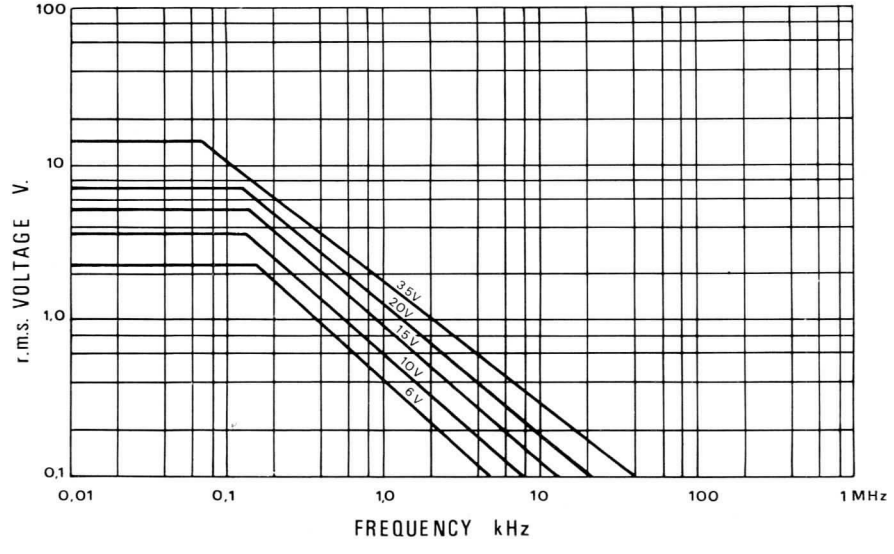
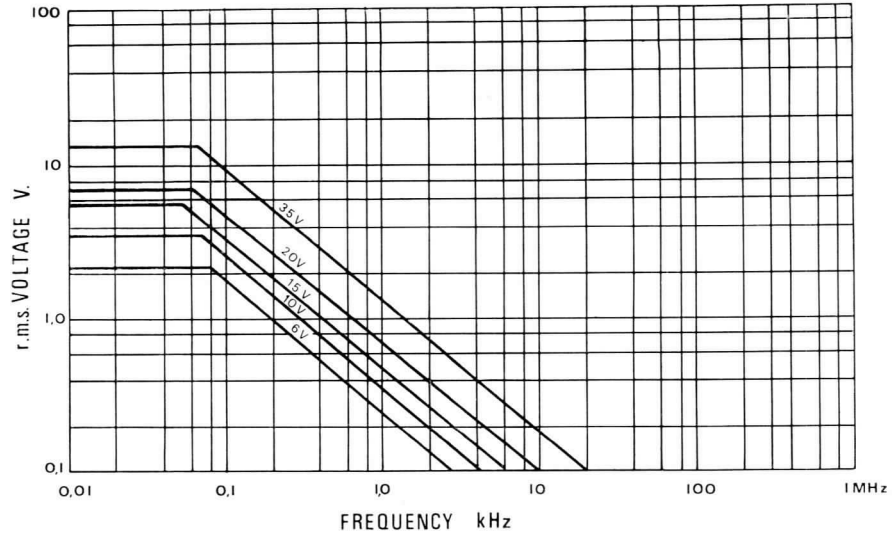


