



Engineering Standard

SAES-A-112

31 October 2006

Meteorological and Seismic Design Data

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Saudi Aramco DeskTop Standards

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1 Scope

This standard defines the basic meteorological and seismic data to be used in the design of all Saudi Aramco facilities. These data are presented in tabular form in Appendix I.

Commentary Notes:

Saudi Aramco meteorological data generally are based on a minimum of 10 years of data. However, where weather records are available, data have been based on longer periods; where records are limited, data have been based on the maximum available time period.

As pertinent reference material becomes available, meteorological data for Saudi Aramco installations will be revised and expanded.

This entire standard may be attached to and made a part of purchase orders.

2 Conflicts and Deviations

- 2.1 Any conflicts between this standard and other applicable Saudi Aramco Engineering Standards (SAESs), Materials System Specifications (SAMSSs), Standard Drawings (SASDs), or industry standards, codes, and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Environmental Protection Department of Saudi Aramco, Dhahran.
- 2.2 Direct all requests to deviate from this standard in writing to the Company or Buyer Representative, who shall follow internal Company procedure [SAEP-302](#) and forward such requests to the Manager, Environmental Protection Department of Saudi Aramco, Dhahran.

3 References

The selection of material and equipment, and the design, construction, maintenance, and repair of equipment and facilities covered by this standard shall comply with the latest edition of the references listed below, unless otherwise noted.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

[SAEP-302](#)

*Instructions for Obtaining a Waiver of a
Mandatory Saudi Aramco Engineering
Requirement*

Saudi Aramco Engineering Reports

SAER-2359

Arabian Gulf Hindcast Study

<i>SAER-5307</i>	<i>Outdoor Design Temperatures for HVAC and Heat Exchangers</i>
<i>SAER-5565</i>	<i>Red Sea Hindcast Study</i>
<i>SAER-6089</i>	<i>Study on Seismic Acceleration Contour Maps for the Kingdom</i>

Note: It provides maximum considered earthquake spectral response accelerations at short and long periods consistent with IBC 2003 (NEHRP 2000).

3.2 Industry Codes and Standards

International Code Council (ICC)

IBC 2003 International Building Code

American Society of Civil Engineers

ASCE 7-02 Minimum Design Loads for Buildings and Other Structures

4 Definitions

This section defines the meteorological and seismic data presented in Tables 1 & 2 and indicates some of the areas in which these data are commonly used.

4.1 **Site elevation and station coordinates:** although not considered meteorological or seismic data, are included in this standard for the convenience of the user.

Elevation Above Mean Sea Level: Approximate elevations are listed for Saudi Aramco sites and referenced to Mean Sea Level (MSL).

Commentary Note:

These elevations are used by process, equipment, and utility engineers for calculation of atmospheric pressure. Seasonal site specific atmospheric pressure is also available from the Environmental Protection Department.

Station Coordinates: The approximate latitude and longitude of the plant site in the units of degrees and minutes.

Commentary Note:

This information can be used in HVAC design to determine the position of the sun at various times of the year.

4.2 **Ambient Air & Soil Temperatures:** Temperature readings obtained from the Saudi Aramco and MEPA local weather stations are as follows:

Average Annual Temperature: An average of the daily temperatures for the year averaged over a number of years.

Average Daily Maximum Temperature: An average of the daily temperatures for the hottest month averaged over a number of years.

Commentary Note:

This value is used in the rating of transformers and electric motors.

Monthly Normal Maximum Temperature: The average of the maximum daily temperature recorded during the hottest month averaged over a number of years.

Commentary Note:

This value is used in the rating of transformers and electric motors.

Average Daily Soil Temperature: The average daily soil temperature for the hottest month, measured one meter below grade, averaged over a number of years.

Commentary Note:

This value is used for underground cable applications and buried pipelines.

Monthly Normal Maximum Soil Temperature: The average of the maximum daily soil temperature, measured one meter below grade, during the hottest month averaged over a number of years.

Commentary Note:

This value is used for underground cable applications and buried pipelines.

Lowest One Day Mean Temperature: This temperature is determined by finding the lowest value of the daily mean temperatures over the entire period of records.

Commentary Note:

An ambient temperature that may be required for the minimum design metal temperature for equipment that is significantly pressurized at ambient temperatures.

Highest One Day Mean Temperature: This temperature is determined by finding the highest value of the daily mean temperatures over the entire period of records.

Commentary Note:

An ambient temperature that may be required to determine the maximum metal temperatures used in the design of structures, piping systems and certain types of equipment.

Lowest Recorded Temperature: The lowest ambient air temperature that has been recorded at a particular site.

Highest Recorded Temperature: The highest ambient air temperature that has been recorded at a particular site.

Summer Design Dry Bulb Temperature: A dry bulb temperature that has been equaled or exceeded by 1%, 2.5% or 5% (30 hrs, 73 hrs, or 146 hrs) of the total hours during the months of June through September.

Wet Bulb Temperature: The lowest temperature that can be obtained by evaporating water into the air.

Mean Coincident Wet Bulb Temperature: The mean of all wet bulb temperatures occurring at the specific Summer Design Dry Bulb Temperature.

Summer Design Wet Bulb Temperature: A wet bulb temperature that has been equaled or exceeded by either 1% or 2.5% (30 hrs or 73 hrs) of the total hours during the months of June through September.

Mean Coincident Dry Bulb Temperature: The mean of all dry bulb temperatures occurring at the specific summer design wet bulb temperature.

Mean Daily Range: The difference between the average daily maximum and average daily minimum temperatures during the month of August.

Winter Design Dry Bulb Temperature: A temperature that has been equaled or exceeded by 99% of the total hours during the months of December, January and February.

4.3 **Wind:** Wind data compiled from local weather stations are reported as follows:

Basic Wind Speed: The wind speeds are derived from local weather station data. Both 3-second gust and Fastest Mile Wind Speeds are expressed in both SI and customary units at 10 m above ground for 50-year mean recurrence intervals.

Commentary Note:

This data is used for the design of structures, buildings, pressure vessels, piping, storage tanks, air-cooled heat exchangers, cooling towers, stacks, and similar equipment.

Exposure Category: An exposure category reflects the characteristic of ground surface irregularities at a particular site.

Commentary Note:

This category is used to account for large variations in ground surface roughness that arises from natural topography and vegetation as well as from constructed features. This factor is used in calculating wind pressures using either the IBC or ASCE 7.

Prevailing Direction: The direction (N, NNE, NE, ENE, E, etc.) from which the wind blows the greatest percentage of the time.

Commentary Note:

Since 16 points of direction (N, NNE, NE, ENE, E, etc.) are used to discuss wind direction, the directions given in Table 1 could represent less than 10% of the total time the wind is blowing. Where wind direction considerations are critical, a wind rose diagram may be available from the Environmental Protection Department.

