Kidde Fire Systems

BULLETIN

#15-51K

Date: October 16, 2015

To: All Kidde® Fire Systems Distributors

From: Mohammed Ateeq, Product Manager – Clean Agent Systems

Subject: Design Concentrations for Clean Agent Systems

Kidde Fire Systems is pleased to provide the following consolidated recommendation for minimum design concentration for Class A, B and C based on NFPA 2001, 2015 edition, our bulletin # 15-06K and the addition of Nitrogen to the Kidde agent portfolio:

Clean Agent	Class A MDC	Class B MDC	Class C MDC
HFC-227ea	6.70%	Refer DIOM Manual	7.00%
FK-5-1-12	4.50%	Refer DIOM Manual	4.50%
HFC-23	19.50%	Refer DIOM Manual	20.30%
IG-55	37.90%	Refer DIOM Manual	42.70%
IG-100	37.20%	Refer DIOM Manual	41.90%

Updated flooding factors for a range of hazard temperatures and agent concentrations are included with this bulletin in metric and US units. These replace the tables included with 2012 bulletin #12-04.

Please note:

1. In jurisdictions where earlier editions of NFPA 2001 are used, it is acceptable to base the minimum design concentration on that edition. The governing authority or authority having jurisdiction (AHJ) must specifically approve the design approach selected.
2. Flooding factors are sourced from NFPA 2001-2015 with the exception for Design Concentrations not covered by NFPA where the data is calculated by Kidde.
3. While the NFPA calculated flooding factors cover a wide range of temperatures, the designer must ensure that system design and application is based on flooding factors within temperature limits defined in respective Kidde DIOM manuals and other literature. The data for temperatures outside of those listed in Kidde literature is informational only.

If you have any questions on design concentrations, please call technical support at (866) 287 2531 or email us at Kidde_techsupport@fs.utc.com.

Flooding Factors – FK-5-1-12 (U.S Units)

Temp t (^{o}F)	Specific Vapor Volume (ft.^{3}/lb.)	Weight Requirements of Hazard Volume, W/V (lb/ft.^{3}) Design Concentrations (% by Volume)										
		3.00	4.00	4.50	4.70	5.00	6.00	7.00	8.00	9.00	10.00	11.00
-20	0.9368	0.0330	0.0445	0.0503	0.0526	0.0562	0.0681	0.0803	0.0928	0.1056	0.1186	0.1319
-10	0.9612	0.0322	0.0433	0.0490	0.0513	0.0548	0.0664	0.0783	0.0905	0.1029	0.1156	0.1286
0	0.9856	0.0314	0.0423	0.0478	0.0500	0.0534	0.0648	0.0764	0.0882	0.1003	0.1127	0.1254
10	1.0100	0.0306	0.0413	0.0467	0.0488	0.0521	0.0632	0.0745	0.0861	0.0979	0.1100	0.1224
20	1.0344	0.0299	0.0403	0.0456	0.0477	0.0509	0.0617	0.0728	0.0841	0.0956	0.1074	0.1195
30	1.0588	0.0292	0.0394	0.0445	0.0466	0.0497	0.0603	0.0711	0.0821	0.0934	0.1049	0.1167
40	1.0832	0.0286	0.0385	0.0435	0.0455	0.0486	0.0589	0.0695	0.0803	0.0913	0.1026	0.1141
50	1.1077	0.0279	0.0376	0.0425	0.0445	0.0475	0.0576	0.0680	0.0785	0.0893	0.1003	0.1116
60	1.1321	0.0273	0.0368	0.0416	0.0436	0.0465	0.0564	0.0665	0.0768	0.0874	0.0981	0.1092
70	1.5650	0.0267	0.0360	0.0407	0.0426	0.0455	0.0552	0.0651	0.0752	0.0855	0.0961	0.1069
80	1.8090	0.0262	0.0353	0.0399	0.0418	0.0446	0.0541	0.0637	0.0736	0.0838	0.0941	0.1047
90	1.2053	0.0257	0.0346	0.0391	0.0409	0.0437	0.0530	0.0624	0.0721	0.0821	0.0922	0.1025
100	1.2297	0.0252	0.0339	0.0383	0.0401	0.0428	0.0519	0.0612	0.0707	0.0804	0.0904	0.1005
110	1.2540	0.0247	0.0332	0.0376	0.0393	0.0420	0.0509	0.0600	0.0693	0.0789	0.0886	0.0986
120	1.2785	0.0242	0.0326	0.0369	0.0386	0.0412	0.0499	0.0589	0.0680	0.0774	0.0869	0.0967
130	1.3029	0.0237	0.0320	0.0362	0.0379	0.0404	0.0490	0.0578	0.0667	0.0759	0.0853	0.0949
140	1.3273	0.0233	0.0314	0.0355	0.0372	0.0397	0.0481	0.0567	0.0655	0.0745	0.0837	0.0931
150	1.3518	0.0229	0.0308	0.0349	0.0365	0.0389	0.0472	0.0557	0.0643	0.0732	0.0822	0.0914
160	1.3762	0.0225	0.0303	0.0342	0.0358	0.0382	0.0464	0.0547	0.0632	0.0719	0.0807	0.0898
170	1.4006	0.0221	0.0297	0.0336	0.0352	0.0376	0.0456	0.0537	0.0621	0.0706	0.0793	0.0882
180	1.4250	0.0217	0.0292	0.0331	0.0346	0.0369	0.0448	0.0528	0.0610	0.0694	0.0780	0.0867
190	1.4494	0.0213	0.0287	0.0325	0.0340	0.0363	0.0440	0.0519	0.0600	0.0682	0.0767	0.0853
200	1.4738	0.0210	0.0283	0.0320	0.0335	0.0357	0.0433	0.0511	0.0590	0.0671	0.0754	0.0839
210	1.4982	0.0206	0.0278	0.0315	0.0329	0.0351	0.0426	0.0502	0.0580	0.0660	0.0742	0.0825
220	1.5226	0.0203	0.0274	0.0309	0.0324	0.0346	0.0419	0.0494	0.0571	0.0650	0.0730	0.0812

