

HFC Retrofit Guidelines

HFC-404A & HFC-507 to: HFC-407F

Genetron® Performax™ LT

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Preface

HFC-404A is a high capacity refrigerant employed in a majority of installed medium- and low- temperature refrigeration systems. R-404A and R-507 refrigeration systems utilizing synthetic lubricants have proven to be reliable performers. However, as facility owners work to reduce their carbon footprint, existing refrigeration equipment may need to be either replaced with new equipment or retrofitted with alternative refrigerants. The selection of a retrofit fluid depends, in part, upon retrofit objectives that may include factors such as efficiency, first cost, Global Warming Potential and capacity. By following equipment manufacturers’ recommendations and Honeywell’s guidelines outlined in this publication, service technicians can readily retrofit many existing R-404A and R-507 medium- and low-temperature refrigeration systems to GENTRON PERFORMAX LT.

Introduction

As the industry continues the move away from the use of high GWP HFCs, refrigerant service personnel will play a key role in the transition to reduced GWP alternatives through retrofitting. Honeywell has produced this paper to help service technicians better understand the various technical and operational aspects of carrying out retrofit procedures using Honeywell Genetron® Performax™ LT (R-407F).

Although the information can be helpful as a general guide, **it should not be used as a substitute for the equipment manufacturer’s specific recommendations. Also, retrofitting should be considered system specific. Since systems can differ in condition and configuration, retrofit actions applied to one system will not necessarily result in the same level of success in another system.** For this reason, Honeywell strongly recommends contacting the equipment manufacturer for detailed information on retrofitting the specific model under consideration. Also, refer to the Material Safety Data Sheet (MSDS) for safety information on the specific Genetron® Refrigerant you will use.

GENETRON HFC Refrigerants

GENETRON PERFORMAX LT (R-407F), GENETRON AZ-50® and GENETRON 404A are HFC refrigerants and are not scheduled for phaseout under current law. Descriptive information including refrigerant type, ASHRAE number, constituents and applications appear in the table below.

Genetron Refrigerant	Type	Replaces	Applications	Comments
AZ-50 R-507 125/143a	Azeotrope	HCFC-22	Supermarket freezer cases, reach-in coolers, display cases, ice machines. Flooded evaporator chillers and industrial cooling.	TXV change. Best for flooded evaporators. Oil change to synthetic lube required.
R-404A 125/143a/134a	Blend	HCFC-22	Supermarket freezer cases, reach-in coolers, display cases, transport refrigeration, ice machines.	TXV change, oil change.
Genetron Performax LT R-407F 32/125/134a	Blend	HCFC-22, R-404A, R-507, R-407A	Supermarket freezers, coolers, display cases. Liquid (DX) chillers. Warehouse refrigeration.	Among the most efficient HCFC-22 replacements. Close mass flow match. Lowest GWP value.

GENETRON PERFORMAX LT is not a “Drop-in” Replacement

GENETRON PERFORMAX LT is an HFC-based refrigerant that utilizes synthetic lubricants. The mass flow differences as well as the higher discharge temperature, particularly in low temperature applications, should be evaluated. Check with the compressor manufacturer to determine if the existing lubricant is acceptable. The compressor manufacturer should be consulted regarding acceptable discharge temperature as well. The retrofit procedures listed here have been developed by Honeywell to address these issues and to help technicians perform successful retrofits of HCFC-22 systems utilizing positive-displacement (reciprocating, rotary, scroll or screw) compressors. When considering replacement of 404A/507 with a refrigerant having lower mass flow relative to 404A/507 such as GENETRON PERFORMAX LT, first confirm that the existing piping is acceptable. It is recommended that piping sizing be checked to determine that pressure drops and velocities would be acceptable with the new refrigerant. Checking piping sizing will confirm that capacity and efficient oil return are not being negatively affected. The TXV must be evaluated to determine its suitability with the reduced (-40%) mass flows relative to 404A/507. Many retrofits have demonstrated the suitability of some installed valves to operate satisfactorily with GENETRON PERFORMAX LT refrigerant. Electronic expansion devices may require very little to no adjustment.

