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EXPLANATION & INSTRUCTIONS FOR THE USE OF: COMPLETE SEISMIC HVAC ENGINEERING SPECIFICATIONS



PART 1

SVCS-110-5 BULLETIN

INTRODUCTION TO SEISMIC VIBRATION CONTROL SPECIFICATIONS FOR OFFICE BUILDINGS, COLLEGES, HOSPITAL, THEATERS AND SIMILAR STRUCTURES

To The Specifying Engineer:

Our company started calling on West Coast engineering firms as early as 1960. We opened our L.A. sales and applications office in 1965 when it became important to provide local service to the most seismically active parts of the country in California, Oregon, Washington and Alaska as well as Vancouver, Canada. Very few competitors, and especially Eastern based firms, have had this exposure. While we offered a broad line of restraints, all of these systems were in their very early stages.

In 1971 there was a major earthquake in San Fernando, California that read 6.0 on the Richter scale with horizontal ground accelerations recorded at 0.2 g. In 12 seconds there was tremendous damage to mechanical installations with virtually every type of support failure and the engineering community became concerned.

While we did not consider ourselves expert, in 1971 the San Francisco Chapter of ASHRAE thought enough of what we had been doing to invite Mason as the principal speaker at one of their meetings. In the three month preparation for this presentation, we intensified our studies and developed the concept of deceleration at acceptable levels and the importance of Neoprene cushioning rather than hard stops. Our philosophy was well received, and with the help of CAL-TEC in Pasadena, California, we developed a dynamic analysis program based on a response spectra as the proper approach to the problem. (See Bulletin SCS-100.)

While a few installations followed this method, we found the program far more useful in bomb blast installations in various parts of the world. Specific response spectra are not readily available for all areas, and the response spectra on a particular floor rather than at ground level, almost non-existent. What the program did, however, was give us a better understanding of the phenomena and the need to provide materials with cushioned restraining capabilities far in excess of ground recorded or predicted acceleration levels.

Most specifications are based on the building code in that part of the country. All of these codes

work with equations for developing a maximum horizontal and vertical force. The most widely used equation for the horizontal is the following:

$$F_p = \frac{0.4(a_p)(S_{ds})I_p[1+2\frac{z}{h}]W_p}{R_p} \quad (0.7)$$

Term	Definition	Value on Page
F _p	Horizontal Seismic Force (G's)	8
a _p	Component Amplification Factor	8
R _p	Component Response Modification Factor	8
S _s	Mapped Spectral Response Acceleration at Short Periods	5,6 & 7
F _{p_v}	Vertical Seismic Force (G's)	8
z	Attachment Height within the Building	
h	Roof Elevation	
W _p	Weight	
I _p	Importance Factor, I _p =1.5 for Life Safety, Hazardous & Essential systems and 1.0 for all other components	
S _{ds}	Design Spectral Response Acceleration S _{ds} =2/3(S _s x F _a) where F _a is the Soil Site Coefficient	
F _a	Site Coefficient for Site Specific Soil. F _a is 1.7 for S _s up to 0.50, 1.2 for S _s above 0.5 up to 0.75, 1.1 for S _s above 0.75 up to 1.0 and 1.0 for S _s above 1.0	
(0.7)	Conversion Factor from Strength Design to Allowable Stress Design	

For examples of the equation, see page 4.

It is extremely important to work with these exact values when dealing with major structural components, such as the steel framing, as a small percentage force difference might literally mean millions of dollars in savings when working to the requirements of a local code. However, vibration isolation and seismic restraints are always a minuscule percentage of a building's cost and a small percentage of the mechanical equipment contract as well. When we or an acoustical consultant write specifications for spring deflections, we use broad categories such as 0.75"(19mm), 1.5"(38mm), 2.5"(64mm), 3.5"(89mm), 4.5"(114mm), etc. It is not practical to specify spring deflections of 1.625(41mm), 1.83(46mm), 2.3(58mm), etc., as no manufacturer designs to these fine limits. All manufacturers supply one of their standard mountings, rather than a special design specific to those numbers to achieve the specified minimum.

Seismic restraints follow this pattern as well. To keep specifications and submittals practical rather than run calculations for each piece of equipment in every location to the exact code minimum, our

suggested specification is broad band. We have selected the higher end of the calculations in a particular zone. When we are the successful vendor, the restraints we submit for your approval are generally well in excess of the specification minimums. Not only have we always preferred to work this way, but we are as concerned with your costs of errors and omissions as our own product liability. Earthquakes involve human lives. Acoustics and vibration control do not.

We cannot ask you to specify higher numbers as the contracting community tends to feel we are "loading" the requirements to increase cost. However, experience has proven that real life resonant forces exceed the static requirements.

In VCS-100, "Complete HVAC Engineering Specifications", we explained what we considered the most important principles to follow in writing specifications to attain proper vibration isolation.

The principles in applying seismic restraints based on static codes are as follows:

1. Use the building code selected by the architect as the model for specifying horizontal and vertical maximum accelerations.
2. Simplify the specifications by specifying the higher level of forces as developed by the selected code in paragraph 1.
3. Never use isolation rails as they rotate and fail when equipment does not have adequate leg strength for direct mounting or a supplementary base is required for other reasons. Always use a one piece reinforced concrete base or a one piece structural steel frame.
4. Do not use the horizontal or vertical spring constant of an unhooded spring to calculate resistive forces. An earthquake is calculated statically, but it is a dynamic event and springs resonate. The spring static resistance has no meaning in seismic restraint design.
5. Limit the motion of spring mounted bases using either separate double acting seismic snubbers with Neoprene cushioned interfaces, or steel springs within self snubbing housings that are also manufactured with Neoprene cushions wherever possible. Restraining housings may be either steel, ductile iron or cast steel. Gray iron castings are not acceptable, as the lack of ductility results in shattering when subjected to shock.
6. Provide anchor bolts or drill in anchors that are seismically approved and properly selected, based on design calculations through the center of gravity. Anchor bolts must be embedded and

spaced in accordance with ICC standards.

7. All housekeeping pads must be structurally doweled or bolted to the structure and adequately reinforced to resist the seismic forces on anchor bolts.

8. When steel frames or concrete piers are used to hold equipment at a higher elevation, they must be properly anchored to the structure and rigidly cross braced.

9. Install double arched rubber flexible connectors at the interfaces of equipment and piping where rubber is acceptable for the service. Use braided stainless steel hoses or stainless steel expansion joints in only those applications where the rubber expansion joints are not suitable.