4.4 **Earthquake Data**

Short Period Acceleration (S_S): The mapped maximum considered earthquake spectral response acceleration at a short period.

One-Second Period Acceleration (S_1): The mapped maximum considered earthquake spectral response acceleration at a period of 1-sec.

Commentary Note:

S_S and S_1 values have been determined based on SAER-6089. They are to be used as per procedures in ASCE 7-02 and IBC 2003 to calculate the design spectral response acceleration parameters.

Site Class: A classification assigned to a site based on the types of soils present and their engineering properties as per IBC or ASCE 7 Site Classification Tables 1615.1.1 or 9.4.1.2 respectively.

4.5 **Precipitation**

Commentary Note:

The amount of precipitation (rainfall) is a factor used in storage tank design, drainage design, waste-water discharge quality control, and similar items. It should be realized that the desert climate and length of record make recorded values highly variable (for example, Dhahran has 60 years of data while Tanajib has 12 years).

Rainfall, Average Annual: This is the annual average rainfall based on as many years of data as available.

Rainfall Maximum in 24 Hours: This is the maximum precipitation recorded in 24 hours.

Rainfall Intensity Coefficients: These coefficients are provided for return periods of 5, 10, 25 and 50 years. The coefficients are used in the Steel Formula [$I = K/(t+b)$] to calculate the average maximum precipitation rates for storm durations up to two hours.

Where: I = Rainfall Intensity in mm/hr (in/hr),
t = time of concentration in minutes, and
K & b are non-dimensional coefficients.

Isokeraunic Levels: A rough measure of lightning frequency.

Commentary Note:

These values are used in the design of grounding and lightning protection systems.

4.6 Ambient Air Quality

Commentary Note:

Air-borne dust concentrations and contaminant levels are used in mechanical equipment design, when sizing air filters and as a measure of potential dust ingress in bearing housings, lube oil systems, etc.

Dust Concentration: Usual airborne dust concentration is 1 mg/m³. During sandstorms, dust concentrations may reach 500 mg/m³. Particle sizes are as follows:

95% of all particles are less than 20 micrometers

50% of all particles are less than 1.5 micrometers

Elements present in dust include compounds of calcium, silicon, magnesium, aluminum, potassium, chlorides and sodium. When wetted (high humidity conditions) these compounds function as electrolytes and can result in severe corrosion.

Other pollutants present in the atmosphere under the most extreme conditions are:

H ₂ S	20 ppm (vol/vol)
Hydrocarbon	150 ppm (vol/vol)
SO ₂	10 ppm (vol/vol)

CO	100 ppm (vol/vol)
NO _x	5 ppm (vol/vol)
O ₃	1 ppm (vol/vol)

4.7 Other Data

Offshore Structures: For the design of offshore structures the wind, current and wave design data should be taken from SAER-2359 "Arabian Gulf Hindcast Study", and SAER-5565 "Red Sea Hindcast Study".

If more precise data becomes available at a given site, it may be used for design with the prior written approval of the Manager of Environmental Protection Department, Dhahran.

21 December 2005
31 October 2006

Revision Summary
Major revision.
Editorial revision.

Appendix

Table 1 – Design Data - SI Units

Data Categories	Abha	Abqaiq	Abu Sa'fah	Al-Baha	Al-Jauf
Elevation Above Mean Sea Level, m	2200	79	16	1651	559
Station Coordinates: Latitude North	18°12'	25°56'	26°54'	20°17'	29°56'
Longitude East	42°29'	49°42'	50°30'	41°38'	40°12'
Ambient Air & Soil Temperatures, (°C):					
Average Annual Temperature	18	27	26	23	22
Average Daily Maximum Temp. (hottest month)	23	37	34	35	33
Monthly Normal Max. Temp. (hottest month)	31	45	35	37	40
Average Daily Soil Temp. (1 m below grade)	-	32	Note 2	-	-
Mo. Normal Max. Soil Temp. (1 m below grade)	-	33	Note 2	-	-
Lowest One-Day Mean Temperature	5	6	10	10	1
Highest One-Day Mean Temperature	28	42	36	36	40
Lowest Recorded Temperature	0	-3	10	0	-
Highest Recorded Temperature	35	52	43	39	46
Summer Design Dry Bulb Temp. @ 1%	32	46	-	-	-
Mean Coincident Wet Bulb Temp. @ 1%	28	22	-	-	-
Summer Design Dry Bulb Temp. @ 2.5%	31	45	-	-	-
Mean Coincident Wet Bulb Temp. @ 2.5%	26	22	-	-	-
Summer Design Wet Bulb Temp. @ 1%	29	29	-	-	-
Mean Coincident Dry Bulb Temp. @ 1%	31	40	-	-	-
Summer Design Wet Bulb Temp. @ 2.5%	28	27	-	-	-
Mean Coincident Dry Bulb Temp. @ 2.5%	30	39	-	-	-
Summer Design Dry Bulb Temp. @ 5%	31	43	-	-	-
Mean Daily Range	14	15	-	13	-
Winter Design Dry Bulb Temp. @ 99%	5	8	-	-	-
Wind:					
Basic Wind Speed, 3-sec gust, km/hr	150	150	Note 2	155	165
Basic Wind Speed, Fastest-mile, (km/hr) 50 yr	126	126	Note 2	-	140
Exposure Category (Note 1)	C	C	Note 2	-	C
Prevailing Direction	N	NW	NW	E	W
Earthquake Data:					
Short Period Acceleration (S_s) in %g	20	14.6	8.3	16	14.5
1-Sec Period Acceleration (S₁) in %g	5.4	3.8	2.8	4.2	4.0
Site Class (Note 4)	D	D	D	D	D
Precipitation, mm:					
Rainfall, Average Annual	330	81	-	154	59
Rainfall Maximum in 24 hours	131	80	-	118	-
Rainfall Intensity	-	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	-	2	10*	33	10*

See page No. 25 for notes

Table 1 – Design Data - SI Units (Continued)

