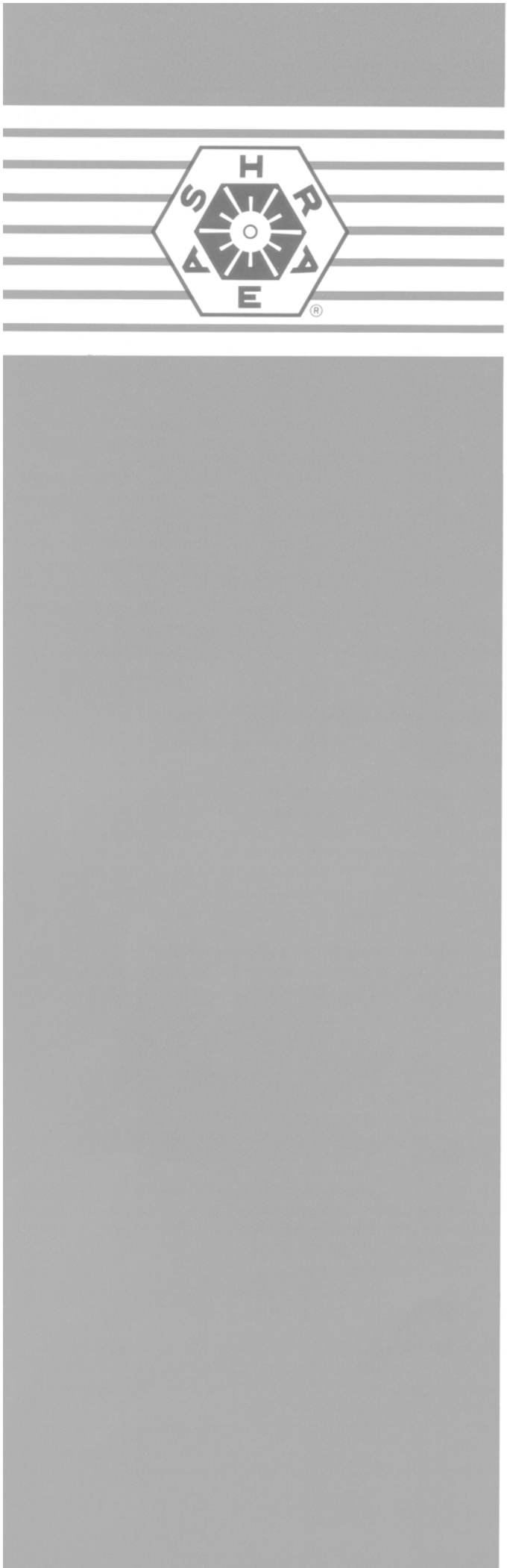

ANSI/ASHRAE Addendum 15*c*-2000
ANSI/ASHRAE Addendum 15*d*-2000
Addenda to ANSI/ASHRAE Standard 15-1994

ASHRAE STANDARD

Addenda to

Safety Code for Mechanical Refrigeration

The ASHRAE Standards Committee approved Standard 15 Addendum *c* on February 5, 2000, and Addendum *d* on June 24, 2000. The ASHRAE Board of Directors approved Standard 15 Addendum *c* on February 10, 2000, and Addendum *d* on June 29, 2000. The American National Standards Institute approved Standard 15 Addendum *c* on April 25, 2000, and Addendum *d* on October 9, 2000.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines are given at the back of this document and may be obtained in electronic form from ASHRAE's Internet Home Page, *http://www.ashrae.org*, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard and printed copies of a public review draft may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: *orders@ashrae.org*. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in U.S. and Canada).

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ASHRAE Standing Standard Project Committee 15
(Addendum 15*c*)
Cognizant TC: TC9.1, Large Building Air Conditioning Systems and
TC 10.1, Custom Engineered Refrigeration Systems
SPLS Liaison: Dean S. Borges

Michael H. Tavares, *Chair**
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Addendum *c*

Add the following definitions to Section 3:

back pressure: the static pressure existing at the outlet of an operating pressure-relief device due to pressure in the discharge line.

balanced relief valve: a pressure-relief valve that incorporates means of minimizing the effect of back pressure on the operational characteristics of the valve (opening pressure, closing pressure, and relieving capacity).

pilot operated relief valve: a pressure-relief valve in which the major relieving device is combined with and is controlled by a self-actuated auxiliary pressure-relief valve.

Replace existing 8.12.3 with the following:

8.12.3 Refrigerant piping shall not penetrate floors, ceilings, or roofs.

Exceptions:

(a) Penetrations connecting the basement and the first floor.

(b) Penetrations connecting the top floor and a machinery penthouse or roof installation.

(c) Penetrations connecting adjacent floors served by the refrigeration system.

(d) Penetrations of a direct system where the refrigerant quantity does not exceed Table 1 quantity for the smallest occupied space through which the refrigerant piping passes.

(e) In other than industrial occupancies and where the refrigerant quantity exceeds Table 1 quantity for the smallest occupied space, penetrations that connect separate pieces of equipment that are

(1) enclosed by an approved gas-tight, fire-resistive duct or shaft with openings to those floors served by the refrigerating system, or

(2) located on the exterior wall of a building when vented to the outside or to the space served by the system and not used as an air shaft, closed court, or similar space.

Add a new subsection to 9.1 Materials as follows:

9.1.5 Piping material used in the discharge line of a pressure-relief device or fusible plug shall be the same as required for refrigerants.

Exception: When discharging to atmosphere, Type F buttweld pipe is allowed.

Replace existing 9.7.5 with the following:

9.7.5 The minimum required discharge capacity of the pressure-relief device or fusible plug for each pressure vessel shall be determined by the following:

$$C = fDL$$

where

C = minimum required discharge capacity of the relief device in pounds of air per minute (kg/s),

D = outside diameter of vessel in feet (m),

L = length of vessel in feet (m),

f = factor dependent upon type of refrigerant.

Note: (1) When combustible materials are used within 20 ft (6.1 m) of a pressure vessel, multiply the value of f by 2.5.