Retrofit Procedures

A word about system preparation: In retrofitting an existing refrigeration system, material compatibility and the condition of the existing seals and gaskets must be taken into account. Heat set, compression set, and seal shrinkage can all impact the condition of an existing seal or gasket. When the system is put under vacuum, the sealing device can be displaced, creating the potential for leakage.

1. Record Baseline Data

Before making any hardware changes, compare current system operating data with normal operating data. Correct any deficiencies and record final data as a performance baseline. Data should include temperature and pressure measurements throughout the system including the evaporator, compressor suction and discharge, condenser and expansion device. These measurements will be useful when adjusting the system with an alternative GENETRON Refrigerant.

2. Isolate R-404/R-507 Refrigerant Charge

The HFC refrigerant charge should be isolated from the system by pumping it down into the receiver. If no receiver is present, the refrigerant must be removed from the system using a recovery machine capable of meeting or exceeding the required levels of evacuation. The charge must be collected in a recovery cylinder.

DO NOT VENT THE REFRIGERANT

Knowing the recommended 404A/507 refrigerant charge size for the system is helpful. If it is not known, weigh the entire amount of refrigerant removed. This amount can be used as a guide for the initial quantity of alternative Genetron® Refrigerant to be charged to the system.

3. Choose Compressor Lubricant

In most instances, the lubricant in use with 404A or 507 is suitable for use with Genetron® Performax™ LT (R-407F). Honeywell recommends using a miscible lubricant approved by the compressor manufacturer. Differences among lubricants make it difficult to assume that they are interchangeable. Check with the compressor manufacturer for the correct viscosity grade and brand for the compressor in the system being retrofitted. If the lubricant is contaminated or an acid test indicates high levels of acidity, then a lubricant change is warranted, go to step 4. If the system is clean, go to step 11.

4. Drain the Lubricant

Many small hermetic compressors do not have oil drains, making it necessary to remove the compressor from the system to drain the lubricant. In this case, the best point in the system to drain the lubricant is the suction line of the compressor. Small hand-operated pumps are available which permit insertion of a tube into the compressor suction line. For compressors with an access port, the same hand-operated pump can be used to remove lubricant without removing the compressor from the system.

For larger systems, the oil should be drained from multiple points in the system. Pay particular attention to low spots in the system and piping close to evaporators.

5. Measure Existing Lubricant

Measure and record the volume of the lubricant removed from the system. Compare this amount with the amount recommended by the manufacturer to ensure that the majority of lubricant has been removed. This volume also will be used as a guide to determine the amount of new lubricant to add in the next step.

6. Recharge Compressor with Polyol Ester Lubricant

Check with the compressor manufacturer for the recommended lubricant. Add to the compressor the same volume of e.g., polyol ester lubricant as the volume of oil drained in Step 5. Follow the lubricant manufacturer's suggestion for handling polyol ester lubricant. For example, it is recommended that polyol ester lubricant be pumped rather than poured to avoid pick-up of atmospheric moisture. Likewise, systems charged with polyol ester lubricant should not be left open to the atmosphere for more than 10 to 15 minutes. Note that evacuation will not remove moisture from polyol ester lubricant. A filter drier is the only effective means to remove moisture from polyol ester lubricant.

7. Reinstall the Compressor

Reinstall the compressor following standard service practices recommended by the manufacturer.

8. Evaluate the Expansion Device

Due to the difference in mass flow of GENTRON PERFORMAX LT as compared to GENETRON AZ-50 and GENETRON 404A, the replacement refrigerant requires that the existing thermostatic expansion valves be adjusted. In some cases, particularly in low temperature applications, the TXV may need to be changed. Consult the valve manufacturer to confirm the suitability of the original valve when using R-407F. For systems equipped with a capillary tube refer to the table below for recommendations. Always consult the manufacturer of the equipment prior to retrofitting.

