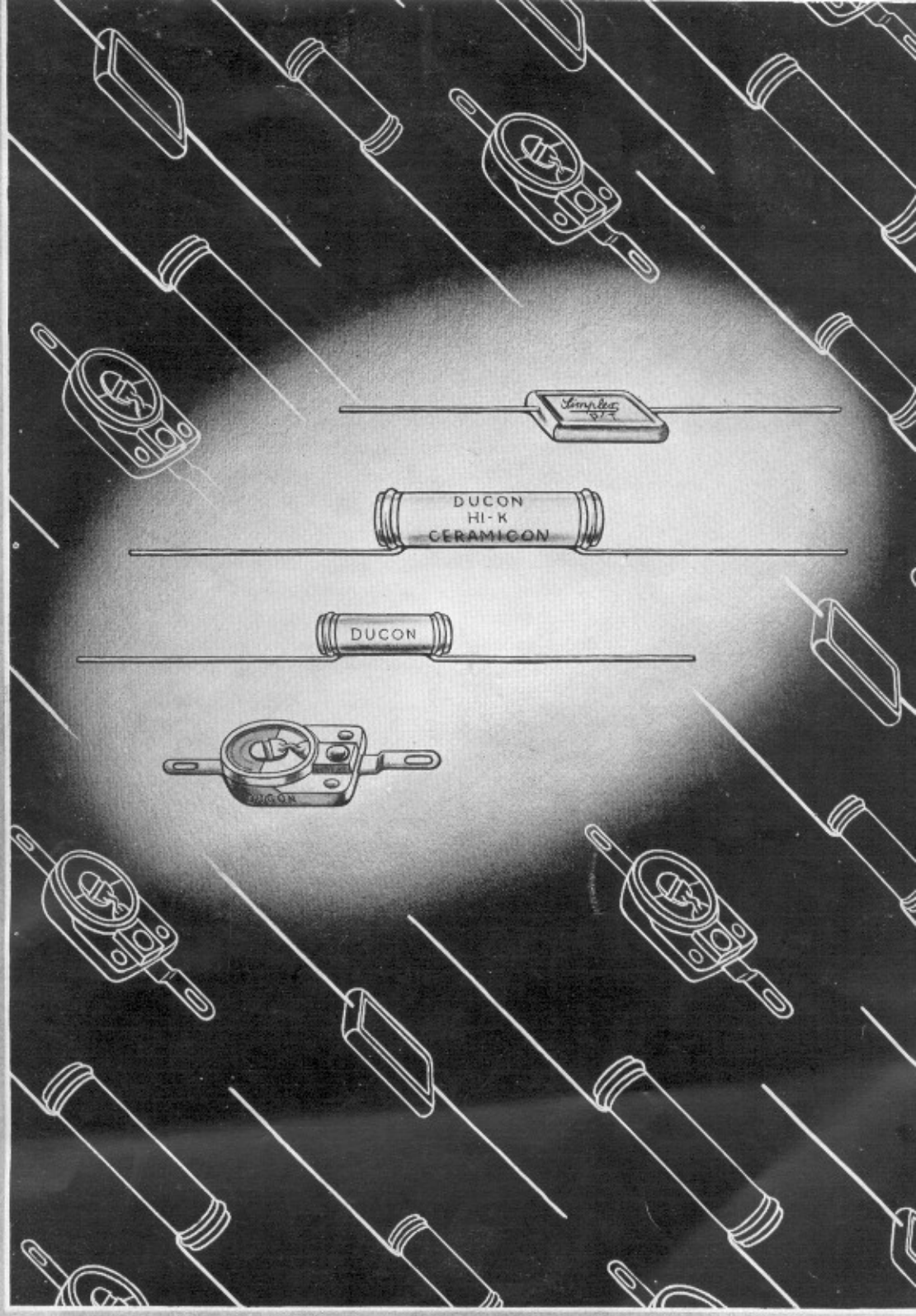
Bulletin No. 103



DUCON

DUCON *and* SIMPLEX

Ceramicon and Mica CAPACITORS

SERVING THE ELECTRONIC INDUSTRY

INTRODUCTION

The wide acceptance of Ducon and Simplex Capacitors by leading radio manufacturers is due in a large extent to unusually good operating characteristics, not just in every day service records but under even the most exacting test specifications.

In this Booklet we have offered the essential technical data relative to our standard Ceramicon, Trimmer and Moulded Mica Capacitors. It has been impossible to include every type that we make as much of our production is devoted to meeting special requirements.

At all times you are invited to submit your needs to our Design Engineers, who are fully qualified to give you every assistance, and who will be happy to co-operate with you fully.

We recommend, however, that whenever possible a standard type be used since, by so doing, we can limit the diversification of types and thereby reduce your cost of required capacitors, as well as better utilize plant facilities to allow for increased production and prompter delivery of capacitors.

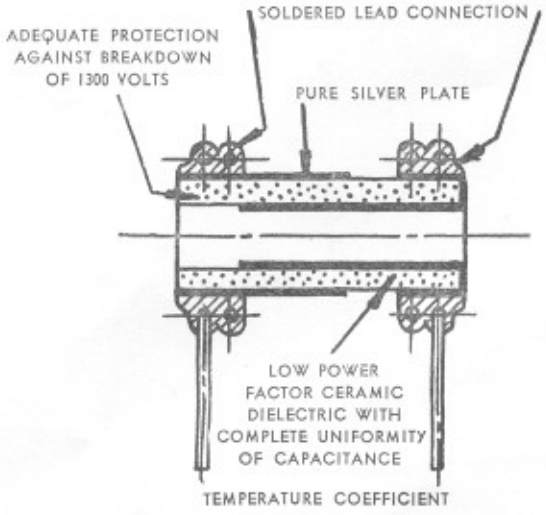
Ducon and Simplex Capacitors are the result of long years of study and close association with overseas manufacturers. Constant testing and control over materials and processes are exercised at every stage of manufacture, and every capacitor is individually tested, electrically and physically, before delivery. Regardless of type or size, Ducon and Simplex Capacitors are your assurance of units of maximum efficiency and minimum costs.