(2) The formula is based on fire conditions. Other heat sources shall be calculated separately.

Refrigerant	**Value of *f***
When used on the lowside of a limited-charge cascade system:	
R-23, R-170, R-744, R-1150, R-508A, R-508B	1.0 (0.082)
R-13, R-13B1, R-503	2.0 (0.163)
R-14	2.5 (0.203)
Other applications:	
R-718	0.2 (0.016)
R-717	0.5 (0.041)
R-11, R-32, R-113, R-123, R-142b, R-152a, R-290, R-600, R-600a, R-764	1.0 (0.082)
R-12, R-22, R-114, R-124, R-134a, R-401A, R-401B, R-401C, R-405A, R-406A, R-407C, R-407D, R-407E, R-409A, R-409B, R-411A, R-411B, R-411C, R-412A, R-414A, R-414B, R-500, R-1270	1.6 (0.131)
R-143a, R-402B, R-403A, R-407A, R-408A, R-413A	2.0 (0.163)
R-115, R-402A, R-403B, R-404A, R-407B, R-410A, R-410B, R-502, R-507A, R-509A	2.5 (0.203)

When one pressure-relief device or fusible plug is used to protect more than one pressure vessel, the required capacity shall be the sum of the capacities required for each pressure vessel.

Replace existing 9.7.8.5 with the following:

9.7.8.5 The maximum length of the discharge piping installed on the outlet of pressure-relief devices and fusible plugs discharging to the atmosphere shall be determined by the method in Appendix H. See Table 3 for the allowable flow capacity of various equivalent lengths of discharge piping for conventional safety relief valves.

Add a new Appendix H:

APPENDIX H

ALLOWABLE EQUIVALENT LENGTH OF DISCHARGE PIPING (NORMATIVE)

The design back pressure due to flow in the discharge piping at the outlet of pressure relief devices and fusible plugs, discharging to atmosphere, shall be limited by the allowable equivalent length of piping determined by equations (1) or (2). See Table 3 for the flow capacity of various equivalent lengths of discharge piping for conventional relief valves.

$$L = \frac{0.2146 d^5 (P_0^2 - P_2^2)}{f C_r^2} - \frac{d^* \ln(P_0 / P_2)}{6f} \qquad (1)$$

$$\left[L = \frac{7.4381 \times 10^{-15} d^5 (P_0^2 - P_2^2)}{f C_r^2} - \frac{d^* \ln(P_0 / P_2)}{500 f} \right] \qquad (2)$$

where

L = equivalent length of discharge piping, ft (m);

C_r = rated capacity as stamped on the relief device in lb/min (kg/s), or in SCFM multiplied by 0.0764, or as calculated in 9.7.7 for a rupture member or fusible plug, or as adjusted for reduced capacity due to piping as specified by the manufacturer of the device, or as adjusted for reduced capacity due to piping as estimated by an approved method;

f = Moody friction factor in fully turbulent flow (see typical values below);

d = inside diameter of pipe or tube, in (mm);

ln = natural logarithm;

P_2 = absolute pressure at outlet of discharge piping, psi (kPa);

P_0 = allowed back pressure (absolute) at the outlet of pressure relief device, psi (kPa).

For the allowed back pressure (P_0), use the percent of set pressure specified by the manufacturer, or, when the allowed back pressure is not specified, use the following values, where P is the set pressure:

* for conventional relief valves, 15% of set pressure,
  $P_0 = (0.15\ P)$ + atmospheric pressure;
* for balanced relief valves, 25% of set pressure,
  $P_0 = (0.25\ P)$ + atmospheric pressure;
* for rupture members, fusible plugs, and pilot operated relief valves, 50% of set pressure,
  $P_0 = (0.50\ P)$ + atmospheric pressure.

Note: For fusible plugs, P is the saturated absolute pressure for the stamped temperature melting point of the fusible plug or the critical pressure of the refrigerant used, whichever is smaller, psi (kPa) and atmospheric pressure is at the elevation of the installation above sea level. A default value is the atmospheric pressure at sea level, 14.7 psi (101.325 kPa).

Typical Moody friction factors (f) for fully turbulent flow:

Tubing OD (in.)	DN	ID (in.)	f
3/8	8	0.315	0.0136
1/2	10	0.430	0.0128
5/8	13	0.545	0.0122
3/4	16	0.666	0.0117
7/8	20	0.785	0.0114
1 1/8	25	1.025	0.0108
1 3/8	32	1.265	0.0104
1 5/8	40	1.505	0.0101

Piping NPS	DN	ID (in.)	f
1/2	15	0.622	0.0259
3/4	20	0.824	0.0240
1	25	1.049	0.0225
1 1/4	32	1.380	0.0209
1 1/2	40	1.610	0.0202
2	50	2.067	0.0190
2 1/2	65	2.469	0.0182
3	80	3.068	0.0173
4	100	4.026	0.0163
5	125	5.047	0.0155
6	150	6.065	0.0149

Replace existing Table 4 with the following new Table 3:

TABLE 3
Pressure-Relief Valve Discharge Line Capacity (lb/min of air) of Various Discharge Line Lengths