Flooding Factors – FK-5-1-12 (Metric Units)

Temp t (^{o}C)	Specific Vapor Volume (m^3/kg)	Weight Requirements of Hazard Volume, W/V (kg/m^3) Design Concentrations (% by Volume)										
		3.00	4.00	4.50	4.70	5.00	6.00	7.00	8.00	9.00	10.00	11.00
-20	0.0609140	0.5077	0.6840	0.7735	0.8096	0.8640	1.0478	1.2356	1.4274	1.6235	1.8239	2.0289
-15	0.6022886	0.4965	0.6690	0.7565	0.7918	0.8450	1.0247	1.2084	1.3960	1.5878	1.7838	1.9842
-10	0.0636570	0.4858	0.6545	0.7402	0.7747	0.8268	1.0027	1.1824	1.3660	1.5536	1.7454	1.9415
-5	0.0650285	0.4756	0.6407	0.7246	0.7584	0.8093	0.9815	1.1575	1.3372	1.5209	1.7086	1.9006
0	0.0664000	0.4658	0.6275	0.7096	0.7427	0.7926	0.9613	1.1336	1.3096	1.4895	1.6734	1.8614
5	0.0677715	0.4564	0.6148	0.6953	0.7277	0.7766	0.9419	1.1106	1.2831	1.4594	1.6395	1.8237
10	0.0691430	0.4473	0.6026	0.6815	0.7133	0.7612	0.9232	1.0886	1.2577	1.4304	1.6070	1.7876
15	0.0705145	0.4386	0.5909	0.6683	0.6994	0.7464	0.9053	1.0675	1.2332	1.4026	1.5758	1.7528
20	0.0718860	0.4303	0.5796	0.6555	0.6861	0.7322	0.8880	1.0471	1.2097	1.3759	1.5457	1.7194
25	0.0732575	0.4222	0.5688	0.6433	0.6733	0.7185	0.8714	1.0275	1.1871	1.3501	1.5168	1.6873
30	0.0746290	0.4145	0.5583	0.6314	0.6609	0.7053	0.8554	1.0087	1.1653	1.3253	1.4890	1.6563
35	0.0760005	0.4070	0.5482	0.6201	0.6490	0.6926	0.8400	0.9905	1.1443	1.3014	1.4621	1.6264
40	0.0773720	0.3998	0.5385	0.6091	0.6375	0.6803	0.8251	0.9729	1.1240	1.2784	1.4362	1.5976
45	0.0787435	0.3928	0.5291	0.5985	0.6264	0.6685	0.8107	0.9560	1.1044	1.2561	1.4112	1.5698
50	0.0801150	0.3861	0.5201	0.5882	0.6157	0.6570	0.7969	0.9396	1.0855	1.2346	1.3871	1.5429
55	0.0814865	0.3796	0.5113	0.5783	0.6053	0.6460	0.7835	0.9238	1.0673	1.2139	1.3637	1.5170
60	0.0828580	0.3733	0.5029	0.5688	0.5953	0.6353	0.7705	0.9085	1.0496	1.1938	1.3412	1.4919
65	0.0842295	0.3672	0.4947	0.5595	0.5856	0.6250	0.7580	0.8938	1.0325	1.1744	1.3194	1.4676
70	0.0856010	0.3614	0.4868	0.5506	0.5762	0.6149	0.7458	0.8794	1.0160	1.1556	1.2982	1.4441
75	0.0869725	0.3557	0.4791	0.5419	0.5671	0.6053	0.7341	0.8656	1.0000	1.1373	1.2778	1.4213
80	0.0883440	0.3501	0.4716	0.5335	0.5584	0.5959	0.7227	0.8522	0.9845	1.1197	1.2579	1.3993
85	0.0897155	0.3448	0.4644	0.5253	0.5498	0.5868	0.7117	0.8391	0.9694	1.1026	1.2387	1.3779
90	0.0910870	0.3396	0.4574	0.5174	0.5415	0.5779	0.7010	0.8265	0.9548	1.0860	1.2201	1.3572
95	0.0924585	0.3346	0.4507	0.5097	0.5335	0.5694	0.6906	0.8142	0.9407	1.0699	1.2020	1.3370
100	0.0938300	0.3297	0.4441	0.5023	0.5257	0.5610	0.6805	0.8024	0.9269	1.0543	1.1844	1.3175

