

R-452A

Zeotropic blend (11 % R-32 - 59 % R-125 - 30 % R-1234yf)

Molecular weight (g/mol)	103.51
Melting point (°C)	N/A
Boiling point (at 1.013 bar)	-46.93
Temperature glide at 1.013 bar (K)	3.79
Critical temperature (°C)	75.6
Critical pressure (bar absolute)	40.67
Specific heat (liquid) at + 25°C (kJ/kg.K)	1.471
Specific heat (vapour) at 1.013 bar and + 25°C (kJ/kg.K)	0.835
Thermal capacity ratio (Cp/Cv) at + 25°C and 1.013 bar	1.117
Viscosity (liquid) at + 25°C in Centipoise (10 ⁻³ Pa.s)	0.136
Surface tension at + 25°C in dyne per centimetre (10 ⁻³ N/m)	5.10
Classification NF-EN 378	A1
GWP (IPCC 4)	2140

🔍 Main applications

R-452A is a "non azeotropic" blend containing refrigerants from the hydrofluoro-olefin (HFO) family, designed to replace R-404A in new or existing installations and especially in transport refrigeration.

🔍 Commercial specifications

Composition: (59 % R-125 – 30 % R-1234yf – 11 % R-32) (±1.8% / ±0.1% - 1% / ±1.7%).

Purity: ≥ 99.5 % weight.

Water content: ≤ 10 ppm weight.

Chlorine ion test (silver nitrate test): negative.

Total Acidity (HCL): ≤ 1 ppm weight.

Non-condensable content (gas phase): ≤ 1.5 % volume.

🔍 Oils

Use a polyol ester (POE) oil.

Consult **Climalife** regarding the viscosity of the oil selected for your system and the most suitable for your application.

🔍 Regulation

The use and implementation of R-452A are governed by the European Regulation N° 517/2014.

The recovery of R-452A is mandatory under the European Regulation N° 517/2014.

(Refer to regulations enforced in each country).