Fig. 2. Ripple voltage characteristics, case size 3



TYPICAL PERFORMANCE—continued

Fig. 3. Ripple voltage characteristics, case size 4

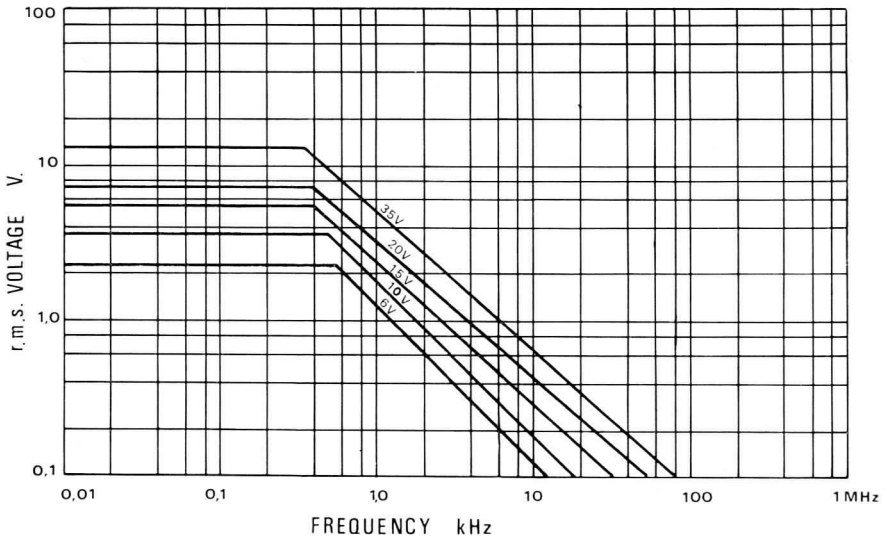
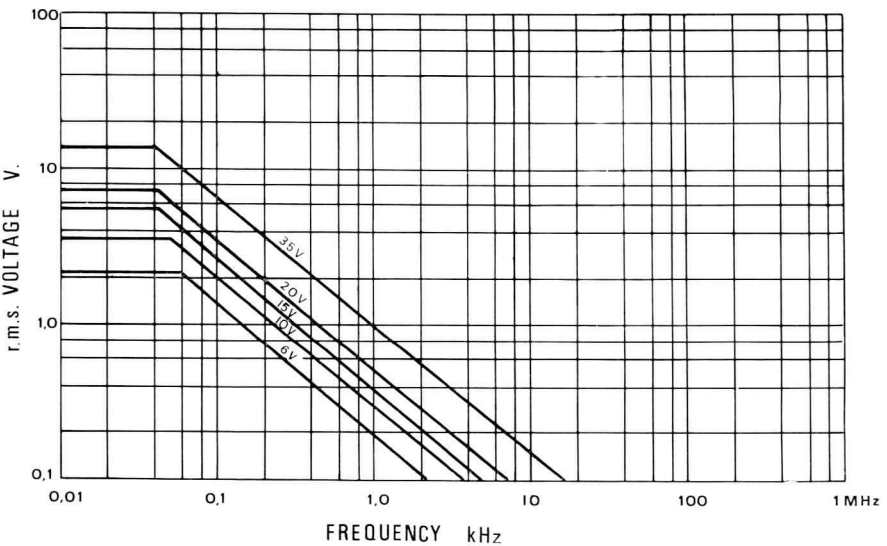


