

HWS1500

RELIABILITY DATA

信頼性データ

INDEX

	PAGE
1. MTBF計算値 Calculated values of MTBF	R - 1
2. 部品ディレーティング Component derating	R - 3
3. 主要部品温度上昇値 Main components temperature rise ΔT list	R - 8
4. 電解コンデンサ推定寿命計算値 Electrolytic capacitor lifetime	R - 10
5. アブノーマル試験 Abnormal test	R - 14
6. 振動試験 Vibration test	R - 18
7. ノイズシミュレート試験 Noise simulate test	R - 19
8. 熱衝撃試験 Thermal shock test	R - 20
9. FAN期待寿命 Fan life expectancy	R - 21

使用記号 Terminology used

FG フレームグラウンド Frame GND

※ 信頼性試験は、代表データであり、全ての製品は、ほぼ同等な特性を示します。
従いましてこの値は実力値とお考え願います。

The above data is typical value. As all units have nearly the same characteristics, the data to be considered as ability value.

1. MTBF計算値 Calculated values of MTBF

(1) 部品ストレス解析法MTBF Parts stress reliability projection MTBF

MODEL : HWS1500-24

算出方法 Calculating Method

Telcordiaの部品ストレス解析法(*1)で算出されています。

故障率 λ_{ssi} は、それぞれの部品ごとに電気ストレスと動作温度によって決定されます。

Calculated based on parts stress reliability projection of Telcordia (*1).

Individual failure rate λ_{ssi} is calculated by the electric stress and temperature rise of the each part.

*1: Telcordia document “Reliability Prediction Procedure for Electronic Equipment”
(Document number SR-332, Issue3)

<算出式>

$$MTBF = \frac{1}{\lambda_{equip}} = \frac{1}{\pi_E \sum_{i=1}^m (N_i \cdot \lambda_{ssi})} \times 10^9 \text{ 時間 (Hours)}$$

$$\lambda_{ssi} = \lambda_{Gi} \cdot \pi_{Qi} \cdot \pi_{Si} \cdot \pi_{Ti}$$

λ_{equip} : 全機器故障率 (FITs) Total equipment failure rate (FITs = Failures in 10^9 hours)

λ_{Gi} : i 番目の部品に対する基礎故障率 Generic failure rate for the ith part

π_{Qi} : i 番目の部品に対する品質ファクタ Quality factor for the ith part

π_{Si} : i 番目の部品に対するストレスファクタ Stress factor for the ith part

π_{Ti} : i 番目の部品に対する温度ファクタ Temperature factor for the ith part

m : 異なる部品の数 Number of different part types

N_i : i 番目の部品の個数 Quantity of ith part type

π_E : 機器の環境ファクタ Equipment environmental factor

MTBF値 MTBF Values

条件 Conditions

・入力電圧 : 230VAC Input voltage	・出力電圧、電流 : 24VDC, 70A (100%) Output voltage & current
・環境ファクタ : GB (Ground, Benign) Environmental factor	・取付方法 : 標準取付 A Mounting method : Standard mounting A

SR-332, Issue3

MTBF(Ta=25°C) ≒ 1,152,309 時間 (Hours)

MTBF(Ta=40°C) ≒ 615,968 時間 (Hours)

(2) 部品点数法MTBF Part count reliability projection MTBF

MODEL : HWS1500-24

算出方法 Calculating Method

JEITA (RCR-9102 , RCR-9102A) の部品点数法で算出されています。
 それぞれの部品ごとに、部品故障率 λ_G が与えられ、各々の点数によって決定されます。
 Calculated based on part count reliability projection of JEITA (RCR-9102 , RCR-9102A).
 Individual failure rates λ_G is given to each part and MTBF is calculated by the count of each part.

<算出式>

$$MTBF = \frac{1}{\lambda_{equip}} = \frac{1}{\sum_{i=1}^n N_i (\lambda_G \pi_Q)_i} \times 10^6 \text{ 時間 (hours)}$$

λ_{equip} : 全機器故障率 (故障数/10⁶時間)
 Total equipment failure rate (Failure/10⁶hours)

λ_G : i 番目の同属部品に対する故障率 (故障数/10⁶時間)
 Generic failure rate for the i th generic part (Failure/10⁶hours)

N_i : i 番目の同属部品の個数
 Quantity of i th generic part

n : 異なった同属部品のカテゴリーの数
 Number of different generic part categories

π_Q : i 番目の同属部品に対する品質ファクタ ($\pi_Q=1$)
 Generic quality factor for the i th generic part ($\pi_Q=1$)

MTBF値 MTBF Values

G_F : 地上固定 (Ground, Fixed)

RCR-9102

$\frac{MTBF}{\text{時間 (hours)}} \doteq 87,292$
 (但し、MTBFにファンは含まれておりません。)
 However MTBF Calculation for FAN isn't included.

RCR-9102A

$\frac{MTBF}{\text{時間 (hours)}} \doteq 43,751$
 (但し、MTBFにファンは含まれておりません。)
 However MTBF Calculation for FAN isn't included.

2. 部品ディレーティング Component derating

MODEL : HWS1500-24

(1) 算出方法 Calculating method

(a) 測定条件 Conditions

・入力 Input	: 100VAC 200VAC	・周囲温度 Ambient temperature	: 50°C
・出力 Output	: 100VAC 24V 65A(100%) 200VAC 24V 70A(100%)	・取付方法 Mounting method	: 標準取付 (A) Standard mounting (A)

(b) 半導体 Semiconductors

ケース温度、消費電力、熱抵抗より使用状態の接合点温度を求め最大定格、接合点温度との比較を求めました。

Compared with maximum junction temperature and actual one which is calculated based on case temperature, power dissipation and thermal impedance.

(c) IC、抵抗、コンデンサー等 IC, Resistors, Capacitors, etc.

周囲温度、使用状態、消費電力など、個々の値は設計基準内に入っています。

Ambient temperature, operating condition, power dissipation and so on are within derating criteria.

(d) 熱抵抗算出方法 Calculating method of thermal impedance

$$\theta_{j-c} = \frac{T_{j(\max)} - T_c}{P_{c(\max)}} \quad \theta_{j-a} = \frac{T_{j(\max)} - T_a}{P_{c(\max)}} \quad \theta_{j-l} = \frac{T_{j(\max)} - T_l}{P_{c(\max)}}$$

T_c : ディレーティングの始まるケース温度 一般に25°C
Case temperature at start point of derating ; 25°C in general

T_a : ディレーティングの始まる周囲温度 一般に25°C
Ambient temperature at start point of derating ; 25°C in general

T_l : ディレーティングの始まるリード温度 一般に25°C
Lead temperature at start point of derating ; 25°C in general

$P_{c(\max)}$
($P_{ch(\max)}$) : 最大コレクタ(チャネル)損失
Maximum collector(channel) dissipation

$T_{j(\max)}$
($T_{ch(\max)}$) : 最大接合点温度
Maximum junction(channel) temperature

θ_{j-c}
(θ_{ch-c}) : 接合点からケースまでの熱抵抗
Thermal impedance between junction(channel) and case