Data Categories	Ar'ar' (Badana)	Berri	Dhahran	Duba (as Al-Wajh)
Elevation Above Mean Sea Level, m	539	10	89	19
Station Coordinates: Latitude North	30°58'	26°57'	26°19'	27°19'
Longitude East	40°59'	49°35'	50°08'	35°44'
Ambient Air & Soil Temperatures, (°C):				
Average Annual Temperature	22	27	27	25
Average Daily Maximum Temp. (hottest month)	34	37	36	30
Monthly Normal Max. Temp. (hottest month)	41	39	42	34
Average Daily Soil Temp. (1 m below grade)	-	32	32	-
Mo. Normal Max. Soil Temp. (1 m below grade)	-	32	33	-
Lowest One-Day Mean Temperature	-1	8	8	11
Highest One-Day Mean Temperature	39	38	39	34
Lowest Recorded Temperature	-	0	-1	5
Highest Recorded Temperature	47	47	51	44
Summer Design Dry Bulb Temp. @ 1%	-	45	45	-
Mean Coincident Wet Bulb Temp. @ 1%	-	24	26	-
Summer Design Dry Bulb Temp. @ 2.5%	-	43	44	-
Mean Coincident Wet Bulb Temp. @ 2.5%	-	24	25	-
Summer Design Wet Bulb Temp. @ 1%	-	33	32	-
Mean Coincident Dry Bulb Temp. @ 1%	-	34	38	-
Summer Design Wet Bulb Temp. @ 2.5%	-	31	30	-
Mean Coincident Dry Bulb Temp. @ 2.5%	-	33	35	-
Summer Design Dry Bulb Temp. @ 5%	-	42	43	-
Mean Daily Range	-	10	12	9
Winter Design Dry Bulb Temp. @ 99%	-	8	8	-
Wind:				
Basic Wind Speed, 3-sec gust, km/hr	181	150	150	155
Basic Wind Speed, Fastest-mile, (km/hr) 50 yr	155	126	126	130
Exposure Category (Note 1)	C	C	C	C
Prevailing Direction	W	NW	NW	W
Earthquake Data:				
Short Period Acceleration (S_s) in %g	3.2	15	8.3	26.6
1-Sec Period Acceleration (S_1) in %g	0.8	4.0	2.8	8.5
Site Class (Note 4)	D	D	D	D
Precipitation, mm:				
Rainfall, Average Annual	73	90	83	28
Rainfall Maximum in 24 hours	27	96	63	41
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	10*	5	10*	10*

See page No. 25 for notes

Table 1 – Design Data - SI Units (Continued)

Data Categories	East/West Pump Stations					
	No. 3	No. 6	No. 10	Hail	Harad	Hawta
Elevation Above Mean Sea Level, m	530	771	866	1001	300	635
Station Coordinates: Latitude North	25°10'	24°42'	24°06'	27°26'	24°04'	22°58'
Longitude East	47°30'	44°58'	41°02'	41°41'	49°01'	46°54'
Ambient Air & Soil Temperatures, (°C):						
Average Annual Temperature	25	25	22	22	27	26
Average Daily Maximum Temp. (hottest month)	36	34	34	39	38	36
Monthly Normal Max. Temp. (hottest month)	43	42	42	42	44	43
Average Daily Soil Temp. (1 m below grade)	33	32	33	-	34	34
Mo. Normal Max. Soil Temp. (1 m below grade)	34	33	34	-	36	35
Lowest One-Day Mean Temperature	5	-	-	4	2	11
Highest One-Day Mean Temperature	38	-	-	40	48	39
Lowest Recorded Temperature	-2	-5	-2	-9	-6	5
Highest Recorded Temperature	47	46	44	44	50	46
Summer Design Dry Bulb Temp. @ 1%	44	43	-	-	-	-
Mean Coincident Wet Bulb Temp. @ 1%	-	-	-	-	-	-
Summer Design Dry Bulb Temp. @ 2.5%	43	41	-	-	-	-
Mean Coincident Wet Bulb Temp. @ 2.5%	-	-	-	-	-	-
Summer Design Wet Bulb Temp. @ 1%	-	-	-	-	-	-
Mean Coincident Dry Bulb Temp. @ 1%	-	-	-	-	-	-
Summer Design Wet Bulb Temp. @ 2.5%	-	-	-	-	-	-
Mean Coincident Dry Bulb Temp. @ 2.5%	-	-	-	-	-	-
Summer Design Dry Bulb Temp. @ 5%	-	-	-	-	-	-
Mean Daily Range	19	17	19	15	21	16
Winter Design Dry Bulb Temp. @ 99%	-	-	-	-	-	-
Wind:						
Basic Wind Speed, 3-sec gust, km/hr	168	168	165	-	150	154
Basic Wind Speed, Fastest-mile, (km/hr) 50 yr	144	144	140	-	126	129
Exposure Category (Note 1)	C	C	C	S	C	C
Prevailing Direction	N	SE	W		-	-
Earthquake Data:						
Short Period Acceleration (S _s) in %g	0.8	14.0	5.0	1.2	16.5	0.6
1-Sec Period Acceleration (S ₁) in %g	0.2	3.6	1.0	0.4	4.2	0.2
Site Class (Note 4)	D	D	D	D	D	D
Precipitation, mm:						
Rainfall, Average Annual	-	-	-	130	40	112
Rainfall Maximum in 24 hours	-	-	-	88	-	50
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	10*	10*	10*	27	10*	10*

See page No. 25 for notes

Table 1 – Design Data - SI Units (Continued)

Data Categories	Hofuf	Jeddah	Jizan	Ju'aymah	Khamis Mushayt
Elevation Above Mean Sea Level, m	160	11	3	5	2051
Station Coordinates: Latitude North	25°30'	21°30'	16°52'	26°47'	18°18'
Longitude East	49°34'	39°12'	42°35'	49°56'	42°48'
Ambient Air & Soil Temperatures, (°C):					
Average Annual Temperature	26	28	30	26	20
Average Daily Maximum Temp. (hottest month)	35	32	34	34	24
Monthly Normal Max. Temp. (hottest month)	45	39	38	42	32
Average Daily Soil Temp. (1 m below grade)	30	-	-	31	-
Mo. Normal Max. Soil Temp. (1 m below grade)	31	-	-	31	-
Lowest One-Day Mean Temperature	6	16	20	8	8
Highest One-Day Mean Temperature	42	36	37	40	28
Lowest Recorded Temperature	-2	10	12	-	-
Highest Recorded Temperature	49	49	45	48	40
Summer Design Dry Bulb Temp. @ 1%	45	41	38	-	-
Mean Coincident Wet Bulb Temp. @ 1%	21	30	28	-	-
Summer Design Dry Bulb Temp. @ 2.5%	44	39	37	-	-
Mean Coincident Wet Bulb Temp. @ 2.5%	21	29	28	-	-
Summer Design Wet Bulb Temp. @ 1%	26	30	30	-	-
Mean Coincident Dry Bulb Temp. @ 1%	36	34	34	-	-
Summer Design Wet Bulb Temp. @ 2.5%	25	29	30	-	-
Mean Coincident Dry Bulb Temp. @ 2.5%	36	33	34	-	-
Summer Design Dry Bulb Temp. @ 5%	43	-	-	-	-
Mean Daily Range	16	12	8	-	-
Winter Design Dry Bulb Temp. @ 99%	3	14	20	-	-
Wind:					
Basic Wind Speed, 3-sec gust, km/hr	150	150	155	150	150
Basic Wind Speed, Fastest-mile, (km/hr) 50 yr	126	126	130	126	126
Exposure Category (Note 1)	C	C	C	C	C
Prevailing Direction	N	NNW	W	N	SW
Earthquake Data:					
Short Period Acceleration (S _s) in %g	15.9	30.6	43.3	8.5	18.4
1-Sec Period Acceleration (S ₁) in %g	4.1	11.0	11.3	2.8	4.8
Site Class (Note 4)	D	E	D	D	D
Precipitation, mm:					
Rainfall, Average Annual	92	54	120	89	220
Rainfall Maximum in 24 hours	52	52	67	66	56
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3	-
Isokeraunic Levels (days lightning/year)	10*	10*	19+	10*	48+