Fig. 4. Ripple voltage characteristics, case size 5



TYPICAL PERFORMANCE—continued

Fig. 5. Variation of capacitance with temperature

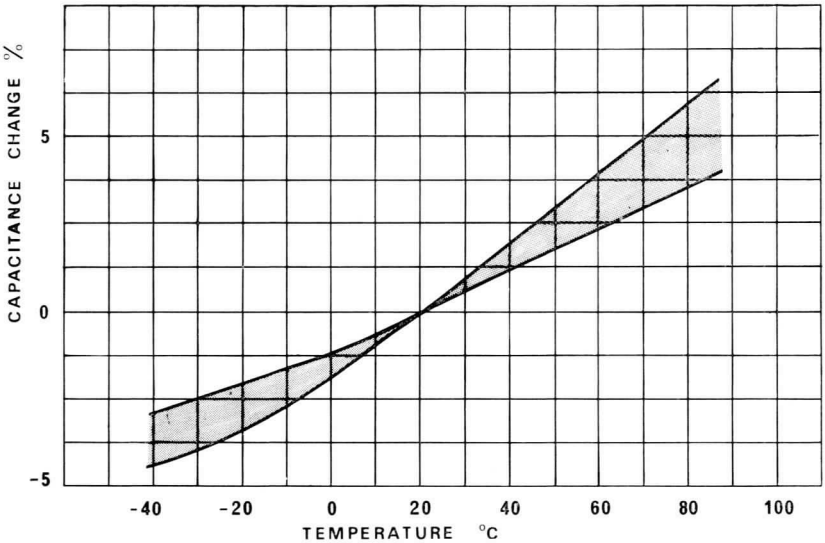
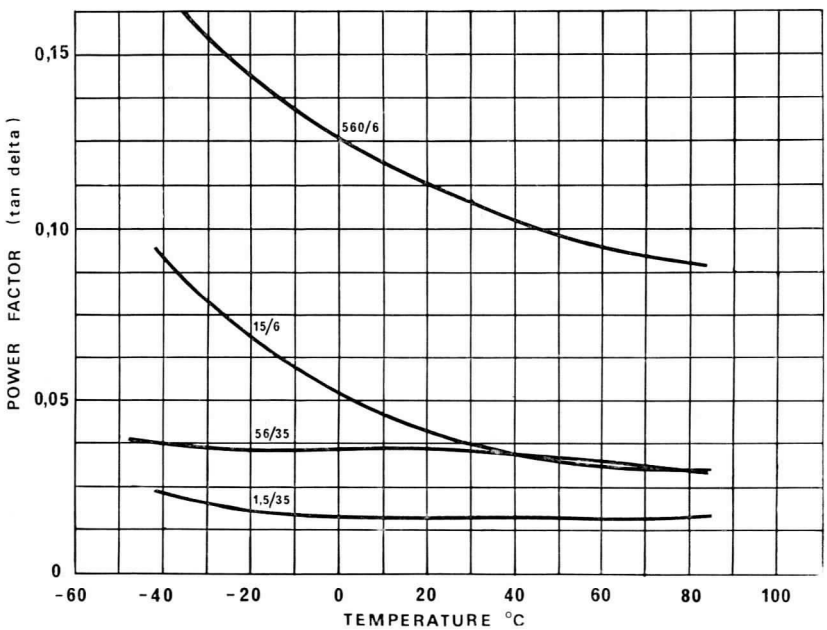
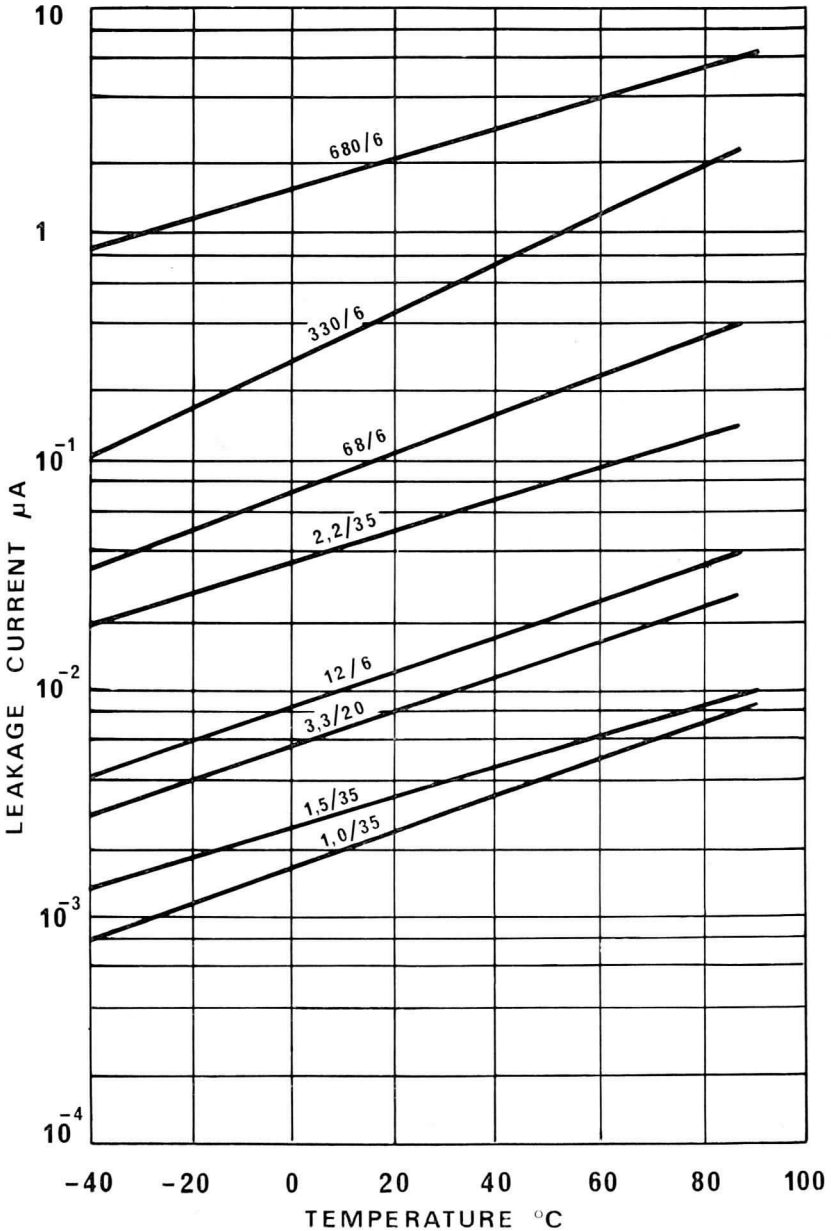