10. All suspended equipment, including piping and duct work whether isolated or not, must be braced against sway and axial motion. Cable braces are recommended for isolated equipment and either cable or solid braces for non-isolated equipment. Suspension rods may require bracing to prevent buckling when subjected to compression stress.

11. Wherever possible use OSHPD or other Government pre-approved seismic devices with pre-approved ratings. When such devices are not available, ratings based on test are more reliable than ratings based on calculations. When testing is impractical, calculation should be made by a professional engineer with a minimum of 5 years experience in the industry. These devices are subtle and both experience and intuition are needed to make calculations meaningful.

12. Engineers and architects already carry "Errors and Omissions" insurance and this should not be a vendor requirement. All acceptable manufacturers should carry product liability with minimum limits of \$2,000,000 and \$5,000,000 in excess liability.

Specifications and instructions together with the selection guide begin on the following page. We certainly hope that you find this tool useful and we continue to invite your comments as to its improvement.

Very truly yours,
MASON INDUSTRIES, INC.



Norman J. Mason, President

GENERAL INSTRUCTIONS

As in VCS-100, we have designed the specification to be written in tabular form. Your specification book would contain all the verbiage in pages 1 through 24. We realize this complete specification is quite long, but providing proper protection is not a simple issue. It is always your option to abbreviate sections, but we have not included anything unnecessary. Only these items called out in the chart that follows are used on a particular project.

The chart is an add on to your equipment schedule. You merely add two columns as shown.

FAN SCHEDULE						Vibration Isolation and/or Seismic Restraints	
Fan No.	Location	Wheel Diam. in (mm)	Arr.	Fan RPM	Motor HP HP (kw)	Isolator, Base, Restraint, Flexible Connector Specification Number	Static Deflection in (mm)
1	Penthouse	60" (1525)	1 SISW	503	30 (22)	7-21	1.50" (36)
2	3rd Floor	49" (1245)	3 SISW	720	25 (19)	7-21	0.75" (19)
3	Penthouse	73" (1850)	3 DIDW	405	75 (56)	5-21-16	3.50" (89)
4	Basement	36" (915)	2 SISW	930	15 (11)	2-20	0.35" (9)
5	3rd Floor	108" (2745)	3 SISW	400	125 (94)	5-21-16	2.50" (64)
6	3rd Floor	2-27" (2-685)	AC Unit	533	10 (7.5)	10A-12	1.00" (25)
7	Penthouse	3-12" (3-305)	AC Unit	630	5 (4)	7	0.75" (19)

PUMP SCHEDULE				Vibration Isolation and/or Seismic Restraints	
Pump No.	Location	Type	Motor HP (kw)		Static Deflection in (mm)
1	Penthouse	Split Casing	75 (56)	5-21-16-23	2.50" (64)
2	2nd Floor	Close Coupled	1/2 (.4)	5-21-16-23	0.75" (19)
3	3rd Floor	End Suction	10 (7.5)	5-21-16-23	0.75" (19)
4	Basement	Close Coupled	3 (2)	2-23	0.35" (9)
5	Basement	Split Casing	50 (38)	Hard Mounted	
6	2nd Floor	Fire Pump		Hard Mounted	

The numbers for the specification column are found in the Seismic Specification Selection Guide pages 9 – 12 of this bulletin. You need only reference the type of equipment and then pick out the appropriate numbers and deflections based on the floor span in the equipment’s location.

In the given example we are assuming that the floor span in the penthouse is 30 ft.(9m) and that there is a 20 ft.(6m) span in other locations. In your application, should the spans be different, you need only refer to the proper floor span tabulation. You will note for pump No. 5 we called out no isolation as it happens to be located in the basement under the garage where any transmitted vibration would annoy no one. Fire pumps (No. 6) are seldom isolated. In preparing your specification this way you have an opportunity to consider every piece of equipment, and there is very little possibility of your overlooking something in the rush of getting a job completed.

The language of the specification is as complete as we could make it without knowing the actual code that you are using. Therefore, in paragraph 1.03 on page 4, you would have to fill the blank space with the code that applies to your project. Typical codes are as in "A" below and you would use one to include in 1.03.

1.03

- A. Typical Applicable Codes and Standards (To the specifying engineer, please select from the following and insert them in section 1.03 of the specification.)
1. The International Building Code, IBC-2000/2003 as published by the International Code Council.
 2. The Building Construction and Safety Code, NFPA 5000 as published by the National Fire Protection Association.
 3. Seismic Design of Buildings, TI-809-04, as published by the US Army Corps of Engineers.
 4. State or Local Code by specific reference.
 5. NFPA - 13 and 14 for fire protection systems, as published by the National Fire Protection Association.

For example, in Charleston S.C. using a zip code of 29401, S_{ds} is 0.93 based on an S_s of 1.38. For a vibration isolated pump attached to concrete at ground level in a commercial building, the following factors apply, $a_p = 2.5$ and $R_p = 2.5$ for vibration isolation, $I_p = 1$ for a commercial building, and the z/h factor equals zero at ground level.

Therefore
$$F_p = \frac{0.4(a_p)(S_{ds})I_p[1+2\frac{z}{h}]W_p}{R_p} (0.7) = 0.26 W_p \text{ or } 0.26 G.$$

In the same building the vibration isolated cooling tower on the roof would have a z/h value of one. This would make

$$F_p = \frac{0.4(a_p)(S_{ds})I_p[1+2\frac{z}{h}]W_p}{R_p} (0.7) = 0.78 W_p \text{ or } 0.78 G.$$

INSTRUCTION:

In paragraph 1.06 on page 5 of SVCS-110 Part 2, please add the seismic force levels. There is no need to do any calculations, because F_p has been calculated for you on page 8. As explained in the earlier pages, we have rounded these numbers to what we consider to be practical levels. Should you disagree with our suggestions, by all means insert levels of your own choosing.