CERAMICONS

PERFORMANCE DATA AND SPECIFICATIONS

GENERAL DESCRIPTION

Ducon Ceramicons are small fixed capacitors consisting essentially of a ceramic dielectric with coated plates of pure silver fired on at a very high temperature. The ceramic dielectric temperature-capacity coefficient can be adjusted between the limits of $+120\times10^{-6}$ to -750×10^{-6} by varying the Titanium Dioxide content in the material. When used unmixed with other ceramics, this material has the very high dielectric constant of 85 and a temperature coefficient of capacity of -750×10^{-6}, as



compared with about 6 and $+120\times10^{-6}$ respectively, for conventional low-loss ceramics. When mixed with certain other ceramic materials, the dielectric constant decreases and the temperature coefficient becomes less and less negative as the % of titanium dioxide is decreased. Consequently, the higher the negative temperature coefficient used, the higher the capacity which can be obtained in a Ceramicon of a given physical size.

Because the temperature coefficients of the various ceramic dielectrics employed are a function of the molecular structure of the material, the temperature coefficient of capacity of Ceramicons is definite and entirely reproduceable under all normal operating conditions. With the silver plates in intimate contact with the surface of the dielectric, there is no possibility of any air space or wax-filled pockets between the two. For this reason, the capacity of Ceramicons is inherently stable. A change of less than 1/4 of 1% will be found after subjecting these capacitors to repeated heating and cooling cycles of 200 hours at 250 deg. F. and 200 hours at –40 deg. F. Maximum safe operating temperature is 212 deg. F.

On the following pages the applications and characteristics of Ducon Ceramicons are described in detail. Our Research and Engineering Departments will be glad to furnish any other necessary data not contained in this catalogue to assist you in adapting Ceramicons to your particular requirements.

CERAMICONS USED AS COMPENSATING CAPACITORS

In all radio receivers the exact frequency of resonance of each resonant circuit will change slightly with changes in temperature. This is due to a great many small changes in capacity or inductance in such components as coils, tube bases, tube sockets, variable capacitors, wiring, etc. It is generally impracticable to correct each of these characteristics by itself at a reasonable cost, but it has been found that for a given design these temperature coefficients are fairly constant and uniform from set to set. Therefore, it is possible to correct the fault by introducing a reactive component having a temperature coefficient of the opposite sign and of such a value as to offset the undesired change with temperature.

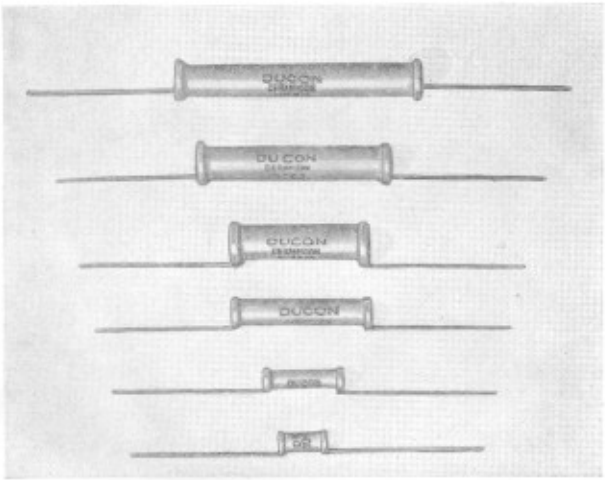
One method of eliminating frequency drift would be to use a compensating capacitor in each reactive circuit; i.e., in each I.F. circuit, in the oscillator circuit, and in the first R.F. circuit. This procedure, however, is generally not necessary. Changes in the I.F. circuits may be allowed for in applying compensation to the oscillator. In other words, a certain amount of frequency change with temperature can be left in the oscillator circuit to make up for shift in resonant frequency of the I.F. circuits. Since the highest selectivity of a superheterodyne receiver is developed in the I.F. section, sufficient compensation may usually be obtained by the addition of a single Ducon Ceramicon in the oscillator circuit.

R.F. circuit reactance change with temperature cannot be corrected by the oscillator, so where practically perfect tuning accuracy is necessary it can be accomplished by using another Ceramicon in this Circuit.

The exact location and size of the compensating Ceramicon used depends upon the design of the oscillator. Where a single coil is tuned by a variable capacitor, compensation is often obtained by using a Ceramicon of rather low capacity but having the highest available temperature coefficient (-750×10^{-6} MMF/MMF/°C.). This allows a low minimum tuning capacitance to be maintained. If the circuit calls for a large fixed capacity, as in iron-core tuned receivers, the total capacity may be secured in a Ceramicon with the desired temperature coefficient. If this results in too bulky a unit, a Simplex Silver Mica

Capacitor having a low temperature coefficient may be shunted by a high coefficient Ceramicon so that the two together provide the required total capacity and temperature coefficient.

Generally it will be found that a negative



temperature coefficient of capacity will be required in receivers of conventional design. The area between the curves on the top of Page 5 illustrates graphically the range of compensation available for any given temperature rise.

GENERAL CHARACTERISTICS

Permanence of Capacity

Ducon Ceramicons, due to the unique method of applying plates directly to the surface of the dielectric, are inherently stable in capacity. A change of less than 1/4 of 1% will be found after subjecting these capacitors to repeated heating and cooling cycles of 200 hours at 212 deg. F. and 200 hours at –40 deg. F.

212 deg. F. is recommended as a maximum safe operating temperature.

Effect of Humidity

Increase in power factor is less than 20% and change in capacity is less than 1/4 of 1% after 100 hours at 100% relative humidity at 40 deg. C. Leakage resistance after this same test, measured at 1,000 volts D.C., is over 1,000 megohms.