Fig. 6. Variation of power factor with temperature



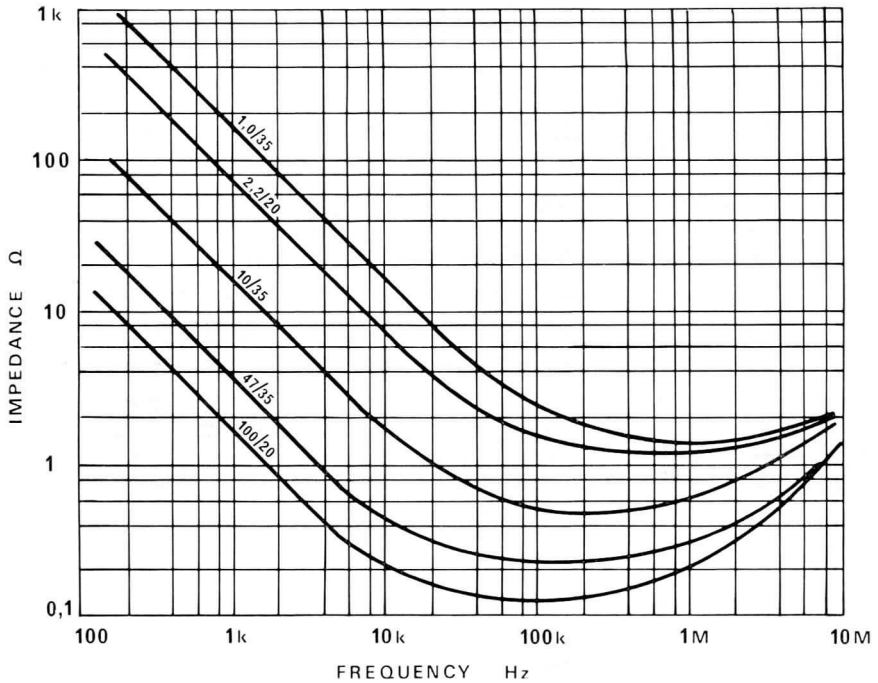
TYPICAL PERFORMANCE—continued

Fig. 7. Variation of leakage current with temperature



TYPICAL PERFORMANCE—continued

Fig. 8. Variation of impedance with frequency



VACUUM

SPECIAL VALVES

Vacuum Capacitors

Codes: K12/2L, K16/2L, K25/2L

These capacitors are small vacuum dielectric units, intended principally for use as part of the tank circuit capacitance in radio frequency amplifiers or oscillators.

The use of vacuum as the dielectric enables the capacitors to be of small dimensions for a high voltage rating and capacitance.

