

Aerovox

Division of Parallax Power Components, LLC



Capacitors for HID Lighting Applications

Catalog HID-cap 2004-R0

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Information presented in this document is believed to be accurate and reliable. The content, however, is subject to change and Aerovox reserves the right to modify this document without notice

Starting in 1922, Aerovox continues as the leading producer of film capacitors for AC voltage applications. After being acquired by Provident Industries in 2002, Aerovox joined with Parallax Power Components capacitor operation located in Bridgeport CT (which Provident acquired from Magnetek in 2001). During 2003, Aerovox & Parallax capacitor operations were consolidated in New Bedford MA. So today Aerovox continues to supply World class film capacitors for wide varieties of applications.

Product details are described at websites www.aerovox.com & www.parallaxpowercaps.com.

This brochure describes capacitors for use in High Intensity Discharge (HID) lighting fixtures. Products in this brochure show Parallax part numbers, which are also available as following Aerovox part numbers (contact Aerovox for details):

Case Type	Aerovox #	Parallax #	Shown on pages
1.25" oval metal oil-filled	Z91P...	... MF	9, 10, & 14
1.50" oval metal oil-filled	Z92P...	... MF	9, 10, & 14
1.75" oval metal oil-filled	Z93P...	... MF	9, 10, & 14
2.00" oval metal oil-filled	Z94P...	... MF	9, 10, & 14
1.75" dia metal oil-filled	Z73P...	... RMF	9, 10, & 14
2.00" dia metal oil-filled	Z74P...	... RMF	9, 10, & 14
2.50" dia metal oil-filled	Z76P...	... RMF	9, 10, & 14
Plastic cases epoxy filled	T...	... P & PQ	11 & 14

*Note: Aerovox part number shows two digit voltage code after prefix listed above, followed by two digit microfarad code (example "Z73P4010" is 1.75" dia metal case @ 10 mfd 400VAC). Parallax part numbers start with 4-digit sequential numbers (no relationship to mfd or voltage).

Quality Assurance

Safety and reliability are the most important aspects of Aerovox capacitors from product design through unique manufacturing processes. Aerovox is actively involved in safety agency programs, capacitor industry design standards, material evaluations and testing.



Process documentation includes statistical process controls per ISO 9001 procedures. QA is also confirmed by accelerated life testing programs, reviewing customer requirements along with field-use analysis. Each Aerovox capacitor is electrically tested and date coded prior to shipment to insure reliable operation and traceability.

Applications

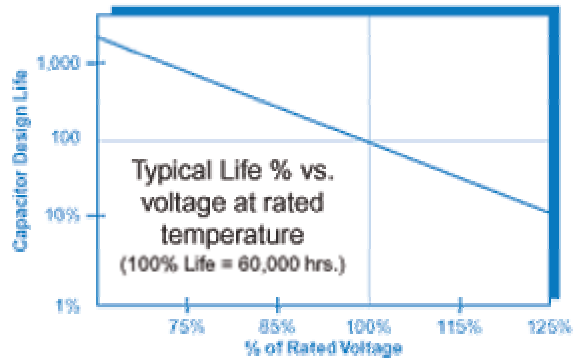
This brochure describes capacitors designed for continuous duty in lighting fixtures (H.I.D. types). Capacitors in this brochure are arranged by case style voltage and nominal microfarads (Mfds or μF). Mfd tolerances are typically $\pm 3\%$ of nominal (specified at 25°C). Aerovox capacitors exceed industry safety guidelines. Capacitors other than those listed in this brochure may also be available from Aerovox (for more information call 508-994-9661).

Capacitor life is mainly affected by voltage and temperature (see charts 1 and 2). Aerovox capacitors for HID Lighting applications are typically marked "90°C" or "100°C max". They are designed for 60,000 hours continuous duty at rated voltage and average operating temperatures of 90°C. Ongoing Accelerated Life Test programs verify Aerovox capacitor designs and production units. Special designs may be supplied where capacitors operate continuously above 90°C. Temperature is defined as the highest reading on any area of capacitor case. Operation over 90°C (212°F) will reduce operating life. Guideline: each 6.5 degree rise over 90°C reduces life by 50%. Aerovox capacitors can be operated at low temperatures (to -40°C without derating). Aerovox capacitors are non-polar (terminals/electrodes can be reversed), unlike many "electrolytic" capacitors which have plus and minus terminals that will cause catastrophic failure when reversed. Along with being non-polar, metallized film capacitors are self-clearing. During momentary faults, small areas of metallized electrodes vaporize and capacitor function is restored (usually with small reductions in microfarads until end of capacitor life).

