

HES - Computer Grade Electrolytic Capacitors



- High Reliability
- 105°C Operation
- Screw Terminals
- Custom Designs Available Upon Request.
- Charge-Discharge applications
 - Welders
 - Photoflash
 - Strobe Lights
 - Magnetizers
 - Demagnetizers
 - LASER Activation
- Ideal for High Power Input Filter Applications

General Specifications

Operating Temperature:
-40°C to +105°C

Voltage Range:
350 WVDC to 450 WVDC

Capacitance Range:
300 µF to 5,600 µF

Capacitance Tolerance:
-0 +50%

DC Leakage Current:

$I = \leq 3 \sqrt{CV}$ mA
 Not to exceed 4.0mA
 C = capacitance in µF
 V = Rated Voltage
 I = Leakage Current in mA

QA Stability Test

- Life Test:
1000 hours @ 105°C
- Ripple Test:
2000 Hrs. full load @ +85°C
- Shelf Test:
500 Hrs. @ +105°C

The maximum ripple current at 85°C and 120Hz for HES capacitors is shown in the Standard Rating Table. Maximum ripple current may be adjusted by the multipliers in the following tables.

Rated WVDC	Ripple Multipliers				
	120Hz	400Hz	1000Hz	2500Hz	10KHz
350 to 450	1.0	1.080	1.130	1.175	1.230

Ambient Temperature	Ripple Multipliers
+85°C	1.00
+65°C	1.42
+55°C	1.58
+45°C	1.72
+35°C	1.88
+25°C	2.00

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Types CGS, CGH, CGO, CGR, CG, HES

Part Number Information

DuraCap Catalog Number **CGS** **184** **U** **010** **X3L** **(3** **P** **H)** **[-S]**

TYPE: _____
Identifies the basic type
CGS, CGH, CGO, CGR, CG, HES

CAPACITANCE: _____
Expressed in microfarads
The first two digits are significant figures
The third digit is the number of zeros

CAPACITANCE TOLERANCE: _____
F = -0 / +30% **R** = -15 / +15% **U** = -10 / +75%
G = -0 / +50% **S** = -10 / +30% **X** = -10 / +20%
M = -20 / +20% **T** = -10 / +50% **Z** = -10 / +10%

DC VOLTAGE RATING: _____
Zeros are used to precede the voltage rating where necessary to complete the three digit block
The letter 'R' indicates a decimal point

CASE CODE: _____
See chart on next page

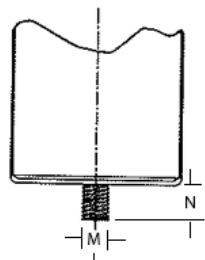
INSULATING SLEEVE: _____
 0 = No sleeve
 1 = Mylar (Polyester)
 3 = Single Layer PVC - .008" thickness
 7 = Double Layer .008" PVC (.016" total thickness)
 8 = Blue PVC - .012" thickness

POLARITY: _____
P = Polar **S** = Semi-Polar **N** = Non-Polar

TERMINAL: _____

- H = High Post
- L = Low Post
- V = Printed Circuit Mount
- D = Low Post, Low Resistance Screw Mount (1/4 - 28 Thread)
- F = High Post Metric Thread
- G = Low Post Metric Thread
- N = High Post, Low Resistance Screw Mount (1/4 - 28 Thread)
- S = Stud Mount (see chart below)

CAN DIAMETER	M THREAD	N INCH	N MM
1.375	M8	.472	12
1.750	M8	.472	12
2.000	M12	.630	16
2.500	M12	.630	16
3.000	M12	.630	16
3.500	M12	.630	16