State, City	ZIP	Ss	State, City	ZIP	Ss
ALABAMA			INDIANA		
Birmingham	35217	0.328	Evansville	47712	0.754
Mobile	36610	0.124	Ft. Wayne	46835	0.162
Montgomery	36104	0.170	Gary	46402	0.173
ARKANSAS			Indianapolis	46260	0.182
Little Rock	72205	0.461	South Bend	46637	0.121
ARIZONA			KANSAS		
Phoenix	85034	0.226	Kansas City	66103	0.122
Tucson	85739	0.325	Topeka	66614	0.184
CALIFORNIA			Wichita	67217	0.141
Fresno	93706	0.592	KENTUCKY		
Los Angeles	90026	1.50	Ashland	41101	0.221
Oakland	94621	1.55	Covington	41011	0.186
Sacramento	95823	0.568	Louisville	40202	0.247
San Diego	92101	1.54	LOUISIANA		
San Francisco	94114	1.50	Baton Rouge	70807	0.144
San Jose	95139	2.05	New Orleans	70116	0.130
COLORADO			Shreveport	71106	0.165
Colorado Springs	80913	0.178	MASSACHUSETTS		
Denver	80239	0.187	Boston	02127	0.325
CONNECTICUT			Lawrence	01843	0.376
Bridgeport	06606	0.332	Lowell	01851	0.355
Hartford	06120	0.274	New Bedford	02740	0.261
New Haven	06511	0.285	Springfield	01107	0.260
Waterbury	06702	0.287	Worcester	01602	0.271
WASHINGTON, D.C.			MARYLAND		
Washington	20002	0.178	Baltimore	21218	0.199
FLORIDA			MAINE		
Ft. Lauderdale	33328	0.070	Augusta	04330	0.318
Jacksonville	32222	0.142	Portland	04101	0.369
Miami	33133	0.061	MICHIGAN		
St. Petersburg	33709	0.078	Detroit	48207	0.123
Tampa	33635	0.083	Flint	48506	0.091
GEORGIA			Grand Rapids	49503	0.087
Atlanta	30314	0.258	Kalamazoo	49001	0.116
Augusta	30904	0.419	Lansing	48910	0.109
Columbus	31907	0.169	MINNESOTA		
Savannah	31404	0.402	Duluth	55803	0.056
HAWAII			Minneapolis	55422	0.057
Hilo	96720	1.50	Rochester	55901	0.055
Honolulu	96801	0.614	St. Paul	55111	0.056
IOWA			MISSOURI		
Council Bluffs	41011	0.186	Carthage	64836	0.149
Davenport	52803	0.130	Columbia	65202	0.178
Des Moines	50310	0.073	Jefferson City	65109	0.207
IDAHO			Joplin	64801	0.138
Boise	83705	0.344	Kansas City	64108	0.122
Pocatello	83201	0.553	Springfield	64501	0.120
ILLINOIS			St. Joseph	64501	0.120
Chicago	60620	0.190	St. Louis	63166	0.586
Moline	61265	0.135	MISSISSIPPI		
Peoria	61604	0.174	Jackson	39211	0.191
Rock Island	61201	0.131	MONTANA		
Rockford	61108	0.170	Billings	59101	0.134
Springfield	62703	0.263	Butte	59701	0.599
			Great Falls	59404	0.248

State, City	ZIP	Ss	State, City	ZIP	Ss
NEBRASKA			RHODE ISLAND		
Lincoln	68502	0.177	Providence	02907	0.267
Omaha	68144	0.127	SOUTH CAROLINA		
NEVADA			Charleston	29406	1.56
Las Vegas	89106	0.637	Columbia	29203	0.578
NV, Reno	89509	1.29	SOUTH DAKOTA		
NEW MEXICO			Rapid City	57703	0.153
Albuquerque	87101	0.562	Sioux Falls	57104	0.113
Santa Fe	87501	0.425	TENNESSEE		
NEW YORK			Chattanooga	37415	0.500
Albany	12205	0.275	Knoxville	37920	0.589
Binghamton	13903	0.185	Memphis	38109	1.25
Buffalo	14222	0.319	Nashville	37211	0.305
Elmira	14905	0.173	TEXAS		
New York	10014	0.425	Amarillo	79111	0.166
Niagara Falls	14303	0.311	Austin	78703	0.088
Rochester	14619	0.248	Beaumont	77705	0.116
Schenectady	12304	0.278	Corpus Christi	78418	0.093
Syracuse	13219	0.192	Dallas	75233	0.117
Utica	13501	0.250	El Paso	79932	0.358
NORTH CAROLINA			Ft. Worth	76119	0.110
Charlotte	28216	0.345	Houston	77044	0.107
Greensboro	27410	0.255	Lubbock	79424	0.099
Raleigh	27610	0.211	San Antonio	78235	0.133
Winston-Salem	27106	0.281	Waco	76704	0.095
NORTH DAKOTA			UTAH		
Fargo	58103	0.073	Salt Lake City	84111	1.79
Grand Forks	58201	0.054	VIRGINIA		
OHIO			Norfolk	23504	0.132
Akron	44312	0.179	Richmond	23233	0.300
Canton	44702	0.316	Roanoke	24017	0.290
Cincinnati	45245	0.191	VERMONT		
Cleveland	44130	0.197	Burlington	05401	0.446
Columbus	43217	0.164	WASHINGTON		
Dayton	45440	0.206	Seattle	98108	1.51
Springfield	45502	0.216	Spokane	99201	0.315
Toledo	43608	0.171	Tacoma	98402	1.23
Youngstown	44515	0.163	WISCONSIN		
OKLAHOMA			Green Bay	54302	0.066
Oklahoma City	73145	0.339	Kenosha	53140	0.133
Tulsa	74120	0.160	Madison	53714	0.114
OREGON			Milwaukee	53221	0.120
Portland	97222	1.04	Racine	53402	0.124
Salem	97301	0.929	Superior	54880	0.055
PENNSYLVANIA			WEST VIRGINIA		
Allentown	18104	0.289	Charleston	25303	0.206
Bethlehem	18015	0.304	Huntington	25704	0.221
Erie	16511	0.164	WYOMING		
Harrisburg	17111	0.224	Casper	82601	0.341
Philadelphia	19125	0.326	Cheyenne	82001	0.183
Pittsburgh	15235	0.129			
Reading	19610	0.293			
Scranton	18504	0.232			