Effect of Temperature

The "N750 type" have a negative coefficient of 750×10^{-6} per degree C. These values correspond to a rise of .36% and a drop of 2.25% respectively as the temperature is raised from 30 deg. to 60 deg. C. Tolerance on temperature coefficient is $\pm 30 \times 10^{-6}$ or ±15%, whichever is the larger.

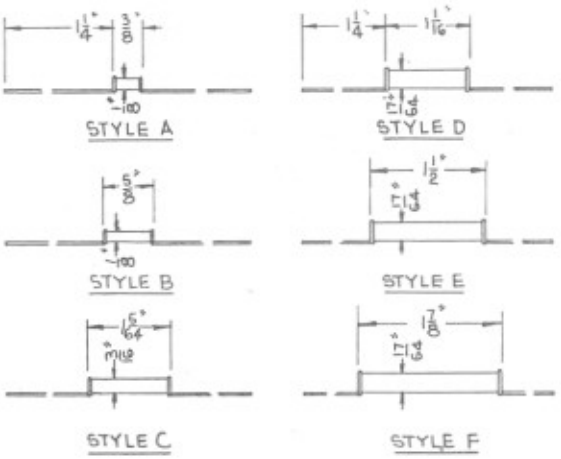
Power Factor

The power factor of all Ceramicons will increase slightly as the temperature increases. For example, a 20% increase in power factor will result from a change in temperature from 30 deg. to 60 deg. C.

Finishing Tests

Ducon Ceramicons are conservatively rated at 500 volts D.C. Flash test voltage is 1,300 volts D.C. Leakage resistance at 1,000 volts D.C. is over 10,000 megohms.

All Ceramicons are individually checked for capacity and power factor at 1 megacycle before shipping. Capacity tolerance is set to customer's specification. Power factor limit is .08%.



RANGE OF CAPACITIES AVAILABLE IN EACH TUBE STYLE

As illustrated above, Ducon Ceramicons are made in 6 sizes — Styles A, B, C, D, E, F. Wire leads on all Ducon Ceramicons are 22 gauge hot tinned copper wire 1¼" long. Co-operation is extended at all times for the development of special units.

All Ducon Ceramicons are referred to by type number, which carries all the necessary information for ordering. Temperature coefficient is always given as a 3-digit whole number times 10^{-6}, preceded by N. or P. to indicate negative or positive. Thus N.750 indicates a negative temperature coefficient of 750×10^{-6} MMF/MMF/deg. C.

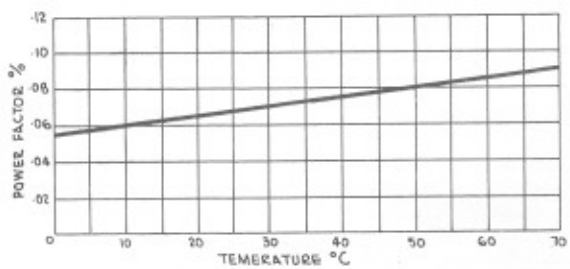
In ordering, place temperature coefficient first; immediately following, place type letter as found in charts above; then add capacity in MMF and tolerance in MMF.

Example: Unit to have a temperature co-efficient of -750×10^{-6} MMF/MMF/deg. C., capacity 140 MMF ± 5 MMF. Referring to chart above, 140 MMF in Type N.750 is found to fall in Style C. Type number for ordering is, therefore, N.750C140 ± 5.

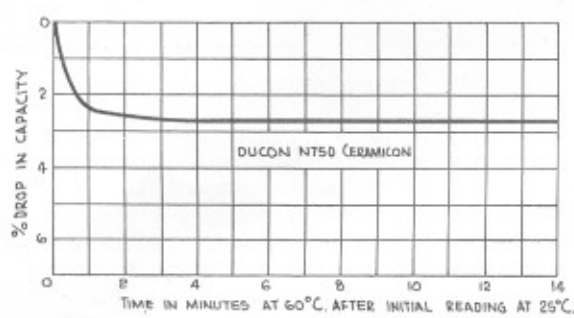
STYLE OF TUBE

TEMP. CO-EFF.	A.	B.	C.	D.	E.	F.
N.P.0	—	0-25 mmf.	26-80 mmf.	81-120 mmf.	—	121-225 mmf.
N.750	0-55 mmf.	56-110 mmf.	111-350 mmf.	351-525 mmf.	526-850 mmf.	851-1100 mmf.

Change in capacity with change in temperature is essentially a straight line function. Performance of this function is quite rapid, particularly in the smaller styles. An N.750B100 Ceramicon will reach 90% of its final change in capacity within 1 minute after being moved from a 25 deg. C. ambient temperature to 80 deg. C. These characteristics allow the receiver designer to select the unit which will most closely track with changes in other components. Difference in response is illustrated graphically on curves below.



POWER FACTOR VS. TEMPERATURE

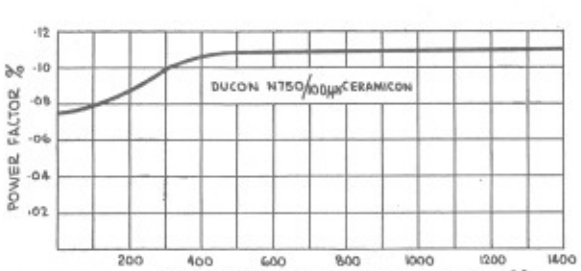


TEMPERATURE COMPENSATION RESPONSE

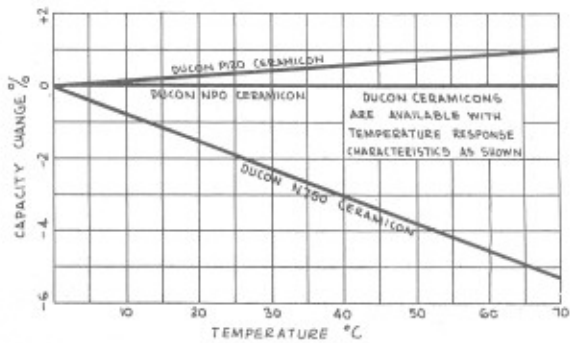
EFFECT OF HUMIDITY

Ceramicons are coated with a moisture-resistant lacquer specially developed for the purpose. This lacquer has been found greatly superior to all other available types of coating materials. Since the dielectric itself is one of the most dense ceramics known, this type of unit stands up very well in humid conditions.