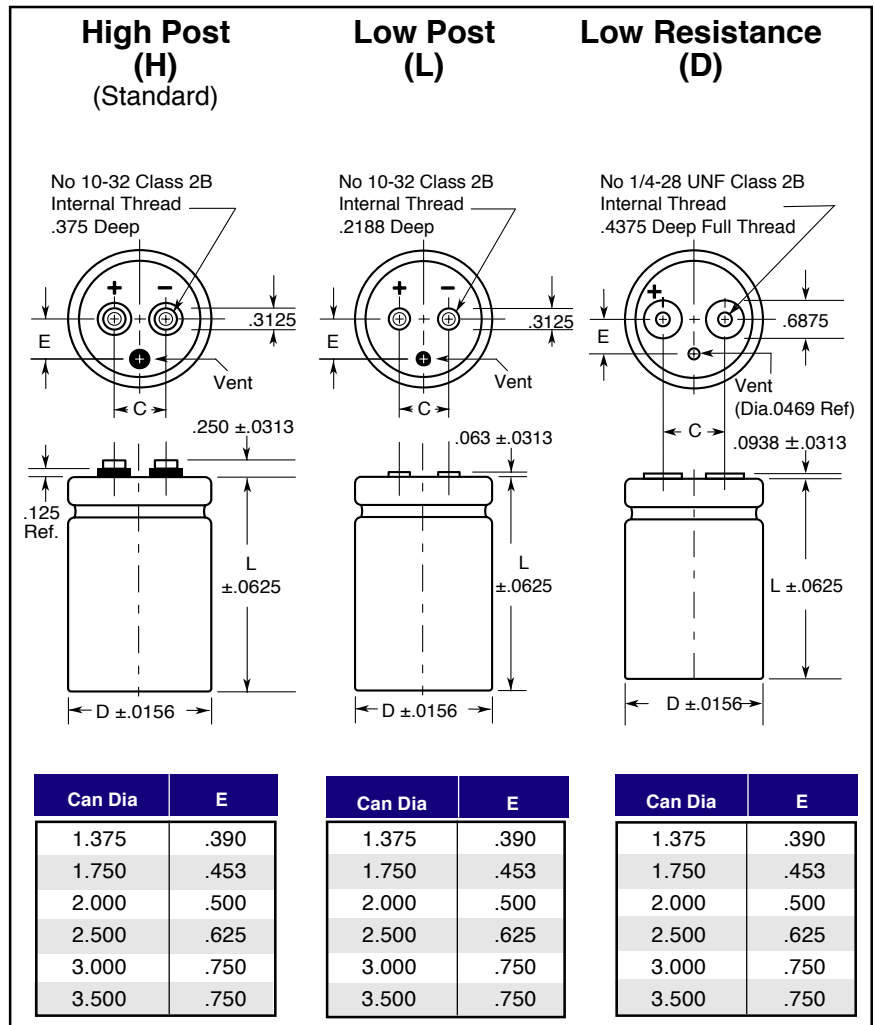


STUDED CAN
CROSS SECTION DETAIL

Type HES Dimensions and Size Charts

Case Code Chart

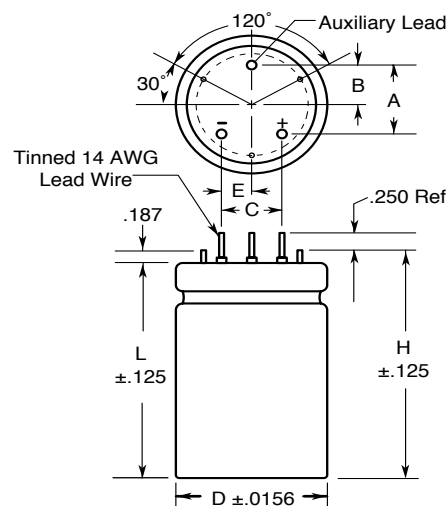
Case Code	Uninsulated Can						Mounting Bracket
	Inches		mm		Inches	mm	
	D	L	D	L	C	C	
R2C	1.375	2.125	35	54	.500	12.7	VR3
R2L	1.375	2.625	35	67	.500	12.7	VR3
R3C	1.375	3.125	35	79.4	.500	12.7	VR3
R3L	1.375	3.625	35	92	.500	12.7	VR3
R4C	1.375	4.125	35	105	.500	12.7	VR3
R4L	1.375	4.625	35	117.5	.500	12.7	VR3
R5C	1.375	5.125	35	130	.500	12.7	VR3
R5L	1.375	5.625	35	143	.500	12.7	VR3
U2C	1.750	2.125	44.5	54	.750	19	VR6
U2L	1.750	2.625	44.5	67	.750	19	VR6
U3C	1.750	3.125	44.5	79.4	.750	19	VR6
U3L	1.750	3.625	44.5	92	.750	19	VR6
U4C	1.750	4.125	44.5	105	.750	19	VR6
U4L	1.750	4.625	44.5	117.5	.750	19	VR6
U5C	1.750	5.125	44.5	130	.750	19	VR6
U5L	1.750	5.625	44.5	143	.750	19	VR6
V2C	2.000	2.125	50.8	54	.875	22.2	VR8
V2L	2.000	2.625	50.8	67	.875	22.2	VR8
V3C	2.000	3.125	50.8	79.4	.875	22.2	VR8
V3L	2.000	3.625	50.8	92	.875	22.2	VR8
V4C	2.000	4.125	50.8	105	.875	22.2	VR8
V4L	2.000	4.625	50.8	117.5	.875	22.2	VR8
V5C	2.000	5.125	50.8	130	.875	22.2	VR8
V5L	2.000	5.625	50.8	143	.875	22.2	VR8
W3C	2.500	3.125	63.5	79.4	1.125	28.6	VR10
W3L	2.500	3.625	63.5	92	1.125	28.6	VR10
W4C	2.500	4.125	63.5	105	1.125	28.6	VR10
W4L	2.500	4.625	63.5	117.5	1.125	28.6	VR10
W5C	2.500	5.125	63.5	130	1.125	28.6	VR10
W5L	2.500	5.625	63.5	143	1.125	28.6	VR10
X3L	3.000	3.625	76.2	92	1.250	31.7	VR12
X4C	3.000	4.125	76.2	105	1.250	31.7	VR12
X4L	3.000	4.625	76.2	117.5	1.250	31.7	VR12