θ_{j-a} : 接合点から周囲までの熱抵抗
Thermal impedance between junction and air

θ_{j-l} : 接合点からリードまでの熱抵抗
Thermal impedance between junction and lead

(2) 部品ディレーティング表 Component derating list

部品番号 Location No.	Vin = 100VAC	Load = 100%	Ta = 50°C
Q1-Q4 SPP20N60C3 INFINEON	Tchmax = 150 °C, Pch = 9.63 W, Tch = Tc + ((θ ch - c) × Pch) = 98.2 °C D.F. = 65.5 %	θ ch-c = 0.6 °C/W, Δ Tc = 42.4 °C,	Pch(max) = 208 W Tc = 92.4 °C
Q106 2SA1213-Y TOSHIBA	Tjmax = 150 °C, Pc = 34.0 mW, Tj = Ta + ((θ j - a) × Pc) = 92.7 °C D.F. = 61.8 %	θ j-a = 250 °C/W, Δ Ta = 34.2 °C,	Pc(max) = 500 mW Ta = 84.2 °C
Q201-Q204 SPP20N60C3 INFINEON	Tchmax = 150 °C, Pch = 8.64 W, Tch = Tc + ((θ ch - c) × Pch) = 89.3 °C D.F. = 59.5 %	θ ch-c = 0.6 °C/W, Δ Tc = 34.1 °C,	Pch(max) = 208 W Tc = 84.1 °C
Q301,Q302 2SA1213-Y TOSHIBA	Tjmax = 150 °C, Pc = 59.3 mW, Tj = Ta + ((θ j - a) × Pc) = 96.6 °C D.F. = 64.4 %	θ j-a = 250 °C/W, Δ Ta = 31.8 °C,	Pc(max) = 500 mW Ta = 81.8 °C
Q303,Q304 2SA1213-Y TOSHIBA	Tjmax = 150 °C, Pc = 7.2 mW, Tj = Ta + ((θ j - a) × Pc) = 76.4 °C D.F. = 50.9 %	θ j-a = 250 °C/W, Δ Ta = 24.6 °C,	Pc(max) = 500 mW Ta = 74.6 °C
Q305,Q306 2SA1213-Y TOSHIBA	Tjmax = 150 °C, Pc = 59.3 mW, Tj = Ta + ((θ j - a) × Pc) = 98.2 °C D.F. = 65.5 %	θ j-a = 250 °C/W, Δ Ta = 33.4 °C,	Pc(max) = 500 mW Ta = 83.4 °C
Q307,Q308 2SK2992 TOSHIBA	Tchmax = 150 °C Pch = 100 mW, Tch = Ta + ((θ ch - a) × Pch) = 100.6 °C D.F. = 67.1 %	θ ch-a = 250 °C/W, Δ Ta = 25.6 °C,	Pch(max) = 500 mW Ta = 75.6 °C
Q701 2SK2865 TOSHIBA	Tchmax = 150 °C, Pch = 0.69 W Tch = Tc + ((θ ch - c) × Pch) = 86.5 °C D.F. = 57.7 %	θ ch-c = 6.25 °C/W Δ Tc = 32.2 °C,	Pch(max) = 20 W Tc = 82.2 °C
Q908 2SA1213-Y TOSHIBA	Tjmax = 150 °C, Pc = 151 mW, Tj = Ta + ((θ j - a) × Pc) = 98.2 °C D.F. = 65.5 %	θ j-a = 250 °C/W, Δ Ta = 10.4 °C,	Pc(max) = 500 mW Ta = 60.4 °C
D1,D2 RBV-2506 SANKEN	Tjmax = 150 °C, Pd = 16.1 W, Tj = Tc + ((θ j - c) × Pd) = 116.2 °C D.F. = 77.5 %	θ j-c = 1.5 °C/W, Δ Tc = 42.0 °C,	Tc = 92.0 °C
D3,D4 SDT12S60 INFINEON	Tjmax = 175 °C, Pd = 5.27 W, Tj = Tc + ((θ j - c) × Pd) = 80.2 °C D.F. = 45.8 %	θ j-c = 1.7 °C/W, Δ Tc = 21.2 °C	Tc = 71.2 °C
D312 D1FL20U SHINDENGEN	Tjmax = 150 °C, Pd = 17.0 mW, Tj = Tl + ((θ j - l) × Pd) = 69.8 °C D.F. = 46.5 %	θ j-l = 23 °C/W, Δ Tl = 19.4 °C	Tl = 69.4 °C

部品番号 Location No.	$V_{in} = 100VAC$	Load = 100%	$T_a = 50^{\circ}C$
D401-D412 ESAD92-02 FUJI ELEC.	$T_{jmax} = 150^{\circ}C,$ $P_d = 4.38 W,$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 89.8^{\circ}C$ D.F. = 59.9 %	$\theta_{j-c} = 1.5^{\circ}C/W,$ $\Delta T_c = 33.2^{\circ}C,$	$T_c = 83.2^{\circ}C$
D701 D1FL20U SHINDENGEN	$T_{jmax} = 150^{\circ}C,$ $P_d = 93.0 mW,$ $T_j = T_l + ((\theta_{j-l}) \times P_d) = 76.0^{\circ}C$ D.F. = 50.7 %	$\theta_{j-l} = 23^{\circ}C/W,$ $\Delta T_l = 23.9^{\circ}C,$	$T_l = 73.9^{\circ}C$
D706 U05NU44 TOSHIBA	$T_{jmax} = 150^{\circ}C,$ $P_d = 50.0 mW,$ $T_j = T_l + ((\theta_{j-l}) \times P_d) = 80.2^{\circ}C$ D.F. = 53.5 %	$\theta_{j-l} = 100^{\circ}C/W,$ $\Delta T_l = 25.2^{\circ}C,$	$T_l = 75.2^{\circ}C$
D900 D1FL20U SHINDENGEN	$T_{jmax} = 150^{\circ}C,$ $P_d = 164.0 mW,$ $T_j = T_l + ((\theta_{j-l}) \times P_d) = 96.0^{\circ}C$ D.F. = 64.0 %	$\theta_{j-l} = 23^{\circ}C/W,$ $\Delta T_l = 42.2^{\circ}C,$	$T_l = 92.2^{\circ}C$
PC700 PS2561L1 (LED) NEC	$T_{jmax} = 125^{\circ}C,$ $P_d = 8.5 mW,$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 57.2^{\circ}C$ D.F. = 45.8 %	$\theta_{j-c} = 150^{\circ}C/W,$ $\Delta T_c = 5.9^{\circ}C,$	$P_d(max) = 150 mW$ $T_c = 55.9^{\circ}C$
PC700 PS2561L1 (TRANSISTOR) NEC	$T_{jmax} = 125^{\circ}C,$ $P_c = 2.6 mW,$ $T_j = T_c + ((\theta_{j-c}) \times P_c) = 56.3^{\circ}C$ D.F. = 45.0 %	$\theta_{j-c} = 150^{\circ}C/W,$ $\Delta T_c = 5.9^{\circ}C,$	$P_c(max) = 150 mW$ $T_c = 55.9^{\circ}C$
PC702 PS2561L1 (LED) NEC	$T_{jmax} = 125^{\circ}C,$ $P_d = 3.3 mW,$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 54.1^{\circ}C$ D.F. = 43.3 %	$\theta_{j-c} = 150^{\circ}C/W,$ $\Delta T_c = 3.6^{\circ}C,$	$P_d(max) = 150 mW$ $T_c = 53.6^{\circ}C$
PC702 PS2561L1 (TRANSISTOR) NEC	$T_{jmax} = 125^{\circ}C,$ $P_c = 1.5 mW,$ $T_j = T_c + ((\theta_{j-c}) \times P_c) = 53.8^{\circ}C$ D.F. = 43.0 %	$\theta_{j-c} = 150^{\circ}C/W,$ $\Delta T_c = 3.6^{\circ}C,$	$P_c(max) = 150 mW$ $T_c = 53.6^{\circ}C$
PC703 PS2561L1 (LED) NEC	$T_{jmax} = 125^{\circ}C,$ $P_d = 4.8 mW,$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 53.3^{\circ}C$ D.F. = 42.6 %	$\theta_{j-c} = 150^{\circ}C/W,$ $\Delta T_c = 2.6^{\circ}C,$	$P_d(max) = 150 mW$ $T_c = 52.6^{\circ}C$
PC703 PS2561L1 (TRANSISTOR) NEC	$T_{jmax} = 125^{\circ}C,$ $P_c = 0.4 mW,$ $T_j = T_c + ((\theta_{j-c}) \times P_c) = 52.7^{\circ}C$ D.F. = 42.2 %	$\theta_{j-c} = 150^{\circ}C/W,$ $\Delta T_c = 2.6^{\circ}C,$	$P_c(max) = 150 mW$ $T_c = 52.6^{\circ}C$
PD900 MPG4361F STANLEY	$I_f = 4.2 mA,$ Allowable $I_f(max) = 16.3 mA$ (at $T_a =$ D.F. = 25.8 %	$\Delta T_a = 1.3^{\circ}C,$	$T_a = 51.3^{\circ}C$