INTERNATIONAL Ss NUMBERS

Country.....City.....Ss	Country.....City.....Ss	Country.....City.....Ss	Country.....City.....Ss
AFRICA			
Algeria.....Alger.....1.24	India.....Bombay.....1.24	CENTRAL AMERICA	United Kingdom.....Belfast.....0.06
.....Oran.....1.24	.....Calcutta.....0.62	Belize.....Beimopan.....0.62	.....Edinburgh.....0.31
Angola.....Luanda.....0.06	.....Madras.....0.31	Canal Zone.....All.....0.62	.....Edzeli.....0.31
Benin.....Cotonou.....0.06	.....New Delhi.....1.24	Costa Rica.....San Jose.....1.24	.....Glasgow.....0.31
Botswana.....Gaborone.....0.06	Indonesia.....Bandung.....1.65	El Salvador.....San Salvador.....1.65	...../Renfrew.....0.31
Burundi.....Bujumbura.....1.24	.....Jakarta.....1.65	Guatemala.....Guatemala.....1.65	.....Hamilton.....0.31
Cameroon.....Douala.....0.06	.....Medan.....1.24	Honduras.....Tegucigalpa.....1.24	.....Liverpool.....0.31
.....Yaounde.....0.06	.....Surabaya.....1.65	Nicaragua.....Managua.....1.65	.....London.....0.62
Cape Verde.....Praia.....0.06	Iran.....Isfahan.....1.24	Panama.....Colon.....1.24	.....Londonderry.....0.31
Central African Republic.....Bangui.....0.06	.....Shiraz.....1.24	.....Galeta.....0.83	.....Thurso.....0.31
Chad.....Njamena.....0.06	.....Tabriz.....1.65	.....Panama.....1.24	U.S.S.R.....Kiev.....0.06
Congo.....Brazzaville.....0.06	.....Tehran.....1.65	Mexico.....Ciudad Juarez.....0.62	.....Leningrad.....0.06
Djibouti.....Djibouti.....1.24	Iraq.....Baghdad.....1.24	.....Guadalejara.....1.24	.....Moscow.....0.06
Egypt.....Alexandria.....0.62	.....Basra.....0.31	.....Hermosillo.....1.24	Yugoslavia.....Belgrade.....0.62
.....Cairo.....0.62	Israel.....Haifa.....1.24	.....Matamoros.....0.06	.....Zagreb.....1.24
.....Port Said.....0.62	.....Jerusalem.....1.24	.....Mazatlan.....0.60	NORTH AMERICA
Equatorial Guinea.....Malabo.....0.06	Japan.....Fukuoka.....1.24	.....Merida.....0.06	Greenland.....All.....0.31
Ethiopia.....Addis Ababa.....1.24	.....Itazuke AFB.....1.24	.....Mexico City.....1.24	Canada.....Argentia NAS.....0.62
.....Asmara.....1.24	.....Misawa AFB.....1.24	.....Monterrey.....0.06	.....Calgary, Alb.....0.31
Gabon.....Libreville.....0.06	.....Naha, Okinawa.....1.65	.....Nuevo Laredo.....0.06	.....Churchill, Man.....0.06
Gambia.....Banjul.....0.06	.....Osaka/Kobe.....1.65	.....Tijuana.....1.24	.....Cold Lake, Alb.....0.31
Ghana.....Accra.....1.24	.....Sapporo.....1.24	EUROPE	.....Edmonton, Alb.....0.31
Guinea.....Bissau.....0.31	.....Tokyo.....1.65	Albania.....Tirana.....1.24	.....E. Harmon, AFB.....0.62
.....Conakry.....0.06	.....Wakkanai.....1.24	Austria.....Salzburg.....0.62	.....Fort Williams, Ont.....0.06
Ivory Coast.....Abidjan.....0.06	.....Yokohama.....1.65	.....Vienna.....0.62	.....Frobisher.....0.06
Kenya.....Nairobi.....0.62	.....Yokota.....1.65	Belgium.....Antwerp.....0.31	.....N.W. Ter.....0.06
Lesotho.....Maseru.....0.62	Jordan.....Amman.....1.24	.....Brussels.....0.62	.....Goose Airport.....0.31
Liberia.....Monrovia.....0.31	Korea.....Kwangju.....0.31	Bulgaria.....Sofia.....1.24	.....Halifax.....0.31
Libya.....Tripoli.....0.62	.....Kimhae.....0.31	Czechoslovakia.....Bratislava.....0.62	.....Montreal, Quebec.....1.24
.....Wheeler AFB.....0.62	.....Pusan.....0.31	.....Prague.....0.31	.....Ottawa, Ont.....0.62
Malagasy Republic.....Tananarive.....0.06	.....Seoul.....0.06	Denmark.....Copenhagen.....0.31	.....St. John's Nfid.....1.24
Malawi.....Blantyre.....1.24	Kuwait.....Kuwait.....0.31	.....Finland.....Helsinki.....0.31	.....Toronto, Ont.....0.31
.....Lilongwe.....1.24	Laos.....Vientiane.....0.31	France.....Bordeaux.....0.62	.....Vancouver.....1.24
.....Zomba.....1.24	Lebanon.....Beirut.....1.24	.....Lyon.....0.31	.....Winnipeg, Man.....0.31
Mali.....Bamako.....0.06	Malaysia.....Kuala Lumpur.....0.31	.....Marseille.....1.24	SOUTH AMERICA
Mauritania.....Nouakchott.....0.06	Nepal.....Kathmandu.....1.65	.....Nice.....1.24	Argentina.....Buenos Aires.....0.25
Mauritius.....Port Louis.....0.06	Oman.....Muscat.....0.62	.....Strasbourg.....0.62	Brazil.....Belem.....0.06
Morocco.....Casablanca.....0.62	Pakistan.....Islamabad.....1.68	Germany, Federal Republic.....Berlin.....0.06	.....Belo Horizonte.....0.06
.....Port Lyautey.....0.31	.....Karachi.....1.65	.....Bonn.....0.62	.....Brasilia.....0.06
.....Rabat.....0.62	.....Lahore.....0.62	.....Bremen.....0.06	.....Manaus.....0.06
.....Tangier.....1.24	.....Peshawar.....1.65	.....Dusseldorf.....0.31	.....Porto Alegre.....0.06