**Capillary Tube Length
(Relative to R-404A, same diameter)**

R-407F	Low Temperature	Medium Temperature
	2 to 2.5	1.7 to 2.2
Retrofit Conditions		
100°F Liquid Temperature at Expansion Device Inlet		
110°F Condensing Temperature		
25°F Compressor Suction Temperature		
Low Evaporating Temperature: -25°F		
Medium Evaporating Temperature: + 20°F		

9. Replace the Filter Drier

Following system maintenance, a recommended service practice is to replace the filter drier. There are two types of filter driers commonly used in refrigeration equipment — loose-fill and solid-core.

Check with your wholesaler to make sure the replacement filter drier is compatible with the Genetron® Refrigerant being used.

When changing to an HFC-miscible lubricant, particularly to a more polar lubricant such as polyol ester, it may be beneficial to add a suction line filter.

10. Reconnect the System and Evacuate

Use normal service practices to reconnect and evacuate the system. To remove air and other non-condensables, Honeywell recommends evacuating the system to a full vacuum of 1,000 microns or less from both sides of the system. However, attempting to evacuate a system with the pump connected only to the low-side of the system will not adequately remove moisture and non-condensables such as air. Use a good electronic gauge to measure the vacuum. An accurate reading cannot be made with a refrigeration gauge.

11. Check the System for Leaks

Check the system for leaks using normal service practices.

12. Charge System with GENETRON HFC Refrigerant

When replacing 404A/507 with Genetron® Performax™ LT, use the same charging procedures that you would use for the refrigerant being replaced. When working with GENTRON PERFORMAX LT, it is important to remember that it is a blend refrigerant. It is essential that blend refrigerants be liquid-charged by removing only liquid from the cylinder. **Never vapor charge the system with vapor from a 400 series refrigerant cylinder.**

Vapor-charging may result in the wrong refrigerant composition and could damage the system.

A throttling valve should be used to control the flow of refrigerant to the suction side to ensure that the liquid is converted to vapor prior to entering the system.

NOTE: To prevent compressor damage, do not charge liquid into the suction line of the unit.

Systems being charged with GENTRON PERFORMAX LT require a slightly larger charge size than 404A/507.

For expansion valves or optimized capillary tube systems, the typical charge size relative to the 404A/507 being replaced appears below.

Relative Charge Size	
GENETRON Refrigerant	R-404A or R-507 Replacement
Performax LT (R-407F)	107%

As part of general procedure, Honeywell recommends initially charging the system with 85 percent by weight of the original charge.

13. Check System Operation

Start the system and allow conditions to stabilize. If the system is undercharged, add refrigerant in increments of 5 percent by weight of the original charge. Continue until desired operating conditions are achieved.

Compressor suction and discharge pressures for GENTRON PERFORMAX LT (R-407F) relative to R-404A are given below.

Comparative Suction and Discharge Pressure Versus R-404A		
	Suction	Discharge
R-407F	0-5 psi (0-35kPa) lower	0-5 psi higher (0-35 kPa) higher

It may be necessary to reset the pressure cutouts to compensate for the different pressures of the replacement refrigerant. This procedure should be done carefully to avoid exceeding the recommended operating limits of the compressor and other system components. The use of an unoptimized capillary tube will make the system more sensitive to charge and/or operating conditions. As a result, system performance will change more quickly if the system is overcharged (or undercharged). To avoid overcharging, it is best to charge the system by first measuring the operating conditions (including discharge and suction pressures, suction line temperature, compressor amps, superheat) instead of using the liquid line sight glass as a guide.

For blend refrigerants, pressure-temperature data will include bubble pressure and dew pressure data. To determine superheat, use the dew pressure column. To determine subcooling, use the bubble pressure column. To find average evaporating or condensing temperature, find the measured pressure in both the bubble and dew columns and take the average of the two corresponding temperatures.