(3) 部品ディレーティング表 Component derating list

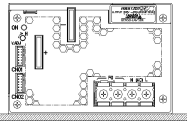
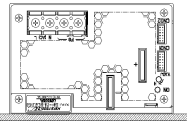
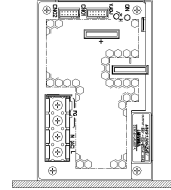
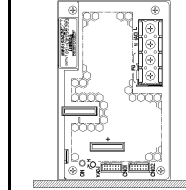
部品番号 Location No.	Vin = 200VAC	Load = 100%	Ta = 50°C
Q1-Q4 SPP20N60C3 INFINEON	Tchmax = 150 °C, Pch = 5.24 W, Tch = Tc + ((θ ch - c) × Pch) = 73.3 °C D.F. = 48.9 %	θ ch-c = 0.6 °C/W, Δ Tc = 20.2 °C,	Pch(max) = 208 W Tc = 70.2 °C
Q106 2SA1213-Y TOSHIBA	Tjmax = 150 °C, Pc = 34.0 mW, Tj = Ta + ((θ j - a) × Pc) = 94.3 °C D.F. = 62.9 %	θ j-a = 250 °C/W, Δ Ta = 35.8 °C,	Pc(max) = 500 mW Ta = 85.8 °C
Q201-Q204 SPP20N60C3 INFINEON	Tchmax = 150 °C, Pch = 9.85 W, Tch = Tc + ((θ ch - c) × Pch) = 94.0 °C D.F. = 62.7 %	θ ch-c = 0.6 °C/W, Δ Tc = 38.1 °C,	Pch(max) = 208 W Tc = 88.1 °C
Q301,Q302 2SA1213-Y TOSHIBA	Tjmax = 150 °C, Pc = 59.3 mW, Tj = Ta + ((θ j - a) × Pc) = 98.6 °C D.F. = 65.7 %	θ j-a = 250 °C/W, Δ Ta = 33.8 °C,	Pc(max) = 500 mW Ta = 83.8 °C
Q303,Q304 2SA1213-Y TOSHIBA	Tjmax = 150 °C, Pc = 7.2 mW, Tj = Ta + ((θ j - a) × Pc) = 78.3 °C D.F. = 52.2 %	θ j-a = 250 °C/W, Δ Ta = 26.5 °C,	Pc(max) = 500 mW Ta = 76.5 °C
Q305,Q306 2SA1213-Y TOSHIBA	Tjmax = 150 °C, Pc = 59.3 mW, Tj = Ta + ((θ j - a) × Pc) = 100.1 °C D.F. = 66.7 %	θ j-a = 250 °C/W, Δ Ta = 35.3 °C,	Pc(max) = 500 mW Ta = 85.3 °C
Q307,Q308 2SK2992 TOSHIBA	Tchmax = 150 °C Pch = 100 mW, Tch = Ta + ((θ ch - a) × Pch) = 102.4 °C D.F. = 68.3 %	θ ch-a = 250 °C/W, Δ Ta = 27.4 °C,	Pch(max) = 500 mW Ta = 77.4 °C
Q701 2SK2865 TOSHIBA	Tchmax = 150 °C, Pch = 0.69 W, Tch = Tc + ((θ ch - c) × Pch) = 85.7 °C D.F. = 57.1 %	θ ch-c = 6.25 °C/W Δ Tc = 31.4 °C,	Pch(max) = 20 W Tc = 81.4 °C
Q908 2SA1213-Y TOSHIBA	Tjmax = 150 °C, Pc = 151 mW, Tj = Ta + ((θ j - a) × Pc) = 97.6 °C D.F. = 65.1 %	θ j-a = 250 °C/W, Δ Ta = 9.8 °C,	Pc(max) = 500 mW Ta = 59.8 °C
D1,D2 RBV-2506 SANKEN	Tjmax = 150 °C, Pd = 6.4 W, Tj = Tc + ((θ j - c) × Pd) = 84.5 °C D.F. = 56.3 %	θ j-c = 1.5 °C/W, Δ Tc = 24.9 °C,	Tc = 74.9 °C
D3,D4 SDT12S60 INFINEON	Tjmax = 175 °C, Pd = 5.85 W, Tj = Tc + ((θ j - c) × Pd) = 78.7 °C D.F. = 45.0 %	θ j-c = 1.7 °C/W, Δ Tc = 18.8 °C	Tc = 68.8 °C
D312 D1FL20U SHINDENGEN	Tjmax = 150 °C, Pd = 17.0 mW, Tj = Tl + ((θ j - l) × Pd) = 71.0 °C D.F. = 47.3 %	θ j-l = 23 °C/W, Δ Tl = 20.6 °C	Tl = 70.6 °C