		K12/2L	K16/2L	K25/2L	
CAPACITANCE ± 10%		12	16	25	pF
MAXIMUM RATINGS					
Maximum peak voltage		32	32	32	kV
Maximum r.m.s. current		28	28	28	A
Maximum frequency		20	20	20	Mc/s
MECHANICAL DATA					
Dimensions	As shown in outline drawing				
Net weight	K12/2L			205	g
	K16/2L			210	g
	K25/2L			220	g

These capacitors may be operated at the full maximum voltage at any frequency below that at which the r.m.s. current through the capacitor is 28 amperes. Above this frequency the r.f. voltage across the capacitor must be reduced to prevent the current exceeding the maximum rating. Curves are included in this data which show the relationship between maximum ratings and frequency.

Where both r.f. and d.c. voltages are applied to the capacitor the sum of the peak r.f. and d.c. voltages must not exceed the peak voltage rating of the capacitor.

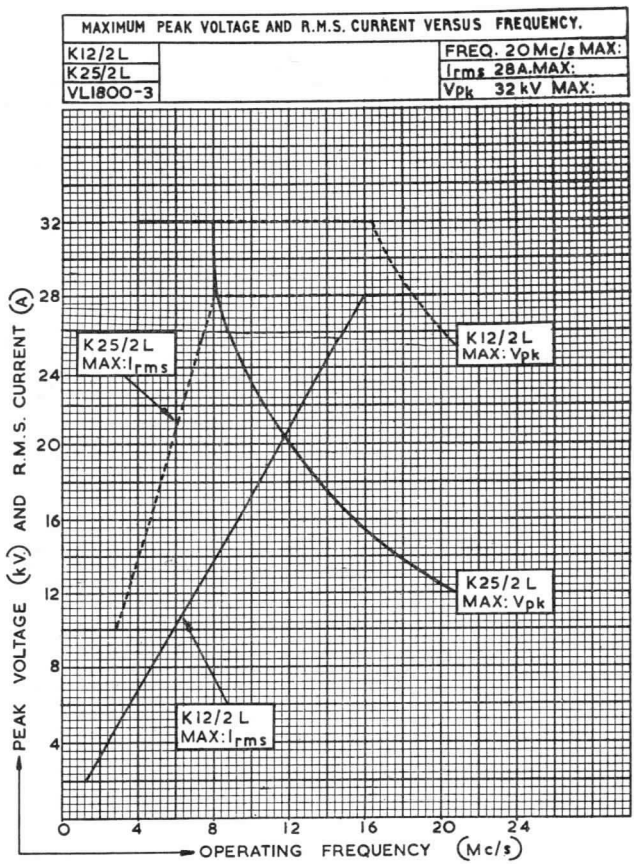
The clips or other devices used to make connection to the end caps of these capacitors must be kept clean and must at all times make good contact with the capacitor end caps. Failure to maintain a low resistance contact may result in excessive heating and permanent damage to the capacitor.

Standard Telephones and Cables Limited
Valve Division, Brixham Road, Paignton, Devon
Telephone: Paignton 50762 Telex: 4230
London Sales Office, Telephone: Footscray 3333
COMPONENTS GROUP