14. Label Components and System

After retrofitting the system with Genetron® Performax™ LT, label the system components to identify the specific refrigerant (GENTRON PERFORMAX LT) and specify the type of lubricant (by brand name) in the system. This will help ensure that the proper refrigerant and lubricant will be used to service the equipment in the future.

Unit Charge labels are available through your Genetron® Wholesaler.

Retrofit Checklist

- | | |
|--|--|
| 1. Record baseline data on original system performance _____ | 10. Evaluate and replace all elastomer seals including receiver float, alarm and level control gaskets. _____ |
| 2. Recover refrigerant charge using appropriate recovery equipment. _____ | 11. Replace filter driers and suction filters. _____ |
| 3. Record the amount of refrigerant recovered. _____ | 12. Leak check the system. _____ |
| 4. Choose compressor lubricant. Consult the compressor manufacturer's data to verify that the same synthetic grade and weight is suitable for use with Genetron®Performax™ LT, this is generally the case. _____ | 13. Evacuate the system. _____ |
| 5. If required, drain the existing lubricant from the compressors, separators and oil reservoirs. _____ | 14. Charge the system with the new refrigerant. In the case of GENETRON PERFORMAX LT (R-407F), remove only liquid from the charging cylinder. Initial charge should be approximately 85% of the R-404A charge by weight. Record the amount of refrigerant charged. _____ |
| 6. Measure amount (volume) of lubricant removed. _____ | 15. Check system operation and adjust TXV's and operating controls. The discharge pressure of R-407F is slightly higher and condenser fan and ambient controls may require adjustment. _____ |
| 7. Change lubricant filters if present. _____ | 16. Adjust refrigerant charge if necessary, final charge should not exceed 107% of the original charge. _____ |
| 8. Recharge the system with polyol ester lubricant, use the same amount (volume) that was removed. _____ | 17. Label components and the system with the type of refrigerant and lubricant. _____ |
| 9. Evaluate the expansion devices; consult the valve manufacturers for recommendations. No change is necessary in most cases. _____ | |

Genetron® Temperature/Pressure Tables

Temperature (°F)	R-507 (AZ-50)		R-404A		R-407F	
	Bubble Pressure (psig)	Dew Pressure (psig)	Bubble Pressure (psig)	Dew Pressure (psig)	Bubble Pressure (psig)	Dew Pressure (psig)
-40	5.4	5.4	4.9	4.3	4.9	0.5" Hg vacuum
-38	6.4	6.4	5.9	5.3	5.9	0.6
-36	7.5	7.5	7.0	6.3	7.0	1.4
-34	8.6	8.6	8.0	7.4	8.1	2.3
-32	9.8	9.8	9.2	8.5	9.2	3.3
-30	11.0	11.0	10.3	9.6	10.4	4.2
-28	12.2	12.2	11.5	10.8	11.7	5.2
-26	13.5	13.5	12.8	12.0	12.9	6.3
-24	14.8	14.8	14.1	13.3	14.3	7.4
-22	16.2	16.2	15.4	14.6	15.7	8.5
-20	17.6	17.6	16.8	16.0	17.1	9.7
-18	19.1	19.1	18.3	17.4	18.6	11.0
-16	20.6	20.6	19.8	18.9	20.1	12.2
-14	22.2	22.2	21.3	20.4	21.7	13.6
-12	23.8	23.8	22.9	22.0	23.4	14.9
-10	25.5	25.5	24.6	23.6	25.1	16.4
-8	27.3	27.2	26.3	25.3	26.8	17.9
-6	29.1	29.0	28.0	27.0	28.7	19.4
-4	30.9	30.9	29.8	28.8	30.6	21.0
-2	32.8	32.8	31.7	30.7	32.5	22.7
0	34.8	34.8	33.7	32.6	34.5	24.4
2	36.9	36.8	35.7	34.6	36.6	26.2
4	39.0	38.9	37.7	36.6	38.7	28.0
6	41.1	41.1	39.8	38.7	41.0	29.9
8	43.4	43.4	42.0	40.9	43.2	31.9
10	45.7	45.7	44.3	43.1	45.6	33.9
12	48.1	48.0	46.6	45.4	48.0	36.0
14	50.5	50.5	49.0	47.8	50.5	38.2
16	53.0	53.0	51.5	50.2	53.1	40.4
18	55.6	55.6	54.0	52.7	55.7	42.7
20	58.3	58.2	56.6	55.3	58.5	45.1
22	61.0	61.0	59.3	58.0	61.3	47.6
24	63.8	63.8	62.0	60.7	64.2	50.1
26	66.7	66.7	64.8	63.5	67.1	52.7