See page No. 25 for notes

Table 1 – Design Data - SI Units (Continued)

Data Categories	Khurais	Medina	Marjan	Najran	Qasim
Elevation Above Mean Sea Level, m	430	632	21	1206	645
Station Coordinates: Latitude North	25°05'	24°31'	28°27'	17°36'	26°18'
Longitude East	48°08'	39°35'	49°42'	44°25'	43°58'
Ambient Air & Soil Temperatures, (°C):					
Average Annual Temperature	27	28	25	26	25
Average Daily Maximum Temp. (hottest month)	38	36	33	33	35
Monthly Normal Max. Temp. (hottest month)	42	42	39	39	41
Average Daily Soil Temp. (1 m below grade)	34	34	Note 2	-	-
Mo. Normal Max. Soil Temp. (1 m below grade)	35	35	Note 2	-	-
Lowest One-Day Mean Temperature	-	-	10	8	4
Highest One-Day Mean Temperature	-	-	36	38	39
Lowest Recorded Temperature	-2	-	8	-1	-4
Highest Recorded Temperature	52	-	42	41	47
Summer Design Dry Bulb Temp. @ 1%	50	44	-	-	44
Mean Coincident Wet Bulb Temp. @ 1%	22	20	-	-	21
Summer Design Dry Bulb Temp. @ 2.5%	49	43	-	-	43
Mean Coincident Wet Bulb Temp. @ 2.5%	22	19	-	-	21
Summer Design Wet Bulb Temp. @ 1%	27	21	-	-	24
Mean Coincident Dry Bulb Temp. @ 1%	40	31	-	-	35
Summer Design Wet Bulb Temp. @ 2.5%	27	20	-	-	23
Mean Coincident Dry Bulb Temp. @ 2.5%	40	31	-	-	35
Summer Design Dry Bulb Temp. @ 5%	47	40	-	-	41
Mean Daily Range	19	15	-	-	16
Winter Design Dry Bulb Temp. @ 99%	8	8	-	-	2
Wind:					
Basic Wind Speed, 3-sec gust, km/hr	163	155	Note 2	150	191
Basic Wind Speed, Fastest-mile, (km/hr) 50 yr	137	130	Note 2	126	165
Exposure Category (Note 1)	C	C	Note 2	C	C
Prevailing Direction	-	-	NW	E	ENE
Earthquake Data:					
Short Period Acceleration (S_s) in %g	5.0	30	8	35.2	14.0
1-Sec Period Acceleration (S_1) in %g	2.0	11	5	9.1	3.6
Site Class (Note 4)	D	D	D	D	D
Precipitation, mm:					
Rainfall, Average Annual	81	-	-	64	135
Rainfall Maximum in 24 hours	-	-	-	35	61
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	10*	10*	10*	10*	10*

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Table 1 – Design Data - SI Units (Continued)

Data Categories	Qaisumah	Qatif	Rabigh	Ras Tanura	Riyadh
Elevation Above Mean Sea Level, m	356	4	5	2	608
Station Coordinates: Latitude North	28°20'	26°30'	22°43'	26°42'	24°42'
Longitude East	46°07'	50°00'	39°01'	50°05'	46°44'
Ambient Air & Soil Temperatures, (°C):					
Average Annual Temperature	26	25	27	26	27
Average Daily Maximum Temp. (hottest month)	37	33	31	33	37
Monthly Normal Max. Temp. (hottest month)	45	39	34	38	43
Average Daily Soil Temp. (1 m below grade)	-	32	-	-	33
Mo. Normal Max. Soil Temp. (1 m below grade)	-	33	-	-	34
Lowest One-Day Mean Temperature	2	8	17	8	5
Highest One-Day Mean Temperature	42	39	35	38	40
Lowest Recorded Temperature	-	2	15	0	-4
Highest Recorded Temperature	50	51	46	47	49
Summer Design Dry Bulb Temp. @ 1%	-	40	41	40	44
Mean Coincident Wet Bulb Temp. @ 1%	-	28	30	27	21
Summer Design Dry Bulb Temp. @ 2.5%	-	39	39	39	43
Mean Coincident Wet Bulb Temp. @ 2.5%	-	28	29	27	20
Summer Design Wet Bulb Temp. @ 1%	-	34	30	33	22
Mean Coincident Dry Bulb Temp. @ 1%	-	34	34	34	34
Summer Design Wet Bulb Temp. @ 2.5%	-	33	29	32	20
Mean Coincident Dry Bulb Temp. @ 2.5%	-	34	33	34	34
Summer Design Dry Bulb Temp. @ 5%	-	36	39	37	42
Mean Daily Range	-	15	13	9	16
Winter Design Dry Bulb Temp. @ 99%	-	8	13	8	3
Wind:					
Basic Wind Speed, 3-sec gust, km/hr	183	150	150	150	165
Basic Wind Speed, Fastest-mile, (km/hr) 50 yr	158	126	126	126	140
Exposure Category (Note 1)	C	C	C	C	C
Prevailing Direction	N	NW	N	NW	N
Earthquake Data:					
Short Period Acceleration (S_s) in %g	1.0	8.5	16.9	8.5	0.8
1-Sec Period Acceleration (S_1) in %g	0.6	2.8	6.2	2.8	0.2
Site Class (Note 4)	D	D	D	D	D
Precipitation, mm:					
Rainfall, Average Annual	121	87	60	89	116
Rainfall Maximum in 24 hours	50	65	40	98	70
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	10*	10*	10*	5	10*

See page No. 25 for notes

Table 1 – Design Data - SI Units (Continued)

