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ASTANA, Kazakhstan

WMO#: **351880**

Lat: **51.13N** Long: **71.37E** Elev: **350** StdP: **97.19** Time Zone: **6.00 (ASC)** Period: **86-10** WBAN: **99999**

Annual Heating and Humidification Design Conditions

	Coldest Month	Heating DB		Humidification DP/MCDB and HR						Coldest month WS/MCDB				MCWS/PCWD to 99.6% DB		
				99.6%			99%			0.4%		1%				
		99.6%	99%	DP	HR	MCDB	DP	HR	MCDB	WS	MCDB	WS	MCDB	MCWS	PCWD	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	
(1)	**1**	**-31.2**	**-29.0**	**-34.9**	**0.1**	**-31.3**	**-32.1**	**0.2**	**-28.8**	**14.2**	**-5.5**	**12.3**	**-7.6**	**3.0**	**50**	(1)

Annual Cooling, Dehumidification, and Enthalpy Design Conditions

	Hottest Month	Hottest Month DB Range	Cooling DB/MCWB						Evaporation WB/MCDB						MCWS/PCWD to 0.4% DB		
			0.4%		1%		2%		0.4%		1%		2%				
			DB	MCWB	DB	MCWB	DB	MCWB	WB	MCDB	WB	MCDB	WB	MCDB	MCWS	PCWD	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	
(2)	**7**	**11.4**	**32.2**	**17.8**	**30.2**	**17.3**	**28.3**	**16.8**	**19.6**	**27.4**	**18.8**	**26.5**	**18.1**	**25.5**	**3.6**	**270**	(2)

Dehumidification DP/MCDB and HR									Enthalpy/MCDB						Hours 8 to 4 & 12.8/20.6	
0.4%			1%			2%			0.4%		1%		2%			
DP	HR	MCDB	DP	HR	MCDB	DP	HR	MCDB	Enth	MCDB	Enth	MCDB	Enth	MCDB		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	
17.2	**12.9**	**21.6**	**16.2**	**12.1**	**21.1**	**15.3**	**11.3**	**20.8**	**57.6**	**27.2**	**55.0**	**26.7**	**52.4**	**25.3**	**642**	(3)

Extreme Annual Design Conditions

Extreme Annual WS			Extreme Max WB	Extreme Annual DB				n-Year Return Period Values of Extreme DB								
				Mean		Standard deviation		n=5 years		n=10 years		n=20 years		n=50 years		
1%	2.5%	5%		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	
11.8	**10.1**	**8.8**	**24.6**	**-34.8**	**36.3**	**3.1**	**2.3**	**-37.0**	**37.9**	**-38.9**	**39.3**	**-40.6**	**40.5**	**-42.9**	**42.2**	(4)