Thermodynamic properties of R-452A - Saturated state

Absolute pressure P (bar)	LIQUID					VAPOUR					Latent heat Lv (kJ/kg)
	Bubble point t' (°C)	Volume v' (dm ³ /kg)	Density ρ' (kg/dm ³)	Enthalpy h' (kJ/kg)	Entropy s' (kJ/kg.K)	Dew point t" (°C)	Volume v" (m ³ /kg)	Density ρ" (kg/m ³)	Enthalpy h" (kJ/kg)	Entropy s" (kJ/kg.K)	
0.029	-100	0.639	1.564	79.771	0.457	-96.81	4.882	0.205	304.775	1.747	225.004
0.045	-95	0.645	1.550	85.468	0.490	-91.74	3.215	0.311	307.754	1.728	222.287
0.068	-90	0.651	1.535	91.157	0.521	-86.66	2.177	0.459	310.756	1.711	219.599
0.101	-85	0.658	1.521	96.851	0.552	-81.6	1.512	0.661	313.775	1.696	216.925
0.145	-80	0.664	1.506	102.557	0.582	-76.53	1.074	0.931	316.808	1.683	214.251
0.205	-75	0.671	1.491	108.284	0.611	-71.47	0.779	1.283	319.848	1.671	211.564
0.283	-70	0.677	1.476	114.038	0.640	-66.42	0.576	1.736	322.892	1.660	208.854
0.384	-65	0.685	1.461	119.824	0.668	-61.37	0.433	2.308	325.933	1.651	206.109
0.512	-60	0.692	1.445	125.648	0.695	-56.32	0.331	3.021	328.968	1.642	203.320
0.672	-55	0.699	1.430	131.514	0.722	-51.28	0.256	3.899	331.991	1.635	200.476
0.870	-50	0.707	1.414	137.427	0.749	-46.23	0.201	4.967	334.997	1.628	197.570
1.013	-46.93	0.712	1.404	141.077	0.765	-43.15	0.175	5.728	336.829	1.624	195.752
1.112	-45	0.715	1.398	143.389	0.775	-41.2	0.160	6.253	337.980	1.622	194.591
1.403	-40	0.724	1.382	149.406	0.801	-36.17	0.128	7.787	340.936	1.617	191.530
1.751	-35	0.733	1.365	155.481	0.827	-31.14	0.104	9.600	343.859	1.613	188.378
2.161	-30	0.742	1.348	161.618	0.853	-26.11	0.085	11.730	346.743	1.609	185.125
2.643	-25	0.752	1.331	167.821	0.878	-21.1	0.070	14.213	349.582	1.605	181.761
3.202	-20	0.762	1.313	174.095	0.902	-16.08	0.058	17.094	352.369	1.602	178.274
3.847	-15	0.772	1.295	180.444	0.927	-11.08	0.049	20.419	355.096	1.599	174.652
4.586	-10	0.784	1.276	186.874	0.952	-6.08	0.041	24.241	357.756	1.597	170.881
5.427	-5	0.796	1.257	193.391	0.976	-1.09	0.035	28.619	360.337	1.594	166.946
6.379	0	0.808	1.237	200.000	1.000	3.9	0.030	33.623	362.827	1.592	162.827
7.451	5	0.822	1.216	206.710	1.024	8.87	0.025	39.330	365.211	1.590	158.501
8.650	10	0.837	1.195	213.528	1.048	13.84	0.022	45.833	367.472	1.588	153.944
9.987	15	0.853	1.173	220.465	1.072	18.79	0.019	53.244	369.591	1.586	149.126
11.471	20	0.870	1.150	227.532	1.096	23.72	0.016	61.693	371.545	1.584	144.013
13.111	25	0.889	1.125	234.744	1.120	28.65	0.014	71.345	373.308	1.582	138.564
14.918	30	0.909	1.100	242.118	1.144	33.56	0.012	82.404	374.850	1.579	132.732
16.901	35	0.932	1.073	249.678	1.168	38.44	0.011	95.133	376.132	1.576	126.454
19.071	40	0.958	1.043	257.458	1.192	43.31	0.009	109.886	377.104	1.572	119.646
21.440	45	0.988	1.012	265.500	1.217	48.15	0.008	127.149	377.695	1.568	112.195
24.018	50	1.024	0.977	273.870	1.242	52.96	0.007	147.638	377.805	1.562	103.935
26.817	55	1.067	0.938	282.667	1.268	57.72	0.006	172.480	377.273	1.555	94.606
29.851	60	1.121	0.892	292.068	1.296	62.44	0.005	203.639	375.822	1.546	83.753
33.131	65	1.196	0.836	302.444	1.326	67.06	0.004	245.140	372.891	1.533	70.447
36.659	70	1.321	0.757	314.847	1.361	71.53	0.003	308.173	366.968	1.512	52.121

Thermodynamic properties of R-452A - (superheated vapour) - Volume (dm³/kg)