Data Categories	Safaniya	Shaybah	Shedgum	Tanajib	Tabuk
Elevation Above Mean Sea Level, m	2	70	294	10	769
Station Coordinates: Latitude North	28°00'	22°21'	25°36'	27°52'	28°22'
Longitude East	48°48'	54°03'	49°24'	48°46'	36°35'
Ambient Air & Soil Temperatures, (°C):					
Average Annual Temperature	25	30	26	25	22
Average Daily Maximum Temp. (hottest month)	34	40	37	35	31
Monthly Normal Max. Temp. (hottest month)	44	44	47	42	39
Average Daily Soil Temp. (1 m below grade)	29	35	33	29	22
Mo. Normal Max. Soil Temp. (1 m below grade)	30	36	34	30	23
Lowest One-Day Mean Temperature	8	10	5	6	3
Highest One-Day Mean Temperature	-	42	41	39	37
Lowest Recorded Temperature	6	2	-1	4	-8
Highest Recorded Temperature	45	53	49	48	44
Summer Design Dry Bulb Temp. @ 1%	41	48	46	41	-
Mean Coincident Wet Bulb Temp. @ 1%	26	20	22	26	-
Summer Design Dry Bulb Temp. @ 2.5%	39	46	45	39	-
Mean Coincident Wet Bulb Temp. @ 2.5%	26	21	22	26	-
Summer Design Wet Bulb Temp. @ 1%	31	25	27	31	-
Mean Coincident Dry Bulb Temp. @ 1%	34	37	38	34	-
Summer Design Wet Bulb Temp. @ 2.5%	30	23	25	30	-
Mean Coincident Dry Bulb Temp. @ 2.5%	34	38	38	34	-
Summer Design Dry Bulb Temp. @ 5%	39	45	44	39	-
Mean Daily Range	7	16	15	12	15
Winter Design Dry Bulb Temp. @ 99%	8	9	6	8	-
Wind:					
Basic Wind Speed, 3-sec gust, km/hr	155	155	155	155	171
Basic Wind Speed, Fastest-mile, (km/hr) 50 yr	130	130	130	130	145
Exposure Category (Note 1)	C	C	C	C	C
Prevailing Direction	NW	-	NW	NW	W
Earthquake Data:					
Short Period Acceleration (S_s) in %g	7.6	5	8.5	7.5	27.2
1-Sec Period Acceleration (S_1) in %g	5	1	2.8	5.0	11.0
Site Class (Note 4)	D	D	D	D	D
Precipitation, mm:					
Rainfall, Average Annual	98	24	81	98	48
Rainfall Maximum in 24 hours	51	12	80	59	48
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	6	10*	10*	6	10*

See page No. 25 for notes

Table 1 – Design Data - SI Units (Continued)

Data Categories	Turaif	Udhailiyah	Uthmaniyah	Yanbu
Elevation Above Mean Sea Level, m	824	245	231	6
Station Coordinates: Latitude North	31°41'	25°09'	25°13'	24°07'
Longitude East	38°40'	49°20'	49°18'	38°03'
Ambient Air & Soil Temperatures, (°C):				
Average Annual Temperature	19	26	25	27
Average Daily Maximum Temp. (hottest month)	30	36	36	32
Monthly Normal Max. Temp. (hottest month)	38	47	47	39
Average Daily Soil Temp. (1 m below grade)	-	32	32	31
Mo. Normal Max. Soil Temp. (1 m below grade)	-	33	33	32
Lowest One-Day Mean Temperature	-1	6	6	12
Highest One-Day Mean Temperature	37	41	41	39
Lowest Recorded Temperature	-8	-1	-1	6
Highest Recorded Temperature	44	49	49	49
Summer Design Dry Bulb Temp. @ 1%	-	46	46	41
Mean Coincident Wet Bulb Temp. @ 1%	-	22	22	25
Summer Design Dry Bulb Temp. @ 2.5%	-	45	45	39
Mean Coincident Wet Bulb Temp. @ 2.5%	-	22	22	25
Summer Design Wet Bulb Temp. @ 1%	-	25	25	29
Mean Coincident Dry Bulb Temp. @ 1%	-	37	37	34
Summer Design Wet Bulb Temp. @ 2.5%	-	24	24	28
Mean Coincident Dry Bulb Temp. @ 2.5%	-	37	37	34
Summer Design Dry Bulb Temp. @ 5%	-	43	43	37
Mean Daily Range	16	16	16	15
Winter Design Dry Bulb Temp. @ 99%	-	3	3	10
Wind:				
Basic Wind Speed, 3-sec gust, km/hr	165	155	155	150
Basic Wind Speed, Fastest-mile, (km/hr) 50 yr	140	130	130	126
Exposure Category (Note 1)	C	C	C	C
Prevailing Direction	W	NW	NW	W
Earthquake Data:				
Short Period Acceleration (S_s) in %g	18.7	15	16.0	18.3
1-Sec Period Acceleration (S_1) in %g	4.8	4	4.5	4.8
Site Class (Note 4)	D	D	D	D
Precipitation, mm:				
Rainfall, Average Annual	78	-	-	36
Rainfall Maximum in 24 hours	30	-	-	48
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	10*	10*	10*	10*

See page No. 25 for notes

Table 2 – Design Data - Customary Units

Data Categories	Abha	Abqaiq	Abu Sa'fah	Al-Jauf	Ar'ar' (Badana)
Elevation Above Mean Sea Level, ft	7218	259	52	1834	1768
Station Coordinates: Latitude North	18°12'	25°56'	26°54'	29°56'	30°58'
Longitude East	42°29'	49°42'	50°30'	40°12'	40°59'
Ambient Air & Soil Temperatures, (°F):					
Average Annual Temperature	64	81	79	72	72
Average Daily Maximum Temp. (hottest month)	73	99	93	91	93
Monthly Normal Max. Temp. (hottest month)	88	113	95	104	106
Average Daily Soil Temp. (3 ft below grade)	-	90	Note 2	-	-
Mo. Normal Max. Soil Temp. (3 ft below grade)	-	92	Note 2	-	-
Lowest One-Day Mean Temperature	41	43	50	34	30
Highest One-Day Mean Temperature	82	108	97	104	102
Lowest Recorded Temperature	32	27	50	-	-
Highest Recorded Temperature	95	126	109	115	117
Summer Design Dry Bulb Temp. @ 1%	90	115	-	-	-
Mean Coincident Wet Bulb Temp. @ 1%	82	72	-	-	-
Summer Design Dry Bulb Temp. @ 2.5%	88	113	-	-	-
Mean Coincident Wet Bulb Temp. @ 2.5%	79	72	-	-	-
Summer Design Wet Bulb Temp. @ 1%	84	84	-	-	-
Mean Coincident Dry Bulb Temp. @ 1%	88	104	-	-	-
Summer Design Wet Bulb Temp. @ 2.5%	82	81	-	-	-
Mean Coincident Dry Bulb Temp. @ 2.5%	86	102	-	-	-
Summer Design Dry Bulb Temp. @ 5%	88	109	-	-	-
Mean Daily Range	25	27	-	-	-
Winter Design Dry Bulb Temp. @ 99%	41	46	-	-	-
Wind:					
Basic Wind Speed, 3-sec gust, mph	93	93	Note 2	103	112
Basic Wind Speed, Fastest-mile, (mph) 50 yr	78	78	Note 2	87	96
Exposure Category (Note 1)	C	C	Note 2	C	C
Prevailing Direction	N	NW	NW	W	W
Earthquake Data:					
Short Period Acceleration (S _s) in %g	20	14.6	8.3	14.5	3.2
1-Sec Period Acceleration (S ₁) in %g	5.4	3.8	2.8	4.0	0.8
Site Class (Note 4)	D	D	D	D	D
Precipitation, inches:					
Rainfall, Average Annual	13	3.2	-	2.3	2.9
Rainfall Maximum in 24 hours	5.2	3.1	-	-	1.1
Rainfall Intensity	-	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	-	2	10*	10*	10*