Monthly Climatic Design Conditions

				Annual (d)	Jan (e)	Feb (f)	Mar (g)	Apr (h)	May (i)	Jun (j)	Jul (k)	Aug (l)	Sep (m)	Oct (n)	Nov (o)	Dec (p)	
(5)	Temperatures, Degree-Days and Degree-Hours	Tavg		**3.2**	**-14.8**	**-14.7**	**-7.3**	**5.0**	**13.5**	**18.8**	**20.1**	**18.2**	**12.0**	**4.5**	**-5.4**	**-12.5**	(5)
(6)		Sd			**7.43**	**6.83**	**6.67**	**6.24**	**4.97**	**4.34**	**3.55**	**4.06**	**4.79**	**5.23**	**7.13**	**6.72**	(6)
(7)		HDD10.0		**3571**	**770**	**691**	**537**	**170**	**24**	**2**	**0**	**1**	**33**	**183**	**463**	**698**	(7)
(8)		HDD18.3		**5722**	**1028**	**924**	**795**	**399**	**162**	**46**	**23**	**53**	**194**	**429**	**713**	**956**	(8)
(9)		CDD10.0		**1090**	**0**	**0**	**0**	**21**	**132**	**265**	**312**	**253**	**94**	**12**	**0**	**0**	(9)
(10)		CDD18.3		**199**	**0**	**0**	**0**	**0**	**11**	**59**	**76**	**48**	**6**	**0**	**0**	**0**	(10)
(11)		CDH23.3		**2372**	**0**	**0**	**0**	**9**	**185**	**728**	**741**	**574**	**132**	**3**	**0**	**0**	(11)
(12)		CDH26.7		**806**	**0**	**0**	**0**	**2**	**44**	**268**	**251**	**198**	**42**	**0**	**0**	**0**	(12)
(13)	Precipitation	PrecAvg		**315**	**17**	**14**	**13**	**20**	**33**	**38**	**50**	**38**	**23**	**27**	**20**	**18**	(13)
(14)		PrecMax		**443**	**53**	**41**	**34**	**66**	**83**	**119**	**163**	**178**	**66**	**71**	**54**	**56**	(14)
(15)		PrecMin		**224**	**2**	**2**	**2**	**0**	**5**	**3**	**0**	**0**	**1**	**0**	**2**	**1**	(15)
(16)		PrecSD		**56.4**	**10.8**	**7.9**	**7.8**	**14.4**	**17.7**	**24.5**	**39.7**	**34.0**	**15.8**	**18.5**	**12.2**	**10.3**	(16)
(17)	Monthly Design Dry Bulb and Mean Coincident Wet Bulb Temperatures	0.4%	DB		**1.1**	**1.0**	**11.0**	**24.5**	**31.0**	**34.7**	**34.4**	**33.8**	**31.2**	**22.3**	**10.1**	**1.9**	(17)
(18)			MCWB		**0.4**	**0.1**	**6.0**	**12.8**	**16.0**	**18.0**	**18.7**	**18.0**	**16.0**	**10.6**	**7.5**	**0.7**	(18)
(19)		2%	DB		**-0.6**	**-0.9**	**5.8**	**20.9**	**27.5**	**31.9**	**31.9**	**31.1**	**26.9**	**18.9**	**7.1**	**0.0**	(19)
(20)			MCWB		**-1.3**	**-1.9**	**3.2**	**11.2**	**15.1**	**17.6**	**18.3**	**17.5**	**14.0**	**10.1**	**5.0**	**-0.7**	(20)
(21)		5%	DB		**-2.5**	**-2.5**	**3.0**	**18.5**	**25.3**	**29.8**	**29.4**	**28.9**	**23.9**	**16.1**	**4.7**	**-1.4**	(21)
(22)			MCWB		**-3.1**	**-3.3**	**1.4**	**9.9**	**13.9**	**16.9**	**18.0**	**17.0**	**13.3**	**8.9**	**3.0**	**-2.1**	(22)
(23)		10%	DB		**-4.4**	**-4.4**	**1.1**	**15.4**	**23.1**	**27.8**	**27.2**	**26.8**	**21.0**	**13.1**	**2.7**	**-3.0**	(23)
(24)			MCWB		**-5.0**	**-5.2**	**0.1**	**8.6**	**13.2**	**16.6**	**17.4**	**16.4**	**12.2**	**7.4**	**1.3**	**-3.7**	(24)
(25)	Monthly Design Wet Bulb and Mean Coincident Dry Bulb Temperatures	0.4%	WB		**0.5**	**0.3**	**6.9**	**13.8**	**18.1**	**20.2**	**20.8**	**20.2**	**17.2**	**12.5**	**8.2**	**0.9**	(25)
(26)			MCDB		**0.9**	**0.8**	**10.0**	**21.4**	**26.2**	**29.0**	**29.1**	**28.7**	**28.2**	**19.3**	**9.3**	**1.4**	(26)
(27)		2%	WB		**-1.3**	**-1.8**	**3.3**	**12.1**	**16.3**	**19.1**	**19.9**	**18.7**	**15.3**	**10.7**	**5.2**	**-0.6**	(27)
(28)			MCDB		**-0.7**	**-1.1**	**5.3**	**19.3**	**24.9**	**28.1**	**27.1**	**27.0**	**24.0**	**17.1**	**6.8**	**0.0**	(28)
(29)		5%	WB		**-3.1**	**-3.4**	**1.4**	**10.4**	**15.1**	**18.2**	**19.2**	**17.7**	**14.1**	**9.3**	**2.9**	**-2.1**	(29)
(30)			MCDB		**-2.6**	**-2.6**	**2.7**	**17.1**	**22.9**	**26.8**	**26.2**	**26.2**	**21.8**	**15.0**	**4.2**	**-1.6**	(30)
(31)		10%	WB		**-5.1**	**-5.3**	**0.1**	**9.0**	**14.0**	**17.3**	**18.4**	**16.9**	**12.9**	**7.9**	**1.3**	**-3.7**	(31)
(32)			MCDB		**-4.5**	**-4.5**	**1.1**	**15.1**	**21.6**	**25.4**	**25.1**	**25.1**	**20.2**	**12.8**	**2.4**	**-3.1**	(32)
(33)	Mean Daily Temperature Range		MDBR		**8.7**	**9.7**	**9.0**	**10.8**	**12.6**	**12.5**	**11.4**	**12.3**	**12.6**	**10.4**	**7.6**	**8.6**	(33)
(34)		5% DB	MCDBR		**7.9**	**9.3**	**8.8**	**15.9**	**16.3**	**15.7**	**14.6**	**16.1**	**17.9**	**15.8**	**9.0**	**8.8**	(34)
(35)			MCWBR		**7.7**	**8.8**	**6.7**	**8.0**	**7.2**	**6.2**	**5.6**	**6.3**	**8.3**	**8.9**	**7.0**	**8.4**	(35)
(36)		5% WB	MCDBR		**8.0**	**8.9**	**8.3**	**14.7**	**14.4**	**13.8**	**12.2**	**14.3**	**16.0**	**14.2**	**8.0**	**8.3**	(36)
(37)			MCWBR		**7.9**	**8.6**	**6.6**	**8.0**	**7.4**	**6.3**	**5.4**	**6.1**	**7.9**	**8.4**	**6.6**	**8.1**	(37)
(38)	Clear Sky Solar Irradiance	taub			**0.326**	**0.370**	**0.364**	**0.369**	**0.348**	**0.355**	**0.365**	**0.360**	**0.353**	**0.351**	**0.329**	**0.337**	(38)
(39)		taud			**2.003**	**1.840**	**1.932**	**2.194**	**2.330**	**2.346**	**2.347**	**2.383**	**2.388**	**2.375**	**2.293**	**2.037**	(39)
(40)		Ebn,noon			**628**	**696**	**809**	**866**	**905**	**899**	**883**	**869**	**834**	**754**	**658**	**543**	(40)
(41)		Edh,noon			**87**	**136**	**150**	**130**	**119**	**118**	**117**	**107**	**95**	**80**	**66**	**73**	(41)

Nomenclature: See separate page