部品番号 Location No.	$V_{in} = 200VAC$	Load = 100%	$T_a = 50^{\circ}C$
D401-D412 ESAD92-02 FUJI ELEC.	$T_{jmax} = 150^{\circ}C$, $P_d = 4.71 W$, $T_j = T_c + ((\theta_{j-c}) \times P_d) = 92.1^{\circ}C$ D.F. = 61.4 %	$\theta_{j-c} = 1.5^{\circ}C/W$, $\Delta T_c = 35.0^{\circ}C$,	$T_c = 85.0^{\circ}C$
D701 D1FL20U SHINDENGEN	$T_{jmax} = 150^{\circ}C$, $P_d = 93.0 mW$, $T_j = T_l + ((\theta_{j-l}) \times P_d) = 76.0^{\circ}C$ D.F. = 50.7 %	$\theta_{j-l} = 23^{\circ}C/W$, $\Delta T_l = 23.9^{\circ}C$,	$T_l = 73.9^{\circ}C$
D706 U05NU44 TOSHIBA	$T_{jmax} = 150^{\circ}C$, $P_d = 50.0 mW$, $T_j = T_l + ((\theta_{j-l}) \times P_d) = 78.8^{\circ}C$ D.F. = 52.5 %	$\theta_{j-l} = 100^{\circ}C/W$, $\Delta T_l = 23.8^{\circ}C$,	$T_l = 73.8^{\circ}C$
D900 D1FL20U SHINDENGEN	$T_{jmax} = 150^{\circ}C$, $P_d = 164.0 mW$, $T_j = T_l + ((\theta_{j-l}) \times P_d) = 95.2^{\circ}C$ D.F. = 63.5 %	$\theta_{j-l} = 23^{\circ}C/W$, $\Delta T_l = 41.4^{\circ}C$,	$T_l = 91.4^{\circ}C$
PC700 PS2561L1 (LED) NEC	$T_{jmax} = 125^{\circ}C$, $P_d = 8.5 mW$, $T_j = T_c + ((\theta_{j-c}) \times P_d) = 56.4^{\circ}C$ D.F. = 45.1 %	$\theta_{j-c} = 150^{\circ}C/W$, $\Delta T_c = 5.1^{\circ}C$,	$P_d(max) = 150 mW$ $T_c = 55.1^{\circ}C$
PC700 PS2561L1 (TRANSISTOR) NEC	$T_{jmax} = 125^{\circ}C$, $P_c = 2.6 mW$, $T_j = T_c + ((\theta_{j-c}) \times P_c) = 55.5^{\circ}C$ D.F. = 44.4 %	$\theta_{j-c} = 150^{\circ}C/W$, $\Delta T_c = 5.1^{\circ}C$,	$P_c(max) = 150 mW$ $T_c = 55.1^{\circ}C$
PC702 PS2561L1 (LED) NEC	$T_{jmax} = 125^{\circ}C$, $P_d = 3.3 mW$, $T_j = T_c + ((\theta_{j-c}) \times P_d) = 53.4^{\circ}C$ D.F. = 42.7 %	$\theta_{j-c} = 150^{\circ}C/W$, $\Delta T_c = 2.9^{\circ}C$,	$P_d(max) = 150 mW$ $T_c = 52.9^{\circ}C$
PC702 PS2561L1 (TRANSISTOR) NEC	$T_{jmax} = 125^{\circ}C$, $P_c = 1.5 mW$, $T_j = T_c + ((\theta_{j-c}) \times P_c) = 53.1^{\circ}C$ D.F. = 42.5 %	$\theta_{j-c} = 150^{\circ}C/W$, $\Delta T_c = 2.9^{\circ}C$,	$P_c(max) = 150 mW$ $T_c = 52.9^{\circ}C$
PC703 PS2561L1 (LED) NEC	$T_{jmax} = 125^{\circ}C$, $P_d = 4.8 mW$, $T_j = T_c + ((\theta_{j-c}) \times P_d) = 55.1^{\circ}C$ D.F. = 44.1 %	$\theta_{j-c} = 150^{\circ}C/W$, $\Delta T_c = 4.4^{\circ}C$,	$P_d(max) = 150 mW$ $T_c = 54.4^{\circ}C$
PC703 PS2561L1 (TRANSISTOR) NEC	$T_{jmax} = 125^{\circ}C$, $P_c = 0.4 mW$, $T_j = T_c + ((\theta_{j-c}) \times P_c) = 54.5^{\circ}C$ D.F. = 43.6 %	$\theta_{j-c} = 150^{\circ}C/W$, $\Delta T_c = 4.4^{\circ}C$,	$P_c(max) = 150 mW$ $T_c = 54.4^{\circ}C$
PD900 MPG4361F STANLEY	$I_F = 4.2 mA$, Allowable $I_F(max) = 16.4 mA$ (at $T_a =$ D.F. = 25.6 %	$\Delta T_a = 1.0^{\circ}C$,	$T_a = 51.0^{\circ}C$

3.主要部品温度上昇値 Main components temperature rise ΔT list

MODEL : HWS1500-24

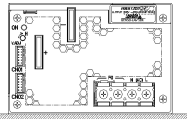
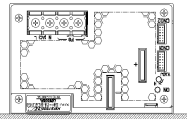
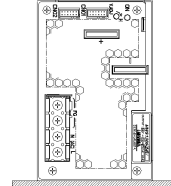
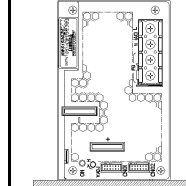
・ 測定条件 Conditions

取付方法 Mounting method (標準取付:(A)) (Standard mounting method:(A))	(A)	(B)	(C)	(D)
				
入力電圧 Input voltage (VAC)	100			
出力電圧 Output voltage (VDC)	24			
出力電流 Output current (A)	65			

出力ディレーティング Output derating $T_a = 50^\circ\text{C}$		・ ΔT temperature rise ($^\circ\text{C}$)			
		$I_o = 100\%$			
部品番号 Location No.	部品名 Parts name	取付方向 Mounting A	取付方向 Mounting B	取付方向 Mounting C	取付方向 Mounting D
D1,D2	BRIDGE DIODE	42.0	41.3	42.6	41.2
D3,D4	Sic DIODE	21.2	21.9	22.1	21.0
D401-D412	LLD	33.2	32.4	34.0	32.8
L3	CHOKE	36.1	36.4	37.6	36.0
L401	CHOKE COIL	37.3	38.5	39.7	38.4
Q1-Q4	MOS FET	42.4	42.3	43.8	41.2
Q701	CHIP MOS FET	32.2	31.4	34.0	30.5
Q201-Q204	MOS FET	34.1	33.0	34.9	33.7
R201,R202	RESISTOR	41.2	41.0	42.4	41.8
T201	TRANS PLUSE	47.6	50.5	51.1	51.4
T202	CURRENT TRANS	24.5	24.5	25.9	24.5
T700	TRANS PLUSE	17.3	16.4	18.1	15.9
TH101	CHIP POSISTOR	22.5	23.4	24.8	22.3
TH201	THERMAL SENSOR	34.0	32.8	34.6	33.2
PCB	PCB	35.7	35.4	36.6	35.9

MODEL : HWS1500-24

・ 測定条件 Conditions

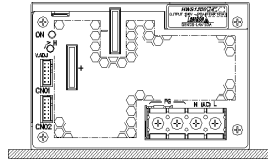
取付方法 Mounting method (標準取付:(A)) (Standard mounting method:(A))	(A)	(B)	(C)	(D)
				
入力電圧 Input voltage (VAC)	200			
出力電圧 Output voltage (VDC)	24			
出力電流 Output current (A)	70			

出力ディレーティング Output derating $T_a = 50^\circ\text{C}$		・ ΔT temperature rise ($^\circ\text{C}$) $I_o = 100\%$			
		取付方向 Mounting A	取付方向 Mounting B	取付方向 Mounting C	取付方向 Mounting D
部品番号 Location No.	部品名 Parts name				
D1,D2	BRIDGE DIODE	24.9	24.2	25.5	24.1
D3,D4	Sic DIODE	18.8	19.5	19.7	18.6
D401-D412	LLD	35.0	34.2	35.8	34.6
L3	CHOKE	24.1	24.4	25.6	24.0
L401	CHOKE COIL	40.3	41.5	42.7	41.4
Q1-Q4	MOS FET	20.2	20.1	21.6	19.0
Q701	CHIP MOS FET	31.4	30.6	33.2	29.7
Q201-Q204	MOS FET	38.1	37.0	38.9	37.7
R201,R202	RESISTOR	44.9	44.7	46.1	45.5
T201	TRANS PLUSE	53.6	56.5	57.1	57.4
T202	CURRENT TRANS	26.4	26.4	27.8	26.4
T700	TRANS PLUSE	16.9	16.0	17.7	15.5
TH101	CHIP POSISTOR	13.3	14.2	15.6	13.1
TH201	THERMAL SENSOR	37.2	36.0	37.8	36.4
PCB	PCB	38.3	38.0	39.2	38.5