See page No. 25 for notes

Table 2 – Design Data - Customary Units (Continued)

Data Categories	Berri	Dhahran	Duba (as Al-Wajh)
Elevation Above Mean Sea Level, ft	33	292	62
Station Coordinates: Latitude North	26°57'	26°19'	27°19'
Longitude East	49°35'	50°08'	35°44'
Ambient Air & Soil Temperatures, (°F):			
Average Annual Temperature	81	81	77
Average Daily Maximum Temp. (hottest month)	99	97	86
Monthly Normal Max. Temp. (hottest month)	102	108	93
Average Daily Soil Temp. (3 ft below grade)	89	90	88
Mo. Normal Max. Soil Temp. (3 ft below grade)	90	91	90
Lowest One-Day Mean Temperature	46	46	52
Highest One-Day Mean Temperature	100	102	93
Lowest Recorded Temperature	32	30	41
Highest Recorded Temperature	95	124	111
Summer Design Dry Bulb Temp. @ 1%	113	113	-
Mean Coincident Wet Bulb Temp. @ 1%	75	79	-
Summer Design Dry Bulb Temp. @ 2.5%	109	111	-
Mean Coincident Wet Bulb Temp. @ 2.5%	75	77	-
Summer Design Wet Bulb Temp. @ 1%	91	90	-
Mean Coincident Dry Bulb Temp. @ 1%	93	100	-
Summer Design Wet Bulb Temp. @ 2.5%	88	86	-
Mean Coincident Dry Bulb Temp. @ 2.5%	91	95	-
Summer Design Dry Bulb Temp. @ 5%	108	109	-
Mean Daily Range	18	22	16
Winter Design Dry Bulb Temp. @ 99%	46	46	-
Wind:			
Basic Wind Speed, 3-sec gust, mph	93	93	96
Basic Wind Speed, Fastest-mile, (mph) 50 yr	78	78	81
Exposure Category (Note 1)	C	C	C
Prevailing Direction	NW	NW	W
Earthquake Data:			
Short Period Acceleration (S_s) in %g	15	8.3	26.6
1-Sec Period Acceleration (S_1) in %g	4.0	2.8	8.5
Site Class (Note 4)	D	D	D
Precipitation, inches:			
Rainfall, Average Annual	3.5	3.3	1.1
Rainfall Maximum in 24 hours	3.8	2.5	1.6
Rainfall Intensity	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	5	10*	10*

See page No. 25 for notes

Table 2 – Design Data - Customary Units (Continued)

Data Categories	East/West Pump Stations			Haradh	Hawtah
	No. 3	No. 6	No. 10		
Elevation Above Mean Sea Level, ft	1739	2530	2841	984	2083
Station Coordinates: Latitude North	25°10'	24°42'	24°06'	24°04'	22°58'
Longitude East	47°30'	44°58'	41°02'	49°01'	46°54'
Ambient Air & Soil Temperatures, (°F):					
Average Annual Temperature	77	77	72	81	-
Average Daily Maximum Temp. (hottest month)	97	93	93	100	-
Monthly Normal Max. Temp. (hottest month)	109	108	108	111	-
Average Daily Soil Temp. (3 ft below grade)	92	89	91	94	92
Mo. Normal Max. Soil Temp. (3 ft below grade)	93	91	93	96	94
Lowest One-Day Mean Temperature	-	-	-	36	52
Highest One-Day Mean Temperature	-	-	-	118	102
Lowest Recorded Temperature	28	23	28	21	41
Highest Recorded Temperature	117	115	111	122	115
Summer Design Dry Bulb Temp. @ 1%	-	-	-	-	-
Mean Coincident Wet Bulb Temp. @ 1%	-	-	-	-	-
Summer Design Dry Bulb Temp. @ 2.5%	-	-	-	-	-
Mean Coincident Wet Bulb Temp. @ 2.5%	-	-	-	-	-
Summer Design Wet Bulb Temp. @ 1%	-	-	-	-	-
Mean Coincident Dry Bulb Temp. @ 1%	-	-	-	-	-
Summer Design Wet Bulb Temp. @ 2.5%	-	-	-	-	-
Mean Coincident Dry Bulb Temp. @ 2.5%	-	-	-	-	-
Summer Design Dry Bulb Temp. @ 5%	-	-	-	-	-
Mean Daily Range	-	-	-	38	29
Winter Design Dry Bulb Temp. @ 99%	-	-	-	-	-
Wind:					
Basic Wind Speed, 3-sec gust, mph	104	104	103	93	96
Basic Wind Speed, Fastest-mile, (mph) 50 yr	89	89	87	78	80
Exposure Category (Note 1)	C	C	C	C	C
Prevailing Direction	N	NNE	W	-	-
Earthquake Data:					
Short Period Acceleration (S _s) in %g	0.8	14.0	5.0	16.5	0.6
1-Sec Period Acceleration (S ₁) in %g	0.2	3.6	1.0	4.2	0.2
Site Class (Note 4)	D	D	D	D	D
Precipitation, inches:					
Rainfall, Average Annual	-	-	-	1.6	4.4
Rainfall Maximum in 24 hours	-	-	-	-	2
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	10*	10*	10*	10*	10*

See page No. 25 for notes

Table 2 – Design Data - Customary Units (Continued)