Agency Listings of Aerovox Capacitors:

- ▶ U.L. files E145088 & E551176
- ▶ C.S.A. file 58450 (metal cases only)
- ▶ ISO 9001 certified facility

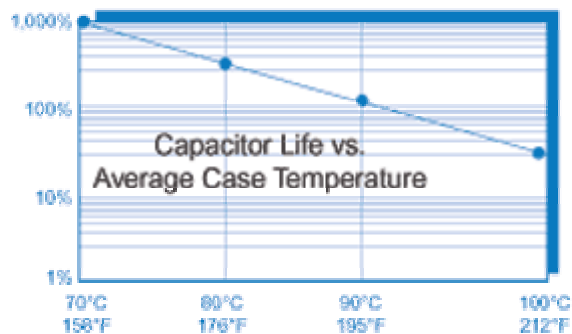
CHART 1



Safety Features

of Aerovox capacitors include: agency listings outlined below), accelerated life testing programs, and protective devices (interrupters). Ongoing testing programs total over 500 million component test hours each year at Aerovox New Bedford. Safety Agency listings are continuously monitored programs. Testing also includes fault-current requirements on interrupter mechanisms per UL#810. Protective devices cause open circuits at end of capacitor life, versus short circuits that can be caused by capacitors without protective devices.

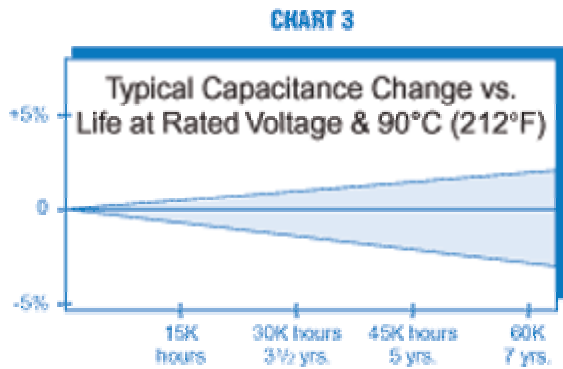
CHART 2



Performance Testing

Capacitors in this brochure are designed to meet performance testing outlined in Electrical Industry Association (EIA) standard #RS-456A. Test programs are run continuously at Aerovox to monitor production and for design improvements. Test programs are also done on production units at regular intervals.

Ongoing tests include: Accelerated Life Testing (ALT, for 2000 hours at 125% voltage rating and temperature rating +10C), fault current, along with mechanical testing. Aerovox testing programs accumulate over 500 million component test hours each year.



Construction

General:

Aerovox capacitors outlined in this catalog utilize two basic types of construction; oil-filled metal cases and dry units (epoxy filled plastic cases). These capacitor designs, materials, and construction are all documented per ISO 9001 and closely controlled. Materials used in Aerovox capacitors are only obtained from certified sources and monitored. Aerovox capacitors cover a wide range of case styles including dual-caps (two capacitors in one case).

Dielectrics:

Aerovox capacitors use special types of polypropylene film. Polypropylene films are the most energy efficient dielectric materials commercially available for continuous duty AC voltage applications. Capacitor efficiency is measured as % DF (dissipation factor). Aerovox capacitor DF's are typically less than 0.1% at 60Hz and 70°C (158F). Other types of capacitors typically have much higher DF's. Examples; Aluminum Electrolytic capacitors can have DF's over 10% at 25°C and polyester film DF increases with temperature. Aerovox capacitors are capable of continuous duty with very low Mfd losses (see chart 3).