4. 電解コンデンサ推定寿命計算値 Electrolytic capacitor lifetime

MODEL : HWS1500-24

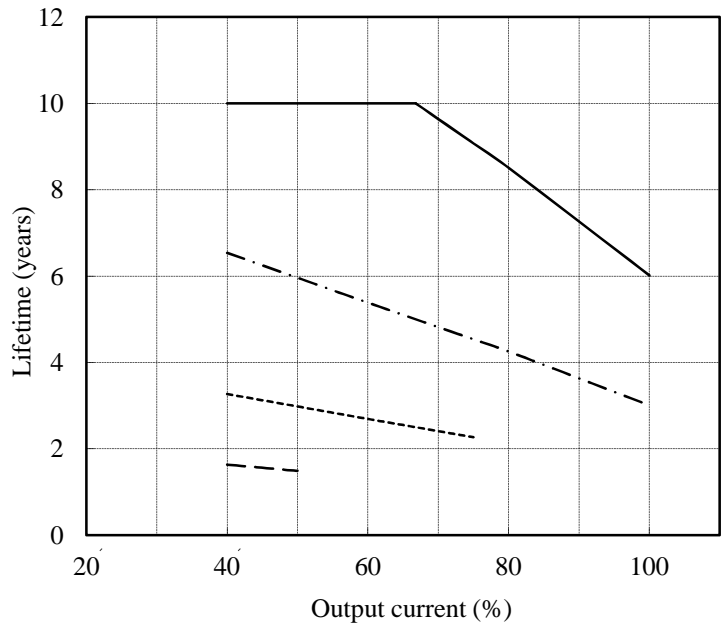
取付方向 A
Mounting A



Conditions Ta 40°C : ———
50°C : - · - ·
60°C : · · · · ·
70°C : - - - -

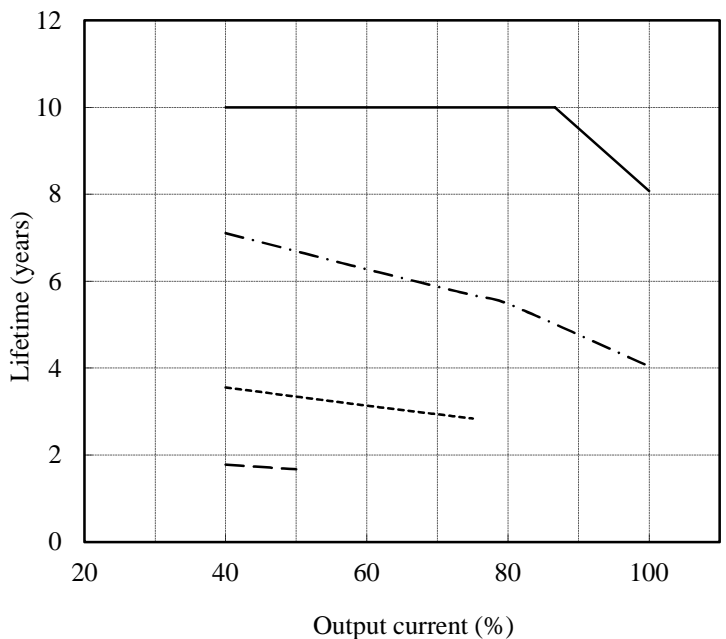
Vin=100VAC

Load (%)	Lifetime (years)			
	Ta=40°C	Ta=50°C	Ta=60°C	Ta=70°C
40	10.0	6.5	3.3	1.6
50	10.0	6.0	3.0	1.5
60	10.0	5.4	2.7	-
75	9.1	4.5	2.3	-
80	8.5	4.3	-	-
100	6.0	3.0	-	-



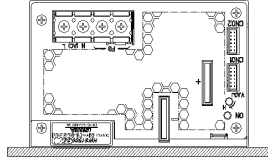
Vin=200VAC

Load (%)	Lifetime (years)			
	Ta=40°C	Ta=50°C	Ta=60°C	Ta=70°C
40	10.0	7.1	3.6	1.8
50	10.0	6.7	3.3	1.7
60	10.0	6.3	3.1	-
75	10.0	5.7	2.8	-
80	10.0	5.5	-	-
100	8.1	4.0	-	-



MODEL : HWS1500-24

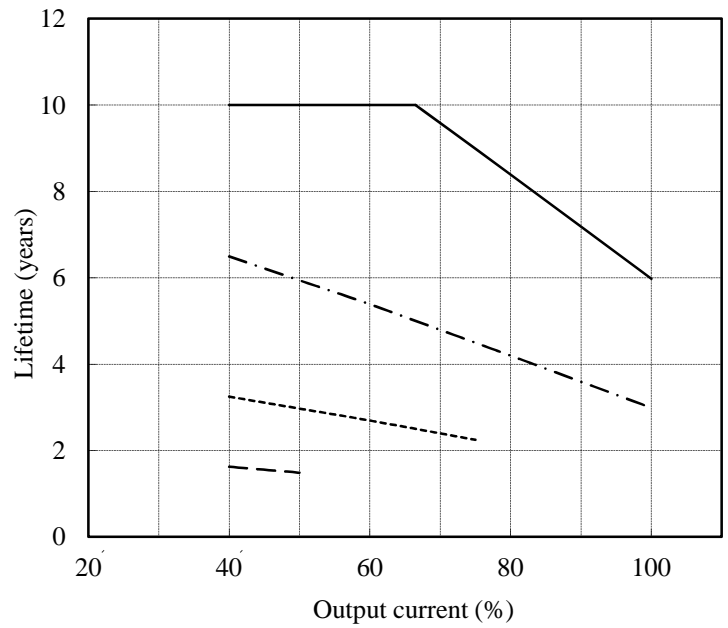
取付方向 B
Mounting B



Conditions Ta 40°C : ———
50°C : - · - ·
60°C : - - - -
70°C : - - - -

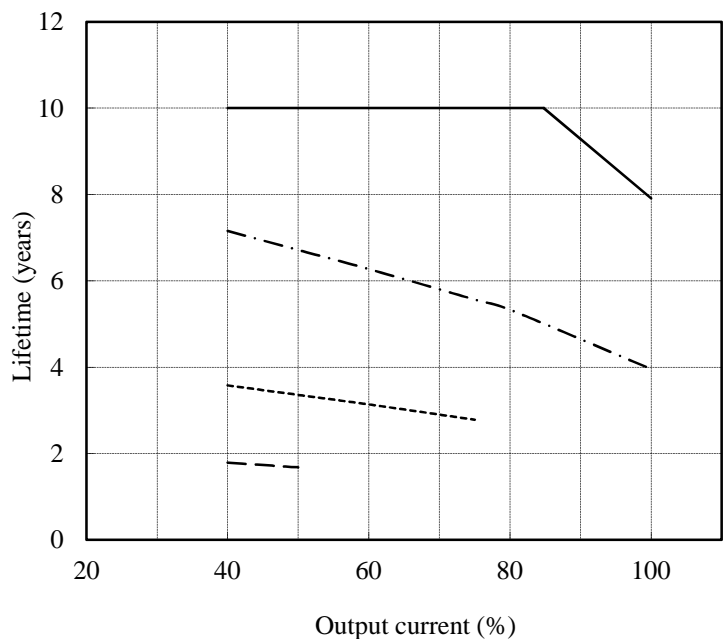
Vin=100VAC

Load (%)	Lifetime (years)			
	Ta=40°C	Ta=50°C	Ta=60°C	Ta=70°C
40	10.0	6.5	3.2	1.6
50	10.0	5.9	3.0	1.5
60	10.0	5.4	2.7	-
75	9.0	4.5	2.2	-
80	8.4	4.2	-	-
100	6.0	3.0	-	-



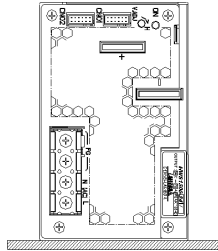
Vin=200VAC

Load (%)	Lifetime (years)			
	Ta=40°C	Ta=50°C	Ta=60°C	Ta=70°C
40	10.0	7.2	3.6	1.8
50	10.0	6.7	3.4	1.7
60	10.0	6.3	3.1	-
75	10.0	5.6	2.8	-
80	10.0	5.3	-	-
100	7.9	4.0	-	-