Flooding Factors – HFC-227ea (U.S. Units)

Temp t (^{o}F)	Specific Vapor Volume (ft.^{3}/lb.)	Weight Requirements of Hazard Volume, W/V (lb/ft.^{3}) Design Concentrations (% by Volume)										
		6.00	**6.70**	**7.00**	**8.00**	**9.00**	**10.00**	**11.00**	**12.00**	**13.00**	**14.00**	**15.00**
30	2.0210	0.0316	0.0355	0.0372	0.0430	0.0489	0.0549	0.0611	0.0674	0.0739	0.0805	0.0872
40	2.0678	0.0309	0.0347	0.0364	0.0420	0.0478	0.0537	0.0597	0.0659	0.0722	0.0787	0.0853
50	2.1146	0.0302	0.0339	0.0356	0.0411	0.0468	0.0525	0.0584	0.0645	0.0707	0.0770	0.0834
60	2.1612	0.0295	0.0332	0.0348	0.0402	0.0458	0.0514	0.0572	0.0631	0.0691	0.0753	0.0816
70	2.2075	0.0289	0.0325	0.0341	0.0394	0.0448	0.0503	0.0560	0.0618	0.0677	0.0738	0.0799
80	2.2538	0.0283	0.0319	0.0334	0.0386	0.0439	0.0493	0.0549	0.0605	0.0663	0.0723	0.0783
90	2.2994	0.0278	0.0312	0.0327	0.0378	0.0430	0.0483	0.0538	0.0593	0.0650	0.0708	0.0767
100	2.3452	0.0272	0.0306	0.0321	0.0371	0.0422	0.0474	0.0527	0.0582	0.0637	0.0694	0.0752
110	2.3912	0.0267	0.0300	0.0315	0.0364	0.0414	0.0465	0.0517	0.0570	0.0625	0.0681	0.0738
120	2.4366	0.0262	0.0295	0.0309	0.0357	0.0406	0.0456	0.0507	0.0560	0.0613	0.0668	0.0724
130	2.4820	0.0257	0.0289	0.0303	0.0350	0.0398	0.0447	0.0498	0.0549	0.0602	0.0656	0.0710
140	2.5272	0.0252	0.0284	0.0298	0.0344	0.0391	0.0439	0.0489	0.0539	0.0591	0.0644	0.0697
150	2.5727	0.0248	0.0279	0.0292	0.0337	0.0384	0.0431	0.0480	0.0530	0.0580	0.0632	0.0685
160	2.6171	0.0244	0.0274	0.0287	0.0332	0.0377	0.0424	0.0472	0.0520	0.0570	0.0621	0.0673
170	2.6624	0.0239	0.0269	0.0282	0.0326	0.0371	0.0417	0.0463	0.0511	0.0560	0.0610	0.0661
180	2.7071	0.0235	0.0265	0.0277	0.0320	0.0365	0.0410	0.0456	0.0503	0.0551	0.0600	0.0650
190	2.7518	0.0231	0.0260	0.0273	0.0315	0.0358	0.0403	0.0448	0.0494	0.0542	0.0590	0.0639
200	2.7954	0.0228	0.0256	0.0268	0.0310	0.0353	0.0396	0.0441	0.0486	0.0533	0.0580	0.0629

Flooding Factors – HFC-227ea (Metric Units)