Set (PSIG)	Length (feet)	Nominal Pipe Size, NPS/DN											Set (PSIG)	Length (feet)	Nominal Pipe Size, NPS/DN									
		0.5	0.75	1	1.25	1.5	2	2.5	3	4	5	6			0.5	0.75	1	1.25	1.5	2	2.5	3	4	5	6
		15	20	25	32	40	50	65	80	100	125	150			15	20	25	32	40	50	65	80	100	125	150
5	2	2.8	5.8	10.7	21.3	31.4	57.8	88.8	148.0	278.9	469	704	50	2	7.6	14.7	25.4	46.5	65.3	111.7	162.8	256	451	718	1045
5	3	2.3	4.8	9.0	18.1	26.8	49.9	77.3	130.4	249.8	426	647	50	3	6.8	13.2	23.2	43.4	61.4	106.3	156.1	248	439	704	1027
5	4	2.0	4.2	7.9	16.0	23.7	44.5	69.4	117.8	228.2	393	601	50	4	6.1	12.2	21.6	40.8	58.1	101.6	150.2	240	429	691	1011
5	5	1.8	3.8	7.1	14.4	21.5	40.6	63.5	108.3	211.4	367	564	50	5	5.7	11.3	20.2	38.6	55.2	97.4	144.9	233	419	678	996
5	6	1.7	3.5	6.6	13.3	19.8	37.5	58.9	100.8	197.8	346	533	50	6	5.3	10.6	19.1	36.7	52.8	93.8	140.1	226	410	666	981
5	8	1.5	3.0	5.7	11.6	17.4	33.1	52.0	89.5	177.0	312	484	50	8	4.7	9.5	17.3	33.6	48.7	87.5	131.8	215	393	644	953
5	10	1.3	2.7	5.1	10.5	15.7	29.9	47.1	81.3	161.7	286	446	50	10	4.3	8.7	15.9	31.2	45.5	82.4	124.8	205	378	624	927
5	15	1.1	2.2	4.2	8.6	12.9	24.7	39.2	67.9	135.9	243	380	50	15	3.6	7.4	13.6	26.9	39.6	72.7	113.3	185	347	582	872
5	20	0.9	1.9	3.7	7.5	11.3	21.6	34.2	59.4	119.5	214	337	50	20	3.1	6.5	12.0	24.0	35.5	65.8	101.4	170	323	547	825
5	25	0.8	1.7	3.3	6.7	10.1	19.4	30.8	53.5	107.9	194	306	50	25	2.8	5.9	10.9	21.9	32.4	60.5	93.8	158	303	517	785
5	30	0.8	1.6	3.0	6.2	9.3	17.8	28.2	49.1	99.1	179	282	50	30	2.6	5.4	10.0	20.3	30.1	56.3	87.6	148	286	492	750
5	40	0.7	1.4	2.6	5.3	8.0	15.4	24.5	42.8	86.5	156	247	50	40	2.3	4.7	8.8	17.8	26.6	50.1	78.3	133	260	451	692
5	60	0.5	1.1	2.1	4.4	6.6	12.6	20.1	35.1	71.2	129	205	50	60	1.9	3.9	7.3	14.8	22.1	42.0	66.0	113	224	393	608
5	100	0.4	0.9	1.7	3.4	5.1	9.8	15.6	27.3	55.6	101	160	50	100	1.4	3.0	5.7	11.6	17.4	33.3	52.6	91	182	323	504
5	160	0.3	0.7	1.3	2.7	4.0	7.8	12.4	21.7	44.1	80	127	50	160	1.1	2.4	4.5	9.3	13.9	26.7	42.3	73	148	265	416
5	250	0.3	0.6	1.0	2.1	3.2	6.2	9.9	17.4	35.3	64	102	50	250	0.9	1.9	3.6	7.5	11.2	21.5	34.2	59	120	217	342
15	2	4.6	9.3	16.7	32.0	46.0	81.6	121.8	196.5	355.2	577	849	75	2	9.1	17.2	29.4	53.3	74.3	126.0	182.7	286	501	795	1154
15	3	3.9	8.0	15.5	28.3	41.0	74.0	111.6	182.3	334.5	550	815	75	3	8.2	15.8	27.3	50.4	70.7	121.2	176.9	279	491	783	1140
15	4	3.5	7.1	13.0	25.6	37.4	68.1	103.6	170.8	317.1	526	784	75	4	7.5	14.6	25.7	47.8	67.6	116.9	171.6	272	482	772	1127
15	5	3.1	6.5	11.9	23.6	34.6	63.5	97.1	161.2	302.2	506	757	75	5	7.0	13.7	24.3	45.7	64.8	113.1	166.8	266	474	762	1114
15	6	2.9	6.0	11.0	22.0	32.3	59.7	91.7	153.1	289.2	487	732	75	6	6.5	13.0	23.1	43.7	62.4	109.6	162.3	260	466	751	1101
15	8	2.5	5.2	9.7	19.5	28.9	53.8	83.2	140.0	267.5	455	689	75	8	5.9	11.8	21.1	40.6	58.3	103.4	154.4	249	450	732	1077
15	10	2.3	4.7	8.8	17.8	26.3	49.3	76.7	129.7	250.1	429	683	75	10	5.4	10.8	19.6	38.0	54.9	98.2	147.5	240	437	714	1054
15	15	1.9	3.9	7.3	14.8	22.1	41.7	65.3	111.6	218.0	379	583	75	15	4.5	9.2	16.9	33.2	48.4	88.0	133.7	220	407	675	1004

TABLE 3 (Continued)
Pressure-Relief Valve Discharge Line Capacity (lb/min of air) of Various Discharge Line Lengths