Data Categories	Hofuf	Jeddah	Jizan	Ju'aymah	Khamis Mushayt
Elevation Above Mean Sea Level, ft	525	36	10	16	6729
Station Coordinates: Latitude North	25°30'	21°30'	16°52'	26°47'	18°18'
Longitude East	49°34'	39°12'	42°35'	49°56'	42°48'
Ambient Air & Soil Temperatures, (°F):					
Average Annual Temperature	79	82	86	79	68
Average Daily Maximum Temp. (hottest month)	95	90	93	93	75
Monthly Normal Max. Temp. (hottest month)	113	102	100	108	90
Average Daily Soil Temp. (3 ft below grade)	86	-	-	87	-
Mo. Normal Max. Soil Temp. (3 ft below grade)	88	-	-	88	-
Lowest One-Day Mean Temperature	43	61	68	46	46
Highest One-Day Mean Temperature	108	97	99	104	82
Lowest Recorded Temperature	28	50	54	-	-
Highest Recorded Temperature	120	120	113	118	104
Summer Design Dry Bulb Temp. @ 1%	113	106	100	-	-
Mean Coincident Wet Bulb Temp. @ 1%	70	86	82	-	-
Summer Design Dry Bulb Temp. @ 2.5%	111	102	99	-	-
Mean Coincident Wet Bulb Temp. @ 2.5%	70	84	82	-	-
Summer Design Wet Bulb Temp. @ 1%	79	86	86	-	-
Mean Coincident Dry Bulb Temp. @ 1%	97	93	93	-	-
Summer Design Wet Bulb Temp. @ 2.5%	77	84	86	-	-
Mean Coincident Dry Bulb Temp. @ 2.5%	97	91	93	-	-
Summer Design Dry Bulb Temp. @ 5%	109	-	-	-	-
Mean Daily Range	29	22	14	-	-
Winter Design Dry Bulb Temp. @ 99%	37	57	68	-	-
Wind:					
Basic Wind Speed, 3-sec gust, mph	93	93	96	93	93
Basic Wind Speed, Fastest-mile, (mph) 50 yr	78	78	80	78	78
Exposure Category (Note 1)	C	C	C	C	C
Prevailing Direction	N	NNW	W	N	SW
Earthquake Data:					
Short Period Acceleration (S _s) in %g	15.9	30.6	43.3	8.5	18.4
1-Sec Period Acceleration (S ₁) in %g	4.1	11.0	11.3	2.8	4.8
Site Class (Note 4)	D	E	D	D	D
Precipitation, inches:					
Rainfall, Average Annual	3.6	2.1	4.7	3.5	8.7
Rainfall Maximum in 24 hours	2	2	2.6	2.6	2.2
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3	-
Isokeraunic Levels (days lightning/year)	10*	10*	19+	10*	48+

See page No. 25 for notes

Table 2 – Design Data - Customary Units (Continued)

Data Categories	Khurais	Medina	Marjan	Najran	Qasim
Elevation Above Mean Sea Level, ft	1411	2073	69	3957	2116
Station Coordinates: Latitude North	25°05'	24°31'	28°27'	17°36'	26°18'
Longitude East	48°08'	39°35'	49°42'	44°25'	43°58'
Ambient Air & Soil Temperatures, (°F):					
Average Annual Temperature	81	82	77	79	77
Average Daily Maximum Temp. (hottest month)	100	97	91	91	95
Monthly Normal Max. Temp. (hottest month)	108	108	102	102	106
Average Daily Soil Temp. (3 ft below grade)	94	93	Note 2	-	-
Mo. Normal Max. Soil Temp. (3 ft below grade)	96	95	Note 2	-	-
Lowest One-Day Mean Temperature	-	-	50	46	39
Highest One-Day Mean Temperature	-	-	97	100	102
Lowest Recorded Temperature	28	-	46	30	25
Highest Recorded Temperature	126	-	108	106	117
Summer Design Dry Bulb Temp. @ 1%	122	111	-	-	111
Mean Coincident Wet Bulb Temp. @ 1%	72	68	-	-	70
Summer Design Dry Bulb Temp. @ 2.5%	120	109	-	-	109
Mean Coincident Wet Bulb Temp. @ 2.5%	72	66	-	-	70
Summer Design Wet Bulb Temp. @ 1%	81	70	-	-	75
Mean Coincident Dry Bulb Temp. @ 1%	104	88	-	-	95
Summer Design Wet Bulb Temp. @ 2.5%	81	68	-	-	73
Mean Coincident Dry Bulb Temp. @ 2.5%	104	88	-	-	95
Summer Design Dry Bulb Temp. @ 5%	117	104	-	-	106
Mean Daily Range	34	27	-	-	29
Winter Design Dry Bulb Temp. @ 99%	46	46	-	-	36
Wind:					
Basic Wind Speed, 3-sec gust, mph	101	96	Note 2	93	119
Basic Wind Speed, Fastest-mile, (mph) 50 yr	85	81	Note 2	78	103
Exposure Category (Note 1)	C	C	Note 2	C	C
Prevailing Direction	-	-	NW	E	ENE
Earthquake Data:					
Short Period Acceleration (S _s) in %g	5.0	30	8	35.2	14.0
1-Sec Period Acceleration (S ₁) in %g	2.0	11	5	9.1	3.6
Site Class (Note 4)	D	D	D	D	D
Precipitation, inches:					
Rainfall, Average Annual	3.2	-	-	2.5	5.3
Rainfall Maximum in 24 hours	-	-	-	1.4	2.4
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	10*	10*	10*	10*	10*

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Table 2 – Design Data - Customary Units (Continued)

Data Categories	Qaisumah	Qatif	Rabigh	Ras Tanura	Riyadh
Elevation Above Mean Sea Level, ft	1168	13	16	7	1995
Station Coordinates: Latitude North	28°20'	26°30'	22°43'	26°42'	24°42'
Longitude East	46°07'	50°00'	39°01'	50°05'	46°44'
Ambient Air & Soil Temperatures, (°F):					
Average Annual Temperature	79	77	81	79	81
Average Daily Maximum Temp. (hottest month)	99	91	88	91	99
Monthly Normal Max. Temp. (hottest month)	113	102	93	100	109
Average Daily Soil Temp. (3 ft below grade)	-	90	-	85	91
Mo. Normal Max. Soil Temp. (3 ft below grade)	-	91	-	87	93
Lowest One-Day Mean Temperature	36	46	63	46	41
Highest One-Day Mean Temperature	108	102	95	100	104
Lowest Recorded Temperature	-	36	59	32	25
Highest Recorded Temperature	122	124	115	117	120
Summer Design Dry Bulb Temp. @ 1%	-	104	106	104	111
Mean Coincident Wet Bulb Temp. @ 1%	-	82	86	81	70
Summer Design Dry Bulb Temp. @ 2.5%	-	102	102	102	109
Mean Coincident Wet Bulb Temp. @ 2.5%	-	82	84	81	68
Summer Design Wet Bulb Temp. @ 1%	-	93	86	91	72
Mean Coincident Dry Bulb Temp. @ 1%	-	93	93	93	93
Summer Design Wet Bulb Temp. @ 2.5%	-	91	84	90	68
Mean Coincident Dry Bulb Temp. @ 2.5%	-	93	91	93	93
Summer Design Dry Bulb Temp. @ 5%	-	97	102	99	108
Mean Daily Range	-	27	23	16	29
Winter Design Dry Bulb Temp. @ 99%	-	46	55	46	37
Wind:					
Basic Wind Speed, 3-sec gust, mph	114	93	93	93	103
Basic Wind Speed, Fastest-mile, (mph) 50 yr	98	78	78	78	87
Exposure Category (Note 1)	C	C	C	C	C
Prevailing Direction	N	NW	N	NW	N
Earthquake Data:					
Short Period Acceleration (S_s) in %g	1.0	8.5	16.9	8.5	0.8
1-Sec Period Acceleration (S_1) in %g	0.6	2.8	6.2	2.8	0.2
Site Class (Note 4)	D	D	D	D	D
Precipitation, inches:					
Rainfall, Average Annual	4.8	3.4	2.4	3.5	4.6
Rainfall Maximum in 24 hours	2	2.6	1.6	3.9	2.8
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	10*	10*	10*	5	10*