Polypropylene plastic films used by Aerovox are specially made to close tolerance thicknesses that are engineered for various AC voltage ratings at 50/60 HZ RMS. These films are met-allized, and wound into rolls (two layers with opposing margins). Roll ends are then sprayed with metal to connect layers and form capacitor electrodes at each end. Note: oil-filled capacitors can use thinner dielectrics than comparable dry capacitors.

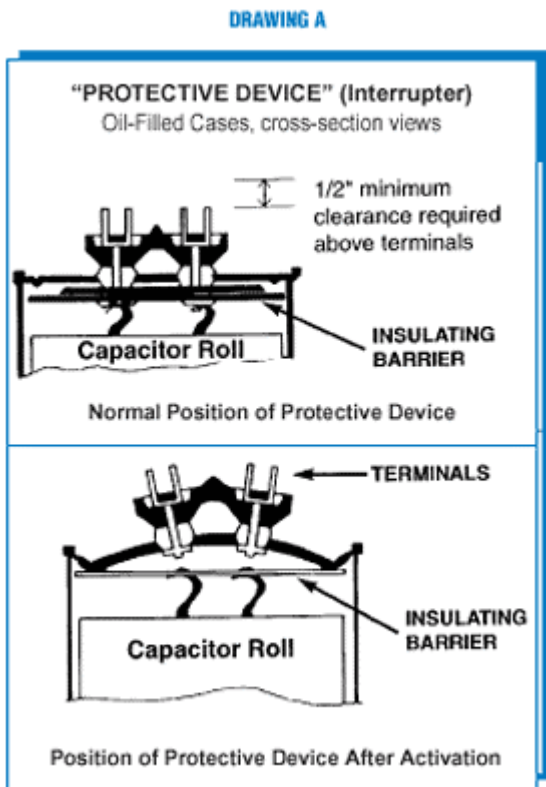
Aerovox Patents:

- ▶ Use of soybean-oil in capacitors: Patents issued
- ▶ Internal resistors in capacitors: Patents issued
- ▶ Dry-Protected capacitor designs: Patents applied for
- ▶ Use of Polyisobutylene in capacitors: / Patents issued

Oil-filled metal cases (Industry-Standard oval and round base sizes):

Aerovox metal case capacitors use soybean-oil or Polyisobutylene-oil, to extend design life. These oils protect metalized film from corrosion, aid heat transfer, and help suppress corona (which may otherwise cause premature failures). Aerovox oil-filling processes utilize proprietary cycles of vacuum and heat to remove ambient moisture in cases (which would otherwise reduce operating life of capacitors).

Protective devices (interrupters) in oil-filled metal cases: Connections to film rolls are made with tabs welded to each end and connected to case terminals through an interrupter mechanism. As illustrated in Drawing A, interrupter mechanisms cause an open circuit at end of capacitor life. Aerovox interrupters meet fault testing per UL test #810 (done on randomly selected production units). Note: interrupters on metal cases require a minimum of 1/2" clearance above terminals.



Dry Plastic Case Capacitors

made by Aerovox for HID lighting applications up to 400 VAC and can be supplied with wire leads or terminals. For similar performance, dry capacitors must use thicker dielectrics than oil-filled capacitors. Therefore, case sizes of dry capacitors are typically larger than oil-filled styles with similar design life performance. Plastic case dry capacitors are lighter weight than oil-filled units, and provide better corrosion resistance than metal case parts. Costs vary considerably depending on styles and quantities being compared. In general, plastic case parts with terminals offer lowest costs in higher quantities. However, oil-filled units may offer lower costs and quickest delivery for small quantities of off-the-shelf standard products.



Unprotected Dry Plastic Case Capacitors

made by Aerovox are outlined on Page 12 of this brochure. They can be supplied with insulated wire leads or terminals. Wire lead styles use suffix "-P" on capacitor part numbers. Wire leads are 8" long 18 gauge stranded copper wire with UL listed insulation rated for 150C. Terminal styles use suffix "-PQ" and have standard single blade 1/4" quick-disconnects (like used on oil-filled capacitors). As clearly noted in this brochure, unprotected capacitors may fail short.