Mozambique.....Maputo.....0.62	Quatar.....Doha.....0.06	.....Frankfurt.....0.62	.....Recife.....0.06
Niger.....Niamey.....0.06	Saudi Arabia.....Al Batin.....0.31	.....Hamburg.....0.06	.....Rio de Janeiro.....0.06
Nigera.....Ibadan.....0.06	.....Dhahran.....0.31	.....Munich.....0.31	.....Salvador.....0.06
.....Kaduna.....0.06	.....Jiddah.....0.62	.....Stuttgart.....0.62	.....Sao Paulo.....0.31
.....Lagos.....0.06	.....Khamis Mushayf.....0.31	.....Vaihigen.....0.62	Bolivia.....La Paz.....1.24
Republic of Rwanda.....Kigali.....1.24	.....Riyadh.....0.06	Greece.....Athens.....1.24	.....Santa Cruz.....0.31
Senegal.....Dakar.....0.06	Singapore.....All.....0.31	.....Kavalla.....1.65	Chile.....Santiago.....1.65
Seychelles.....Victoria.....0.06	South Yemen.....Aden City.....1.24	.....Makri.....1.65	.....Valparaiso.....1.65
Sierra Leone.....Freetown.....0.06	Sir Lanka.....Colombo.....0.06	.....Rhodes.....1.24	Colombia.....Bogata.....1.24
Somalia.....Mogadishu.....0.06	Syria.....Aleppo.....1.24	.....Sauda Bay.....1.65	Ecuador.....Quito.....1.65
South Africa.....Cape Town.....1.24	.....Damascus.....1.24	.....Thessaloniki.....1.65	.....Guayaquil.....1.24
.....Durban.....0.62	Taiwan.....Ail.....1.65	Hungary.....Budapest.....0.62	Paraguay.....Asuncion.....0.06
.....Johannesburg.....0.62	Thailand.....Bangkok.....0.31	Iceland.....Keflavick.....1.24	Peru.....Lima.....1.65
.....Natal.....0.31	.....Chinmg Mai.....0.62	Ireland.....Dublin.....0.06	.....Piura.....1.65
.....Pretoria.....0.62	.....Songkhia.....0.06	Italy.....Aviano AFB.....1.24	Uruguay.....Montevideo.....0.06
Swaziland.....Mbabane.....0.62	.....Udorn.....0.31	.....Brindisi.....0.06	Venezuela.....Maracaibo.....0.62
Tanzania.....Dar es Salaam.....0.62	Turkey.....Adana.....0.62	.....Florence.....1.24	.....Caracas.....1.65
.....Zanzibar.....0.62	.....Ankara.....0.62	.....Genoa.....1.24	PACIFIC OCEAN AREA
Togo.....Lome.....0.31	.....Istanbul.....1.65	.....Milan.....0.62	Australia.....Brisbane.....0.31
Tunisia.....Tunis.....1.24	.....Izmir.....1.65	.....Naples.....1.24	.....Canberra.....0.31
Uganda.....Kampala.....1.24	.....Karamursel.....1.24	.....Palermo.....1.24	.....Melbourne.....0.31
Upper Volta.....Ougadougou.....0.06	United Arab Emirates.....Abu Dhabi.....0.06	.....Rome.....0.62	.....Perth.....0.31
Zaire.....Bukavu.....1.24	.....Dubai.....0.06	.....Sicity.....1.24	.....Sydney.....0.31
.....Kinshasa.....0.06	Viet Nam.....Ho Chi Minh City (Saigon).....0.06	.....Trieste.....1.24	Caroline Islands.....Koror, Paulau Is.....0.62
.....Lubumbashi.....0.62	Yemen Arab Republic.....Sanaa.....1.24	.....Turin.....0.62	.....Ponape.....0.06
Zambia.....Lusaka.....0.62	ATLANTIC OCEAN AREA	Luxembourg.....Luxembourg.....0.31	.....Suva.....1.24
Zimbabwe.....Harare (Salisbury).....1.24	Azorea.....All.....0.62	Malta.....Valletta.....0.62	Johnston Island.....All.....0.31
ASIA	Bermuda.....All.....0.31	Netherlands.....All.....0.06	Mariana Islands.....Guam.....1.24
Afghanistan.....Kabul.....1.65	CARIBBEAN SEA	Norway.....Oslo.....0.62	.....Saipan.....1.24
Bahrain.....Manama.....0.06	Bahama Islands.....All.....0.31	Poland.....Krakow.....0.62	.....Tinian.....1.24
Bangladesh.....Dacca.....1.24	Cuba.....Ail.....0.62	.....Poznan.....0.31	Marshall Islands.....Ail.....0.31
Brunei.....Bandar Seri Begawan.....0.31	Dominican Republic.....Santo Domingo.....1.24	.....Warszawa.....0.31	New Zealand.....Auckland.....1.24
Burma.....Mandalay.....1.24	French West Indies.....Martinique.....1.24	Portugal.....Lisbon.....1.65	.....Wellington.....1.65
China.....Canton.....0.62	Grenada.....Saint Georges.....1.24	.....Oporto.....1.24	Papau New Guinea.....Port Moresby.....1.24
.....Chengdu.....1.24	Haiti.....Port au Prince.....1.24	Romania.....Bucharest.....1.24	Phillipine Islands.....Cebu.....1.65
.....Nanking.....0.62	Jamaica.....Kingston.....1.24	Spain.....Barcelona.....0.62	.....Manila.....1.65
.....Peking.....1.65	Leeward Islands.....All.....1.24	.....Madrid.....0.06	.....Bagulo.....1.24
.....Shanghai.....0.62	Puerto Rico.....All.....0.83	.....Rota.....0.62	Samoa.....All.....1.24
.....Shengyang.....1.65	Trinidad & Tobago.....All.....1.24	.....Seville.....0.62	Wake Island.....All.....0.06
.....Tibwa.....1.65		Sweden.....Goteborg.....0.62	
.....Tsingtao.....1.24		.....Stockholm.....0.31	
.....Wuhan.....0.62		Switzerland.....Geneva.....0.31	
Cyprus.....Nicosia.....1.24		.....Zurich.....0.62	
Hong Kong.....Hong Kong.....0.62			