Sat. Temp. °C	Sat. Pressure bar	Superheat (°C)																				
		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
-100	0.022	6443.464	6631.632	6819.599	7007.398	7195.056	7382.594	7570.027	7757.371	7944.636	8131.834	8318.972	8506.058	8693.098	8880.097	9067.060	9253.991	9440.893	9627.770	9814.624	10001.457	10188.272
-95	0.034	4191.806	4311.312	4430.644	4549.831	4668.896	4787.856	4906.725	5025.517	5144.240	5262.903	5381.514	5500.079	5618.603	5737.091	5855.546	5973.973	6092.375	6210.753	6329.111	6447.451	6565.774
-90	0.052	2805.530	2883.771	2961.860	3039.824	3117.681	3195.447	3273.133	3350.751	3428.309	3505.815	3583.273	3660.691	3738.073	3815.423	3892.744	3970.039	4047.311	4124.564	4201.796	4279.012	4356.214
-85	0.078	1926.726	1979.400	2031.942	2084.373	2136.711	2188.969	2241.158	2293.286	2345.361	2397.389	2449.377	2501.327	2553.246	2605.136	2657.000	2708.841	2760.661	2812.463	2864.248	2916.018	2967.774
-80	0.113	1354.554	1390.939	1427.207	1463.378	1499.467	1535.486	1571.443	1607.346	1643.202	1679.017	1714.796	1750.541	1786.258	1821.949	1857.617	1893.264	1928.893	1964.505	2000.102	2035.684	2071.255
-75	0.162	972.814	998.551	1024.183	1049.730	1075.204	1100.616	1125.973	1151.282	1176.550	1201.781	1226.979	1252.147	1277.290	1302.410	1327.508	1352.588	1377.652	1402.699	1427.734	1452.755	1477.766
-70	0.226	712.357	730.965	749.481	767.921	786.295	804.614	822.885	841.112	859.303	877.460	895.588	913.690	931.768	949.826	967.864	985.886	1003.892	1021.884	1039.864	1057.832	1075.790
-65	0.309	530.956	544.687	558.335	571.915	585.436	598.909	612.337	625.728	639.084	652.412	665.712	678.989	692.245	705.481	718.701	731.905	745.096	758.273	771.439	784.595	797.741
-60	0.416	402.199	412.524	422.775	432.964	443.102	453.195	463.248	473.267	483.256	493.218	503.156	513.073	522.970	532.850	542.715	552.565	562.403	572.229	582.044	591.850	601.648
-55	0.551	309.199	317.101	324.936	332.715	340.448	348.140	355.797	363.423	371.021	378.595	386.147	393.679	401.194	408.694	416.179	423.651	431.111	438.561	446.001	453.433	460.856
-50	0.719	240.933	247.081	253.168	259.204	265.198	271.156	277.081	282.978	288.850	294.700	300.530	306.342	312.138	317.919	323.688	329.444	335.190	340.926	346.654	352.373	358.084
-45	0.925	190.070	194.927	199.728	204.484	209.201	213.884	218.538	223.166	227.772	232.357	236.923	241.474	246.010	250.532	255.042	259.542	264.031	268.512	272.984	277.449	281.906
-43.15	1.013	174.576	179.042	183.456	187.824	192.156	196.455	200.725	204.971	209.194	213.398	217.584	221.754	225.910	230.053	234.185	238.305	242.417	246.519	250.613	254.700	258.780
-40	1.176	151.646	155.538	159.380	163.180	166.944	170.678	174.385	178.068	181.730	185.373	189.000	192.611	196.209	199.795	203.370	206.934	210.489	214.036	217.575	221.107	224.633
-35	1.478	122.243	125.405	128.520	131.597	134.641	137.657	140.648	143.618	146.567	149.500	152.417	155.320	158.211	161.090	163.959	166.818	169.669	172.512	175.348	178.177	181.001
-30	1.838	99.473	102.075	104.633	107.156	109.649	112.115	114.558	116.981	119.386	121.775	124.150	126.512	128.862	131.201	133.531	135.852	138.165	140.471	142.770	145.063	147.350