STC

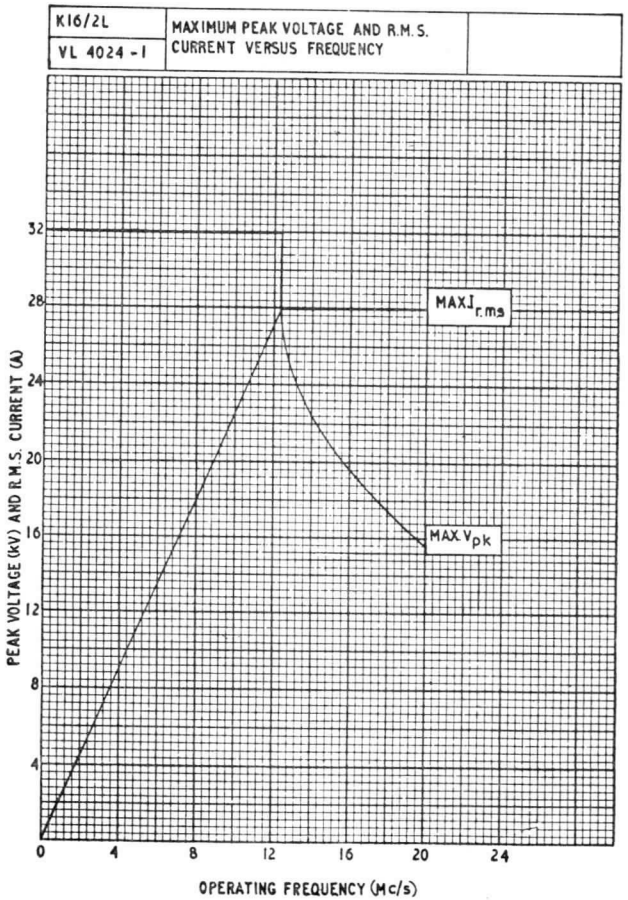
Codes: K12/2L
K25/2L

CONTINUED



Code: K16/2L

CONTINUED

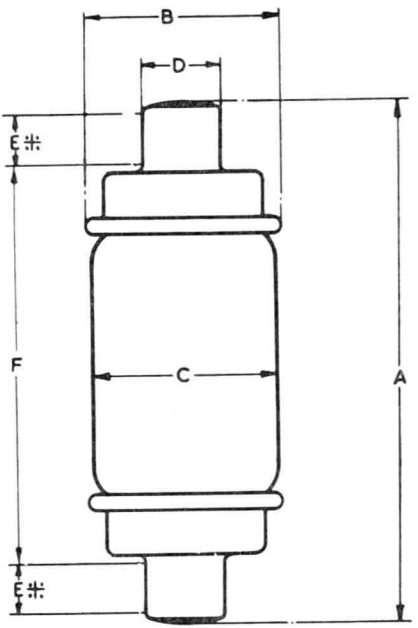


STC

Codes: K12/2L K16/2L K25/2L

CONTINUED

K12/2L, K16/2L, K25/2L Outline



DIM	MILLIMETRES	INCHES
A	170 MAX.	6 11/16 MAX.
	164 MIN.	6 7/16 MIN.
B	61,9 MAX.	2 7/16 MAX.
C	58,7 MAX.	2 5/16 MAX.
D	25,40 ± 0,25	1·000 ± 0·010
E	16 MIN.	5/8 MIN.
F	135 MAX.	5 5/16 MAX.

⁜ DENOTES:– CONTACT LENGTH.

NOTE:– BASIC FIGURES ARE INCHES.

SPECIAL VALVES

Vacuum Capacitors

Codes: K50/2L
K100/2L

These capacitors are small vacuum dielectric units, intended principally for use as part of the tank circuit capacitance in radio frequency amplifiers or oscillators.

The use of vacuum as the dielectric enables the capacitors to be of small dimensions for a high voltage rating and capacitance.

	K50/2L	K100/2L	
CAPACITANCE ± 10%	50	100	pF
MAXIMUM RATINGS			
Maximum peak voltage	32	28	kV
Maximum r.m.s. current	28	28	A
Maximum frequency	20	20	Mc/s
MECHANICAL DATA			
Dimensions	As shown in outline drawing		
Net weight	K50/2L	230	g
	K100/2L	260	g

These capacitors may be operated at the full maximum voltage at any frequency below that at which the r.m.s. current through the capacitor is 28 amperes. Above this frequency the r.f. voltage across the capacitor must be reduced to prevent the current exceeding the maximum rating. Curves are included in this data which show the relationship between maximum ratings and frequency.

Where both r.f. and d.c. voltages are applied to the capacitor the sum of the peak r.f. and d.c. voltages must not exceed the peak voltage rating of the capacitor.