1.06 Seismic Force Levels

A. The following force levels will be used on this project based on IBC-2000, IBC-2003, TI-809-04 and NFPA-5000.

Changes may be made as codes are updated.

MINIMUM F_p (G's) FORCES EQUAL TO OR EXCEEDING BUILDING CODE LISTED IN 1.03.

		IBC-2000		IBC-2003		TI-809-04		NFPA-5000	
		"G" Forces for High Deformability Pipe, Bus Ducts, Conduits & Cabletrays a_p*=1.0, R_p*=3.5		"G" Forces for Rigidly Mounted Equipment & Limited Deformability Pipe a_p*=1.0, R_p*=2.5		"G" Forces for Vibration Isolated Equipment & Pipe Pressure Vessels a_p*=2.5, R_p*=2.5		"G" Forces for Low Deformability Pipe a_p*=1.0, R_p*=1.25	
		Horiz.	Vert.	Horiz.	Vert.	Horiz.	Vert.	Horiz.	Vert.
Lower Levels and Ground Level	Ss less than 0.15	0.08	0.05	0.08	0.05	0.10	0.05	0.08	0.05
	Ss between 0.15 & 0.25	0.13	0.08	0.13	0.08	0.17	0.08	0.13	0.08
	Ss between 0.26 & 0.50	0.17	0.11	0.17	0.11	0.23	0.11	0.18	0.11
	Ss between 0.51 & 1.00	0.22	0.15	0.22	0.15	0.29	0.15	0.23	0.15
	Ss between 1.01 & 1.50	0.30	0.20	0.30	0.20	0.40	0.20	0.32	0.20
	Ss greater than 1.50	0.50	0.33	0.50	0.33	0.67	0.33	0.53	0.33
Above Ground Level up to 1/4 of the Height of Building	Ss less than 0.15	0.08	0.05	0.08	0.05	0.15	0.05	0.12	0.05
	Ss between 0.15 & 0.25	0.13	0.08	0.13	0.08	0.25	0.08	0.20	0.08
	Ss between 0.26 & 0.50	0.17	0.11	0.17	0.11	0.34	0.11	0.27	0.11
	Ss between 0.51 & 1.00	0.22	0.15	0.22	0.15	0.44	0.15	0.35	0.15
	Ss between 1.01 & 1.50	0.30	0.20	0.30	0.20	0.60	0.20	0.48	0.20
	Ss greater than 1.50	0.50	0.33	0.50	0.33	1.00	0.33	0.80	0.33
Above 1/4 up to 1/2 of the Height of the Building	Ss less than 0.15	0.08	0.05	0.08	0.05	0.20	0.05	0.16	0.05
	Ss between 0.15 & 0.25	0.13	0.08	0.13	0.08	0.34	0.08	0.27	0.08
	Ss between 0.26 & 0.50	0.17	0.11	0.18	0.11	0.46	0.11	0.36	0.11
	Ss between 0.51 & 1.00	0.22	0.15	0.23	0.15	0.58	0.15	0.47	0.15
	Ss between 1.01 & 1.50	0.30	0.20	0.32	0.20	0.80	0.20	0.64	0.20
	Ss greater than 1.50	0.50	0.33	0.53	0.33	1.34	0.33	1.07	0.33
Above 1/2 up to 3/4 of the Height of the Building	Ss less than 0.15	0.08	0.05	0.10	0.05	0.25	0.05	0.20	0.05
	Ss between 0.15 & 0.25	0.13	0.08	0.17	0.08	0.42	0.08	0.34	0.08
	Ss between 0.26 & 0.50	0.17	0.11	0.23	0.11	0.57	0.11	0.46	0.11
	Ss between 0.51 & 1.00	0.22	0.15	0.29	0.15	0.73	0.15	0.58	0.15
	Ss between 1.01 & 1.50	0.30	0.20	0.40	0.20	1.00	0.20	0.80	0.20
	Ss greater than 1.50	0.50	0.33	0.67	0.33	1.67	0.33	1.34	0.33
Above 3/4 of the Height of Building up to the Roof	Ss less than 0.15	0.09	0.05	0.12	0.05	0.30	0.05	0.24	0.05
	Ss between 0.15 & 0.25	0.14	0.08	0.20	0.08	0.50	0.08	0.40	0.08
	Ss between 0.26 & 0.50	0.20	0.11	0.27	0.11	0.68	0.11	0.54	0.11
	Ss between 0.51 & 1.00	0.25	0.15	0.35	0.15	0.88	0.15	0.70	0.15
	Ss between 1.01 & 1.50	0.34	0.20	0.48	0.20	1.20	0.20	0.96	0.20
	Ss greater than 1.50	0.57	0.33	0.80	0.33	2.00	0.33	1.60	0.33

*See definitions on page one of this bulletin.

Table above has rounded values from solving equation $F_p = \frac{0.4(a_p)(S_{ds})I_p[1+2\frac{Z}{h}]W_p}{R_p}$ (0.7)

INSTRUCTION:

Use these values to complete specification section 1.06 as previously noted on page 4.

See next bulletin, SVCS-110 Part 2, for complete specifications and product details.

SPECIFICATION SELECTION GUIDE

to be used with Vibration Control Engineering Specifications for HVAC Equipment in Office Buildings, Colleges, Theatres and Similar Structures

	ISOLATION, DEFLECTION AND SEISMIC RESTRAINT CRITERIA FOR 4"(100mm)THRU 6"(150mm)THICK SOLID CONCRETE FLOORS (note 7)									
	Ground Supported Slab or Basement		20'(6m) Floor Span Possible Floor Defl.-0.67"(17mm)		30'(9m) Floor Span Possible Floor Defl.-1.0"(25mm)		40'(12m) Floor Span Possible Floor Defl.-1.33"(34mm)		50'(15m) Floor Span Possible Floor Defl.-1.67"(42mm)	
	Isolation & Seismic Spec.	Isolation Deflection in(mm)	Isolation & Seismic Spec.	Isolation Deflection in(mm)	Isolation & Seismic Spec.	Isolation Deflection in(mm)	Isolation & Seismic Spec.	Isolation Deflection in(mm)	Isolation & Seismic Spec.	Isolation Deflection in(mm)
REFRIG. MACHINES										
Absorption Machines	2-23	0.35(9)	6-23	0.75(19)	6-23	0.75(19)	6-23	1.5(38)	6-23	1.5(38)
Centrifugal Chillers or Heat Pumps										
Cooler Condenser Mounted Hermetic Compressors	2-23	0.35(9)	6-23	0.75(19)	6-23 or 9*-23	1.5(38)	6-23 or 9*-23	1.5(38)	6-20-23 or 9*-23	2.5(64)
Cooler Condenser Alongside Hermetic Compressors	2-23	0.35(9)	6-23	0.75(19)	6-23 or 9*-23	1.5(38)	6-23 or 9*-23	1.5(38)	6-23 or 9*-23	2.5(64)
Open Type Compressors (note 3)	2-20-23 or 2-20-23	0.35(9)	6-20-23 or 6-20-23	0.75(19)	6-20-23 or 9*-20-23	1.5(38)	6-20-23 or 9*-20-23	1.5(38)	6-20-23 or 9*-20-23	2.5(64)
Refrig. Reciprocating Compressors										
500 rpm to 750 rpm	6-23	0.75(19)	6-23	1.5(38)	6-23	1.5(38)	6-20-23	2.5(64)	6-20-23	3.5(89)
751 rpm and Over	6-23	0.75(19)	6-23	0.75(19)	6-23 or 9*-23	1.5(38)	6-20-23 or 9*-20-23	2.5(64)	6-20-23 or 9*-20-23	3.5(89)
Reciprocating Chillers or Heat Pumps										
500 rpm to 750 rpm	6-23	0.75(19)	6-23	1.5(38)	6-23	1.5(38)	6-20-23	2.5(64)	6-20-23	3.5(89)
751 rpm and Over	6-23	0.75(19)	6-23	0.75(19)	6-20-23	1.5(38)	6-20-23	2.5(64)	6-20-23	3.5(89)
Refrigeration Screw Compressors	9*-23		9*-23		9*-23		9*-23		9*-23	
PACKAGED STEAM GENERATIONS (Boilers)	2-24	0.35(9)	6-24	0.75(19)	6-24	0.75(19)	6-24	1.5(38)	5,23,24	2.5(64)
Pumps										
Close Coupled										
Thru 5hp (4kw)	2-21-23	0.35(9)	5-16-21-23	0.75(19)	5-16-21-23	0.75(19)	5-16-21-23	1.5(38)	5-16-21-23	1.5(38)
7 1/2hp (5.6kw) and Larger	5-16-21-23	0.75(19)	5-16-21-23	0.75(19)	5-16-21-23	1.5(38)	5-16-21-23	1.5(38)	5-16-21-23	2.5(64)
Base Mounted (note 2)										
Thru 60hp (45kw)	5-16-21-23	0.75(19)	5-16-21-23	0.75(19)	5-16-21-23	1.5(38)	5-16-21-23	1.5(38)	5-16-21-23	2.5(64)
75hp (56kw) and Larger	5-16-21-23 or 8*-16 21-23	0.75(19)	5-16-21-23 or 8*-16 21-23	1.5(38)	5-16-21-23 or 8*-16 21-23	2.5(64)	5-16-21-23 or 8*-16 21-23	2.5(64)	5-16-21-23 or 8*-16 21-23	3.5(89)
PIPE RISERS	5 or 10-25-26	Spec. 5 if floor supported and Spec. 10 if ceiling suspended. Spec. 25 anchors if required, Spec. 26 guides required on all risers. Deflections are based on the expansion or contraction of each riser.								