X5C	3.000	5.125	76.2	130	1.250	31.7	VR12
X5L	3.000	5.625	76.2	143	1.250	31.7	VR12
X5R	3.000	5.875	76.2	149	1.250	31.7	VR12
X6L	3.000	6.625	76.2	168	1.250	31.7	VR12
X7L	3.000	7.625	76.2	194	1.250	31.7	VR12
X8L	3.000	8.625	76.2	219	1.250	31.7	VR12
Y3L	3.500	3.625	88.9	92	1.25	31.7	N/A
Y4C	3.500	4.125	88.9	105	1.25	31.7	N/A
Y4L	3.500	4.625	88.9	117.5	1.25	31.7	N/A
Y5C	3.500	5.125	88.9	130	1.25	31.7	N/A
Y5L	3.500	5.625	88.9	143	1.25	31.7	N/A
Y5R	3.500	5.875	88.9	149	1.25	31.7	N/A
Y6L	3.500	6.625	88.9	168	1.25	31.7	N/A
Y7L	3.500	7.625	88.9	194	1.25	31.7	N/A
Y8L	3.500	8.625	88.9	219	1.25	31.7	N/A



Add .015 inches to diameter and .045 inches to length for PVC insulating sleeve.

PC Mounting Board Dimensions

Case Code	Uninsulated Can						
	Inches						
	D	L	H	A	B	C	E
R1N	1.375	1.750	1.937	.550	.375	.500	.250
R2C	1.375	2.125	2.312	.550	.375	.500	.250
R2L	1.375	2.625	2.812	.550	.375	.500	.250
R3C	1.375	3.125	3.312	.550	.375	.500	.250
R3L	1.375	3.625	3.812	.550	.375	.500	.250
R4C	1.375	4.125	4.312	.550	.375	.500	.250
R4L	1.375	4.625	4.812	.550	.375	.500	.250
R5C	1.375	5.125	5.312	.550	.375	.500	.250
R5L	1.375	5.625	5.812	.550	.375	.500	.250
V2C	2.000	2.125	2.312	1.000	.575	.800	.400
V2L	2.000	2.625	2.812	1.000	.575	.800	.400
V3C	2.000	3.125	3.312	1.000	.575	.800	.400
V3L	2.000	3.625	3.812	1.000	.575	.800	.400
V4C	2.000	4.125	4.312	1.000	.575	.800	.400
V4L	2.000	4.625	4.812	1.000	.575	.800	.400
V5C	2.000	5.125	5.312	1.000	.575	.800	.400
V5L	2.000	5.625	5.812	1.000	.575	.800	.400