Connections:

While oil-filled parts are only supplied with terminals, plastic case styles are made by Aerovox with terminals or wire leads. Wire leads are 8" long 18 gauge stranded copper wire with UL listed insulation rated for 150°C. Terminals are 1/4" wide x 1/32" thick standard electrical terminals that mate to connectors available from a variety of sources. Standard terminals are two-blade style on oil-filled metal cases (with ground lugs and three or four blade terminals available on special request). Standard terminals on Aerovox plastic cases are 1/4" single blades (two-blade available on special request).

Marking:

Each capacitor label includes the following information: AEROVOX, four-digit date code (yr/wk), μF (microfarads), VAC rating, our part numbers, and safety agency symbols. Special marking is also available. PROTECTED is clearly marked where that feature is included, otherwise NOT PROTECTED is shown on labels where plastic cases are unprotected. (See pages 5 to 7.) Dual-Section capacitors have Microfarads printed next to the terminal (common in middle).

Microfarads:

Are denoted by Mfds or μF . Nominal mfds listed in this brochure have allowable tolerances of $\pm 3\%$. Special mfds or special tolerances can also be supplied. Aerovox capacitors are calibrated to U.S. Bureau of Standards at 25°C.



Temperature Markings:

Plastic case parts are labeled 100°C max. Standard oil-filled oval cases made by Aerovox which had been labeled 90°C can now also be labeled 100°C max (because these oil-filled capacitors perform as well on accelerated tests as plastic case capacitors labeled 100°C max).

Testing:

Along with general testing outlined on pages 4 and 5, each Aerovox capacitor passes specific requirements for:

- ▶ Voltage (at VAC and hi-pot VDC)
- ▶ Insulation (rated voltage +1000 VDC)
- ▶ Capacitance (insure microfarads are within tolerance)
- ▶ Dissipation Factor (DF measurement of internal losses)
- ▶ Terminal to terminal voltage (checks for internal defects)
- ▶ Terminal to case voltage on metal cases (checks for shorts)
- ▶ Leak testing on metal cases (insures proper sealing)
- ▶ Visual inspection (to verify label and general condition)

Packing:

As shown in Chart 4, Aerovox & PPC capacitors use various cardboard cartons and counts. Cartons are used as shipping containers (or stacked on pallets). Standard quantity per carton are shown in Chart 4. Aerovox capacitors are also available packed in individual cartons for additional costs. Capacitor weights vary from approximately 1/8 to one pound each. Each carton is labeled with part# & qty. Bar code labels on cartons are available upon request.

Cartons used with Aerovox part numbers are different than cartons used with PPC part numbers (various sizes & qty's, consult factory for details).



Resistors:

Capacitors outlined in this brochure include resistors. Bleeder resistors typically reduce voltage stored in capacitors to less than 50V within 60 seconds of voltage removal. Capacitors without resistors can cause accidental shock hazards. Aerovox active Patents include unique internal resistors which are standard for most PPC HID-caps. Where internal resistors are used, labels include notations "INT RES" (& megaohm rating). External resistors are used on Aerovox parts or as alternates to PPC internal resistors.



CHART 4

Quantity Per Carton (bulk-packed in cartons 11" wide x 17" long)		
Case Code	Description	Qty./Carton*
A	1.25" oval	63
B	1.50" oval	42
C	1.75" oval	33
D	2.00" oval	25
P	1.75" dia	50
S	2.00" dia	40
T	2.50" dia	24
AA	1.18" dia (30mm)	117
BB	1.58" dia (40mm)	69
CC	1.77" dia (45mm)	54
DD	1.97" dia (50mm)	45

*Aerovox qty's vary from those in PPC cartons noted above. Consult factory for details.