-25	2.262	81.643	83.809	85.936	88.029	90.094	92.134	94.153	96.153	98.137	100.105	102.060	104.003	105.935	107.857	109.770	111.675	113.572	115.463	117.347	119.225	121.098
-20	2.758	67.535	69.360	71.147	72.903	74.633	76.339	78.026	79.695	81.348	82.988	84.614	86.230	87.835	89.430	91.018	92.597	94.169	95.735	97.296	98.850	100.400
-15	3.334	56.263	57.817	59.335	60.824	62.289	63.731	65.155	66.562	67.954	69.333	70.700	72.056	73.403	74.741	76.071	77.393	78.709	80.019	81.323	82.622	83.916
-10	3.998	47.175	48.512	49.815	51.091	52.343	53.574	54.788	55.985	57.169	58.340	59.500	60.649	61.790	62.922	64.046	65.164	66.275	67.380	68.480	69.576	70.666
-5	4.759	39.784	40.946	42.076	43.179	44.260	45.321	46.365	47.394	48.410	49.413	50.406	51.389	52.363	53.329	54.288	55.241	56.187	57.128	58.064	58.995	59.922
0	5.625	33.724	34.744	35.734	36.697	37.639	38.562	39.468	40.360	41.239	42.106	42.963	43.810	44.649	45.481	46.306	47.124	47.937	48.744	49.547	50.345	51.139
5	6.606	28.717	29.622	30.497	31.346	32.174	32.983	33.777	34.556	35.323	36.078	36.824	37.561	38.289	39.011	39.725	40.434	41.137	41.835	42.529	43.218	43.903
10	7.711	24.550	25.361	26.141	26.897	27.631	28.347	29.047	29.734	30.408	31.071	31.725	32.370	33.007	33.638	34.262	34.880	35.492	36.100	36.703	37.301	37.898
15	8.952	21.057	21.791	22.495	23.173	23.829	24.468	25.091	25.700	26.298	26.884	27.462	28.030	28.592	29.146	29.694	30.237	30.775	31.308	31.836	32.361	32.882
20	10.337	18.111	18.782	19.422	20.036	20.628	21.202	21.760	22.305	22.838	23.361	23.874	24.379	24.877	25.368	25.853	26.332	26.807	27.277	27.743	28.205	28.664
25	11.880	15.609	16.230	16.818	17.378	17.916	18.436	18.940	19.430	19.909	20.378	20.837	21.288	21.732	22.170	22.602	23.028	23.450	23.867	24.280	24.690	25.095
30	13.591	13.470	14.052	14.597	15.113	15.606	16.080	16.538	16.983	17.416	17.838	18.252	18.658	19.056	19.449	19.835	20.216	20.593	20.967	21.334	21.699	22.060
35	15.484	11.632	12.183	12.693	13.173	13.628	14.063	14.483	14.888	15.282	15.665	16.040	16.407	16.767	17.120	17.468	17.811	18.149	18.483	18.814	19.140	19.464
40	17.574	10.039	10.569	11.052	11.501	11.925	12.328	12.714	13.086	13.446	13.796	14.138	14.471	14.798	15.118	15.433	15.743	16.048	16.349	16.647	16.941	17.231
45	19.874	8.651	9.168	9.630	10.055	10.451	10.827	11.185	11.528	11.860	12.181	12.493	12.798	13.096	13.388	13.674	13.954	14.232	14.505	14.774	15.040	15.302
50	22.405	7.430	7.943	8.391	8.796	9.171	9.522	9.856	10.175	10.482	10.778	11.066	11.345	11.618	11.885	12.146	12.403	12.655	12.903	13.148	13.389	13.627
55	25.187	6.344	6.865	7.305	7.695	8.051	8.383	8.696	8.994	9.279	9.554	9.820	10.077	10.328	10.573	10.813	11.048	11.278	11.505	11.728	11.948	12.165
60	28.247	5.362	5.909	6.346	6.726	7.068	7.383	7.678	7.957	8.224	8.479	8.726	8.964	9.196	9.422	9.643	9.858	10.070	10.277	10.482	10.682	10.880
65	31.627	4.448	5.050	5.494	5.866	6.196	6.498	6.777	7.040	7.290	7.529	7.758	7.980	8.195	8.404	8.607	8.806	9.000	9.191	9.378	9.563	9.744
70	35.400	3.543	4.263	4.722	5.092	5.414	5.703	5.969	6.218	6.453	6.676	6.891	7.097	7.296	7.490	7.678	7.862	8.041	8.216	8.389	8.558	8.724