Selector Guide & Performance Specifications

Computer Grade Capacitors



Type	Temperature Range	VDC Range	Life Test Hours @°C	High Cap	Low ESR	Low Hi-Freq. Imped.	High Ripple	Long Life	Low Cost	Comment
CGS / CGH	-40°C to +85°C	10 to 500	1000 +85	Good	Good	Good	Good		Best	Max Cap, Best Value Standard Life & Ripple
CG	-40°C to +85°C	10 to 450	2000 +85	Best		Good	Good		Good	Max Cap, Long Life Max Ripple, Low ESR
HES	-40°C to +105°C	350 to 400	1000 +105	Good	Good	Good	Good	Good	Good	Motor Control, Ultra High Ripple High Voltage
CGR	-40°C to +105°C	7.5 to 200	2000 +105	Good	Good	Good	Good	Good	Good	Wide Temperature Range, MIL-C-39018/04, 06, 10 equivalent
CGO	-40°C to +85°C	5 to 55	1000 +85		Best				Good	Lowest ESR

Storage: From -55°C to maximum operating temperature up to 200,000 feet above sea level.

Test Conditions

Surge Test: Connect capacitor in series with resistor as follows:

- C = 0 - 2500 μ F R = 1000 Ω
- C = 2500 - 25k μ F R = 500 Ω
- C = \geq 25,001 μ F R = 100 Ω

Subject the series combination to rated surge voltage. For capacitors rated at +85°C, apply surge voltage for 30 seconds. Allow capacitor to discharge through resistor. Apply voltage again after 9.5 minutes. Repeat 10 minute cycle for 24 hours. For capacitors rated at +105°C, apply voltage for 30 seconds and off for 5.5 minutes for 1,000 cycles. Following surge test, allow capacitors to cool to room temperature and measure DCL. DCL is not to increase from initial requirement and no electrolyte shall have leaked.

Load Life Test: Use a circulating air oven set to capacitor(s) maximum operating temperature. Separate capacitors to maintain temperature -0°C +3°C. Apply rated VDC for rated life \pm 12 hours using regulated power supply free from turn-on / turn-off voltage transients. At end of test, return capacitors to room temperature for 24 hours (minimum).

DCL is not to exceed initial requirement.
Capacitance must not be less than 85% of initial measured value.
ESR must not be greater than:

Type	% of Initial Requirement
CGS / CGH	175
CG / HES	175
CGR	100
CGO	175

Full Ripple Life Test: Use a circulating air oven as in Load Life Test. Apply DC voltage with rated ripple current from AC source and reduce DC voltage unit sum of DC voltage and peak AC voltage equals capacitor's rated voltage. At end of life test return capacitors to room temperature for 24 hours (minimum). Capacitance, ESR and DCL must meet Load Life Test requirements.

Shelf Life Test: Use a circulating air oven as above for rated shelf life \pm 6 hours. Allow capacitors to cool to room temperature and stabilize for a minimum of 16 hours. Capacitance, ESR and DCL will meet initial requirements.

Vibration: Clamp capacitor to a vibrating platform and subject it to a simple harmonic motion with a maximum peak-to-peak amplitude of 0.06" and maximum acceleration of 10g. Vary the frequency linearly between 10 and 55Hz. Entire range of 10-55Hz must be traversed in one minute. Vibrate capacitor for 1-1/2 hours with the direction of motion being parallel to the axis of the capacitor. Then move the capacitor so the direction of motion is perpendicular to the axis of the capacitor and continue the vibration for an additional 1-1/2 hours. During the last 30 minutes of the test connect the capacitor to a bridge and observe for 3 minutes. There will be no evidence of loosening of the capacitor element within the case when shaken by hand following the test. No indication of intermittent contact, open or shorting is allowed during the 3 minute observation period.