*NOTE: Isolators in Red are Air Springs recommended for highly critical locations.

See next bulletin, SVCS-110 Part 2, for complete specifications and product details.

SPECIFICATION SELECTION GUIDE

to be used with Vibration Control Engineering Specifications for HVAC Equipment in Office Buildings, Colleges, Theatres and Similar Structures

	ISOLATION, DEFLECTION AND SEISMIC RESTRAINT CRITERIA FOR 4"(100mm)THRU 6"(150mm)THICK SOLID CONCRETE FLOORS (note 7)									
	Ground Supported Slab or Basement		20'(6m) Floor Span Possible Floor Defl.-0.67"(17mm)		30'(9m) Floor Span Possible Floor Defl.-1.0"(25mm)		40'(12m) Floor Span Possible Floor Defl.-1.33"(34mm)		50'(15m) Floor Span Possible Floor Defl.-1.67"(42mm)	
	Isol. & Seismic Spec.	Isol. Defl. in(mm)	Isol. & Seismic Spec.	Isol. Defl. in(mm)	Isol. & Seismic Spec.	Isol. Defl. in(mm)	Isol. & Seismic Spec.	Isol. Defl. in(mm)	Isol. & Seismic Spec.	Isol. Defl. in(mm)
FACTORY ASSEMBLED H & V UNITS										
Curb Mounted Roof Top Units	—	—	22	1.0(25)	22	1.5(38)	22	2.5(64)	22	2.5(64)
Suspended Units (for Fan Heads see Blowers Guide)										
Thru 5hp (4kw)	10A-12	1.0(25)	10A-12	1.0(25)	10A-12	1.0(25)	10A-12	1.0(25)	10A-12	1.0(25)
7 1/2 hp (5.6kw) and Larger-275 rpm to 400 rpm	10A-12	1.5(38)	10A-12	1.5(38)	10A-12	1.5(38)	10A-12	1.5(38)	10A-12	1.5(38)
7 1/2 hp (5.6kw) and Larger-401 rpm and Over	10A-12	1.0(25)	10A-12	1.0(25)	10A-12	1.0(25)	10A-12	1.5(38)	10A-12	2.5(64)
Floor Mounted Units (for Fan Heads see Blowers Guide)										
Thru 5hp (4kw)	2	0.35(9)	7	0.75(19)	7	0.75(19)	7	0.25(6)	7	0.75(19)
7 1/2 hp (5.6kw) and Larger-275 rpm to 400 rpm	2	0.35(9)	7	1.5(38)	7	1.5(38)	7	1.5(38)	7	1.5(38)
7 1/2 hp (5.6kw) to 40hp-401 rpm and Over	2	0.35(9)	7	0.75(19)	7	0.75(19)	7	1.5(38)	5-16-20	2.5(64)
50hp (38kw) and Larger-401 rpm and Over	2	0.35(9)	7	0.75(19)	7	1.5(38)	5-16-20	2.5(64)	5-16-20	3.5(89)
AIR COMPRESSOR										
Tank Mounted Type	5-16-21-24	0.75(19)	5-16-21-24	0.75(19)	5-16-21-24	1.5(38)	5-16-21-24	2.5(64)	5-16-21-24	3.5(89)
V - W Type	5-16-21-24	0.75(19)	5-16-21-24	0.75(19)	5-16-21-24	1.5(38)	5-16-21-24	2.5(64)	5-16-21-24	3.5(89)
Horz, Vert, 1 or 2 Cylinders										
275 rpm to 499 rpm	5-16-21-24	2.5(64)	5-16-21-24	2.5(64)	5-16-21-24	2.5(64)	5-16-21-24	3.5(89)	5-16-21-24	3.5(89)
500 rpm to 800 rpm	5-16-21-24	1.5(38)	5-16-21-24	1.5(38)	5-16-21-24	2.5(64)	5-16-21-24	3.5(89)	5-16-21-24	3.5(89)

Specification should read "21" type inertia bases with sufficient mass to limit motion to a theoretical double amplitude of 0.03".(7mm)

SPECIFICATION SELECTION GUIDE

to be used with Vibration Control Engineering Specifications for HVAC Equipment in Office Buildings, Colleges, Theatres and Similar Structures