Set (PSIG)	Length (feet)	Nominal Pipe Size, NPS/DN											Set (PSIG)	Length (feet)	Nominal Pipe Size, NPS/DN									
		0.5	0.75	1	1.25	1.5	2	2.5	3	4	5	6			0.5	0.75	1	1.25	1.5	2	2.5	3	4	5	6
		15	20	25	32	40	50	65	80	100	125	150			15	20	25	32	40	50	65	80	100	125	150
15	20	1.6	3.4	6.4	13.0	19.4	36.8	57.9	99.4	195.8	344	532	75	20	4.0	8.2	15.1	29.9	43.8	80.5	123.1	204	383	641	960
15	25	1.5	3.1	5.7	11.7	17.5	33.3	52.5	90.5	179.3	316	492	75	25	3.6	7.4	13.7	27.4	40.3	74.6	114.8	192	363	612	921
15	30	1.3	2.8	5.3	10.7	16.1	30.7	48.4	83.6	166.3	295	460	75	30	3.3	6.8	12.7	25.4	37.6	69.8	107.9	181	345	587	887
15	40	1.2	2.4	4.6	9.4	14.0	26.8	42.4	73.5	147.1	262	411	75	40	2.9	6.0	11.2	22.5	33.4	62.5	97.2	164	317	544	828
15	60	1.0	2.0	3.8	7.7	11.6	22.1	35.1	61.0	122.7	220	347	75	60	2.4	5.0	9.3	16.8	28.0	52.9	82.8	141	276	481	739
15	100	0.7	1.5	2.9	6.0	9.0	17.3	27.5	47.9	96.8	175	276	75	100	1.9	3.9	7.3	14.8	22.2	42.2	66.5	115	227	401	623
15	160	0.6	1.2	2.3	4.7	7.1	13.7	21.8	38.1	77.3	140	222	75	160	1.5	3.1	5.8	11.9	17.8	34.0	53.8	93	186	332	520
15	250	0.5	1.0	1.9	3.8	5.7	11.0	17.5	30.6	62.3	113	179	75	250	1.2	2.5	4.7	9.6	14.4	27.5	43.6	76	153	274	432
25	2	5.7	11.3	20.0	37.6	53.5	93.2	137.5	219.2	390.5	628	918	100	2	10.3	19.4	32.9	59.3	82.2	138.8	200.8	314	547	868	1258
25	3	4.9	9.9	17.8	34.0	48.8	86.5	128.8	207.5	374.4	608	893	100	3	9.4	17.9	30.9	56.4	78.9	134.4	195.4	307	539	857	1246
25	4	4.4	8.9	16.2	31.3	45.3	81.0	121.6	197.6	360.1	589	869	100	4	8.7	16.8	29.2	54.0	75.9	130.3	190.4	301	531	847	1234
25	5	4.0	8.2	14.9	29.1	42.3	76.4	115.5	188.9	347.3	572	848	100	5	8.1	15.8	27.8	51.8	73.2	126.6	185.9	295	523	837	1222
25	6	3.7	7.6	13.9	27.4	39.9	72.6	110.2	181.3	335.8	556	828	100	6	7.6	15.0	26.5	49.9	70.8	123.2	181.7	289	515	828	1210
25	8	3.3	6.7	12.4	24.6	36.1	66.4	101.5	168.5	315.9	529	791	100	8	6.9	13.7	24.5	46.6	66.6	117.2	174.0	279	501	810	1188
25	10	3.0	6.1	11.3	22.6	33.3	61.5	94.6	158.1	299.1	505	759	100	10	6.3	12.7	22.8	43.9	63.1	112.0	167.2	270	488	793	1167
25	15	2.5	5.1	9.5	19.1	28.3	52.9	82.1	138.7	266.6	457	694	100	15	5.4	10.9	19.9	38.7	56.3	101.4	153.1	250	459	756	1120
25	20	2.1	4.5	8.3	16.8	25.0	47.1	73.5	125.0	242.9	420	643	100	20	4.7	9.7	17.8	35.1	51.3	93.4	142.1	234	435	723	1077
25	25	1.9	4.0	7.5	15.2	22.7	42.9	67.1	114.7	224.5	391	602	100	25	4.3	8.8	16.3	32.3	47.4	87.0	133.2	221	415	694	1039
25	30	1.8	3.7	6.9	14.0	20.9	39.6	62.2	106.6	209.8	367	568	100	30	4.0	8.2	15.1	30.1	44.3	81.8	125.8	210	397	668	1005
25	40	1.5	3.2	6.0	12.2	18.3	34.8	54.9	94.5	187.3	331	514	100	40	3.5	7.2	13.3	26.7	39.5	73.7	114.0	192	367	625	946
25	60	1.3	2.6	4.9	10.1	15.1	28.9	45.7	79.1	158.0	281	440	100	60	2.9	5.9	11.1	22.4	33.4	62.7	97.9	166	323	558	853
25	100	1.0	2.0	3.8	7.9	11.8	22.7	36.0	62.5	125.8	226	356	100	100	2.2	4.7	8.7	17.8	26.6	50.4	79.2	136	268	471	728
25	160	0.8	1.6	3.1	6.3	9.4	18.1	28.7	50.0	101.1	183	289	100	160	1.8	3.7	7.0	14.3	21.4	40.7	64.3	111	222	393	614
25	250	0.6	1.3	2.4	5.0	7.6	14.5	32.1	40.3	81.7	148	235	100	250	1.4	3.0	5.6	11.5	17.3	33.0	52.3	91	182	326	513

Notes: SI Conversions; kPa = psig × 6.895, mm = inches × 25.4, kg/s = lb/min × 0.007559, m = feet × 0.3048.

TABLE 3 (Continued)
Pressure-Relief Valve Discharge Line Capacity (lb/min of air) of Various Discharge Line Lengths