Thermodynamic properties of R-452A - (superheated vapour) - Enthalpy (kJ/kg)

Sat. Temp. °C	Sat. Pressure bar	Superheat (°C)																				
		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
-100	0.022	302.918	305.921	308.971	312.069	315.213	318.405	321.644	324.929	328.261	331.640	335.065	338.537	342.054	345.616	349.224	352.877	356.575	360.318	364.105	367.936	371.810
-95	0.034	305.835	308.893	311.998	315.149	318.346	321.589	324.879	328.215	331.597	335.026	338.500	342.019	345.584	349.194	352.849	356.549	360.293	364.081	367.913	371.789	375.709
-90	0.052	308.779	311.894	315.054	318.259	321.510	324.806	328.144	331.533	334.968	338.446	341.969	345.537	349.150	352.808	356.506	360.245	364.027	367.851	371.718	375.629	379.644
-85	0.078	311.745	314.919	318.136	321.397	324.703	328.052	331.447	334.886	338.370	341.898	345.471	349.088	352.749	356.455	360.205	363.998	367.835	371.715	375.638	379.604	383.613
-80	0.113	314.730	317.965	321.240	324.558	327.919	331.324	334.772	338.264	341.799	345.379	348.902	352.468	356.076	359.726	363.416	367.138	370.893	374.681	378.501	382.352	386.233
-75	0.162	317.729	321.026	324.362	327.738	331.157	334.617	338.120	341.665	345.253	348.884	352.559	356.276	360.036	363.838	367.684	371.572	375.503	379.476	383.491	387.548	391.647
-70	0.226	320.736	324.098	327.496	330.933	334.410	337.928	341.486	345.086	348.728	352.412	356.138	359.906	363.716	367.569	371.463	375.399	379.377	383.397	387.459	391.562	395.706
-65	0.309	323.746	327.176	330.639	334.138	337.676	341.252	344.868	348.524	352.221	355.958	359.737	363.557	367.418	371.320	375.264	379.249	383.275	387.342	391.451	395.600	399.789
-60	0.416	326.756	330.255	333.785	337.349	340.949	344.585	348.260	351.974	355.726	359.519	363.351	367.224	371.136	375.090	379.084	383.118	387.193	391.308	395.463	399.659	403.895
-55	0.551	329.760	333.332	336.931	340.561	344.225	347.924	351.659	355.431	359.241	363.090	366.977	370.903	374.869	378.874	382.919	387.003	391.127	395.291	399.494	403.737	408.019
-50	0.719	332.753	336.400	340.071	343.771	347.501	351.264	355.061	358.893	362.762	366.668	370.611	374.592	378.611	382.669	386.766	390.901	395.075	399.287	403.539	407.829	412.159
-45	0.925	335.730	339.456	343.202	346.972	350.771	354.600	358.461	362.355	366.284	370.249	374.249	378.286	382.361	386.472	390.621	394.808	399.032	403.295	407.596	411.934	416.311
-43.15	1.013	336.829	340.585	344.359	348.157	351.981	355.835	359.721	363.639	367.591	371.577	375.599	379.657	383.752	387.884	392.053	396.259	400.502	404.784	409.103	413.459	417.854
-40	1.176	338.686	342.494	346.318	350.162	354.031	357.928	361.855	365.813	369.804	373.829	377.888	381.983	386.113	390.279	394.481	398.721	402.997	407.310	411.661	416.048	420.473
-35	1.478	341.617	345.510	349.414	353.335	357.277	361.245	365.239	369.263	373.318	377.404	381.524	385.677	389.864	394.086	398.343	402.636	406.965	411.330	415.731	420.168	424.641
-30	1.838	344.515	348.498	352.485	356.486	360.504	364.545	368.610	372.701	376.821	380.971	385.152	389.365	393.611	397.890	402.203	406.551	410.933	415.350	419.802	424.290	428.813
-25	2.262	347.377	351.452	355.528	359.611	363.708	367.824	371.961	376.122	380.310	384.525	388.769	393.044	397.350	401.687	406.058	410.461	414.898	419.368	423.873	428.411	432.984