Temp t (^{o}C)	Specific Vapor Volume (m^3/kg)	Weight Requirements of Hazard Volume, W/V (kg/m^3) Design Concentrations (% by Volume)										
		6.00	6.70	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00
-10	0.1215	0.5254	0.5891	0.6196	0.7158	0.8142	0.9147	1.0174	1.1225	1.2301	1.3401	1.4527
-5	0.1241	0.5142	0.5773	0.6064	0.7005	0.7987	0.8951	0.9957	1.0985	1.2032	1.3114	1.4216
0	0.1268	0.5034	0.5659	0.5936	0.6858	0.7800	0.8763	0.9748	1.0755	1.1785	1.2838	1.3918
5	0.1294	0.4932	0.5550	0.5817	0.6720	0.7643	0.8587	0.9551	1.0538	1.1548	1.2580	1.3638
10	0.1320	0.4834	0.5444	0.5700	0.6585	0.7490	0.8414	0.9360	1.0328	1.1319	1.2328	1.3264
15	0.1347	0.4740	0.5343	0.5589	0.6457	0.7344	0.8251	0.9178	1.0126	1.1096	1.2089	1.3103
20	0.1373	0.4650	0.5246	0.5483	0.6335	0.7205	0.8094	0.9004	0.9936	1.0885	1.1859	1.2856
25	0.1399	0.4564	0.5151	0.5382	0.6217	0.7071	0.7944	0.8837	0.9750	1.0684	1.1640	1.2618
30	0.1425	0.4481	0.5061	0.5284	0.6104	0.6945	0.7800	0.8676	0.9573	1.0490	1.1427	1.2388
35	0.1450	0.4401	0.4973	0.5190	0.5996	0.6819	0.7661	0.8522	0.9402	1.0303	1.1224	1.2168
40	0.1476	0.4324	0.4888	0.5099	0.5891	0.6701	0.7528	0.8374	0.9233	1.0122	1.1022	1.1956
45	0.1502	0.4250	0.4807	0.5012	0.5790	0.6586	0.7399	0.8230	0.9080	0.9950	1.0840	1.1751
50	0.1527	0.4180	0.4728	0.4929	0.5694	0.6476	0.7276	0.8093	0.8927	0.9784	1.0660	1.1555
55	0.1557	0.4111	0.4651	0.4847	0.5632	0.6369	0.7156	0.7960	0.8782	0.9623	1.0484	1.1365
60	0.1578	0.4045	0.4577	0.4770	0.5510	0.6267	0.7041	0.7832	0.8641	0.9469	1.0316	1.1183
65	0.1604	0.3980	0.4505	0.4694	0.5423	0.6167	0.6929	0.7707	0.8505	0.9318	1.0152	1.1005
70	0.1629	0.3919	0.4436	0.4621	0.5338	0.6072	0.6821	0.7588	0.8371	0.9175	0.9994	1.0834
75	0.1654	0.3859	0.4368	0.4550	0.5257	0.5979	0.6717	0.7417	0.8245	0.9033	0.9841	1.0668
80	0.1679	0.3801	0.4303	0.4482	0.5178	0.5890	0.6617	0.7360	0.8120	0.8898	0.9694	1.0509
85	0.1704	0.3745	0.4239	0.4416	0.5102	0.5803	0.6519	0.7251	0.8000	0.8767	0.9551	1.0354
90	0.1730	0.3690	0.4178	0.4351	0.5027	0.5717	0.6423	0.7145	0.7833	0.8638	0.9411	1.0202

Flooding Factors – IG-55 (U.S. Units)

