MecaWind v2342

Calculations Prepared by:
Date: Apr 29, 2020

File Location : M:\Website\Website Content\Chimney\mw_stack.wnd

Basic Wind Parameters

Wind Load Standard	= ASCE 7-16	Exposure Category	= C
Wind Design Speed	= 120.0 mph	Risk Category	= III
Structure Type	= Other	Other Structure Type	= Chimney

General Wind Settings

=	ASCE 7-16 Wind Parameters	=
Incl_LF	= Include ASD Load Factor of 0.6 in Pressures	= False
DynType	= Dynamic Type of Structure	= Flexible
NF	= Natural Frequency of Structure (Mode 1)	= 1.644 Hz
NF	= Natural Frequency of Structure	= 1.644
Bs	= Structural Damping (Used for Flexible Only)	= 0.0110
Zg	= Altitude (Ground Elevation) above Sea Level	= 0.000 ft
Bdist	= Base Elevation of Structure	= 0.000 ft
GenElev	= Specify the Elevations For Wind Pressures	= Mean Roof Ht
Reacs	= Show the Base Reactions in the output	= False
O_Kd	= Override the Directionality Factor 'Kd'	= 1.000
O_G	= Override the Gust Factor 'G'	= 0.991
MWFRSType	= MWFRS Method Selected	= Ch 27 Pt 1

Topographic Factor per Fig 26.8-1

Topo	= Topographic Feature	= None
Kzt	= Topographic Factor	= 1.000

Chimney:

Top Elev ft	Bot Elev ft	Diameter ft	Shape	Width_Addl ft^2/ft
100.000	90.000	3.000	Round Moderately Smooth	0.00
90.000	80.000	3.000	Round Moderately Smooth	0.00
80.000	70.000	3.000	Round Moderately Smooth	0.00
70.000	60.000	3.000	Round Moderately Smooth	0.00
60.000	55.000	3.000	Round Moderately Smooth	0.00
55.000	50.000	4.000	Round Moderately Smooth	0.00
50.000	40.000	5.000	Round Moderately Smooth	0.00
40.000	30.000	5.000	Round Moderately Smooth	0.00
30.000	20.000	5.000	Round Moderately Smooth	0.00
20.000	15.000	5.000	Round Moderately Smooth	0.00
15.000	0.000	5.000	Round Moderately Smooth	0.00

Exposure Constants per Table 26.11-1:

Alpha:	Const from Table 26.11-1= 9.500	Zg:	Const from Table 26.11-1= 900.000 ft
At:	Const from Table 26.11-1= 0.105	Bt:	Const from Table 26.11-1= 1.000
Am:	Const from Table 26.11-1= 0.154	Bm:	Const from Table 26.11-1= 0.650
C:	Const from Table 26.11-1= 0.200	Eps:	Const from Table 26.11-1= 0.200

Gust Factor Calculation:

Gust Factor Category I Rigid Structures - Simplified Method

G1	= For Rigid Structures (Nat. Freq.>1 Hz) use 0.85	= 0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Zm	= 0.6 * Ht	= 60.000 ft
Izm	= Cc * (33 / Zm) ^ 0.167	= 0.181
Lzm	= L * (Zm / 33) ^ Epsilon	= 563.505
Q	= (1 / (1 + 0.63 * ((B + Ht) / Lzm)^0.63))^0.5	= 0.906
G2	= 0.925*((1+1.7*lzm*3.4*Q)/(1+1.7*3.4*lzm))	= 0.881

Gust Factor Used in Analysis

G	= Lessor Of G1 Or G2	= 0.850
G	= User has elected to override the calculated G value	= 0.991

Main Wind Force Resisting System (MWFRS) Calculations for Chimney per Ch 29:

LF	= Load Factor based upon STRENGTH Design	= 1.00
hs	= Overall height of structure	= 100.000 ft
h	= Mean Roof Height above grade	= 100.000 ft
Kh	= 15 ft [4.572 m]< Z <Zg -->(2.01*(Z/zg)^(2/Alpha) {Table 26.10-1}	= 1.266
Kzt	= Topographic Factor is 1 since no Topographic feature specified	= 1.000
Kd	= Wind Directionality Factor Manually Specified by Designer	= 1.00
qh	= (0.00256 * Kh * Kzt * Kd * Ke * V^2) * LF	= 46.66 psf

MWFRS Chimney Pressures per Fig 29.4-1
All wind pressures include a load factor of 1.0

Top Elev ft	Bot Elev ft	D ft	Cross Section	h/D	Af sq ft	Ae sq ft
100.000	90.000	3.000	Round Moderately Smooth	33.33	30.00	0.00
90.000	80.000	3.000	Round Moderately Smooth	33.33	30.00	0.00
80.000	70.000	3.000	Round Moderately Smooth	33.33	30.00	0.00
70.000	60.000	3.000	Round Moderately Smooth	33.33	30.00	0.00
60.000	55.000	3.000	Round Moderately Smooth	33.33	15.00	0.00

55.000	50.000	4.000	Round Moderately Smooth	25.00	20.00	0.00
50.000	40.000	5.000	Round Moderately Smooth	20.00	50.00	0.00
40.000	30.000	5.000	Round Moderately Smooth	20.00	50.00	0.00
30.000	20.000	5.000	Round Moderately Smooth	20.00	50.00	0.00
20.000	15.000	5.000	Round Moderately Smooth	20.00	25.00	0.00
15.000	0.000	5.000	Round Moderately Smooth	20.00	75.00	0.00
Total					405.00	0.00

MWFRS Chimney Forces

Top Elev ft	Bot Elev ft	Kz	qz psf	Dqz	Cf	Atot sq ft	F lb	Mbot lb-ft
100.000	90.000	1.266	46.66	139.97	0.700	21.00	971	92240.6
90.000	80.000	1.238	45.63	136.90	0.700	21.00	950	80720.5
80.000	70.000	1.208	44.51	133.54	0.700	21.00	926	69479.6
70.000	60.000	1.174	43.28	129.84	0.700	21.00	901	58546.5
60.000	55.000	1.137	41.90	125.70	0.700	10.50	436	25068.7
55.000	50.000	1.116	41.14	164.55	0.700	14.00	571	29964.4
50.000	40.000	1.094	40.32	201.60	0.672	33.61	1343	60436.5
40.000	30.000	1.044	38.47	192.35	0.672	33.61	1281	44849.0
30.000	20.000	0.982	36.21	181.05	0.672	33.61	1206	30152.4
20.000	15.000	0.902	33.25	166.24	0.672	16.81	554	9689.9
15.000	0.000	0.849	31.29	156.47	0.672	50.42	1564	11726.3
Total						276.56	10702	512874.4

Notes:

D = Diameter of Circular Cross Section or Least Horizontal Dim of Polygon
h = Overall Height of Structure
qz = Wind Pressure: 0.00256 * Kz * Kzt * Kd * V^2 * LF {Eqn 29.3-1}
Cf = Force Coefficient per Fig 29.4-1
Af = Area of Chimney
Ae = Area of Additional Attachments (Cf = 1)
Atot = Total Effective Area: Cf * Af + Ae
Dqz = D * qz^0.5 {Imperial Units}
F = Total Force: qz * G * At {Eqn 29.4-1}
Mbot = Moment about Base @ Elevation 0: F * (Elev_Top + Elev_Bot)*0.5