-20	2.758	350.195	354.368	358.535	362.704	366.883	371.077	375.289	379.523	383.780	388.062	392.372	396.710	401.077	405.474	409.903	414.363	418.856	423.380	427.938	432.529	437.153
-15	3.334	352.964	357.239	361.501	365.760	370.024	374.299	378.589	382.897	387.226	391.578	395.955	400.358	404.788	409.247	413.736	418.254	422.803	427.384	431.996	436.640	441.316
-10	3.998	355.675	360.058	364.420	368.773	373.126	377.486	381.856	386.245	390.645	395.069	399.515	403.985	408.481	412.003	417.552	422.131	426.738	431.375	436.042	440.740	445.469
-5	4.759	358.319	362.816	367.283	371.735	376.182	380.630	385.085	389.551	394.032	398.531	403.048	407.587	412.150	416.737	421.349	425.989	430.656	435.351	440.074	444.828	449.610
0	5.625	360.887	365.504	370.084	374.640	379.185	383.727	388.270	392.821	397.383	401.958	406.550	411.161	415.792	420.446	425.123	429.825	434.553	439.308	444.089	448.899	453.737
5	6.606	363.364	368.112	372.812	377.480	382.130	386.770	391.407	396.046	400.691	405.347	410.016	414.700	419.404	424.126	428.870	433.637	438.427	443.242	448.083	452.951	457.845
10	7.711	365.736	370.626	375.456	380.245	385.007	389.752	394.487	399.219	403.953	408.693	413.442	418.203	422.980	427.774	432.586	437.419	442.274	447.152	452.054	456.980	461.932
15	8.952	367.984	373.033	378.007	382.927	387.810	392.667	397.507	402.337	407.163	411.990	416.823	421.664	426.517	431.385	436.268	441.170	446.091	451.033	455.997	460.984	465.995
20	10.337	370.087	375.317	380.451	385.516	390.530	395.506	400.457	405.391	410.315	415.230	420.154	425.088	430.011	434.955	439.912	444.884	449.874	454.882	459.910	464.969	470.030
25	11.880	372.020	377.460	382.775	387.999	393.156	398.262	403.332	408.376	413.403	418.419	423.430	428.441	433.457	438.480	443.513	448.559	453.619	458.695	463.789	468.903	474.036
30	13.591	373.756	379.442	384.963	390.365	395.679	400.925	406.123	411.284	416.420	421.538	426.645	431.748	436.850	441.955	447.068	452.189	457.323	462.470	467.632	472.811	478.008
35	15.484	375.259	381.238	386.997	392.599	398.085	403.485	408.821	414.108	419.359	424.585	429.794	434.992	440.185	445.377	450.572	455.772	460.981	466.201	471.434	476.681	481.943
40	17.574	376.478	382.819	388.856	394.684	400.363	405.930	411.415	416.838	422.213	427.554	432.870	438.169	443.457	448.739	454.020	459.303	464.590	469.886	475.191	480.508	485.839
45	19.874	377.358	384.145	390.511	396.600	402.494	408.247	413.895	419.464	424.973	430.436	435.866	441.272	446.660	452.037	457.407	462.776	468.145	473.519	478.900	484.290	489.690
50	22.405	377.802	385.168	391.931	398.322	404.460	410.420	416.247	421.975	427.627	433.222	438.774	444.292	449.786	455.262	460.727	466.185	471.641	477.096	482.555	488.020	493.493
55	25.187	377.669	385.817	393.071	399.818	406.237	412.427	418.453	424.355	430.164	435.900	441.581	447.220	452.826	458.408	463.972	469.524	475.069	480.610	486.151	491.694	497.242
60	28.247	376.714	385.991	393.871	401.046	407.790	414.243	420.490	426.585	432.564	438.454	444.275	450.042	455.768	461.461	467.131	472.782	478.421	484.051	489.677	495.302	500.929
65	31.627	374.448	385.531	394.240	401.941	409.069	415.825	422.323	428.632	434.799	440.856	446.829	452.736	458.590	464.403	470.184	475.940	481.678	487.403	493.119	498.830	504.538
70	35.400	369.575	384.140	394.008	402.380	409.974	417.088	423.875	430.428	436.807	443.052	449.192	455.252	461.246	467.189	473.091	478.960	484.805	490.631	496.442	502.244	508.039