Temp. t (°F)	Specific Vapor Volume (ft^3/lb.)	Weight Requirements of Hazard Volume, W/V (lb./ft^3) Design Concentration (% by Volume)									
		34	38	40	42	42.7	46	50	54	58	62
-40	9.021	0.0461	0.0530	0.0566	0.0604	0.0617	0.0683	0.0768	0.0861	0.0962	0.1073
-35	9.128	0.0455	0.0524	0.0560	0.0597	0.0610	0.0675	0.0759	0.0851	0.0950	0.1060
-30	9.236	0.0450	0.0518	0.0553	0.0590	0.0603	0.0667	0.0750	0.0841	0.0939	0.1048
-25	9.343	0.0445	0.0512	0.0547	0.0583	0.0596	0.0659	0.0742	0.0831	0.0928	0.1036
-20	9.451	0.0440	0.0506	0.0541	0.0576	0.0589	0.0652	0.0733	0.0822	0.0918	0.1024
-15	9.558	0.0435	0.0500	0.0534	0.0570	0.0583	0.0645	0.0725	0.0812	0.0908	0.1012
-10	9.666	0.0430	0.0495	0.0528	0.0564	0.0576	0.0637	0.0717	0.0803	0.0897	0.1001
-5	9.773	0.0425	0.0489	0.0523	0.0557	0.0570	0.0630	0.0709	0.0795	0.0888	0.0990
0	9.881	0.0421	0.0484	0.0517	0.0551	0.0564	0.0624	0.0702	0.0786	0.0878	0.0979
5	9.988	0.0416	0.0479	0.0511	0.0545	0.0558	0.0617	0.0694	0.0777	0.0869	0.0969
10	10.096	0.0412	0.0473	0.0506	0.0540	0.0552	0.0610	0.0687	0.0769	0.0859	0.0958
15	10.203	0.0407	0.0469	0.0501	0.0534	0.0546	0.0604	0.0679	0.0761	0.0850	0.0948
20	10.311	0.0403	0.0464	0.0495	0.0528	0.0540	0.0598	0.0672	0.0753	0.0841	0.0938
25	10.418	0.0399	0.0459	0.0490	0.0523	0.0535	0.0591	0.0665	0.0745	0.0833	0.0929
30	10.526	0.0395	0.0454	0.0485	0.0518	0.0529	0.0585	0.0659	0.0738	0.0824	0.0919
35	10.633	0.0391	0.0450	0.0480	0.0512	0.0524	0.0579	0.0652	0.0730	0.0816	0.0910
40	10.741	0.0387	0.0445	0.0476	0.0507	0.0518	0.0574	0.0645	0.0723	0.0808	0.0901
45	10.848	0.0383	0.0441	0.0471	0.0502	0.0513	0.0568	0.0639	0.0716	0.0800	0.0892
50	10.956	0.0379	0.0436	0.0466	0.0497	0.0508	0.0562	0.0633	0.0709	0.0792	0.0883
55	11.063	0.0376	0.0432	0.0462	0.0492	0.0503	0.0557	0.0627	0.0702	0.0784	0.0875
60	11.171	0.0372	0.0428	0.0457	0.0488	0.0499	0.0552	0.0620	0.0695	0.0777	0.0866
65	11.278	0.0368	0.0424	0.0453	0.0483	0.0494	0.0546	0.0615	0.0689	0.0769	0.0858
70	11.386	0.0365	0.0420	0.0449	0.0478	0.0489	0.0541	0.0609	0.0682	0.0762	0.0850
75	11.493	0.0362	0.0416	0.0444	0.0474	0.0485	0.0536	0.0603	0.0676	0.0755	0.0842
80	11.601	0.0358	0.0412	0.0440	0.0470	0.0480	0.0531	0.0597	0.0669	0.0748	0.0834
85	11.708	0.0355	0.0408	0.0436	0.0465	0.0476	0.0526	0.0592	0.0663	0.0741	0.0826
90	11.816	0.0352	0.0405	0.0432	0.0461	0.0471	0.0521	0.0587	0.0657	0.0734	0.0819
95	11.923	0.0348	0.0401	0.0428	0.0457	0.0467	0.0517	0.0581	0.0651	0.0728	0.0812
100	12.031	0.0345	0.0397	0.0425	0.0453	0.0463	0.0512	0.0576	0.0645	0.0721	0.0804