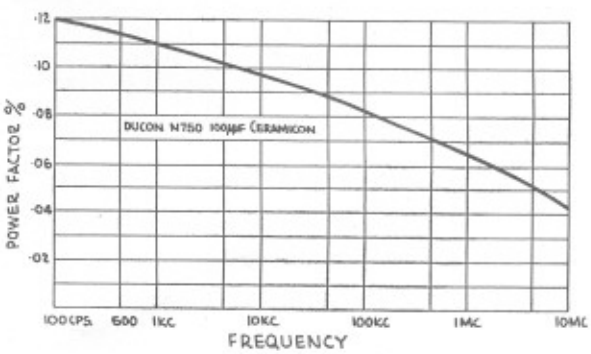
The curve below indicates the effect of humidity on the power factor of Ceramicons. The change in capacity after 1,000 hours in 100% relative humidity at 40 deg. C. is less than ¼ of 1%, and leakage resistance at 1,000 volts D.C. is over 1,000 megohms.



POWER FACTOR VS. HUMIDITY



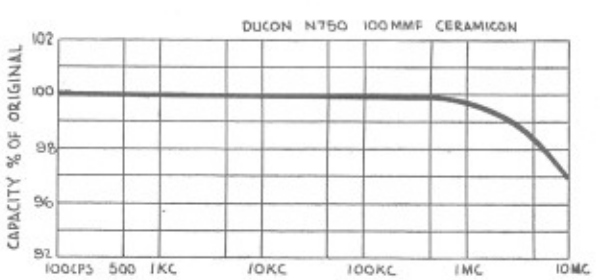
CAPACITY VS. TEMPERATURE



POWER FACTOR VS. FREQUENCY

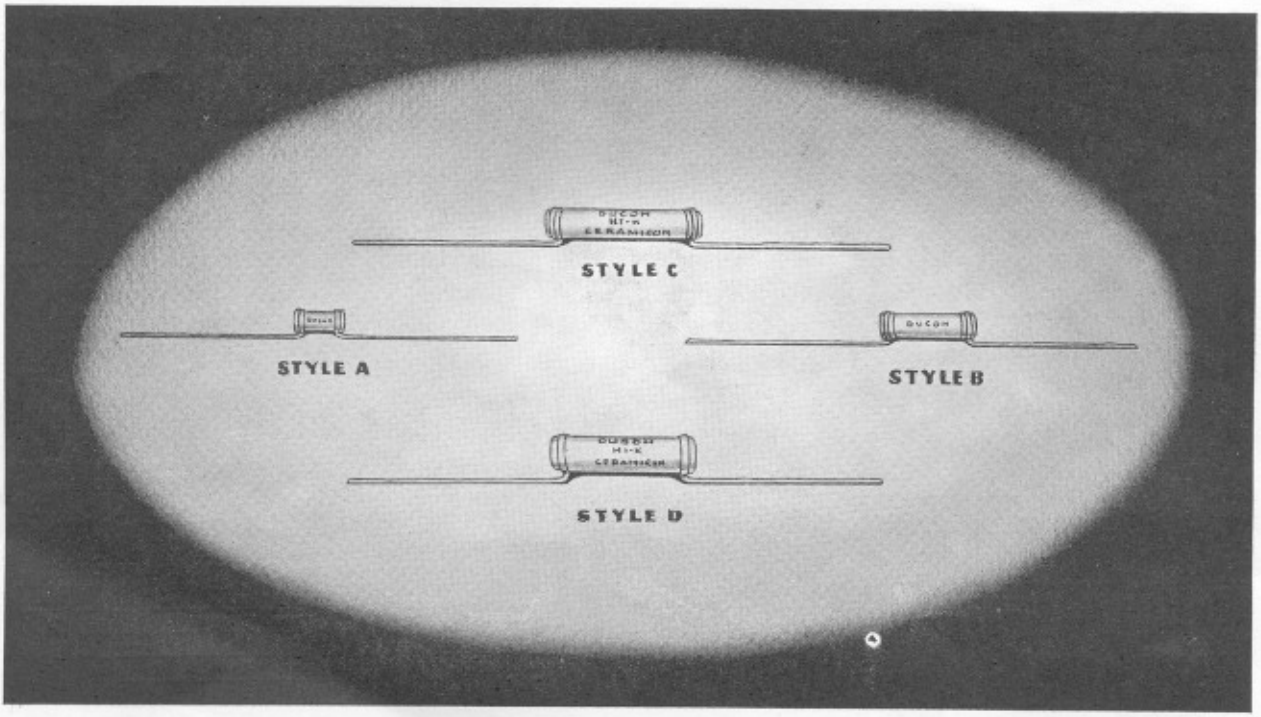
EFFECT OF FREQUENCY

Frequency changes up to 1 megacycle have little effect on capacity of Ducon Ceramicons. Above 1 megacycle, capacity drops off somewhat, amounting to about –3% at 10 megacycles. In making calculations for the Capacity vs. Frequency Curve shown below, an inductance of .06 microhenry was assumed for the General Radio Type 722 capacitor used as a standard for measurements. Slight variations in this inductance from the assumed value of .06 microhenry would alter these results somewhat, particularly at the higher frequencies. The simple tubular construction of Ducon Ceramicons admirably adapts them to use at ultra-high frequencies. Referring to the accompanying curves, it is noted that power factor improves as frequency is increased.