Aerovox Oil-Filled Capacitors for HID Lighting

For use up to 100°C, rated for 60,000 hour duty @ 90°C (195°F)

Marked "100°C Max", or 90°C

(All dimensions are +/- .06")

uF	VACr	Part #	Case	Ht(")
5.0	300	005-1466-MF	1.25 oval	2.2
6.0	300	005-1561-MF	1.25 oval	2.2
7.0	300	005-1410-MF	1.25 oval	2.2
8.0	330	005-1411-MF	1.25 oval	2.2
9.0	300	005-1412-MF	1.25 oval	2.7
10.0	330	005-1413-MF	1.25 oval	2.7
10.0	400	005-2666-MF	1.25 oval	3.9
10.0	400	005-1184-MF	1.50 oval	2.7
10.0	400	005-2167-RMF	1.75 dia	2.9
10.0	480	005-2883-MF	1.50 oval	2.7
12.0	280	005-1962-RMF	1.75 dia	2.3
12.0	300	005-1467-MF	1.25 oval	3.1
12.0	400	005-2799-MF	1.50 oval	2.7
12.0	440	005-1464-MF	1.50 oval	3.1
13.0	300	005-1414-MF	1.25 oval	3.1
14.0	240	005-1884-RMF	1.75 dia	2.3
14.0	300	005-1415-MF	1.50 oval	2.7
15.0	300	005-1416-MF	1.50 oval	2.7
15.0	400	005-1185-MF	1.75 oval	2.7
15.0	400	005-2170-RMF	1.75 dia	2.9
15.0	480	005-2201-MF	1.50 oval	3.9
16.0	300	005-1498-MF	1.50 oval	2.7
16.0	525	005-1471-MF	2.00 oval	3.1
17.5	300	005-1417-MF	1.50 oval	3.1
18.0	440	005-1401-MF	1.75 oval	3.1
18.0	510	005-1762-MF	1.75 oval	3.9
18.5	330	005-1796-MF	1.50 oval	3.1
20.0	240	005-1885-RMF	1.75 dia	2.3
20.0	330	005-1418-MF	1.50 oval	3.1
20.0	440	005-2387-MF	1.75 oval	3.9
20.5	400	005-3262-MF	1.75 oval	3.1
21.0	525	005-1495-MF	1.75 oval	3.9
22.5	300	005-1419-MF	1.50 oval	3.5
22.5	300	005-2200-RMF	1.75 dia	2.9
24.0	360	005-3160-MF	1.75 oval	3.1
24.0	400	005-2664-MF	1.75 oval	3.1

uF	VACr	Part #	Case	Ht(")
24.0	400	005-2592-RMF	1.75 dia	3.8
24.0	480	005-2779-MF	1.75 oval	3.9
24.0	525	005-2777-MF	1.75 oval	4.3
24.5	300	005-3278-MF	1.75 oval	2.7
26.0	330	005-2669-MF	1.75 oval	3.1
26.0	525	005-2776-MF	1.75 oval	4.3
28.0	240	005-1886-RMF	1.75 dia	2.3
28.0	300	005-1468-MF	1.75 oval	3.1
28.0	425	005-1799-MF	1.75 oval	3.9
28.0	525	005-2778-MF	2.00 oval	4.3
30.0	440	005-1475-MF	1.75 oval	3.9
32.0	300	005-2351-MF	1.75 oval	3.1
32.0	525	005-1474-MF	2.00 oval	3.9
33.0	300	005-1470-MF	1.75 oval	3.1
34.0	330	005-1609-MF	1.75 oval	3.1
34.0	525	005-2893-MF	2.00 oval	3.9
35.0	240	005-2754-RMF	1.75 dia	3.8
35.0	330	005-1421-MF	1.75 oval	3.1
35.0	525	005-2686-MF	2.00 oval	3.9
36.0	525	005-2793-MF	2.00 oval	4.3
38.0	300	005-2019-MF	1.75 oval	3.9
40.0	240	005-1887-RMF	1.75 dia	2.7
40.0	300	005-1768-MF	1.75 oval	3.9
42.0	300	005-1764-MF	1.75 oval	3.9
45.0	330	005-1610-MF	1.75 oval	3.9
48.0	330	005-1422-MF	1.75 oval	3.9
50.0	240	005-3209-MF	1.75 oval	3.5
50.0	300	005-3207-MF	1.75 oval	3.9
52.0	240	005-1888-RMF	2.00 dia	2.9
55.0	240	005-1594-MF	1.75 oval	3.5
55.0	300	005-2117-MF	1.75 oval	3.9
56.0	300	005-3609-MF	1.75 oval	3.9
62.0	240	005-2362-MF	1.75 oval	3.9
80.0	240	005-2365-RMF	2.00 dia	3.8
90.0	240	005-2154-RMF	2.50 dia	3.8
100.0	240	005-3218-RMF	2.50 dia	3.8