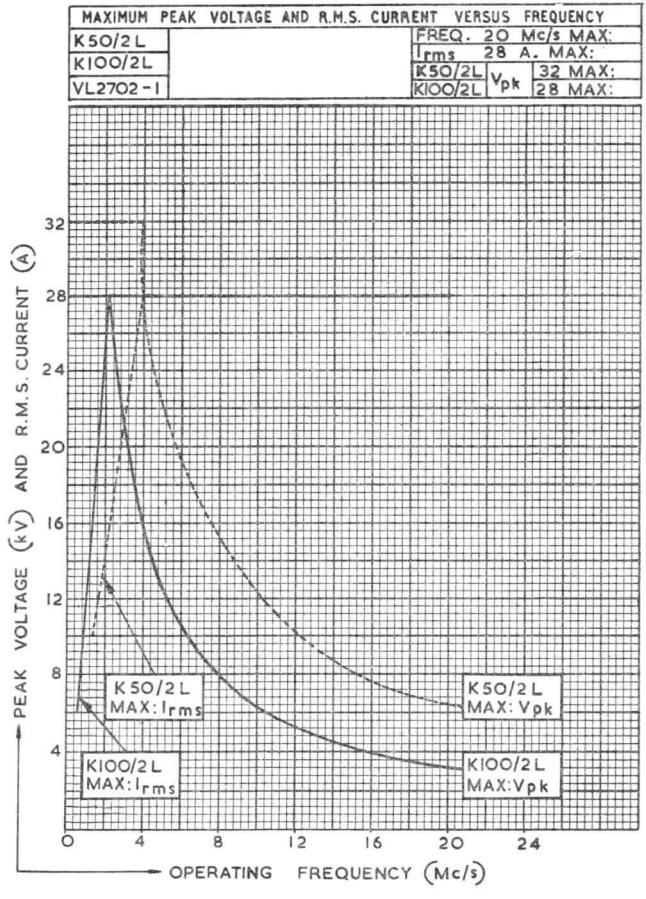
The clips or other devices used to make connection to the end caps of these capacitors must be kept clean and must at all times make good contact with the capacitor end caps. Failure to maintain a low resistance contact may result in excessive heating and permanent damage to the capacitor.

Standard Telephones and Cables Limited
Valve Division, Brixham Road, Paignton, Devon
Telephone: Paignton 50762 Telex: 4230
London Sales Office, Telephone: Footscray 3333
C O M P O N E N T S G R O U P

STC

Codes: K50/2L
K100/2L

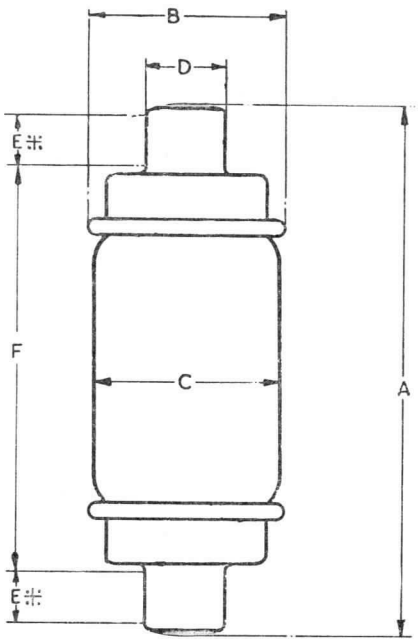
CONTINUED



Codes: K50/2L
K100/2L

CONTINUED

K50/2L and K100/2L Outline



DIM	MILLIMETRES	INCHES
A	170 MAX.	6 11/16 MAX.
	164 MIN.	6 7/16 MIN.
B	61,9 MAX.	2 7/16 MAX.
C	58,7 MAX.	2 5/16 MAX.
D	25,40 ± 0,25	1·000 ± 0·010
E	16 MIN.	5/8 MIN.
F	135 MAX.	5 5/16 MAX.

⁜ DENOTES:— CONTACT LENGTH.

NOTE:— BASIC FIGURES ARE INCHES.