MODEL : HWS1500-24

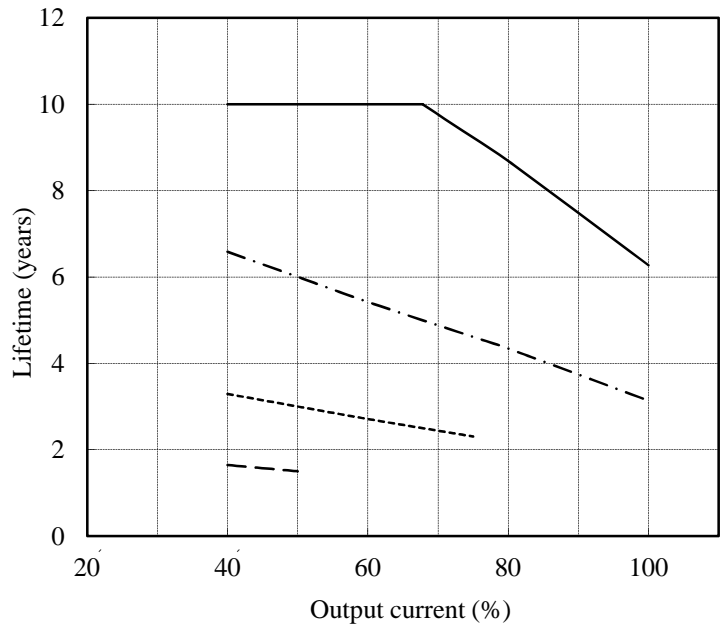
取付方向 C
Mounting C



Conditions Ta 40°C : ———
50°C : - · - ·
60°C : · · · · ·
70°C : - - - -

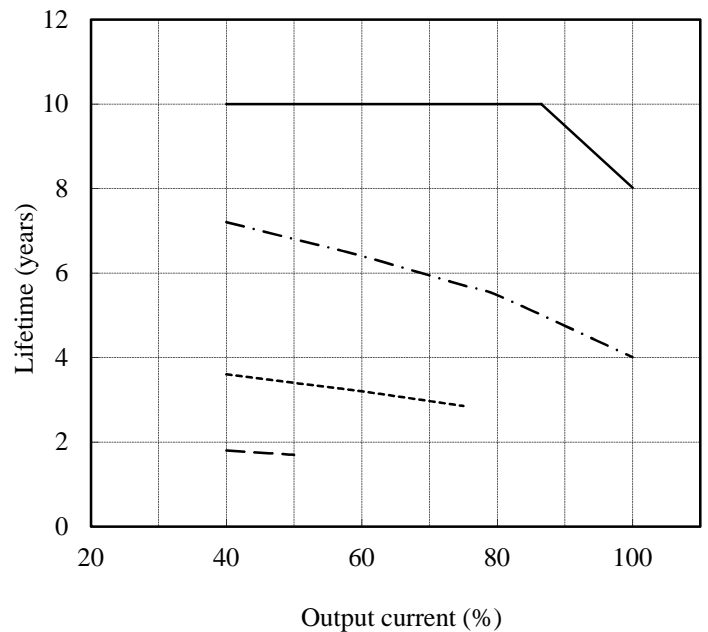
Vin=100VAC

Load (%)	Lifetime (years)			
	Ta=40°C	Ta=50°C	Ta=60°C	Ta=70°C
40	10.0	6.6	3.3	1.6
50	10.0	6.0	3.0	1.5
60	10.0	5.4	2.7	-
75	9.2	4.6	2.3	-
80	8.7	4.3	-	-
100	6.3	3.1	-	-



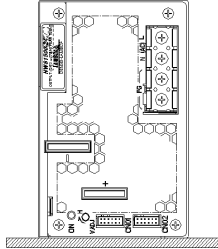
Vin=200VAC

Load (%)	Lifetime (years)			
	Ta=40°C	Ta=50°C	Ta=60°C	Ta=70°C
40	10.0	7.2	3.6	1.8
50	10.0	6.8	3.4	1.7
60	10.0	6.4	3.2	-
75	10.0	5.7	2.9	-
80	10.0	5.5	-	-
100	8.0	4.0	-	-



MODEL : HWS1500-24

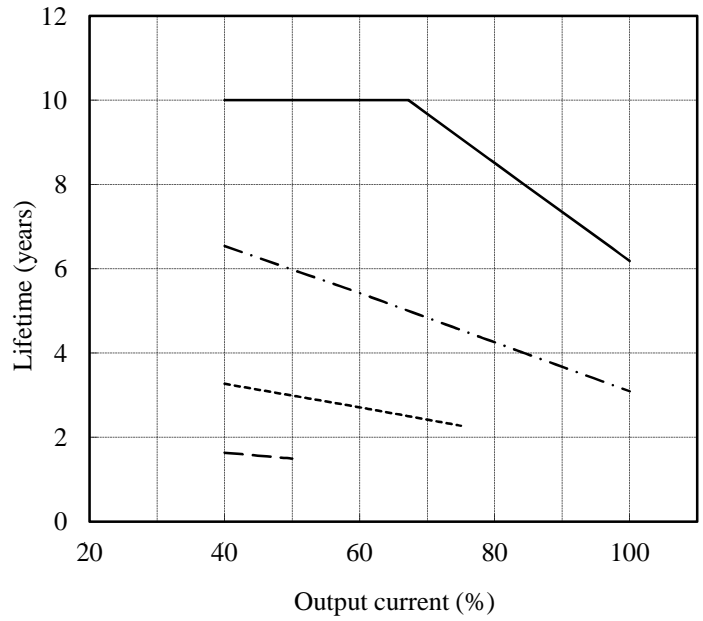
取付方向 D
Mounting D



Conditions Ta 40°C : ———
50°C : - · - · -
60°C : · · · · ·
70°C : - - - - -

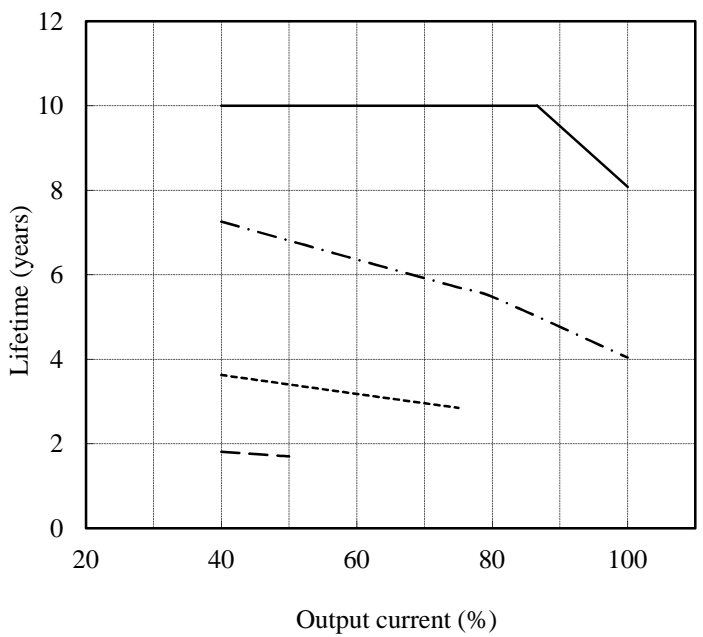
Vin=100VAC

Load (%)	Lifetime (years)			
	Ta=40°C	Ta=50°C	Ta=60°C	Ta=70°C
40	10.0	6.5	3.3	1.6
50	10.0	6.0	3.0	1.5
60	10.0	5.4	2.7	-
75	9.1	4.5	2.3	-
80	8.5	4.3	-	-
100	6.2	3.1	-	-



Vin=200VAC

Load (%)	Lifetime (years)			
	Ta=40°C	Ta=50°C	Ta=60°C	Ta=70°C
40	10.0	7.3	3.6	1.8
50	10.0	6.8	3.4	1.7
60	10.0	6.4	3.2	-
75	10.0	5.7	2.8	-
80	10.0	5.5	-	-
100	8.1	4.0	-	-