CAPACITY VS. FREQUENCY

DUCON HI-K CERAMICONS



COMPACT, HIGH CAPACITY, CERAMIC CAPACITORS FOR BY-PASS APPLICATIONS

DUCON HI-K CERAMICONS are fixed silvered-ceramic capacitors providing high capacity in very compact units. In design, these units are similar to the well-known temperature compensating Ceramicons manufactured by Ducon Condenser Ltd.

Hi-K Ceramicons are designed primarily for use as by-pass and blocking capacitors, where extreme stability with respect to temperature is not a basic requirement and where moderate power factor is permissible. In addition to their compact size, Ducon Hi-K Ceramicons have high insulation resistance and are affected less by humidity than many other types of capacitors often used for by-passing.

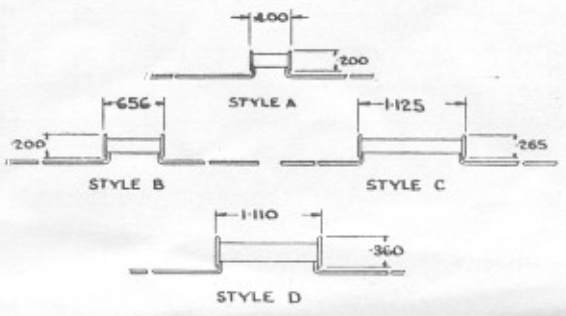
Electrical Specifications for Ducon Hi-K Ceramicons:

Standard Capacity Tolerance	± 20%.
Initial Insulation Resistance	7,500 megohms, minimum.
Power Factor	3% maximum at 1 Mc.
Flash Test	1,500 volts D.C.
Voltage Rating	350 volts D.C.
Life Test	2 times rated D.C. working voltage for 1,000 hours at 85° C., after which insulation resistance shall be at least 100 megohms and capacity shall not have changed by more than 10%.
Humidity Test	100 hours, 95% relative humidity at 40° C., after which insulation resistance shall be at least 100 megohms and capacity shall not have changed by more than 15%. (Units to dry at room temperature for a minimum of 15 minutes and a maximum of 30 minutes before measuring.)

All values shown are referred to room temperature (25° C.) unless otherwise specified.

DUCON HI-K CERAMICONS are available in the following styles:—

Style	CAPACITY Minimum		Maximum
A	271	—	600 μμF.
B	601	—	1,500 μμF.
C	1,501	—	5,000 μμF.
D	5,001	—	7,700 μμF.



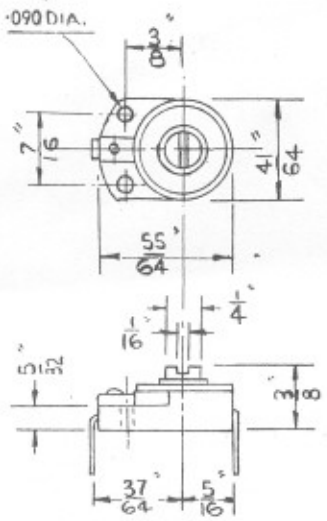
DUCON CERAMICON TRIMMERS

DESCRIPTION AND CHARACTERISTICS

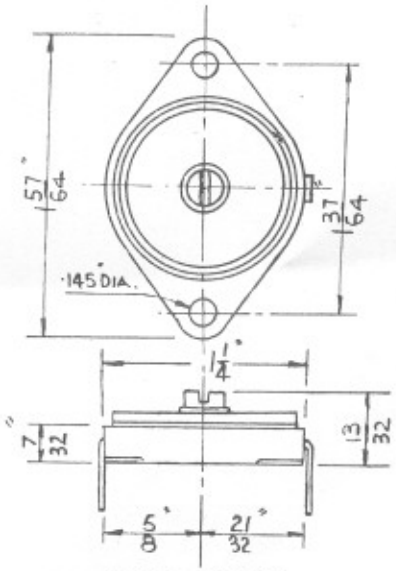
Ducon Ceramicon Trimmer Capacitors are designed for applications where maximum stability and ease of adjustment are desired. The Steatite base is lapped perfectly flat and smooth, and carries a semi-circular coating of silver, fired to the lapped surface and then burnished smooth. The dielectric rotor is also ceramic, being made of the same materials as are used for Ceramicon fixed capacitors. The rotor is circular, lapped flat and smooth on the bottom side, with another semi-circular coating of silver fired on the top, which is not lapped. In assembly, the lapped surface of the rotor is held closely against the silver and lapped surface of the base by a central rivet acting against a spring terminal. The head of the rivet carries a screwdriver slot and is keyed to the hub of the rotor.

Metal parts are electro-silver plated to guard against corrosion. All connections between terminals and silver electrodes are soldered, with the exception, of course, of the connection made by a silvered washer acting as a bearing against the spring ground terminal.

By turning the rotor, the amount of overlap between base silver and rotor silver can be varied from zero to full area. The capacitor thus formed consists of a ceramic dielectric with one electrode fired on in intimate contact, the other electrode held closely against a lapped surface by a spring. Such an assembly is basically stable, as there is no air space to vary with temperature, and no unstable compression of dielectric. Since the capacity of these capacitors is adjusted by varying the amount of overlap between the two semi-circular silver plates, capacity change per degree of rotation is a constant, resulting in a smoothness of adjustment not possible with compression type trimmers, where the greater part of capacity change is concentrated close to one end of adjustment.



STYLE - TS2A



STYLE - TS5D.

General Characterics:

Power Factor at 1 Mc.	Less than .15% for N.500. Less than .20% N.P.0.
Voltage Rating	500 volts D.C.
Flash Test	1,300 volts D.C.
Tolerance on Temperature Coefficient	$\pm$ 100 $\times$ 10^{-6}MMF/MMF/deg. C.