Bi-Level (dual) Capacitors for HID Lighting

For use up to 100°C, and rated for 60,000 hour duty @ 90°C (195°F)

Marked "100°C Max", or 90°C

(Nominal dimensions are +/- .06")

Mfd + Mfd	VACr	Part #	Case x Ht(")
7 + 3	400	005-1966-MF	C x 2.7
7.5 + 2	400	005-3173-MF	C x 2.7
9 + 5	400	005-3357-MF	C x 2.7
10 + 4.2	400	005-3172-MF	C x 2.7
11 + 4	330	005-3389-MF	C x 2.7
12 + 3	400	005-3367-MF	C x 2.7
13 + 5.5	330	005-3376-MF	C x 2.7
14 + 8	400	005-2690-MF	C x 2.7
15 + 9	400	005-1964-MF	C x 3.1
15.3 + 6.9	400	005-3175-MF	C x 3.1
16 + 8	400	005-2784-MF	C x 3.1
16.5 + 7	400	005-3171-MF	C x 3.1
17 + 7	330	005-3377-MF	C x 2.7
18 + 7.5	330	005-3378-MF	C x 2.7
19.5 + 8	330	005-3379-MF	C x 2.7
20 + 8	240	005-3355-MF	C x 3.9
20 + 8	480	005-2964-MF	C x 3.9
20 + 15	300	005-2363-MF	C x 3.9
22 + 7	280	005-3219-MF	C x 3.1
22 + 13	300	005-2798-MF	C x 2.7
23 + 5	280	005-3289-MF	C x 3.1
23 + 9	525	005-2907-MF	D x 3.9
25 + 10	280	005-3289-MF	C x 3.9
27.5 + 7	330	005-3169-MF	C x 3.1
33 + 15	300	005-1901-MF	C x 3.9
35 + 20	300	005-2292-MF	C x 3.9
36 + 12	300	005-2059-MF	D x 3.9
36 + 12	400	005-3279-MF	C x 3.9
38 + 9	300	005-3167-MF	C x 3.9
42 + 12	240	005-3168-MF	C x 3.5
45 + 19	300	005-3152-MF	D x 3.9
54 + 21	280	005-3159-MF	D x 3.9



Aerovox dual-capacitors printed labels show microfarads by each outside terminal (middle terminal is always common).

Aerovox Unprotected Capacitors (Dry Caps) for HID Lighting

Marked "100C Max", and Rated for 60,000 hour duty @ 90°C (195°F)

Suffix "P" dry-caps have wire leads (8long insulated wire). For terminals use suffix "PQ" and add 0.1 " (2mm) to ht. (All dimensions are +/- .06")