ISOLATION, DEFLECTION AND SEISMIC RESTRAINT CRITERIA FOR 4"(100mm)THRU 6"(150mm)THICK SOLID CONCRETE FLOORS (note 7)										
Ground Supported Slab or Basement		20'(6m) Floor Span Possible Floor Defl. 0.67"(17mm)		30'(9m) Floor Span Possible Floor Defl. 1.0"(25mm)		40'(12m) Floor Span Possible Floor Defl. 1.33"(34mm)		50'(15m) Floor Span Possible Floor Defl. 1.67"(42mm)		
Isolation & Seismic Spec.	Isolation Deflection in(mm)	Engineering Specifications and Minimum Static Deflection as tabulated below (note 1)								
BLOWERS										
Utility Sets										
Floor Mounted (note 5)	2	0.35(9)	Spec 7 for 0.75" (19mm) and 1.5" (38mm) deflection and Spec 5-20-16 for over 1.5" (38mm) deflection with deflection from Blower Minimum Deflection Guide, but not to exceed 2.5" (64mm)							
Roof Mounted	—	—	Spec 5-21-16 with deflection from Blower Minimum Deflection Guide. If roof will not handle concrete base load use Spec 6 for 0.75" (19mm) and 1.5" (38mm) deflection and Spec 6-20 for over 1.5" (38mm) deflection.							
Suspended Unit (note 5)	—	—	Spec 10A-12 with deflection from Blower Minimum Deflection Guide, not to exceed 2.5" (64mm) deflection.							
Centrifugal Blowers (note 6)	2-21	0.35(9)	Spec 5-21-16 with deflection from Blower Minimum Deflection Guide.							
Fan Heads										
Floor Mounted	2-28	0.35(9)	Spec 7-28 if 0.75" (19mm) or 1.5" (38mm) deflection or Spec 5-20-16-28 for deflection over 1.5" (38mm) to 4.5" (114mm) from Blower Minimum Deflection Guide.							
Suspended Units			Spec 10A-12-28 with deflection from Blower Minimum Deflection Guide.							
Tubular Centrifugal and Axial Fans										
Suspended Units			Spec 10A-12 with deflection from Blower Minimum Deflection Guide, Spec 10A-12-28 for over 4" (100) static pressure.							
Floor Mounted with Motor on/in Fan Casing	2	0.35(9)	Spec 7 for 0.75" (19mm) to 1.5" (38mm) deflection and Spec 5-20-16 for over 1.5" (38mm) deflection with deflection from Blower Minimum Deflection Guide, Spec 5-21-16 or 5-16-28 for over 4" (100mm) static pressure.							
Floor Mounted Arrangement 1 or any Separately Mounted Motor	2-21	0.35(9)	Spec 5-21-16 with deflection from Blower Minimum Deflection Guide.							
COOLING TOWERS & CONDENSING UNITS	2	0.35(9)	Spec 6 or 9* with deflection from Blower Minimum Deflection Guide.							
ELECTRICAL EQUIPMENT										
Transformers										
Wall Mounted	3-18	—	3-18	—	3-18	—	3-18	—	3-18	—
Floor Mounted	2-19	0.2(5)	6-19 or 9*-19	0.75(19)	6-19 or 9*-19	1.50(38)	6-19 or 9*-19	2.5(64)	6-19 or 9*-19	3.5(89)
Switchgear & Substations	4-19		4-19		4-19		4-19		4-19	
Generators										
500 rpm to 750 rpm	5-17-21-23	0.75(19)	5-17-21-23	1.50(38)	5-17-21-23	1.50(38)	5-17-21-23	2.5(64)	5-17-21-23	3.5(89)
751 rpm and over	5-17-21-23	0.75(19)	5-17-21-23	0.75(19)	5-17-21-23	1.50(38)	5-17-21-23	2.5(64)	5-17-21-23	3.5(89)
Panelboards	3-18	—	3-18	—	3-18	—	3-18	—	3-18	—
Motor Starters										
Wall Mounted	3-18	—	3-18	—	3-18	—	3-18	—	3-18	—
Floor Mounted	4-19	—	4-19	—	4-19	—	4-19	—	4-19	—
Cable Trays, Bus Ducts & Conduit	12 or 13	—	12 or 13	—	12 or 13	—	12 or 13	—	12 or 13	—

*NOTE: Isolators in Red are Air Springs recommended for highly critical locations.

Blower Minimum Deflection Guide

When blowers are 60 HP (45kw) or larger, select deflection requirements for next larger span. A minimum of 2.5" (64mm) should be used unless larger deflections are called for on the chart or these fans are located in the lowest sub-basement or on a slab on grade.

Fan Speed RPM	Required Deflection for Ground Supported Slab or Basement	Required Deflection for 20' (6m) Floor Span	Required Deflection for 30' (9m) Floor Span	Required Deflection for 40' (12m) Floor Span	Required Deflection for 50' (15m) Floor Span
500 and up	0.35" (9mm)	0.75" (19mm)	1.5" (38mm)	2.5" (64mm)	3.5" (89mm)
375-499	0.35" (9mm)	1.5" (38mm)	2.5" (64mm)	3.5" (89mm)	3.5" (89mm)
300-374	0.35" (9mm)	2.5" (64mm)	2.5" (64mm)	3.5" (89mm)	3.5" (89mm)
225-299	0.35" (9mm)	3.5" (89mm)	3.5" (89mm)	3.5" (89mm)	3.5" (89mm)
175-224	0.35" (9mm)	3.5" (89mm)	4.5" (114mm)	4.5" (114mm)	4.5" (114mm)

Notes:

- Minimum deflection called for in this specification are not 'nominal' but certifiable minimums. The 0.75"(19mm), 1.5"(38mm), 2.5"(64mm), 3.5"(89mm), and 4.5"(114mm) minimums should be selected from manufacturers nominal 1"(25mm), 2"(50mm), 3"(75mm), 4"(100mm) and 5"(125mm) series respectively. Air spring isolation specifications 8 & 9 may be substituted for steel springs above in highly sensitive noise free locations.
- Vacuum, Condensate or Boiler Feed Pumps shall be mounted with their tanks on a common spec. 21 base with deflections as specified for base mounted pumps.
- The base described in spec. 20 is used under the drive side. Individual mountings as described in spec. 6 are used under the Cooler and Condenser.
- This type of compressor is highly unbalanced and sometimes requires inertia bases weighing 5 to 7 times equipment weight to reduce running motion.
- Limit deflection for utility sets 18" (450mm) wheel diameter and smaller to 1 1/2" (38mm).
- FLOATING CONCRETE INERTIA BASES. Floating concrete inertia bases do not reduce vibration transmitted to the structure through the mountings. These bases will reduce vibratory motion, provide a very rigid machine base and minimize spring reactions to fan thrust. Engineers preferring steel bases rather than the concrete mentioned above in specification 5-21 should change the designation to 5-20. Concrete is preferred for all fans operating at static pressure above 4" (100mm) and on roof tops.
- LIGHT FLOOR CONSTRUCTION. When floors or roofs are lighter than 4" (100mm) solid concrete it is desirable to introduce a localized mass under the vibration mountings in the form of a sub-base. This sub-base should be 12" (300mm) thick and 12" (300mm) longer and wider than the mechanical equipment above it. When this mass is provided the 30' (9m) minimum static deflection requirements will suffice even in longer bays. The mass is also useful for unusually large bays over 50' (15m). When floors are lighter than the 4" (100mm) concrete or the location is in a particularly sensitive area and the mass described above cannot be introduced, select deflection requirements for the next larger span.
- For equipment where increased resiliency and decreased accelerations are required, change specification 16 snubbers to specification 17 snubbers.