Container Seal: Following the vibration test, each capacitor for seal tightness as follows:

Subject the capacitors to two successive temperature cycles in circulating air. One temperature cycle is:

- A. 85°C for 30 minutes
- B. 25°C for 30 minutes
- C. -40°C for 30 minutes
- D. 25°C for 30 minutes

Following the second cycle, immerse the capacitor in 90-95°C water for five minutes. A failure is a continuous chain of bubbles when immersed.

Vent Test: Apply reverse DC voltage to a capacitor at 15-25 Amperes. If the capacitor is open or shorts and the vent has not operated, test additional capacitors. The vent must operate and there must be no explosion.

Shelf Life: Capacitors stored more than 5 years should be checked for DCL to see if they meet requirements. Apply rated VDC for 30 minutes through a 1000 Ω resistor to bring DCL within limits.

Voltage Reversal: Capacitors will withstand a maximum 1.5 VDC reverse bias.

Mounting: The preferred mounting for large computer grade capacitors is in the vertical position with the pressure relief vent up or horizontal with the pressure relief valve up. Be sure to allow 1/2 inch (minimum) clearance to permit the vent to operate.

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Capacitance (μ F)	Max ESR (Ohms) @120Hz	Max Ripple Amps RMS @120Hz +85°C	Diameter	Length	Part Description
350 WVDC; 400 VDC Surge					
600	0.173	2.6	2.000	2.125	HES601G350V2C
900	0.110	4.6	2.000	5.125	HES901G350V5C
1100	0.099	4.0	2.000	3.125	HES112G350V3C
1400	0.080	6.2	2.500	5.125	HES142G350W5C
1600	0.062	5.6	2.000	4.125	HES162G350V4C
1900	0.053	6.4	2.000	4.625	HES192G350V4L
2500	0.045	7.4	2.500	4.125	HES252G350W4C
3100	0.040	8.6	3.000	3.625	HES312G350X3L
3400	0.034	9.4	2.500	5.125	HES342G350W5C
3700	0.034	9.8	3.000	4.125	HES372G350X4C
4400	0.029	11.0	3.000	4.625	HES442G350X4L
5000	0.026	12.1	3.000	5.125	HES502G350X5C
5600	0.024	13.2	3.000	5.625	HES562G350X5L

400 WVDC; 450 VDC Surge					
300	0.275	2.2	1.750	3.125	HES301G400U3C
500	0.180	2.6	2.000	2.125	HES501G400V2C
1300	0.066	5.4	2.000	4.125	HES132G400V4C
2000	0.044	7.3	2.000	5.625	HES202G400V5L
2000	0.048	7.3	2.500	4.125	HES202G400W4C
2100	0.045	9.5	3.000	5.625	HES212G400X5L
3000	0.033	9.9	2.500	5.625	HES302G400W5L
3500	0.031	10.7	3.000	4.625	HES352G400X4L
4100	0.027	11.9	3.000	5.125	HES412G400X5C
4600	0.025	13.0	3.000	5.625	HES462G400X5L

Capacitance (μ F)	Max ESR (Ohms) @120Hz	Max Ripple Amps RMS @120Hz +85°C	Diameter	Length	Part Description
450 WVDC; 525 VDC Surge					
300	0.268	2.4	2.000	3.125	HES301G450V3C
400	0.203	2.9	2.000	3.625	HES401G450V3L
550	0.150	3.6	2.000	4.125	HES551G450V4C
700	0.125	3.5	2.000	3.125	HES701G450V3C
1200	0.069	7.1	3.000	4.625	HES122G450X4L
1500	0.056	8.5	3.000	5.625	HES152G450X5L
1600	0.053	6.9	2.000	5.625	HES162G450V5L
1700	0.051	7.1	2.500	4.125	HES172G450W4C
2000	0.041	9.7	3.000	5.625	HES202G450X5L
2200	0.040	10.1	3.000	5.625	HES222G450X5L
2400	0.038	9.0	2.500	5.125	HES242G450W5C
2700	0.034	9.9	2.500	5.625	HES272G450W5L
3600	0.028	11.7	3.000	5.125	HES362G450X5C
4000	0.025	12.7	3.000	5.625	HES402G450X5L