See page No. 25 for notes

Table 2 – Design Data - Customary Units (Continued)

Data Categories	Safaniya	Shaybah	Shedgum	Tanajib	Tabuk
Elevation Above Mean Sea Level, ft	7	230	965	33	2523
Station Coordinates: Latitude North	28°00'	22°21'	25°36'	27°52'	28°22'
Longitude East	48°48'	54°03'	49°24'	48°46'	36°35'
Ambient Air & Soil Temperatures, (°F):					
Average Annual Temperature	77	86	79	77	72
Average Daily Maximum Temp. (hottest month)	93	104	99	95	88
Monthly Normal Max. Temp. (hottest month)	111	111	117	108	102
Average Daily Soil Temp. (3 ft below grade)	84	95	92	84	72
Mo. Normal Max. Soil Temp. (3 ft below grade)	86	97	94	86	73
Lowest One-Day Mean Temperature	-	50	41	43	37
Highest One-Day Mean Temperature	-	108	106	102	99
Lowest Recorded Temperature	43	36	30	39	18
Highest Recorded Temperature	113	127	120	118	111
Summer Design Dry Bulb Temp. @ 1%	106	118	115	106	-
Mean Coincident Wet Bulb Temp. @ 1%	79	68	72	79	-
Summer Design Dry Bulb Temp. @ 2.5%	102	115	113	102	-
Mean Coincident Wet Bulb Temp. @ 2.5%	79	70	72	79	-
Summer Design Wet Bulb Temp. @ 1%	88	77	81	88	-
Mean Coincident Dry Bulb Temp. @ 1%	93	99	100	93	-
Summer Design Wet Bulb Temp. @ 2.5%	86	73	77	86	-
Mean Coincident Dry Bulb Temp. @ 2.5%	93	100	100	93	-
Summer Design Dry Bulb Temp. @ 5%	102	113	111	102	-
Mean Daily Range	13	29	27	22	27
Winter Design Dry Bulb Temp. @ 99%	46	48	43	-	-
Wind:					
Basic Wind Speed, 3-sec gust, mph	96	96	96	96	106
Basic Wind Speed, Fastest-mile, (mph) 50 yr	81	81	81	81	90
Exposure Category (Note 1)	C	C	C	C	C
Prevailing Direction	NW	-	NW	NW	W
Earthquake Data:					
Short Period Acceleration (S _s) in %g	7.6	5	8.5	7.5	27.2
1-Sec Period Acceleration (S ₁) in %g	5	1	2.8	5.0	11.0
Site Class (Note 4)	D	D	D	D	D
Precipitation, inches:					
Rainfall, Average Annual	3.9	1.0	3.2	3.9	1.9
Rainfall Maximum in 24 hours	2.0	0.5	3.2	-	1.9
Rainfall Intensity	Note 3	Note 3*	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	6	10*	10*	6	10*

See page No. 25 for notes

Table 2 – Design Data - Customary Units (Continued)

Data Categories	Turaif	Udhailiyah	Uthmaniyah	Yanbu
Elevation Above Mean Sea Level, ft	2703	804	758	20
Station Coordinates: Latitude North	31°41'	25°09'	25°13'	24°07'
Longitude East	38°40'	49°20'	49°18'	38°03'
Ambient Air & Soil Temperatures, (°F):				
Average Annual Temperature	66	79	77	81
Average Daily Maximum Temp. (hottest month)	86	97	97	90
Monthly Normal Max. Temp. (hottest month)	100	117	117	102
Average Daily Soil Temp. (3 ft below grade)	-	90	90	88
Mo. Normal Max. Soil Temp. (3 ft below grade)	-	92	92	90
Lowest One-Day Mean Temperature	30	43	43	54
Highest One-Day Mean Temperature	99	106	106	102
Lowest Recorded Temperature	18	30	30	43
Highest Recorded Temperature	111	120	120	120
Summer Design Dry Bulb Temp. @ 1%	-	115	115	106
Mean Coincident Wet Bulb Temp. @ 1%	-	72	72	77
Summer Design Dry Bulb Temp. @ 2.5%	-	113	113	102
Mean Coincident Wet Bulb Temp. @ 2.5%	-	72	72	77
Summer Design Wet Bulb Temp. @ 1%	-	77	77	84
Mean Coincident Dry Bulb Temp. @ 1%	-	99	99	93
Summer Design Wet Bulb Temp. @ 2.5%	-	75	75	82
Mean Coincident Dry Bulb Temp. @ 2.5%	-	99	99	93
Summer Design Dry Bulb Temp. @ 5%	-	109	109	99
Mean Daily Range	29	29	29	27
Winter Design Dry Bulb Temp. @ 99%	-	37	37	50
Wind:				
Basic Wind Speed, 3-sec gust, mph	103	96	96	93
Basic Wind Speed, Fastest-mile, (mph) 50 yr	87	81	81	78
Exposure Category (Note 1)	C	C	C	C
Prevailing Direction	W	NW	NW	W
Earthquake Data:				
Short Period Acceleration (S_s) in %g	18.7	15	16.0	18.3
1-Sec Period Acceleration (S_1) in %g	4.8	4	4.5	4.8
Site Class (Note 4)	D	D	D	D
Precipitation, inches:				
Rainfall, Average Annual	3.1	-	-	1.4
Rainfall Maximum in 24 hours	1.2	-	-	1.9
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	10*	10*	10*	10*

See page No. 25 for notes

Notes:

- 1 Exposure D shall be used within 0.46 km (.2 mi) of the shoreline
- 2 Offshore station - apply SAES-M-005
- 3 Rainfall intensity - I

$$I = \frac{K}{(t + b)}$$

Freq.	K		b
	SI units	Customary units	
5 yr	2443	96.2	27.5
10 yr	2941	115.8	24.9
25 yr	3420	134.6	23.7
50 yr	3810	150.0	21.0

- 4 Site classification shall be based on site-specific geotechnical investigation to be carried out as per requirements of Section 4 of SAES-A-113. Accordingly, the site classes indicated in the Appendices are to be used for preliminary structural analyses only when soil geotechnical data is not available.
- * Minimum value for sites without many years of recorded data
+ Taken from 1 year of data only
NA Not applicable
- Data not available on document issue date