Thermodynamic properties of R-452A - (superheated vapour) - Entropy (kJ/kg.K)

Sat. Temp. °C	Sat. Pressure bar	Superheat (°C)																				
		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
-100	0.022	1.760	1.777	1.794	1.811	1.827	1.843	1.860	1.876	1.891	1.907	1.923	1.938	1.953	1.968	1.983	1.998	2.013	2.028	2.042	2.056	2.071
-95	0.034	1.740	1.757	1.774	1.790	1.806	1.823	1.839	1.854	1.870	1.886	1.901	1.916	1.931	1.946	1.961	1.976	1.991	2.005	2.020	2.034	2.048
-90	0.052	1.722	1.739	1.755	1.772	1.788	1.804	1.820	1.836	1.851	1.867	1.882	1.897	1.912	1.927	1.942	1.956	1.971	1.985	2.000	2.014	2.028
-85	0.078	1.706	1.723	1.739	1.755	1.771	1.787	1.803	1.819	1.834	1.849	1.865	1.880	1.894	1.909	1.924	1.938	1.953	1.967	1.981	1.996	2.010
-80	0.113	1.692	1.708	1.725	1.741	1.757	1.772	1.788	1.804	1.819	1.834	1.849	1.864	1.879	1.893	1.908	1.923	1.937	1.951	1.965	1.979	1.993
-75	0.162	1.679	1.695	1.712	1.728	1.743	1.759	1.775	1.790	1.805	1.820	1.835	1.850	1.865	1.879	1.894	1.908	1.922	1.937	1.951	1.965	1.979
-70	0.226	1.667	1.684	1.700	1.716	1.732	1.747	1.763	1.778	1.793	1.808	1.823	1.838	1.852	1.867	1.881	1.895	1.910	1.924	1.938	1.952	1.965
-65	0.309	1.657	1.674	1.690	1.705	1.721	1.737	1.752	1.767	1.782	1.797	1.812	1.827	1.841	1.856	1.870	1.884	1.898	1.912	1.926	1.940	1.954
-60	0.416	1.648	1.664	1.680	1.696	1.712	1.727	1.743	1.758	1.773	1.787	1.802	1.817	1.831	1.846	1.860	1.874	1.888	1.902	1.916	1.929	1.943
-55	0.551	1.640	1.656	1.672	1.688	1.704	1.719	1.734	1.749	1.764	1.779	1.793	1.808	1.822	1.837	1.851	1.865	1.879	1.893	1.906	1.920	1.934
-50	0.719	1.633	1.649	1.665	1.681	1.696	1.712	1.727	1.742	1.757	1.771	1.786	1.800	1.815	1.829	1.843	1.857	1.871	1.885	1.898	1.912	1.925
-45	0.925	1.627	1.643	1.659	1.674	1.690	1.705	1.720	1.735	1.750	1.765	1.779	1.793	1.808	1.822	1.836	1.850	1.864	1.877	1.891	1.905	1.918
-43.15	1.013	1.624	1.641	1.656	1.672	1.688	1.703	1.718	1.733	1.748	1.762	1.777	1.791	1.805	1.820	1.834	1.847	1.861	1.875	1.889	1.902	1.915
-40	1.176	1.621	1.637	1.653	1.669	1.684	1.699	1.714	1.729	1.744	1.759	1.773	1.787	1.802	1.816	1.830	1.844	1.857	1.871	1.885	1.898	1.911
-35	1.478	1.616	1.632	1.648	1.664	1.679	1.694	1.709	1.724	1.739	1.754	1.768	1.782	1.796	1.810	1.824	1.838	1.852	1.866	1.879	1.892	1.906
-30	1.838	1.612	1.628	1.644	1.659	1.675	1.690	1.705	1.720	1.735	1.749	1.763	1.778	1.792	1.806	1.820	1.834	1.847	1.861	1.874	1.888	1.901
-25	2.262	1.608	1.624	1.640	1.656	1.671	1.686	1.701	1.716	1.731	1.745	1.760	1.774	1.788	1.802	1.816	1.829	1.843	1.857	1.870	1.883	1.897
