HEAT LOAD CALCULATION

PACKAGED FOR TRANSFORMER

STX-0702-SB

1. DESIGN CONDITION

A. Temperature

	SUMMER			WINTER		
OUTSIDE AIR	(T_{OS})	35 ℃ DB	70 % RH	(T_{OW})	-25 ℃ DB	% RH
ROOM AIR	(T_{RS})	22 ℃ DB	50 % RH	(T_{RW})	20 ℃ DB	50 % RH
FRESH AIR		32 ℃			℃	

B. Fresh air ratio

- SUMMER 10 %
- WINTER 10 %
- MIN. FRESH AIR 25.5 m^3/h.pers

C. Air change per hour

(a) Transformer room : **6** T/h

D. Steam pressure

kg/cm^2G

2. RESULT OF THE CALCULATION

A. Summer condition

1) Total Heat Gain Q_R = **10,804** kcal/h

a) Sensible Heat Gain (Q_S) 10,741 kcal/h

- Transmission Heat Gain **4,315** kcal/h
- Solar Heat Gain - kcal/h
- Equipment Heat Gain **63,365** kcal/h
- Light Heat Gain 205 kcal/h
- Heat Emission (person) 150 kcal/h

b) Latent Heat Gain (Q_L) Q_L = 63 kcal/h

2) SHF(Sensible Heat Factor) **0.99**

3) Air Flow Rate V_F = **25,845** m^3/h

a) Normal room V_N = **23,494** m^3/h

b) Final air volume (selection) V_F = 25,845 m^3/h

4) Cooling capacity Q_C = 146,351 kcal/h

a) Return Air Temperature T_B = 22.0 ℃ % RH

T_B = T_R + 0.0 ℃

b) Air-cooler Inlet(Mixed) Air temp. T_{C1} = 23.3 ℃ 53 % RH

c) Air-cooler Outlet Air temp. T_{C2} = 11.0 ℃ 95 % RH

T_{C2} = T_R − 11.0 ℃

d) Cooling Capacity

$Q_C = V_F \times \Delta i_c \times (1/v)$ = **146,351** kcal/h

Δi_c : The difference of the enthalpy 4.70 kcal/kg

v : The specific volume 0.83 m^3/kg

B. Winter condition

1) Total Heat Loss Q_R = −1,953 kcal/h

2) Air Flow Rate V_F = 25,845 m^3/h

3) Heating Capacity Q_H = 11,765 kcal/h

a) Heater outlet air temp.

$T_F = T_R + Q_H / (C_P \times 1/v \times V_F)$ ℃ T_F = 19.7 ℃ ▷ 32℃

T_R : Room inside air temp. 20 ℃

C_P : Specific heat 0.24 kcal/kg℃

v : Specific volume 0.86 m^3/kg

V_F : Fan air volume 25,845 m^3/h

b) Heater inlet(mixed) air temp.

$T_M = T_O \times \beta/100 + T_B \times (100 - \beta)/100$ T_M = 15.5 ℃

T_O : Outside air temp. −25 ℃

β : Fresh air ratio 10 %

T_B : Return air temp. 20.0 ℃

T_B = T_R − 0.0 ℃

c) Heating capacity

① For Heating Q_{HST} = 110,893 kcal/h

$Q_{HST} = V_F \times (1/v) \times (i_D - i_M)$

i_D : Enthalpy of Heater outlet 11.79 kcal/kg

i_M : Enthalpy of Heater inlet 8.1 kcal/kg

V_F : Fan air volume **25,845** m^3/h

② For Humidifyimg Q_{HLT} = kcal/h

$Q_{HLT} = V_F \times (1/v) \times (i_F - i_D)$

i_F : Enthalpy of Blower outlet kcal/kg

4) Steam Consumption (for Steam Heater)

a) For Heater S_H = 0.0 kg/h

$S_H = Q_{HST} \div Y_L$

Q_{HST} = 0 kcal/h

Y_L = - kcal/kg

b) For Humidifier S_L = 0.0 kg/h

$S_L = Q_{HLT} \div Y_L$

Q_{HLT} = 0 kcal/h

Y_L = - kcal/kg

c) Total Steam Consumption S_T = 0.0 kg/h

5) Electric power consumption (for Electric heater)

a) For Heater E_H = 128.9 kW/h

$E_H = Q_{HST} \div P_W$

Q_{HST} = 110,893 kcal/h

P_W = 860 kcal/kW

b) For Humidifier E_L = 0 kW/h

$E_L = Q_{HLT} \div P_W$

Q_{HLT} = 0 kcal/h

P_W = 860 kcal/kW

c) Total E_T = 128.9 kW/h