Temperature (°F)	R-507 (AZ-50)		R-404A		R-407F	
	Bubble Pressure (psig)	Dew Pressure (psig)	Bubble Pressure (psig)	Dew Pressure (psig)	Bubble Pressure (psig)	Dew Pressure (psig)
28	69.7	69.6	67.8	66.4	70.2	55.4
30	72.7	72.7	70.7	69.3	73.3	58.2
32	75.9	75.8	73.8	72.4	76.5	61.1
34	79.1	79.0	77.0	75.5	79.9	64.0
36	82.4	82.3	80.2	78.7	83.3	67.0
38	85.8	85.7	83.5	82.0	86.8	70.1
40	89.2	89.2	86.9	85.4	90.4	73.4
42	92.8	92.7	90.4	88.8	94.0	76.7
44	96.5	96.4	94.0	92.4	97.8	80.1
46	100.2	100.1	97.6	96.0	101.7	83.5
48	104.1	104.0	101.4	99.8	105.7	87.1
50	108.0	107.9	105.3	103.6	109.7	90.8
52	112.0	111.9	109.2	107.5	113.9	94.6
54	116.2	116.1	113.3	111.6	118.2	98.5
56	120.4	120.3	117.4	115.7	122.6	102.5
58	124.7	124.6	121.7	119.9	127.1	106.6
60	129.2	129.1	126.0	124.2	131.7	110.8
62	133.7	133.6	130.5	128.7	136.4	115.1
64	138.4	138.3	135.0	133.2	141.2	119.5
66	143.1	143.0	139.7	137.8	146.2	124.1
68	148.0	147.9	144.4	142.6	151.2	128.7
70	153.0	152.8	149.3	147.4	156.4	133.5
72	158.1	157.9	154.3	152.4	161.7	138.4
74	163.3	163.1	159.4	157.5	167.1	143.4
76	168.6	168.5	164.6	162.7	172.6	148.6
78	174.1	173.9	169.9	168.0	178.3	153.8
80	179.6	179.5	175.4	173.4	184.1	159.2
82	185.3	185.1	181.0	179.0	190.0	164.7
84	191.1	190.9	186.7	184.6	196.1	170.4
86	197.1	196.9	192.5	190.4	202.2	176.2
88	203.1	202.9	198.4	196.4	208.5	182.1
90	209.3	209.1	204.5	202.4	215.0	188.2
92	215.6	215.4	210.7	208.6	221.6	194.4
94	222.1	221.9	217.0	214.9	228.3	200.7
96	228.7	228.5	223.4	221.3	235.1	207.2
98	235.4	235.2	230.0	227.9	242.1	213.8
100	242.3	242.1	236.8	234.6	249.3	220.6

Genetron® Temperature/ Pressure Tables (cont'd)