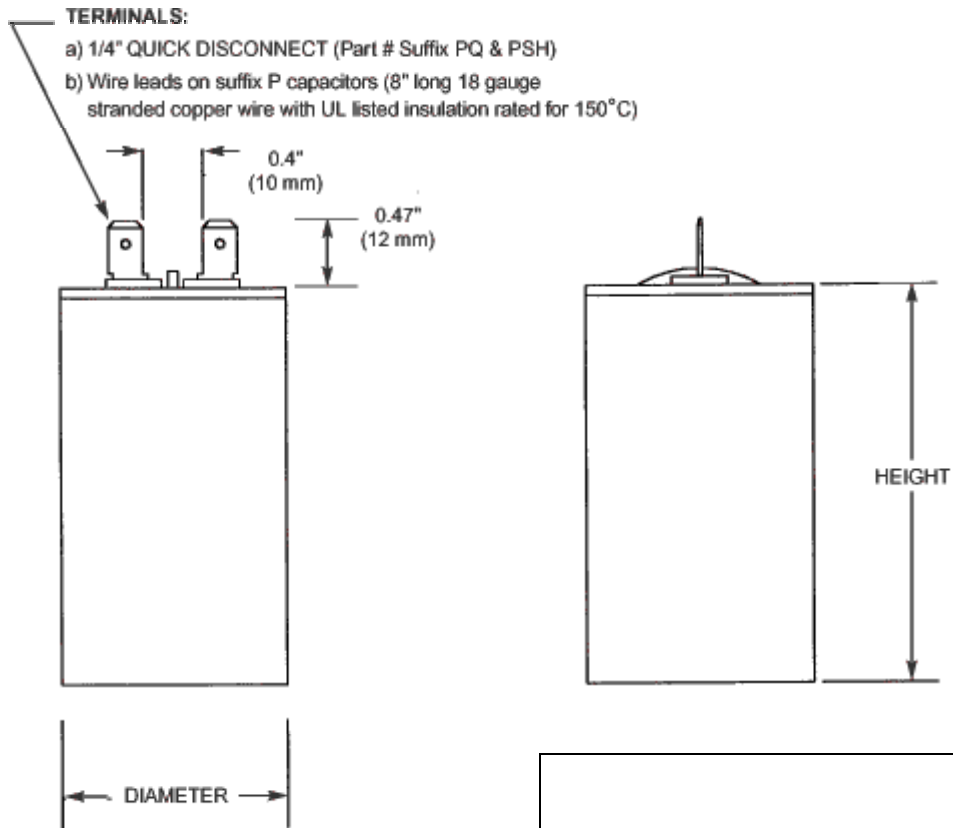
uF	VACr	Part #	Dia(")	Ht(")	mm
5.0	280	005-4440-P	1.2	2.2	30 55
5.0	330	005-4401-P	1.2	2.2	30 55
6.0	280	005-4402-P	1.2	2.2	30 55
7.0	280	005-4403-P	1.2	2.2	30 55
7.0	330	005-4404-P	1.2	2.7	30 68
8.0	280	005-4405-P	1.2	2.7	30 68
8.0	330	005-4406-P	1.6	2.7	40 68
10.0	280	005-4407-P	1.2	2.7	30 68
10.0	330	005-4408-P	1.6	2.7	40 68
10.0	400	005-4409-P	1.6	2.7	40 68
12.0	280	005-4410-P	1.6	2.7	40 68
12.0	330	005-4411-P	1.6	2.7	40 68
12.0	400	005-4412-P	1.6	3.6	40 92
13.0	280	005-4413-P	1.6	2.7	40 68
13.0	330	005-4414-P	1.6	2.7	40 68
14.0	240	005-4415-P	1.2	2.7	30 68
14.0	280	005-4416-P	1.6	2.7	40 68
15.0	240	005-4417-P	1.6	2.7	40 68
15.0	330	005-4418-P	1.6	2.7	40 68
15.0	400	005-4419-P	1.6	3.6	40 92
16.0	280	005-4420-P	1.6	2.7	40 68
16.0	330	005-4421-P	1.6	3.6	40 92
17.5	240	005-4422-P	1.6	2.7	40 68
17.5	280	005-4423-P	1.6	2.7	40 68
17.5	330	005-4424-P	1.6	3.6	40 92
18.0	400	005-4425-P	1.6	3.6	40 92
18.5	280	005-4426-P	1.6	2.7	40 68
18.5	330	005-4427-P	1.6	3.6	40 92
20.0	240	005-4428-P	1.6	2.7	40 68
20.0	280	005-4429-P	1.6	2.7	40 68
20.0	330	005-4430-P	1.6	3.6	40 92
20.0	400	005-4431-P	1.8	3.6	40 92
20.5	400	005-4432-P	1.8	3.6	45 92
21.0	280	005-4433-P	1.6	2.7	40 68
22.0	280	005-4434-P	1.6	3.6	40 92

