Test

Shelf Test

Capacitors shall be subjected to the maximum operating temperature ±1°C for 96±4 hours.
No voltage shall be applied and the electrical parameters must be within the specified range (see IEC 68-2-2 and subq.)

Surge Voltage Test

The capacitor shall be subjected to 1000 cycles each consisting of 30s charge, followed by a no load period of 330s at surge voltage, as defined in detail specification. Test temperature is room temperature for general use capacitors and upper category temperature for long life capacitors. A series resistor must be connected to the capacitor with a value of:

- 1000Ω for C<3300μF
- $2,5 \bullet 10^6 / C$ Ω for C>3300μF

After test, a recovery period of 2hrs is required before taking any measurement. The requirements are:

- no electrolyte leakage,
- leakage current lower than stated limit
- tangent of the loss angle lower than stated limit
- ΔC/C=<15% (CECC 30300-4.14)

Vibration Test

Screw Terminals

Capacitors, mounted with a proper ring clip (or with the mounting stud) shall be subjected to a vibration test in accordance with IEC 411.
All parameters, measured after each cycle, must be within the limits and the leakage current must be lower than the maximum limits.

Solder pins

Capacitors, mounted on to a printed wiring board shall be subjected to a vibration test in accordance with IEC60684-2-6/test F_c.
All parameters, measured after each cycle, must be within the limits and the leakage current must be lower than the maximum limits

Sealing Test

The capacitors shall be tested for seal tightness in accordance with IEC 68-2-17.

Low Pressure

In accordance with IEC 60384-4 subclause 4.11.4 capacitors can operate at a minimum pressure of 8.5 kPa for short period.

Important:

- Continous operation at extreme altitude can impair useful life.
- The capability to withstand to low pressure is for unit mounted in accordance with related specification.

Life Test

Life Test Procedures

The following notes are intended as a clarification of tests employed at ITELCOND Quality Control Laboratory to ascertain the quality of the finished products along the years. The life test duration for each series is in accordance with IEC 60384-4 requirements.

LONG LIFE SERIES = 2000 hours at maximum category temperature

GENERAL USE = 1000 hours at maximum category temperature

In addition, ITELCOND quality program provides that life tests are performed for a minimum number of hours, usually higher than required by IEC, in accordance with Table 11.

Series	Working Voltage	Temperature	Hours of test	Series	Working Voltage	Temperature	Hours of test
AR	<150	85°	2000	AKS	All voltages	85°	2000
AR	>150	85°	2000	AZK	All voltages	105°	2000
AS	<150	85°	10000	ATK	All voltages	105°	2000
AS/AP	>150	85°	5000	ACC	All voltages	85°	2000
AF	>150	85°	5000	AZC	All voltages	105°	2000
AY	All voltages	85°	2000	ATC	All voltages	105°	2000
AZ	All voltages	105°	2000	ARC	All voltages	85°	2000
AT	All voltages	105°	5000				

Table 11

From the data obtained performing these life tests ITELCOND Quality Control had the possibility to draw the tables shown for each series. The "EXPECTED LIFE TABLES" are calculated with the same "electrical parameters changes" used for life test procedure and shown here below.

Electrical Parameters Change

The electrical parameters variations during life test are strictly connected with the quality of finished units and must be within maximum limits given in Table 12

Working Voltage	Capacitance Change	Tanδ/ESR Change	ILeakage Change
Screw inserts			
2000 hrs			
<150V	±15%	1,3 • data book limit	Less than initial specified limit
≥150V	±10 %	1.3 • data book limit	Less than initial specified limit
5000 hrs			
<150Vdc	±15 %	1.3 • data book limit	Less than initial specified limit
≥150Vdc	±15 %	1.3 • data book limit	Less than initial specified limit
10000 hrs			
< 150 Vdc	•15 %	1.5 • data book limit	Less than initial specified limit
Solder Pins			
All voltages	±10 %	2.0 • data book limit	Less than initial specified limit

Table 12

The above electrical parameter changes are considered as final limits when the expected life curves are drawn. From the data obtained performing these life tests ITELCOND Quality Control had drawn the tablesnamed "Expected Life Tables and shown for each series. The "Expected Life Tables" are calculated with the same "electrical parameters changes" used for life test procedure and here indicated.