Flooding Factors – IG-55 (Metric)Units

Temp t (^oC)	Specific Vapor Volume (m^3/kg)	Weight Requirements of Hazard Volume, W/V (kg/m^3) Design Concentrations (% by Volume)									
		34.00	**38.00**	**40.00**	**42.00**	**42.70**	**46.00**	**50.00**	**54.00**	**58.00**	**62.00**
-40	0.5637	0.7380	0.8491	0.9073	0.9675	0.9891	1.0945	1.2312	1.3793	1.5409	1.7186
-35	0.56324	0.7225	0.8312	0.8882	0.9472	0.9683	1.0714	1.2053	1.3503	1.5084	1.6825
-30	0.58732	0.7076	0.8141	0.8699	0.9277	0.9483	1.0494	1.1804	1.3224	1.4774	1.6478
-25	0.5994	0.6933	0.7977	0.8524	0.9089	0.9292	1.0282	1.1566	1.2957	1.4475	1.6145
-20	0.61148	0.6796	0.7819	0.8355	0.8910	0.9108	1.0078	1.1337	1.2701	1.4189	1.5826
-15	0.62355	0.6664	0.7667	0.8193	0.8737	0.8931	0.9883	1.1117	1.2454	1.3913	1.5519
-10	0.63553	0.6537	0.7521	0.8037	0.8570	0.8761	0.9695	1.0905	1.2217	1.3649	1.5223
-5	0.64771	0.6415	0.7381	0.7887	0.8410	0.8598	0.9513	1.0702	1.1989	1.3394	1.4939
0	0.65979	0.6298	0.7245	0.7742	0.8256	0.8440	0.9339	1.0505	1.1769	1.3148	1.4665
5	0.67186	0.6184	0.7115	0.7603	0.8107	0.8288	0.9171	1.0316	1.1557	1.2911	1.4401
10	0.68394	0.6075	0.6989	0.7468	0.7964	0.8141	0.9009	1.0134	1.1353	1.2683	1.4146
15	0.696602	0.5969	0.6867	0.7338	0.7825	0.8000	0.8852	0.9958	1.1155	1.2462	1.3900
20	0.7081	0.5867	0.6750	0.7213	0.7692	0.7863	0.8701	0.9787	1.0965	1.2249	1.3663
25	0.72017	0.5769	0.6637	0.7092	0.7563	0.7731	0.8555	0.9623	1.0781	1.2044	1.3433
30	0.73225	0.5673	0.6527	0.6975	0.7438	0.7603	0.8413	0.9464	1.0603	1.1845	1.3211
35	0.74433	0.5581	0.6421	0.6861	0.7317	0.7480	0.8277	0.9310	1.0430	1.1652	1.2996
40	0.75641	0.5492	0.6318	0.6752	0.7200	0.7360	0.8144	0.9161	1.0263	1.1466	1.2789
45	0.76848	0.5405	0.6219	0.6645	0.7086	0.7244	0.8016	0.9017	1.0102	1.1285	1.2587
50	0.78056	0.5322	0.6122	0.6542	0.6977	0.7132	0.7892	0.8877	0.9945	1.1110	1.2392
55	0.79264	0.5240	0.6029	0.6442	0.6870	0.7023	0.7771	0.8742	0.9794	1.0941	1.2203
60	0.80471	0.5162	0.5938	0.6346	0.6767	0.6918	0.7654	0.8611	0.9646	1.0776	1.2020
65	0.81679	0.5085	0.5850	0.6252	0.6667	0.6815	0.7541	0.8483	0.9503	1.0617	1.1842
70	0.82887	0.5011	0.5765	0.6160	0.6569	0.6716	0.7431	0.8359	0.9365	1.0462	1.1669
75	0.84095	0.4939	0.5682	0.6072	0.6475	0.6619	0.7324	0.8239	0.9230	1.0311	1.1501
80	0.85302	0.4869	0.5602	0.5986	0.6383	0.6525	0.7220	0.8122	0.9099	1.0165	1.1338
85	0.8651	0.4801	0.5523	0.5902	0.6294	0.6434	0.7119	0.8009	0.8972	1.0023	1.1179
90	0.87718	0.4735	0.5447	0.5821	0.6207	0.6345	0.7021	0.7898	0.8848	0.9885	1.1025
95	0.88926	0.4670	0.5373	0.5742	0.6123	0.6259	0.6926	0.7791	0.8728	0.9750	1.0875
100	0.90133	0.4608	0.5301	0.5665	0.6040	0.6175	0.6833	0.7686	0.8611	0.9620	1.0729

Flooding Factors – HFC-23 (U.S. Units)

Temp t (^{o}F)	Specific Vapor Volume (ft^3/lb)	Weight Requirements of Hazard Volume, W/V (lb/ft^3) Design Concentrations (% by Volume)									
		14.00	**15.00**	**16.00**	**17.00**	**18.00**	**19.00**	**19.50**	**20.00**	**20.30**	**22.00**
-70	3.9636	0.0411	0.0445	0.0481	0.0517	0.0554	0.0592	0.0611	0.0631	0.0643	0.0712
-60	4.0752	0.0399	0.0433	0.0467	0.0503	0.0539	0.0576	0.0594	0.0613	0.0625	0.0692
-50	4.1859	0.0389	0.0422	0.0455	0.0489	0.0524	0.0560	0.0579	0.0597	0.0608	0.0674
-40	4.2959	0.0379	0.0411	0.0443	0.0477	0.0511	0.0546	0.0564	0.0582	0.0593	0.0657
-30	4.4053	0.0370	0.0401	0.0432	0.0465	0.0498	0.0532	0.0550	0.0567	0.0578	0.0640
-20	4.5151	0.0361	0.0391	0.0422	0.0454	0.0486	0.0520	0.0537	0.0554	0.0564	0.0625
-10	4.6225	0.0352	0.0382	0.0412	0.0443	0.0475	0.0507	0.0524	0.0541	0.0551	0.0610
0	4.7305	0.0344	0.0373	0.0403	0.0433	0.0464	0.0496	0.0512	0.0528	0.0538	0.0596
10	4.8383	0.0336	0.0365	0.0394	0.0423	0.0454	0.0485	0.0501	0.0517	0.0526	0.0583
20	4.9457	0.0329	0.0357	0.0385	0.0414	0.0444	0.0474	0.0490	0.0505	0.0515	0.0570
30	5.0529	0.0322	0.0349	0.0377	0.0405	0.0434	0.0464	0.0479	0.0495	0.0504	0.0558
40	5.1599	0.0815	0.0342	0.0369	0.0397	0.0425	0.0455	0.0469	0.0485	0.0494	0.0547
50	5.2666	0.0309	0.0335	0.0362	0.0389	0.0417	0.0445	0.0460	0.0475	0.0484	0.0536
60	5.3733	0.0303	0.0328	0.0354	0.0381	0.0409	0.0437	0.0451	0.0465	0.0474	0.0525
70	5.4797	0.0297	0.0322	0.0348	0.0374	0.0401	0.0428	0.0442	0.0456	0.0465	0.0515
80	5.5860	0.0291	0.0316	0.0341	0.0367	0.0393	0.0420	0.0434	0.0448	0.0456	0.0505
90	5.6922	0.0286	0.0310	0.0335	0.0360	0.0386	0.0412	0.0426	0.0439	0.0447	0.0496
100	5.7983	0.0281	0.0304	0.0329	0.0353	0.0879	0.0405	0.0418	0.0431	0.0439	0.0486
110	5.9043	0.0276	0.0299	0.0323	0.0347	0.0372	0.0397	0.0410	0.0423	0.0431	0.0478
120	6.0102	0.0271	0.0294	0.0317	0.0341	0.0365	0.0390	0.0403	0.0416	0.0424	0.0469
130	6.1160	0.0266	0.0289	0.0311	0.0335	0.0359	0.0384	0.0396	0.0409	0.0416	0.0461
140	6.2217	0.0262	0.0284	0.0306	0.0329	0.0353	0.0377	0.0389	0.0402	0.0409	0.0453
150	6.3274	0.0257	0.0279	0.0301	0.0324	0.0347	0.0371	0.0383	0.0395	0.0403	0.0446
160	6.4330	0.0255	0.0274	0.0296	0.0318	0.0341	0.0365	0.0377	0.0389	0.0396	0.0438
170	6.5385	0.0249	0.0270	0.0291	0.0313	0.0336	0.0359	0.0370	0.0382	0.0390	0.0431
180	6.6440	0.0245	0.0266	0.0287	0.0308	0.0330	0.0353	0.0365	0.0376	0.0383	0.0424
190	6.7494	0.0241	0.0261	0.0282	0.0303	0.0325	0.0348	0.0359	0.0370	0.0377	0.0418