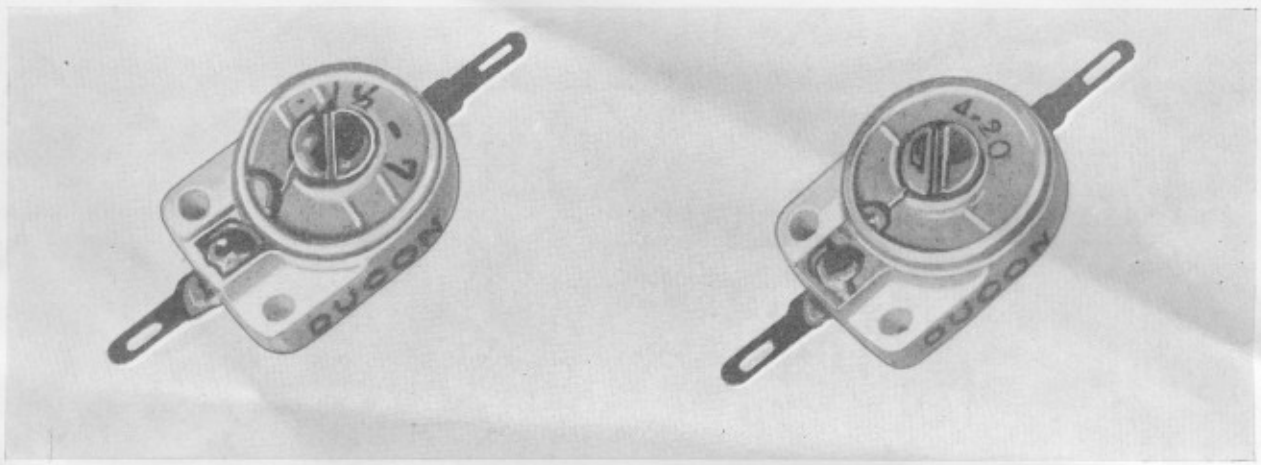
CAPACITY RANGE

Since the mounting base of Ducon Ceramicon Trimmers is made of low dielectric constant Steatite, these units may be mounted flat against a metal chassis with little increase in minimum capacity. This increase amounts to about 1 MMF over those minimums listed in the table at the bottom of the page. Because the dielectric constant increases with negative temperature coefficient, more capacity may be placed on an N.750 type unit than on an N.P.0 (zero coefficient unit).

TEMPERATURE COEFFICIENT

Ceramicon Trimmers are made in two temperature coefficients of capacity; zero, maximum negative, and an intermediate negative coefficient. Capacity setting of the rotor is indicated by a coloured dot on the surface of the rotor near its edge, which, when in line with stator terminal, indicates that the capacitor is set at maximum capacity. The colour of this dot designates temperature coefficient of capacity as indicated in the following table. Tolerance on nominal temperature coefficient is ± .0001 per deg. C.

STYLE	TYPE (Temp. co-ef. x 10^{-6})	
	NPO BLACK DOT	N500 GREEN DOT
.TS2A	1½- 7 uuF. 3 -12 uuF.	4- 20 uuF. 5- 30 uuF. 7- 45 uuF.
TS5D	....	10-110 uuF



DESIGN AND CONSTRUCTION FEATURES

THICK STURDY BASE

The base of Ceramicon Trimmers is made of a dense grade of Steatite and is heavy enough to withstand all normal shock and strain. Provision has been made in Ceramicon Trimmer design for the use of sufficiently large mounting screws

All T.S.2A Trimmers use 8BA screws; Style T.S.5D uses $\frac{1}{8}$" screw.

SOLDERED INTERNAL CONNECTIONS

To prevent open circuiting and to insure a low-loss electrical path, all internal connections are soldered, with the exception, of course, of the wiping contact of the rotor shaft. All metal parts are non-ferrous and are silver-plated to guard against corrosion.

COMPLETELY COVERED TRACK

Ceramicon Trimmers have a 360 deg. rotor that completely covers the entire track on the stator. Contacting surfaces of the rotor and stator are lapped optically flat. These features prevent dust and other foreign matter from affecting the characteristics of the unit, regardless of the point at which the trimmer is set.

VIBRATION-PROOF ADJUSTMENT

Once the rotor has been adjusted, it will not be altered by vibration, as, in addition to being statically balanced, a constant-pressure, non-ferrous spring holds it firmly in place. Complete Ceramicon Trimmer specifications for rotor torque are on the next page.

LITTLE CAPACITY CHANGE WHEN MOUNTED ON CHASSIS

Since the base of Ducon Ceramicon Trimmers is made of a low dielectric-constant Steatite, rise in both maximum and minimum capacities when the unit is mounted directly on a metal chassis is quite small. This increase amounts to approximately 1 MMF.

CAPACITY AND SETTING EASY TO READ

The minimum and maximum capacity of each Ducon Ceramicon Trimmer is stamped on the non-silvered portion of the rotor. When the temperature-coefficient-designating colour dot on the rotor is lined up with the high potential terminal eyelet, the trimmer is set at maximum capacity. Turning the rotor 180 deg. gives minimum capacity setting.

SPECIFICATIONS AND STANDARD DUCON TEST PROCEDURE FOR CHECKING TRIMMERS

Specification: *Capacity.* Capacity must not be greater than that specified at minimum setting nor less than that specified for maximum setting for the style called for on order.

Test Method: Capacity is measured by a substitution method using a resonant circuit operating at 1 megacycle. The standard capacitor should be a precision air capacitor across which is placed the capacitor to be measured.

Specification: *Power Factor.* Power Factor must be less than 0.08% for all types.

Test Method: Test at same time as capacity test described above, using substitution method in resonant circuit at 1 Megacycle, reading R.F. voltage developed across this circuit. Secondary standard to have power factor adjusted to upper limit of power factor by insertion of fixed wire or composition resistor in series. This adjustment to be made as indicated by readings taken by substitution method on General Radio R.F. Bridge. Calibration of standard to be checked at least once each month.