5. アブノーマル試験 Abnormal test

MODEL : HWS1500-24

(1) 試験条件 Conditions

Input : 200VAC Output : 24V 70A Ta : 25°C 70%RH

(2) 試験結果 Test result

(Fu : Fuse Blown)

(Da : Damaged)

No.	試験箇所 Test position		試験モード Test mode		試験結果 Test result												記事 Note	
	部品No. Location No.	試験端子 Test point	ショート Short	オープン Open	① 発火 Fire	② 発煙 Smoke	③ 破裂 Burst	④ 異臭 Smell	⑤ 発熱 Red Hot	⑥ 破損 Damaged	⑦ ヒューズ断 Fuse Blown	⑧ OVP	⑨ OCP	⑩ 出力断 No Output	⑪ 変化なし No Change	⑫ その他 Others		
1	Q1-Q4	D - G	○							○	○			○			Fu:F1 / Da: RL1,Q1-4, R141-184	
2		D - S	○							○	○			○			Fu: F1 / Da: RL1,R141- 184	
3		G - S	○												○			
4		G		○							○	○			○			Fu:F1 / Da: RL1, Q1-4,D106A-107D, R141-184
5		D		○											○			
6		S		○											○			
7	D1,D2	AC-AC	○								○			○			Fu: F1	
8		AC-DC	○							○	○			○			Fu: F1 / Da: RL1	
9		AC		○											○			
10		DC		○											○			
11	D3,D4	A - K	○							○	○			○			Fu:F1 / Da: RL1, Q1-4, R141-184	
12		A, K		○											○			
13	D108- D110	A - K	○							○	○			○			Fu:F1 / Da: RL1, Q1-4, R141-184	
14		A, K		○											○			
15	L3	1,3,5 -	○							○	○			○			Fu:F1 / Da: RL1, Q1-4, R141-184	
16		2,4,6		○											○			
17	C7-C12		○							○	○			○			Fu:F1 / Da: RL1, Q1-4, D3-4,R141-184	
18				○											○			

No.	試験箇所 Test position		試験モード Test mode		試験結果 Test result												記事 Note	
	部品No. Location No.	試験端子 Test point	ショート Short	オープン Open	① 発火 Fire	② 発煙 Smoke	③ 破裂 Burst	④ 異臭 Smell	⑤ 発熱 Red Hot	⑥ 破損 Damaged	⑦ ヒューズ断 Fuse Blown	⑧ OVP	⑨ OCP	⑩ 出力断 No Output	⑪ 変化なし No Change	⑫ その他 Others		
19	Q201, Q202	D-G	○							○	○			○			Fu: F201 / Da: Q201-204, Z301-302	
20		D-S	○							○	○			○			Fu: F201	
21		G-S	○											○				
22		G		○						○	○			○				Fu: F201 / Da: Q201-204
23		D		○											○			
24		S		○											○			
25	Q203, Q204	D-G	○							○	○			○			Fu: F201 / Da: Q201-204, Z303-304	
26		D-S	○							○	○			○			Fu: F201	
27		G-S	○											○				
28		G		○						○	○			○				Fu: F201 / Da: Q201-204
29		D		○											○			
30		S		○											○			
31	D401-404,	A - K	○											○				
32	D409,D411	A, K		○											○			
33	D405-408,	A - K	○											○				
34	D410,D412	A, K		○											○			
35	C207A,		○								○			○			Fu: F201	
36	C207B			○											○			
37	C405-		○											○				
38	C412			○												○	出力リップル大 Output ripple increase	
39	L401	1 - 2	○											○				
40		1, 2		○										○				
41	T201	A - B	○							○	○			○			Fu: F201 / Da: Q201-204	
42		C - D	○											○				
43		D - E	○											○				
44		A, B		○										○				
45		C, D, E		○										○				

No.	試験箇所 Test position		試験 モード Test mode		試験結果 Test result												記事 Note	
	部品No. Location No.	試験端子 Test point	ショート Short	オープン Open	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫		
					発火 Fire	発煙 Smoke	破裂 Burst	異臭 Smell	発熱 Red Hot	破損 Damaged	ヒューズ断 Fuse Blown	OVP	OCP	出力断 No Output	変化なし No Change	その他 Others		
46	Q701	D-G	○							○				○			Da: R882,R717A-717B, Z703,Q701,A700, T700(3-4)	
47		D-S	○							○				○			Da: R882,R717A-717B, Z710,D706,Q701	
48		G-S	○											○				
49		G		○							○				○			Da: R882,R717A-717B, Z710, D706, Q701
50		D		○											○			
51		S		○											○			
52	Q706	D-G	○							○				○			Da: R882,CN705,A703, Q706	
53		D-S	○							○				○			Da: R882,CN705,A703	
54		G-S	○												○			
55		G		○							○				○			Da: R882,CN705,A703, Q706
56		D		○											○			
57		S		○											○			
58	D701, D727	A - K	○											○				
59		A, K		○											○			
60	D707	A - K	○											○				
61		A, K		○										○				
62	D900, D911	A - K	○											○				
63		A, K		○											○			
64	D902		○											○				
65				○											○			
66	C703		○											○				
67				○												○		
68	C709,C710, C719,C721		○												○			
69				○												○		
70	C903A, C903B		○												○			
71				○												○		
72	C904		○											○				
73				○											○			

No.	試験箇所 Test position		試験 モード Test mode		試験結果 Test result												記事 Note
	部品No. Location No.	試験端子 Test point	ショート Short	オープン Open	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	
					発火 Fire	発煙 Smoke	破裂 Burst	異臭 Smell	発熱 Red Hot	破損 Damaged	ヒューズ断 Fuse Blown	OVP	OCP	出力断 No Output	変化なし No Change	その他 Others	
75	T700	1 - 2	○											○			
76		2 - 3	○							○				○		Da: R882, CN705	
77		3 - 4	○							○				○		Da: Q701,R717A-717B, R882,CN705	
78		6 - 7	○											○			
79		A - B	○											○			
80		1, 2		○										○			
81		3, 4		○										○			
82		6, 7		○										○			
83		A, B		○										○			
84	R882		○											○			
85			○										○				
86	R734A- R734E		○												○	力率低下 Power Factor Low	
87			○										○				
88	R754A- R754E		○												○	力率低下 Power Factor Low	
89			○											○		力率低下 Power Factor Low	
90	R733A- R733D		○												○	力率低下 Power Factor Low	
91			○											○		力率低下 Power Factor Low	
92	R743A- R743E		○										○				
93			○										○				

6. 振動試験 Vibration test

MODEL : HWS1500-48

(1) 振動試験種類 Vibration test class

掃引振動数耐久試験 Frequency variable endurance test

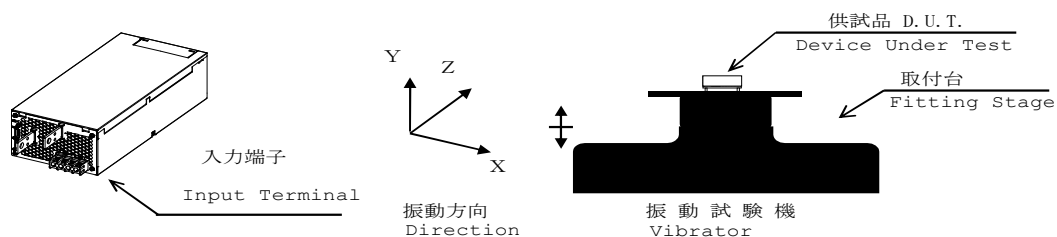
(2) 使用振動試験装置 Equipment used

・ EMIC (株)製 ・ 制御部 : VA-5 ・ 加振部 : VE-1000
 EMIC CORP. Controller Vibrator

(3) 試験条件 Test conditions

- ・ 周波数範囲 10~55Hz
Sweep frequency
- ・ 掃引時間 1.0分間
Sweep time 1.0min.
- ・ 加速度 一定 19.6m/s^2 (2G)
Acceleration Constant
- ・ 振幅方向 X, Y, Z
Direction
- ・ 試験時間 各方向共 1 時間
Test time 1 hour each

