How to calculate the dimension of the rotary dryer for wood chips?

The information as follows:

The material: wet wood chips, sawdust

The output: 3ton per hour

A: Drying intensity (35kg/m3h)

G_1: Dry Material Production (3t/h)

V: Dry Space needed(m3)

W_1: Initial Moisture Content(55%)

W_2: Final Moisture Content(12%)

Material Calculation:

For every 1000kg wet material evaporation and moisture content:

W=1000×（0.55-0.12）/(1-0.12)=488.6kg(H20)

For every 1000kg wet material quantity after evaporate: M=1000-488.6=511.4kg

To produce 1000kg of end product need to feed in:

G=1000/511.4×1000=1955.4kg(wet raw material)

Rotary Dryer Calculation:

Volume calculation:

G_1=AV÷｛1000×〖W1—W2〗÷〖100—W1〗｝

3=AV÷｛1000×(55-12)/(100-55)｝=AV/956

V=81.9m3

Provided Drum dimension:Φ2.2×24m

$V=\pi r^2 L$=3.14x（1.1）²x24=91m3 >82m3（fulfill requirement)

Rotary Dryer Energy Balance

Air Flow Velocity: v=1.5m/s,

Dry Air Density: ρ=1.2kg/m^3,

Air Humidity: H=0.007kg/$kg_{dry\ air}$,

Ambient Air Temperature: t_0=30°

Inlet Hot Air Temperature: t_1=250°

Outlet Hot Air Temperature: t_2=70°

Dry air consumption:

$L=\pi r^2 v \rho 3600=3.14\times 1^2 x 1.5\times 1.2\times 3600=20347.2kg/h$

Wet air consumption:

$L_1=L(1+H)=20347.2X(1+0.007)=20490kg/h$

Heating value for ambient air:

$Q_1=L(1.01+1.88H)(t_2-t_0)=20347.2\div 3600x\ (1.01+1.88\times 0.007)\ x\ (70-30)=231.3kw$

Heating value for evaporating moisture:

$Q_2=W(2490+1.88t_2-4.187\times 30°)$

$=955.4\div 3600x\ (2490+1.88\times 70-125.61)=622.4kw$

Heating value for wet material:

$Q_3=Gc\ (\ wood\ )\ (t_2-t_0)=1955.4\times 2.5\times 10^3 x 40\div 3600\div 1000=54.3kw$

Heating value loses:

$Q_4=(Q_1+Q_2+Q_3)\ 0.22=908\times 0.22=199.76kw$

Total Heating Value:

$Q=Q_1+Q_2+Q_3+Q_4=1107.76kw$

Rotary Dryer Gas Quantity Needed

For standard condition

Dry Air Density: $\rho=1.29kg/m^3$

Air Specific Heat Capacity: $c=1.0\times10^3J/(kg.℃)$

$Q=V(T-t_2)\rho c=V(400-70)\rho c$

$V=2303.4*3.6\times10^6/370*1.29*10^3=17373m^3$

Single Rotary Dryer System Air Flow Rate

Evaporation=955.4kg, $t_1=250°$, $t_2=70°$

System Air Flow Rate=Evaporation*3000/(t_1-t_2) $=16000m^3/h$

Air Flow Rate =1.3*System Air Flow Rate=20800$m^3/hm^3/h$

Provided model: 4-72-8C-22kw

Rotary Dryer Draft Fan Air Flow Rate

Draft Fan Air Flow Rate=2*System Air Flow Rate=32000m^3/h

Provided model: 4-72-10C-45kw