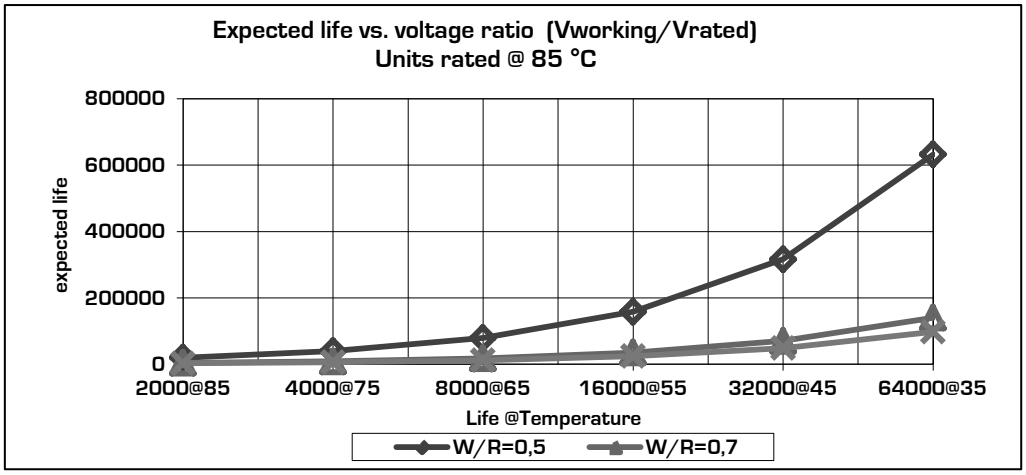
The expected life values that appear on standard graphs must be multiplied by 2.0 for all series if the parameter's change is in Table 13.

Quantity	Working Voltage<150V	Working Voltage≥150V
Capacitance	±15%	±10%
ESR	≤3 • data book limit	≤3 • data book limit
DC	≤Data book limit	≤Data book limit
Total failure in percent	≤1%	≤3%

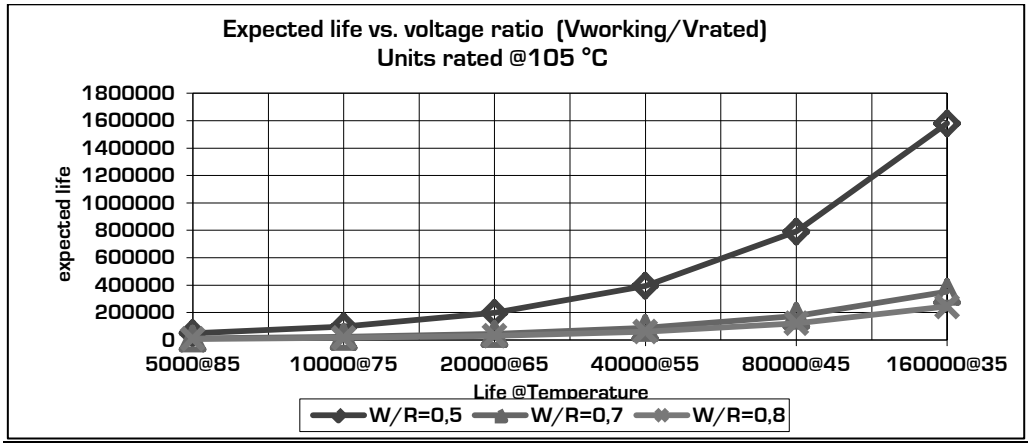
Table 13

Operational Life Time and Voltage Derating

Operating life time depends on the capacitor general working conditions; if the capacitor is subjected to a temperature or to a voltage lower than rated (see par.1.8) there is a consistent increase in life. Assuming that life is doubled at every temperature decrease of 10°C, when the applied voltage is lower than the rated one the expected life increase is shown on Graph 1 and Graph 2.



Graph 1



Graph 2

Useful Life Calculation

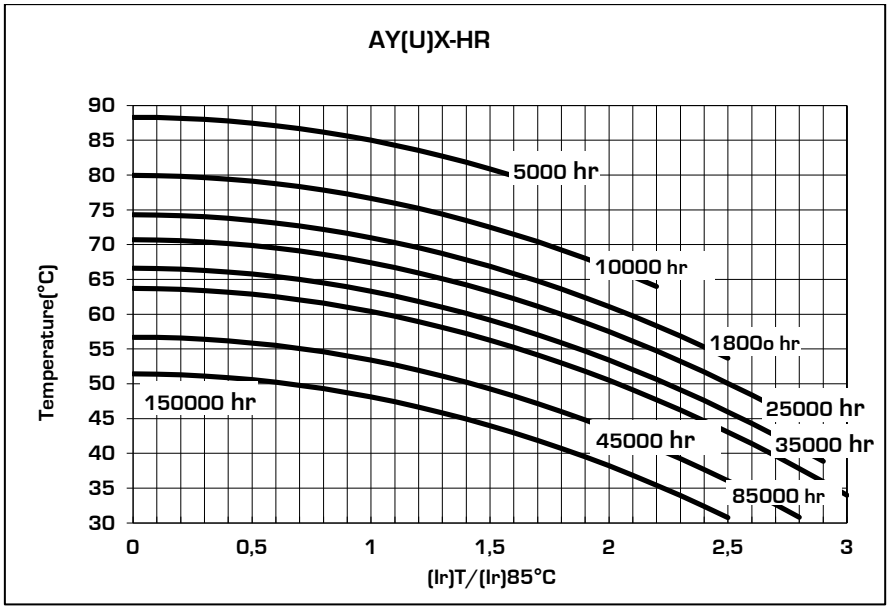
The useful life of a capacitor is calculated in accordance with the tables of expected life per each series.