Set (PSIG)	Length (feet)	Nominal Pipe Size, NPS/DN											Set (PSIG)	Length (feet)	Nominal Pipe Size, NPS/DN									
		0.5	0.75	1	1.25	1.5	2	2.5	3	4	5	6			0.5	0.75	1	1.25	1.5	2	2.5	3	4	5	6
		15	20	25	32	40	50	65	80	100	125	150			15	20	25	32	40	50	65	80	100	125	150
150	2	12.5	23.3	39.2	70.1	96.8	162.7	234.5	366	636	1006	1457	300	2	18.4	33.7	56.1	99.4	136.7	228.3	328	510	884	1395	2019
150	3	11.6	21.8	37.2	67.4	93.7	158.5	229.6	360	628	996	1446	300	3	17.3	32.1	54.0	96.0	133.5	224.2	323	504	877	1386	2009
150	4	10.8	20.6	35.5	64.9	90.8	154.7	225.1	354	621	987	1435	300	4	16.4	30.8	52.2	94.1	130.6	220.4	319	498	869	1378	1998
150	5	10.2	19.6	34.0	62.8	88.1	151.2	220.7	348	613	979	1425	300	5	15.6	29.6	50.5	91.7	127.8	216.8	314	493	862	1369	1988
150	6	9.6	18.7	32.7	60.8	85.7	147.8	216.6	343	606	970	1414	300	6	14.9	28.5	49.0	89.6	125.2	213.4	310	488	856	1361	1978
150	8	8.8	17.3	30.5	57.3	81.4	141.8	209.1	333	593	954	1394	300	8	13.8	26.6	46.3	85.6	120.4	206.9	302	478	843	1345	1959
150	10	8.1	16.1	28.7	54.4	77.7	136.5	202.3	324	581	938	1375	300	10	12.8	25.1	44.1	82.2	116.2	201.0	295	468	830	1330	1940
150	15	6.9	14.0	25.2	48.7	70.3	125.4	187.8	304	553	902	1330	300	15	11.2	22.2	39.6	75.1	107.2	188.3	279	447	801	1293	1895
150	20	6.2	12.5	22.8	44.5	64.6	116.6	176.0	288	529	870	1289	300	20	10.0	20.1	36.2	69.6	100.1	177.7	265	428	775	1260	1853
150	25	5.6	11.4	21.0	41.2	60.2	109.4	166.2	274	507	841	1251	300	25	9.2	18.6	33.6	65.2	94.2	168.7	253	412	751	1229	1814
150	30	5.2	10.6	19.5	38.6	56.5	103.4	157.9	261	488	815	1217	300	30	8.5	17.3	31.5	61.5	89.2	160.9	243	397	729	1200	1777
150	40	4.5	9.4	17.3	34.5	50.8	93.9	144.5	241	456	769	1156	300	40	7.5	15.4	28.2	55.6	81.3	148.2	225	372	691	1148	1710
150	60	3.8	7.8	14.5	29.2	43.3	80.8	125.4	212	407	696	1058	300	60	6.3	12.9	23.9	47.7	70.2	129.7	199	333	639	1061	1595
150	100	2.9	6.1	11.5	23.3	34.7	65.6	102.7	175	343	597	918	300	100	4.9	10.3	19.1	38.5	57.2	107.1	167	282	544	934	1422
150	160	2.3	4.9	9.2	18.7	28.0	53.3	84.0	145	286	505	785	300	160	3.9	8.2	15.4	31.3	46.6	88.1	138	236	463	807	1243
150	250	1.9	3.9	7.4	15.2	22.7	43.4	68.6	119	238	423	662	300	250	3.2	6.6	12.5	25.4	38.0	72.3	114	196	389	687	1068
200	2	14.6	26.9	45.0	80.2	110.6	185.2	266.6	415	721	1139	1649	350	2	20.3	37.0	61.4	108.6	149	249	358	556	963	1519	2199
200	3	13.6	25.4	43.1	77.5	107.4	181.2	261.9	409	713	1130	1638	350	3	19.1	35.3	59.3	105.8	146	245	353	550	956	1510	2189
200	4	12.7	24.2	41.3	75.1	104.6	177.4	257.4	404	706	1121	1628	350	4	18.1	33.9	57.4	103.3	143	241	348	544	949	1502	2178
200	5	12.0	23.1	39.8	72.8	101.9	173.9	253.1	398	699	1113	1618	350	5	17.3	32.7	55.7	100.9	140	237	344	539	941	1493	2168
200	6	11.5	22.1	38.4	70.8	99.4	170.6	249.1	393	692	1105	1608	350	6	16.6	31.5	54.1	98.6	137	234	340	534	935	1484	2158
200	8	10.5	20.5	36.0	67.2	95.0	164.5	241.5	383	679	1089	1588	350	8	15.3	29.6	51.3	94.5	132	227	331	523	921	1468	2139
200	10	9.7	19.2	34.0	64.1	91.1	159.0	234.6	374	667	1073	1570	350	10	14.4	28.0	48.9	90.9	128	221	324	514	908	1452	2120
200	15	8.4	16.8	30.2	57.9	83.2	147.3	219.6	354	639	1038	1525	350	15	12.5	24.8	44.1	83.5	119	208	307	492	879	1414	2075
200	20	7.5	15.2	27.5	53.2	77.0	137.9	207.2	337	614	1005	1485	350	20	11.3	22.6	40.5	77.6	111	196	293	473	852	1379	2032

TABLE 3 (Continued)
Pressure-Relief Valve Discharge Line Capacity (lb/min of air) of Various Discharge Line Lengths