(4) 試験方法 Test method



(5) 試験結果 Test results

合格 OK

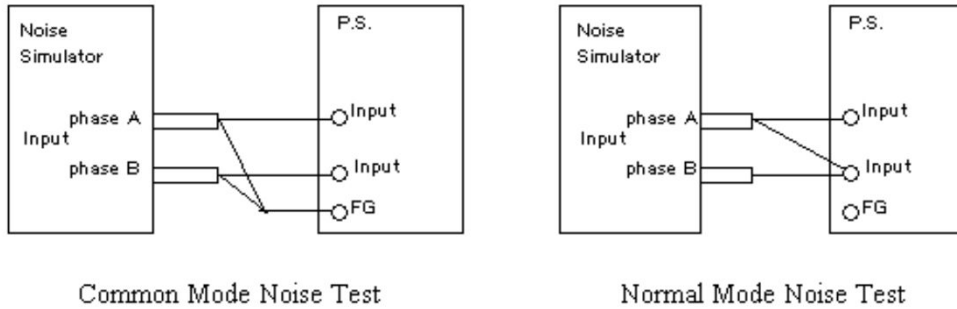
入力電圧 V_{in} :100VAC出力電流 I_o :100%

測定確認項目 Check item	出力電圧 (V) Output voltage	リップルノイズ (mVp-p) Ripple noise	機構・実装状態 D.U.T.State
試験前 Before test	47.98	85.6	—————
試験後 After test	X	47.97	異常なし OK
	Y	47.97	異常なし OK
	Z	47.97	異常なし OK

7. ノイズシミュレート試験 Noise simulate test

MODEL : HWS1500-24

(1) 試験回路及び測定器 Test circuit and equipment



シミュレーター : INS-4320(A) (ノイズ研究所)
 Simulator (Noise Laboratory Co.,LTD)

(2) 試験条件 Test Conditions

・入力電圧 Input voltage	: 100,230VAC	・ノイズ電圧 Noise level	: 0V~2kV
・出力電圧 Output voltage	: 定格 Rated	・位相 Phase shift	: 0°~360°
・出力電流 Output Current	: 0%,100%	・極性 Polarity	: +,-
・周囲温度 Ambient temperature	: 25°C	・印加モード Mode	: Normal Common
・パルス幅 Pulse width	: 50ns ~ 1000ns	・トリガ選択 Trigger select	: Line

(3) 判定条件 Acceptable conditions

- 1.破壊しない事 Not to be broken.
- 2.出力がダウンしない事 Not to be shut down output.
- 3.その他異常のない事 No other out of orders.

(4) 試験結果 Test Result

合 格 O K

8. 熱衝撃試験 Thermal shock test

MODEL : HWS1500-12

(1) 使用計測器 Equipment used

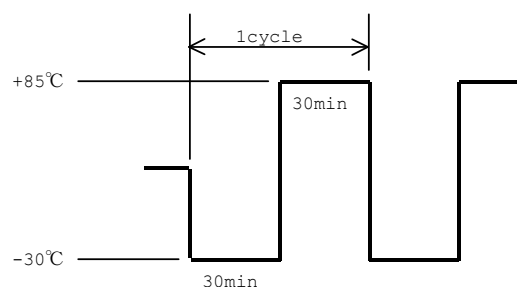
Thermal Shock Chamber TSA-101L-A(2) (TABAI ESPEC CORP).

(2) 供試品台数 The number of D.U.T.(Device Under Test)

2 台 (units)

(3) 試験条件 Test conditions

- ・電源周囲温度 : $-30^{\circ}\text{C} \Leftrightarrow 85^{\circ}\text{C}$
Ambient temperature
- ・試験時間 : 図参照
Test time Refer to Dwg.
- ・試験サイクル : 100 サイクル
Test cycle 100 cycles
- ・非動作
Not operating



(4) 試験方法 Test method

初期測定の後、供試品を試験槽に入れ、上記サイクルで試験を行う。100サイクル後に、供試品を常温常湿下に1時間放置し、出力に異常がない事を確認する。

Before testing, check if there is no abnormal output, then put the D.U.T. in testing chamber, and test it according to the above cycle. 100 cycles later, leave it for 1 hour at the room temperature, then check if there is no abnormal output.

(5) 試験結果 Test results

合格 OK

入力電圧 V_{in} :100VAC 出力電流 I_o :100%			12V			
			From		To	
リップルノイズ電圧 Ripple noise voltage		mVp-p	79.8		103.7	
入力変動 Line regulation	MIN	V	11.985	7 mV	11.976	9 mV
	MAX	V	11.992		11.985	
負荷変動 Load regulation	0%	V	12.004	19 mV	12.002	26 mV
	100%	V	11.985		11.976	
効率 Efficiency	P_{in}	W	1789.5	83.7%	1790.7	83.6%
	V_{out}	V	11.985		11.980	
	I_{out}	A	125		125	
半田状態・その他 Solder condition・etc.			—————		異常なし OK	

9. FAN期待寿命 Fan life expectancy

MODEL : HWS1500

- (1) 使用製品名 Part name
9A0812G4D031 (SANYO DENKI CO.)
- (2) 期待寿命 Life expectancy
メーカーによるファン単体の期待寿命データを示す（残存率90%）。
また、ファン排気温度測定箇所は、fig 1 .に示す。

The data shows fan life expectancy for fan only by manufacture (90% survival rate).
Fig 1 shows measuring point of fan exhaust temperature.

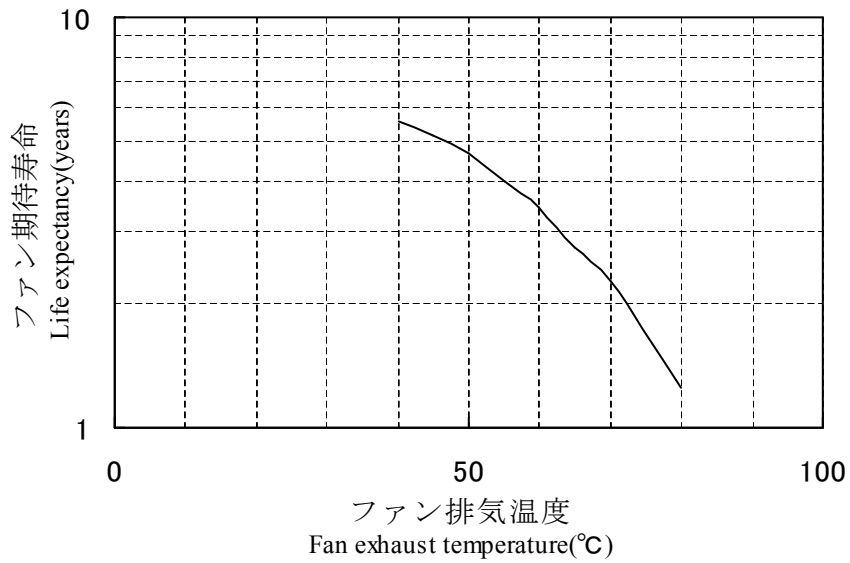


fig 1 . ファン排気温度測定箇所
Measuring point of fan exhaust temperature.