Specification: *Torque.* Rotor to turn smoothly and with a reasonably constant torque between .25 and 1.7 inch pounds.

Test Method: Use test fixture consisting of screwdriver blade turning in ball bearings, torque applied by weights attached to cords running over 2-inch drum fastened to screwdriver shaft. Base of condenser held to keep it from turning, but free enough to insure against binding of blade in rotor slot.

Test Method: Spot Check in Laboratory. Use resonant circuit at approximately 20 Megacycles, capacitor being tested to form major portion of capacitive reactance. Resonance indicated by V.T. voltmeter using 0-200 microammeter in plate circuit. Adjust output and frequency of oscillator so that with circuit at resonance and trimmer capacitor set at 50% to 90% of maximum, a current reading of 200 microamps is obtained. Decrease capacity of trimmer, then increase slowly to 150 microamp reading. Stop, and note current variation. Reverse slowly and note sudden change in current. Stop again and apply torque not sufficient to turn rotor, in both directions, and note current variation. Check observed current variation against current-capacity calibration of instrument. Reject if more than 0.5% of maximum capacity.

Specification: *Flash Test and Leakage.* Trimmer Capacitor to withstand short time application of 1,300 volts D.C. and under this condition leakage resistance must be more than 10,000 Megohms.

Test Method: Use calibrated V.T. voltmeter circuit reading voltage developed across a 10 Megohm resistor in series with capacitor under test across 1,300 volt D.C. supply. Indicator used is a 6ES Electric Eye Type Tube, circuit adjusted to cause eye to open when leakage resistance is less than 10,000 Megohms.

Specification: *Temperature Coefficient.* Temperature coefficient of capacity to be within ± .0001 MMF/MMF/Deg. C. of coefficient indicated by type number.

Test Method: Spot Check in Laboratory. Mount 5 Capacitors to be tested in enclosed heat-box. Read capacity of each at 30 deg. C. and 80 deg. C. by substitution method on R.F. Bridge. Calculate temperature coefficient of capacity from observed differences in capacity between these two temperatures.

SIMPLEX MIDGET MICA CAPACITORS

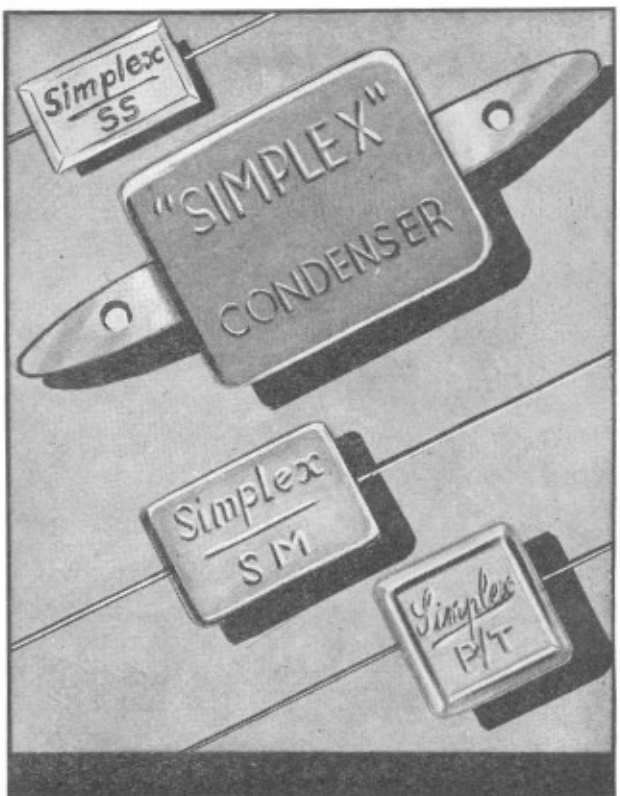
These midget moulded mica capacitors, despite their ultra small size, undergo the same thorough treatment and individual testing as all other Ducon and Simplex products. These capacitors have the advtantage of a moulding that definitely aids the electrical characteristics of specially designed mica units. Increased insulation resistance, decreased moisture permeability, better power factor, and a tough durable casing are just a few of the benefits derived from this mica filled phenolic resin moulded capacitor case.

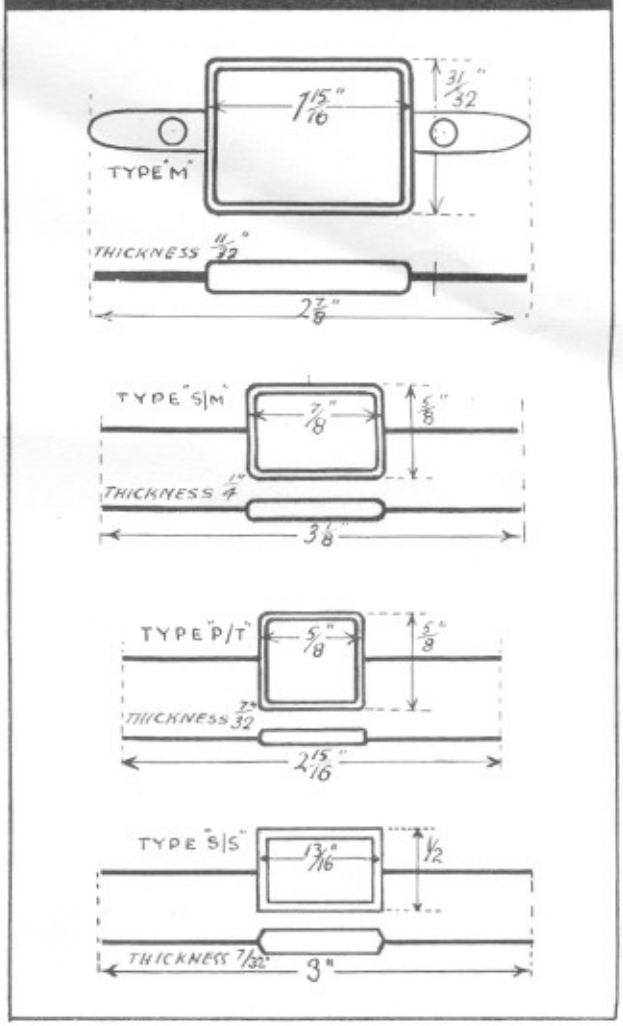
Types P/T, S/M and M are the standard plate mica constructions. For the more critical applications which require precise capacitance values and extreme stability of those capacitances type SS, silver mica P/T and silver mica S/M are ideal.