Set (PSIG)	Length (feet)	Nominal Pipe Size, NPS/DN											Set (PSIG)	Length (feet)	Nominal Pipe Size, NPS/DN									
		0.5	0.75	1	1.25	1.5	2	2.5	3	4	5	6			0.5	0.75	1	1.25	1.5	2	2.5	3	4	5	6
		15	20	25	32	40	50	65	80	100	125	150			15	20	25	32	40	50	65	80	100	125	150
200	25	6.8	13.9	24.3	49.5	72.0	130.1	196.6	322	592	967	1447	350	25	10.3	20.8	37.6	72.8	105	187	280	455	827	1347	1992
200	30	6.3	12.9	23.6	46.5	67.9	123.4	187.6	309	572	949	1412	350	30	9.6	19.4	35.3	68.8	99	178	269	440	804	1317	1954
200	40	5.6	11.4	21.1	41.8	61.4	112.8	172.6	287	538	901	1349	350	40	8.5	17.3	31.7	62.4	91	163	250	413	764	1262	1885
200	60	4.6	9.6	17.7	35.5	52.5	97.7	151.1	254	484	823	1245	350	60	7.1	14.6	26.9	53.7	79	145	222	372	699	1170	1765
200	100	3.6	7.5	14.1	28.5	42.4	79.9	124.7	212	413	714	1094	350	100	5.6	11.6	21.6	43.5	64	120	186	316	607	1034	1582
200	160	2.9	6.0	11.3	23.0	34.4	65.2	102.5	176	347	610	944	350	160	4.5	9.3	17.4	35.4	52	99	155	266	519	897	1390
200	250	2.3	4.9	9.1	18.6	27.9	53.3	84.1	145	290	514	802	350	250	3.6	7.5	14.1	28.8	43	81	128	222	438	766	1200
250	2	16.5	30.4	50.7	89.9	123.8	207.0	297.7	463	803	1268	1836	400	2	22.0	40.2	66.6	117.7	161.7	269.6	387	601	1041	1642	2376
250	3	15.5	28.8	48.6	87.2	120.7	203.0	293.0	457	796	1260	1826	400	3	20.9	38.5	64.5	114.8	158.4	265.5	382	595	1034	1633	2366
250	4	14.6	27.5	46.9	84.7	117.8	199.3	288.5	452	789	1251	1815	400	4	19.8	37.0	62.5	112.2	155.3	261.5	378	589	1026	1625	2355
250	5	13.8	26.4	45.2	82.4	115.1	195.7	284.2	446	782	1243	1805	400	5	18.9	35.7	60.7	109.7	152.4	257.7	373	584	1019	1616	2345
250	6	13.2	25.4	43.8	80.3	112.5	192.3	280.2	441	775	1234	1795	400	6	18.2	34.5	59.1	107.4	149.6	254.1	369	578	1012	1608	2335
250	8	12.2	23.6	41.3	76.6	107.9	186.1	272.5	431	762	1219	1776	400	8	16.9	32.5	56.1	103.1	144.5	247.3	360	568	999	1591	2315
250	10	11.3	22.2	39.1	73.3	103.9	180.4	265.4	422	750	1203	1757	400	10	15.8	30.7	53.6	99.3	139.9	241.0	353	558	986	1575	2295
250	15	9.8	19.6	35.0	66.7	95.4	168.2	249.8	401	721	1167	1713	400	15	13.9	27.4	48.5	91.5	130.1	227.1	335	535	955	1537	2249
250	20	8.8	17.7	31.9	61.5	88.7	158.1	236.7	383	696	1135	1672	400	20	12.5	24.9	44.6	85.2	122.0	215.4	320	515	927	1502	2205
250	25	8.0	16.3	29.5	57.5	83.3	149.7	225.5	368	673	1104	1634	400	25	11.4	23.0	41.6	80.1	115.3	205.4	307	497	902	1469	2164
250	30	7.4	15.1	27.6	54.1	78.7	142.5	215.7	354	652	1076	1598	400	30	10.6	21.5	39.0	75.8	109.6	196.6	296	481	878	1438	2125
250	40	6.5	13.4	24.7	48.8	71.5	130.7	199.5	330	616	1026	1533	400	40	9.4	19.2	35.1	68.9	100.4	182.0	276	453	836	1382	2052
250	60	5.4	11.3	20.9	41.7	61.5	114.0	175.6	294	558	944	1423	400	60	7.9	16.2	26.9	59.4	87.2	160.4	246	409	767	1286	1927
250	100	4.3	8.9	16.6	33.6	49.9	93.7	145.9	248	479	826	1261	400	100	6.2	12.9	24.0	48.3	71.5	133.4	207	349	669	1143	1734
250	160	3.4	7.1	13.4	27.2	40.6	76.8	120.5	207	406	710	1096	400	160	5.0	10.4	19.4	39.3	58.5	110.3	173	294	574	996	1529
250	250	2.7	5.8	10.8	22.1	33.0	62.9	99.2	171	340	602	937	400	250	4.0	8.4	15.7	32.0	47.9	90.9	143	246	468	854	1324

Notes: SI Conversions; kPa = psig × 6.895, mm = inches × 25.4, kg/s = lb/min × 0.007559, m = feet × 0.3048.

Addendum *d*

Changes in this addendum are a result of continuous maintenance submissions approved by SSPC 15. The changes in this addendum concern the requirement for self-contained breathing apparatus currently in ANSI/ASHRAE 15-1994. The changes in this addendum include:

- Number the second paragraph in 8.13.2 to make a new subsection, 8.13.2.1.
- Add new wording at the end of 8.13.2.1 and add a new paragraph.
- Add a new subsection, 11.2.4 (wording for signs at entrances to refrigerating machinery rooms).
- Delete 11.6 Self-Contained Breathing Apparatus (SCBA).
- Add a new paragraph to the end of 11.8 Responsibility for Operation and Emergency Shutdown.
- Add a new Informative Appendix I, Emergencies in Refrigerating Machinery Rooms.

Change existing 8.13.2 as follows:

8.13.2 Each refrigerating machinery room shall have a tight-fitting door or doors opening outward, self-closing if they open into the building, and adequate in number to ensure freedom for persons to escape in an emergency. With the exception of access doors and panels in air ducts and air handling units conforming to 8.13.7, there shall be no openings that will permit passage of escaping refrigerant to other parts of the building.

8.13.2.1 Each refrigerating machinery room shall contain a detector, located in an area where refrigerant from a leak will concentrate, that actuates an alarm and mechanical ventilation in accordance with 8.13.4 at a value not greater than the corresponding TLV-TWA (or toxicity measure consistent therewith). The alarm shall annunciate visual and audible alarms inside the refrigerating machinery room and outside each entrance to the refrigerating machinery room. The alarms required in this section shall be of the manual reset type with the reset located inside the refrigerating machinery room.

Alarms set at other levels (such as IDLH) and automatic reset alarms are permitted in addition to those required by this section. The meaning of each alarm shall be clearly marked by signage near the annunciators.

Exceptions: For ammonia, refer to 8.14(g).

Add a new subsection, 11.2.4 as follows:

11.2.4 Each entrance to a refrigerating machinery room shall be provided with a legible permanent sign, securely attached and easily accessible, reading "Machinery Room – Authorized Personnel Only." The sign shall further communicate that entry is forbidden except by those personnel trained in the emergency procedures required by 11.8 when the refrigerant alarm, required by 8.13.2.1, has been activated.

Delete 11.6 as follows:

~~**11.6 Self-Contained Breathing Apparatus (SCBA).** When a machinery room is required per the rules of 7.4, at least one approved self-contained breathing apparatus, suitable for the refrigerant used, shall be located outside of, but close to, the machinery room. A second, backup, self-contained breathing apparatus shall also be provided.~~

Renumber the remaining sections of Section 11.