uF	VACr	Part #	Dia(")	Ht(")	mm
22.5	240	005-4435-P	1.6	2.7	40 68
22.5	280	005-4436-P	1.6	3.6	40 92
24.0	280	005-4437-P	1.6	3.6	40 92
24.0	400	005-4438-P	1.8	3.6	45 92
24.5	280	005-4440-P	1.6	3.6	40 92
24.5	330	005-4441-P	1.8	3.6	45 92
25.0	280	005-4442-P	1.6	3.6	40 92
26.0	280	005-4443-P	1.6	3.6	40 92
26.0	330	005-4444-P	1.8	3.6	45 92
28.0	240	005-4445-P	1.6	2.7	40 68
28.0	280	005-4446-P	1.6	3.6	40 92
28.0	330	005-4447-P	1.8	3.6	45 92
30.0	240	005-4448-P	1.6	2.7	40 68
30.0	280	005-4449-P	1.6	3.6	40 92
30.0	400	005-4450-P	1.8	4.6	45 117
32.0	280	005-4451-P	1.6	3.6	40 92
34.0	240	005-4452-P	1.6	3.6	40 92
35.0	240	005-4453-P	1.6	3.6	40 92
35.0	280	005-4454-P	1.8	3.6	45 92
36.0	240	005-4455-P	1.6	3.6	40 92
40.0	240	005-4456-P	1.6	3.6	40 92
40.0	280	005-4457-P	1.8	3.6	45 92
45.0	240	005-4458-P	1.6	3.6	40 92
45.0	300	005-4459-P	1.8	4.6	45 117
45.0	330	005-4460-P	1.8	4.6	45 117
48.0	240	005-4461-P	1.8	3.6	45 92
48.0	280	005-4462-P	1.8	4.6	45 117
48.0	330	005-4463-P	2.0	4.6	50 117
52.0	240	005-4464-P	1.8	3.6	45 92
55.0	240	005-4465-P	1.8	3.6	45 92
55.0	280	005-4466-P	1.8	4.6	45 117
56.0	240	005-4467-P	1.8	3.6	45 92
56.0	280	005-4468-P	1.8	4.6	45 117
62.0	240	005-4469-P	1.8	3.6	45 92



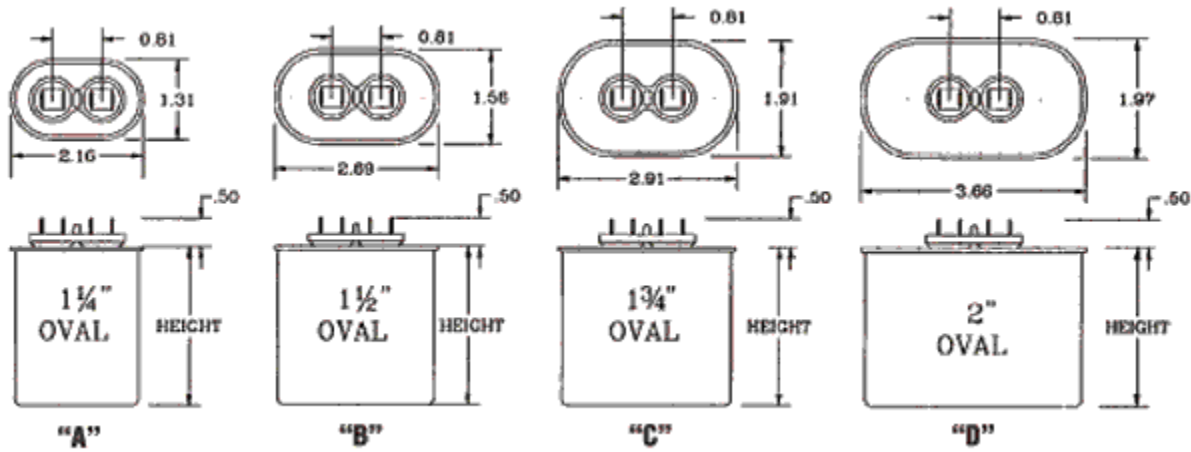
Aerovox Dry Cap Case Sizes

(All dimensions are +/- .06")



Aerovox Oval Oil-Filled Case Sizes

(All dimensions are +/- .06")



Aerovox Round Oil-Filled Case Sizes

(All dimensions are +/- .06")