All types, except M, are constructed with 20 gauge copper wire leads for flexibility, and hot tinned for ease of soldering. Type M is fitted with 26 gauge tinned copper solder lugs.

SS	PT	Silver Mica P/T	S/M Silver Mica S/M	M
1,000V. D.C. Test—500V. D.C. Working				
.000003	.000003	.000003	.000003	—
.000005	.000005	.000005	.000005	—
.00001	.00001	.00001	.00001	—
.000025	.000025	.000025	.000025	—
.00005	.00005	.00005	.00005	—
.0001	.0001	.0001	.0001	.0001
.00015	.00015	—	.00015	.00015
.0002	.0002	—	.0002	.0002
.00025	.00025	—	.00025	.00025
.0005	.0005	—	.0005	.0005
.00075	.00075	—	.00075	.00075
.001	.001	—	.001	.001
—	—	—	.0025	.0025
—	—	—	.005	.005
—	—	—	.01	.01
—	—	—	—	.02

Capacitance tolerance on all units is taken to be 20% unless expressly ordered otherwise. Minimum tolerance on small values *1MMF*. A higher voltage rating of 2,000 volts D.C. Test — 1,000 volts D.C. working is obtainable in type M. Maximum capacitance available at this rating is .01 MFD.





Products of Ducon Condenser Ltd.:

The Company manufactures all types of Static Capacitors in their modern plants at Waterloo and St. Marys, New South Wales, and Wellington, N.Z. The production area covers over 100,000 square feet, and a staff of 950 (including technicians and engineers) is employed. The plant comprises all modern processes of manufacture and is complete with a large electrical and chemical laboratory.

Ducon Condenser Ltd. are licensees of:—
International General Electric Co. (U.S.A.).
Aerovox Corp. (U.S.A.).
P. R. Mallory & Co. Inc. (U.S.A.).
Erie Resistor Corp. (U.S.A.).
Western Electric Co. (U.S.A.).

Products manufactured include the following, which are manufactured under one or more of the following patents:—

18,768	109,329	117,892
18,769	110,140	117,917
101,304	113,522	119,926
101,449	113,591	119,087
101,450	114,414	119,404
101,257	114,533	121,280
102,151	114,534	86,228
107,688	115,087	86,229
107,986	115,277	86,230
109,861	115,836	86,550
		86,551

Patent No. 5488/31
" " 114,787
Appln. No. 10624/43
" " 11584/43
" " (GE Docket 73301)
" " (" " 73867)

Paper Dielectric Capacitors. For the following uses:—

Power Factor Correction.
Transmission, Filter H.T. & L.T.
Noise Suppression.
Automobile Ignition.
Television and F.M.
Telephone.
Radio Receivers.
Defence Equipment.

Electrolytic Capacitors. Of the following types:—

Semi-Dry, for Radio Receivers.
A.C. Motor Start.
Television and F.M.
Telephone.
Transmission: High capacity, low voltage.

Mica Capacitors. For the following uses:—

Radio Transmission.
Radio Receivers.
Television and F.M.
Ultra High Frequency.
Magneto.

Carbonised Ceramic Resistors.

Temperature Compensating Ceramicon Capacitors.

High Grade Ceramics for H.F. applications.

Electrical Porcelains.

GUARANTEE

All "Ducon" capacitors are subject to the following guarantee of satisfaction:—

THIS CAPACITOR IS GUARANTEED TO BE FREE OF DEFECTS IN WORKMANSHIP AND MATERIALS FOR ONE YEAR. WITHIN THIS PERIOD, DUCON WILL REPLACE, FREE OF CHARGE, ANY CAPACITOR RETURNED TO THEM IF FOUND TO BE DEFECTIVE AND WHICH HAS NOT BEEN TAMPERED WITH OR MISUSED.

Immediately above is Ducon's main factory in Sydney. Top left: The N.Z. factory. Top right: The factory at St. Marys, N.S.W. Centre: Villawood factory, N.S.W. The total factory area at present exceeds 107,000 square ft.

DUCON CERAMICONS AND SIMPLEX MICA CAPACITORS ARE MANUFACTURED AND MERCHANDISED BY . . .

SIMPLEX PRODUCTS PTY. LTD.

716 Parramatta Rd., PETERSHAM.

TELEPHONE: LM 5615

CABLES AND TELEGRAMS: "SIMPRODUCT"

A Division of DUCON CONDENSER LTD., Waterloo, N.S.W.

Factory Representatives:

DUCON CONDENSER LTD.,
450 Collins Street,
Melbourne.
Cables & Telegrams: "Hecht"

DUCON N.Z. LTD.,
23-25 Haining Street,
Wellington, N.Z.
Cables & Telegrams: "Attendo," Wellington, N.Z.

CARLYLE & CO. LTD.,
917 Hay Street,
Perth, W.A.
Cables & Telegrams: "Lylecar," Perth

ATKINS (W.A.) LTD.,
894 Hay Street,
Perth, W.A.
Cables & Telegrams: "Cacolim," Perth

P. H. PHILLIPS PTY. LTD.,
123-125 Charlotte Street,
Brisbane, Queensland.
Cables & Telegrams: "Philectric," Bris.

W. T. MATTHEW,
95 Grenfell Street,
Adelaide, S.A.
Cables & Telegrams: "Adorwhoop," Adelaide