Add the following paragraph to the end of 11.8 (now 11.7):

11.7 ~~11.8~~ Responsibility for Operation and Emergency Shutdown. It shall be the duty of the person in charge of the premises on which a refrigerating system containing more than 55 lb (25 kg) of refrigerant is installed to provide a schematic drawing or panel giving directions for the operation of the system at a location that is convenient to the operators of the equipment.

Emergency shutdown procedures, including precautions to be observed in case of a breakdown or leak, shall be displayed on a conspicuous card located as near as possible to the refrigerant compressor. These precautions shall address

(a) instructions for shutting down the system in case of emergency;
(b) the name, address, and day and night telephone numbers for obtaining service; and
(c) the names, addresses, and telephone numbers of all corporate, local, state, and federal agencies to be contacted as required in the event of a reportable incident.

When a refrigerating machinery room is used, the emergency procedures shall be posted outside the room, immediately adjacent to each door.

The emergency procedures shall forbid entry into the refrigerating machinery room when the refrigerant alarm required by 8.13.2.1 has been activated except by persons provided with the appropriate respiratory and other protective equipment and trained in accordance with jurisdictional requirements.

Add a new Informative Appendix I

APPENDIX I

(This appendix is not part of this standard and is included for information only.)

EMERGENCIES IN REFRIGERATING MACHINERY ROOMS

This standard specifies refrigerating machinery rooms under some conditions to reduce risks from large refrigeration systems and large amounts of refrigerant. One purpose of the requirements is to warn of emergencies in the refrigerating machinery room. The refrigerant detector required by 8.13.2.1 triggers alarms inside and outside the refrigerating machinery room; signage warns refrigeration technicians and bystanders not to enter when the alarm has activated.

This appendix provides guidance on integrating the minimum emergency warning and training requirements of this standard with measures often taken in occupational health and safety programs.

The requirements in the standard provide minimum protection to help prevent injury from refrigerating machinery room accidents. Minimal conformance to the standard's specifications does not necessarily facilitate the convenient handling of incidents in the room. For example, if only the minimum protective steps are taken, refrigeration technicians may not reenter the machinery room after an alarm has sounded (to silence the alarm and repair any damage) without calling on the services of emergency responders (generally the local hazardous materials team). Many other approaches are possible, especially in facilities that prepare sophisticated emergency response plans.

Alarm Levels

A refrigerant level above the TLV-TWA activates the alarms required by 8.13.2.1. If personnel working in the refrigerating machinery room are not provided with and trained to use respiratory protection equipment appropriate for the refrigerant (such as canister respirators or self-contained breathing apparatus), they must leave the room immediately. Presence of refrigerant above the TLV-TWA does not by itself signal an emergency; many routine service operations can create such levels. Local or national regulations often prescribe that steps be taken to protect the health and safety of personnel working in the machinery room when refrigerant concentrations rise above the TLV-TWA.

In a more sophisticated facility, with appropriate training and other measures specified by local regulations, refrigeration technicians might use this alarm as a signal to don respiratory protection. Evacuation of the machinery room may not be necessary, although warning bystanders not to enter still is. Selection of the proper respiratory protection for the particular situation may require additional information (e.g., whether or not the refrigerant concentration is above the IDLH level).

Note that donning respiratory protection is a last-resort option under most industrial hygiene regimens; it is preferable to provide engineering controls to reduce refrigerant concentrations to tolerable levels. The refrigerant detector required by 8.13.2.1 activates the machinery room ventilation automatically. In many cases, this may be entirely adequate to reduce the concentration, and respiratory protection may not be needed. (An alarm silence switch is useful for situations where personnel are to remain working in the room.)

Alternate Refrigerant Level Measurements

The required alarms signal only that refrigerant was detected at concentrations above the TLV-TWA. Some facilities may find it useful to have multiple levels of alarms or to provide an instrument that indicates the actual refrigerant level (digital readout in parts per million refrigerant). Selecting proper respiratory protection for technicians or other responders, as mentioned above, is one reason. This is perfectly acceptable, provided that the additional alarms or indicators are clearly distinguished from the main alarm. Bystanders should not be confused by the alarm arrangements.

The main alarm must still be manual-reset only. It is unwise to rely on automatic detectors to announce that an event is over. A technician could not distinguish between an alarm that reset when the refrigerant concentration dropped (e.g., because ventilation fans controlled the incident) and one that reset because the refrigerant detector was damaged. In the latter case, anyone entering the refrigerating machinery room might be entering a hazardous area. Alarms or indicators intended to communicate current conditions inside the refrigeration machinery room may, of course, be automatically-resetting.

Reentry into Refrigerating Machinery Rooms

Reentering an area during an emergency requires sophisticated equipment and training; many national and local regulations govern such activities. Prepositioning emergency response equipment (e.g., self-contained breathing apparatus) should be done only by arrangement with emergency responders, and any prepositioned equipment should be clearly labeled for use by trained personnel only. Doing otherwise invites unauthorized use (or vandalism) by untrained personnel, with dangerous consequences.

Facilities should note, however, that the alarms required in this standard annunciate not that an emergency is occurring but that an abnormal situation is occurring. It may be acceptable for trained personnel to enter the refrigeration machinery room to investigate the situation, repair minor leaks, reset alarms tripped in error, etc. Any personnel required to enter should be provided with appropriate personal protective equipment (especially respiratory protection, if needed) and should be trained to recognize an emergency situation requiring professional emergency response.

Example Emergency Procedures

As an example (and there are many other possibilities), consider a facility that wishes to use its own technicians to

handle minor problems in the refrigerating machinery room. The facility takes the following steps:

1. Provides the refrigerant alarm required by 8.13.2.1, along with signage warning "Authorized Personnel Only. Stay Out When Refrigerant Alarm Sounds; Call Facilities Management Immediately." This alarm triggers at the TLV-TWA.
2. Provides a digital readout of the current refrigerant detector reading outside the refrigerating machinery room. A sign distinguishes the current-reading indicator from the alarm-activation indicator required by 8.13.2.1.
3. Provides the refrigeration technicians with appropriate respiratory protection suitable for use in an atmosphere containing refrigerant in concentrations below the IDLH, in accordance with all applicable national and local regulations.
4. Defines as "incidental" any refrigerant release that is not producing levels above the IDLH in the machinery room. (The ventilation system will render many potential releases incidental.)
5. Trains the technicians to leave the refrigerating machinery room when the refrigerant alarm sounds. After donning appropriate respiratory protection (if necessary), they may reenter the machinery room to close valves, fix leaks, shut off alarms, etc., if and only if the current refrigerant level is below the IDLH. That is, technicians may reenter the room if the refrigerant release is incidental. If the level exceeds the IDLH or the problem seems uncontrolled in the sense that it may unpredictably worsen or require a team of technicians to fix, they are to leave and call for emergency responders.
6. Coordinates emergency procedures with the local emergency response agencies in advance.