Flooding Factors – HFC-23 (Metric Units)

Temp t (^{o}C)	Specific Vapor Volume (m^3/kg)	Weight Requirements of Hazard Volume, W/V (kg/m^3) Design Concentrations (% by Volume)									
		14.00	**15.00**	**16.00**	**17.00**	**18.00**	**19.00**	**19.50**	**20.00**	**20.30**	**22.00**
-60	0.2432	0.6693	0.7255	0.7831	0.8421	0.9025	0.9644	0.9960	1.0278	1.0473	1.1596
-55	0.2495	0.6524	0.7072	0.7633	0.8208	0.8797	0.9400	0.9709	1.0018	1.0209	1.1303
-50	0.2558	0.6364	0.6899	0.7446	0.8007	0.8581	0.9170	0.9470	0.9773	0.9957	1.1026
-45	0.2620	0.6213	0.6735	0.7270	0.7817	0.8378	0.8953	0.9246	0.9542	0.9722	1.0765
-40	0.2682	0.6070	0.6580	0.7102	0.7637	0.8185	0.8746	0.9032	0.9322	0.9497	1.0517
-35	0.2743	0.5934	0.6433	0.6943	0.7466	0.8002	0.8551	0.8831	0.9113	0.9286	1.0281
-30	0.2805	0.5805	0.6292	0.6792	0.7303	0.7827	0.8364	0.8636	0.8914	0.9080	1.0057
-25	0.2866	0.5681	0.6158	0.6647	0.7148	0.7661	0.8186	0.8452	0.8724	0.8887	0.9843
-20	0.2926	0.5563	0.6031	0.6509	0.6999	0.7502	0.8016	0.8279	0.8544	0.8705	0.9639
-15	0.2987	0.5450	0.5908	0.6377	0.6857	0.7349	0.7853	0.8110	0.8370	0.8527	0.9443
-10	0.3047	0.5342	0.5791	0.6251	0.6721	0.7203	0.7698	0.7950	0.8204	0.8359	0.9256
-5	0.3108	0.5238	0.5679	0.6129	0.6591	0.7064	0.7548	0.7794	0.8045	0.8195	0.9076
0	0.3168	0.5139	0.5571	0.6013	0.6466	0.6929	0.7405	0.7646	0.7892	0.8040	0.8904
5	0.3228	0.5043	0.5467	0.5901	0.6345	0.6800	0.7267	0.7504	0.7745	0.7890	0.8738
10	0.3288	0.4951	0.5367	0.5793	0.6229	0.6676	0.7134	0.7367	0.7604	0.7747	0.8578
15	0.3348	0.4863	0.5271	0.5690	0.6118	0.6557	0.7007	0.7235	0.7468	0.7608	0.8425
20	0.3408	0.4777	0.5179	0.5590	0.6011	0.6442	0.6884	0.7108	0.7337	0.7474	0.8277
25	0.3467	0.4695	0.5089	0.5493	0.5907	0.6331	0.6765	0.6987	0.7210	0.7347	0.8134
30	0.3527	0.4616	0.5003	0.5401	0.5807	0.6224	0.6651	0.6868	0.7088	0.7222	0.7997
35	0.3587	0.4539	0.4920	0.5311	0.5711	0.6120	0.6540	0.6753	0.6970	0.7101	0.7864
40	0.3646	0.4465	0.4840	0.5224	0.5617	0.6020	0.6433	0.6644	0.6856	0.6986	0,7735
45	0.3706	0.4393	0.4762	0.5140	0.5527	0.5923	0.6330	0.6536	0.6746	0.6873	0.7611
50	0.3765	0.4323	0.4687	0.5059	0.5440	0.5830	0.6230	0.6434	0.6640	0.6765	0.7491
55	0.3825	0.4256	0.4614	0.4980	0.5355	0.5739	0.6133	0.6333	0.6536	0.6659	0.7374
60	0.3884	0.4191	0.4543	0.4904	0.5273	0.5652	0.6039	0.6237	0.6436	0.6558	0.7262
65	0.3944	0.4128	0.4475	0.4830	0.5194	0.5566	0.5948	0.6142	0.6340	0.6458	0.7152
70	0.4003	0.4067	0.4409	0.4759	0.5117	0.5484	0.5860	0.6051	0.6246	0.6363	0.7046