The rated ripple current at upper category is listed in the data sheets, while the ripple current at different temperature can be calculated using the tables shown on each series.

To know the useful life proceed as follows :

- calculate the ratio $[I_R]/[I_{85°C}]$ or $[I_R]/[I_{105°C}]$
- find on to the table the crossing between the working temperature an the calculated ratio
- on top of the table it appears the useful life in hour

The example does not consider the frequency dependence of ripple current : the corresponding factor listed on each type must be used as an additional factor.



Example 1:

- **Capacitor AY(U)X-HR472M350DF1**
- **Working conditions: I_{Ripple}=25A@100Hz**
- **Ambient temperature =70°C**

VN=350V

Capacitance	Case	Tanδ	ESRmax/typ		Zmax	Iripple55°C/85°C		Ordering Code
[µF]@100Hz		[%]@100Hz	[mΩ]@100Hz		[mΩ]@10KHz	[A]@100Hz	[A]@100Hz	(U) for mountig stud
4700	DF	0,08	27	20	17	23,9	17,1	AY(U)X-HR472M350DF1

1. $I_{Ripple} / I_{Ripple@85°C} = 25 / 17,1 = 1,46$
   a. **Crossing 1,46 and T=70°C expected life is about 10000 hours**

Example 2:

- **Capacitor AY(U)X-HR472M350DF1**
- **Working conditions: IRipple=25A@500Hz**
- **Ambient temperature =70°C**

VN=350V

Capacitance	Case	Tanδ	ESRmax/typ		Zmax	Iripple55°C/85°C		Ordering Code
[µF]@100Hz		[%]@100Hz	[mΩ]@100Hz		[mΩ]@10KHz	[A]@100Hz	[A]@100Hz	(U) for mountig stud
4700	DF	0,08	27	20	17	23,9	17,1	AY(U)X-HR472M350DF1

1. $I_{Ripple} = 25 / 1,32 = 18,9$

2. $I_{Ripple} / I_{Ripple@85°C} = 18,9 / 17,1 = 1,10$

   a. Crossing 1,10 and T = 70 °C expected life is about 14000 hours

Example 3:

- Capacitor AY(U)X-HR472M350DF1
- Working conditions: IRipple=25A@500Hz
- Ambient temperature =60°C

VN=350V

Capacitance	Case	Tanδ	ESRmax/typ		Zmax	Iripple55°C/85°C		Ordering Code
[µF]@100Hz		[%]@100Hz	[mΩ]@100Hz		[mΩ]@10KHz	[A]@100Hz	[A]@100Hz	(U) for mountig stud
4700	DF	0,08	27	20	17	23,9	17,1	AY(U)X-HR472M350DF1

3. $I_{Ripple} = 25 / 1,32 = 18,9$

4. $I_{Ripple} / I_{Ripple@85°C} = 18,9 / 17,1 = 1,10$

   a. Crossing 1,10 and T =60 °C expected life is about 36000 hours

Capacitor Connection

The aluminium electrolytic capacitors can be connected in parallel : the connection must e as such that the current flows equally through each unit

The aluminium electrolytic capacitors can be connected in series: use balancing resistors to control the voltage distribution across each unit.

For more detailed information contact our engineering service

Insulation Strenght

-Insulation resistance @100V, 60". between terminals and mounting hardware =100 MΩ.

-Dielectric strength of the sleeve =2500VDC.

Self recharging (Dielectric Absorption)

It is important to take note that Aluminium Electrolytic Capacitors undergo to the phenomenon of self recharging .

Generally speaking it is impossible to give a precise rule to predict which voltage an unit, even when completely charged and discharged, can reach if left open circuit.

Itelcond has observed a maximum of 30 volt across the terminals but sometimes the value could be higher and not predictable.

It is therefore suggested to discharge the units before touching or connect ing the terminals.