None of these steps contradicts the requirements of the standard, but the additional procedures significantly aid the facility's efforts to handle minor maintenance problems safely.

NOTICE

INSTRUCTIONS FOR SUBMITTING A PROPOSED CHANGE TO THIS STANDARD UNDER CONTINUOUS MAINTENANCE

This standard is maintained under continuous maintenance procedures by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. SSPC consideration will be given to proposed changes according to the following schedule:

Deadline for receipt of proposed changes	SSPC will consider proposed changes at next
February 20	ASHRAE Annual Meeting (normally June)

Proposed changes must be submitted to the Manager of Standards (MOS) in the latest published format available from the MOS. However, the MOS may accept proposed changes in an earlier published format if the MOS concludes that the differences are immaterial to the proposed changes. If the MOS concludes that the current form must be utilized, the proposer may be given up to 20 additional days to resubmit the proposed changes in the current format.

Specific changes in text or values are required and must be substantiated. The Manager of Standards will return to the submitter any change proposals that do not meet these requirements. Supplemental background documents to support changes submitted may be included.

FORM FOR SUBMITTAL OF PROPOSED CHANGE TO ASHRAE STANDARD UNDER CONTINUOUS MAINTENANCE

(Please type)

1. Submitter: _____
(name—type)

Affiliation: _____

Address: _____ City: _____ State: _____ Zip: _____

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I hereby grant the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) the non-exclusive royalty rights, including non-exclusive royalty rights in copyright, in my proposals and I understand that I acquire no rights in publication of this standard in which my proposal in this or other similar analogous form is used. I hereby attest that I have the authority and am empowered to grant this copyright release.

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NOTE: Use a separate form for each comment, completing each section (including Sections 1 and 2) to facilitate processing.

2. Number and Year of Standard:

3. Clause (i.e., Section), Subclause or Paragraph Number, and Page Number:

4. I Propose To: (check one)
[ ] Change to read as shown
[ ] Add new text as shown
[ ] Delete and substitute as shown
[ ] Delete without substitution

(Indicate the proposed change by showing a strikeout line through material to be deleted and underlining material to be added. After showing the text to be changed, insert a horizontal line and state the purpose, reason, and substantiation for the proposed change. Use additional pages if necessary.)

5. Proposed Change:

6. Purpose, Reason, and Substantiation Statements:
(Be brief; provide abstracts of lengthy substantiation; full text should be enclosed for reference on request by project committee members.)

[ ] Check if additional pages are attached. Number of additional pages: _____

NOTE: Use separate form for each comment. Submittals (MS Word 7 preferred) may be attached to e-mail (preferable), submitted on diskettes, uploaded to ASHRAE's ftp site, or submitted in paper form by mail or fax to ASHRAE, Manager of Standards, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305.
E-mail: change.proposal@ashrae.org. Ftp server address: ftp.ashrae.org, directory: *change.proposal*. Fax: 404-321-5478

ELECTRONIC PREPARATION/SUBMISSION OF FORM FOR PROPOSING CHANGES

An electronic version of each change, which must comply with the instructions in the Notice and the Form, is the preferred form of submittal to ASHRAE Headquarters at the address shown below. The electronic format facilitates both paper-based and computer-based processing. Submittal in paper form is acceptable. The following instructions apply to change proposals submitted in electronic form.

Use the appropriate file format for your word processor and save the file in either Microsoft Word 7 (preferred) or higher or WordPerfect 5.1 for DOS format. Please save each change proposal file with a different name (example, prop001.doc, prop002.doc, etc., for Word files—prop001.wpm, prop002.wpm, etc., for WordPerfect files). If supplemental background documents to support changes submitted are included, it is preferred that they also be in electronic form as wordprocessed or scanned documents.

Electronic change proposals may be submitted either as files (MS Word 6 preferred) attached to an e-mail (uuencode preferred), files uploaded to an ftp site, or on 3.5" floppy disk. ASHRAE will accept the following as equivalent to the signature required on the change submittal form to convey non-exclusive copyright:

Files attached to e-mail:	Electronic signature on change submittal form (as a picture; *.tif, or *.wpg), or e-mail address.
Files on disk or uploaded to ftp site:	Electronic signature on change submittal form (as a picture; *.tif, or *.wpg), listing of the submitter's e-mail address on the change submittal form, or a letter with submitter's signature accompanying the disk or sent by facsimile (single letter may cover all of proponent's proposed changes).

Submit e-mail, ftp file, or disks containing change proposal files to:
Manager of Standards
ASHRAE
1791 Tullie Circle, NE
Atlanta, GA 30329-2305
E-mail: *change.proposal@ashrae.org*
Ftp server address: *ftp.ashrae.org*, logon to anonymous ftp in directory: *change.proposal*.
(Alternatively, mail paper versions to ASHRAE address or Fax: 404-321-5478.)

The form and instructions for electronic submittal to ASHRAE's ftp site or as attachments to e-mail may be obtained from the Standards section of ASHRAE's Home Page, *http://www.ashrae.org*, or by contacting a Standards Secretary, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. Phone: 404-636-8400. Fax: 404-321-5478.
Email: *standards.section@ashrae.org*.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the standards and guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive technical committee structure, continue to generate up-to-date standards and guidelines where appropriate and adopt, recommend, and promote those new and revised standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating standards and guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.