Flooding Factors IG-100 (Metric Units)

- Total Flooding Quantities - Volume Requirements of Nitrogen - Metric - M (Kg/M^3)							
Temp (°C)	Typical Design Concentration (% by Volume) - From NFPA 2001						
	36	37	38	40	42	46	50
-30	0.758	0.786	0.812	0.868	0.926	1.047	1.178
-25	0.728	0.754	0.780	0.834	0.889	1.005	1.131
-20	0.700	0.725	0.749	0.801	0.854	0.966	1.087
-15	0.673	0.697	0.721	0.770	0.821	0.929	1.045
-10	0.647	0.671	0.694	0.741	0.790	0.894	1.006
-5	0.624	0.646	0.668	0.714	0.761	0.861	0.968
0	0.601	0.622	0.644	0.688	0.733	0.830	0.933
5	0.579	0.600	0.621	0.663	0.707	0.800	0.900
10	0.559	0.579	0.599	0.640	0.683	0.727	0.869
15	0.540	0.559	0.578	0.618	0.659	0.745	0.839
20	0.522	0.540	0.559	0.597	0.637	0.720	0.810
25	0.504	0.522	0.540	0.577	0.616	0.696	0.783
30	0.488	0.505	0.522	0.558	0.595	0.673	0.758
35	0.472	0.489	0.506	0.540	0.576	0.652	0.733
40	0.457	0.473	0.490	0.523	0.558	0.631	0.710
45	0.443	0.459	0.474	0.507	0.541	0.611	0.688
50	0.429	0.445	0.460	0.491	0.524	0.593	0.667
55	0.416	0.431	0.446	0.476	0.508	0.575	0.646

Flooding Factors IG-100 (U.S. Units)

- Total Flooding Quantities - Volume Requirements of Nitrogen-US Standard-M (Kg/Ft^3)							
Temp (°F)	Typical Design Concentration (% by Volume) - Based on NFPA 2001						
	36	37	38	40	42	46	50
-20	0.02129	0.02220	0.02280	0.02436	0.02598	0.02939	0.03306
-10	0.02035	0.02107	0.02180	0.02329	0.02484	0.02810	0.03160
0	0.01947	0.02017	0.02086	0.02229	0.02377	0.02689	0.03024
10	0.01865	0.01932	0.01998	0.02135	0.02277	0.02575	0.02897
20	0.01788	0.01852	0.01915	0.02047	0.02183	0.02469	0.02777
30	0.01716	0.01777	0.01838	0.01964	0.02094	0.02369	0.02665
40	0.01648	0.01706	0.01765	0.01886	0.02011	0.02275	0.02559
50	0.01584	0.01640	0.01696	0.01813	0.01933	0.02187	0.02460
60	0.01523	0.01578	0.01632	0.01744	0.01859	0.02103	0.02366
70	0.01466	0.01518	0.01571	0.01678	0.01790	0.02024	0.02277
80	0.01412	0.01463	0.01513	0.01617	0.01724	0.01950	0.02194
90	0.01361	0.01410	0.01458	0.01582	0.01662	0.01880	0.02114
100	0.01313	0.01360	0.01407	0.01503	0.01603	0.01830	0.02040
110	0.01267	0.01313	0.01358	0.01451	0.01547	0.01750	0.01969
120	0.01224	0.01268	0.01311	0.01401	0.01494	0.01690	0.01901
130	0.01183	0.01225	0.01267	0.01354	0.01444	0.01633	0.01837