-20	2.758	1.604	1.621	1.637	1.652	1.668	1.683	1.698	1.713	1.727	1.742	1.756	1.770	1.785	1.798	1.812	1.826	1.840	1.853	1.866	1.880	1.893
-15	3.334	1.601	1.618	1.634	1.649	1.665	1.680	1.695	1.710	1.725	1.739	1.753	1.768	1.782	1.796	1.809	1.823	1.837	1.850	1.863	1.877	1.890
-10	3.998	1.599	1.615	1.631	1.647	1.662	1.678	1.693	1.708	1.722	1.737	1.751	1.765	1.779	1.793	1.807	1.821	1.834	1.847	1.861	1.874	1.887
-5	4.759	1.596	1.613	1.629	1.645	1.660	1.676	1.691	1.706	1.720	1.735	1.749	1.763	1.777	1.791	1.805	1.818	1.832	1.845	1.859	1.872	1.885
0	5.625	1.594	1.611	1.627	1.643	1.659	1.674	1.689	1.704	1.719	1.733	1.747	1.762	1.776	1.789	1.803	1.817	1.830	1.844	1.857	1.870	1.883
5	6.606	1.592	1.609	1.625	1.641	1.657	1.672	1.688	1.703	1.717	1.732	1.746	1.760	1.774	1.788	1.802	1.815	1.829	1.842	1.856	1.869	1.882
10	7.711	1.590	1.607	1.624	1.640	1.656	1.671	1.686	1.701	1.716	1.731	1.745	1.759	1.773	1.787	1.801	1.814	1.828	1.841	1.854	1.868	1.881
15	8.952	1.588	1.605	1.622	1.638	1.654	1.670	1.685	1.700	1.715	1.730	1.744	1.758	1.772	1.786	1.800	1.814	1.827	1.840	1.854	1.867	1.880
20	10.337	1.586	1.603	1.621	1.637	1.653	1.669	1.684	1.700	1.714	1.729	1.744	1.758	1.772	1.786	1.800	1.814	1.827	1.840	1.853	1.866	1.879
25	11.880	1.584	1.602	1.619	1.636	1.652	1.668	1.684	1.699	1.714	1.729	1.743	1.757	1.772	1.785	1.799	1.813	1.826	1.840	1.853	1.866	1.879
30	13.591	1.581	1.600	1.617	1.635	1.651	1.667	1.683	1.698	1.713	1.728	1.743	1.757	1.771	1.785	1.799	1.813	1.826	1.839	1.853	1.866	1.879
35	15.484	1.578	1.597	1.616	1.633	1.650	1.666	1.682	1.698	1.713	1.728	1.743	1.757	1.771	1.785	1.799	1.813	1.826	1.840	1.853	1.866	1.879
40	17.574	1.575	1.595	1.614	1.632	1.649	1.665	1.682	1.697	1.713	1.728	1.742	1.757	1.771	1.785	1.799	1.813	1.826	1.840	1.853	1.866	1.879
45	19.874	1.571	1.592	1.612	1.630	1.648	1.664	1.681	1.697	1.712	1.727	1.742	1.757	1.771	1.785	1.799	1.813	1.826	1.840	1.853	1.866	1.879
50	22.405	1.566	1.589	1.609	1.628	1.646	1.663	1.680	1.696	1.712	1.727	1.742	1.757	1.771	1.785	1.799	1.813	1.827	1.840	1.853	1.866	1.880
55	25.187	1.560	1.584	1.606	1.626	1.644	1.662	1.679	1.695	1.711	1.727	1.742	1.757	1.771	1.785	1.799	1.813	1.827	1.840	1.854	1.867	1.880
60	28.247	1.551	1.579	1.602	1.623	1.642	1.660	1.678	1.694	1.710	1.726	1.741	1.756	1.771	1.785	1.800	1.813	1.827	1.841	1.854	1.867	1.880
65	31.627	1.540	1.572	1.597	1.619	1.639	1.658	1.676	1.693	1.709	1.725	1.741	1.756	1.771	1.785	1.799	1.814	1.827	1.841	1.854	1.868	1.881
70	35.400	1.521	1.563	1.591	1.615	1.636	1.655	1.674	1.691	1.708	1.724	1.740	1.755	1.770	1.785	1.799	1.813	1.827	1.841	1.854	1.868	1.881