Temperature (°F)	R-507 (AZ-50)		R-404A		R-407F	
	Bubble Pressure (psig)	Dew Pressure (psig)	Bubble Pressure (psig)	Dew Pressure (psig)	Bubble Pressure (psig)	Dew Pressure (psig)
102	249.3	249.1	243.6	241.5	256.6	227.6
104	256.5	256.2	250.6	248.5	264.0	234.7
106	263.8	263.5	257.8	255.6	271.6	241.9
108	271.2	271.0	265.1	262.9	279.3	249.4
110	278.8	278.6	272.5	270.4	287.2	256.9
112	286.6	286.3	280.1	278.0	295.3	264.7
114	294.5	294.2	287.9	285.7	303.5	272.6
116	302.6	302.3	295.8	293.6	311.8	280.7
118	310.8	310.5	303.8	301.7	320.4	289.0
120	319.2	318.9	312.0	309.9	329.0	297.4
122	327.8	327.5	320.4	318.3	337.9	306.0
124	336.5	336.2	329.0	326.8	346.9	314.8
126	345.4	345.1	337.7	335.5	356.1	323.8
128	354.5	354.2	346.6	344.4	365.5	333.0
130	363.8	363.5	355.6	353.5	375.0	342.4
132	373.2	372.9	364.9	362.8	384.7	352.0
134	382.9	382.6	374.3	372.2	394.6	361.8
136	392.7	392.4	383.9	381.9	404.7	371.8
138	402.7	402.4	393.7	391.7	415.0	382.0
140	413.0	412.7	403.7	401.7	425.4	392.4
142	423.4	423.1	413.9	411.9	436.1	403.1
144	434.1	433.8	424.3	422.4	446.9	414.0
146	444.9	444.7	434.9	433.1	457.9	425.1
148	456.1	455.8	445.7	443.9	469.1	436.4
150	467.4	467.2	456.8	455.1	480.6	448.0

Genetron Temperature/ Pressure Tables SI Units

Temperature (°C)	R-507 (AZ-50)		R-404A		R-407F	
	Bubble Pressure (kPa)	Dew Pressure (kPa)	Bubble Pressure (kPa)	Dew Pressure (kPa)	Bubble Pressure (kPa)	Dew Pressure (kPa)
-40	139	139	135	131	135.0	99.6
-39	145	145	141	137	141.4	104.7
-38	152	152	148	143	147.9	110.0
-37	158	158	155	150	154.7	115.5
-36	165	165	161	157	161.7	121.1
-35	173	173	169	164	169.0	127.1
-34	180	180	176	171	176.5	133.2
-33	188	188	183	178	184.3	139.6
-32	196	196	191	186	192.4	146.2
-31	204	204	199	194	200.7	153.0
-30	213	213	208	202	209.3	160.1
-29	222	222	216	211	218.2	167.4
-28	231	231	225	220	227.4	175.1
-27	240	240	235	229	236.8	182.9
-26	250	250	244	238	246.6	191.1
-25	260	260	254	248	256.7	199.5
-24	270	270	264	257	267.1	208.3
-23	281	281	274	268	277.8	217.3
-22	292	292	285	278	288.9	226.6
-21	303	303	296	289	300.2	236.2
-20	315	314	307	300	312.0	246.2
-19	326	326	319	312	324.0	256.4
-18	339	339	331	324	336.5	267.0
-17	351	351	343	336	349.3	277.9
-16	364	364	356	348	362.4	289.2
-15	377	377	369	361	376.0	300.8
-14	391	391	382	374	389.9	312.8
-13	405	405	396	388	404.2	325.2
-12	420	419	410	402	418.9	337.9
-11	434	434	424	416	434.0	351.0
-10	450	449	439	431	449.6	364.4
-9	465	465	454	446	465.5	378.3
-8	481	481	470	461	481.9	392.6
-7	498	497	486	477	498.7	407.3
-6	514	514	502	494	515.9	422.4

Genetron® Temperature/ Pressure Tables SI Units (cont'd)

Temperature (°C)	R-507 (AZ-50)		R-404A		R-407F	
	Bubble Pressure (kPa)	Dew Pressure (kPa)	Bubble Pressure (kPa)	Dew Pressure (kPa)	Bubble Pressure (kPa)	Dew Pressure (kPa)
-5	532	531	519	510	533.6	437.9
-4	549	549	537	527	551.8	453.9
-3	567	567	554	545	570.4	470.3
-2	586	586	573	563	589.5	487.1
-1	605	605	591	581	609.0	504.4
0	624	624	610	600	629.1	522.2
1	644	644	630	620	649.6	540.5
2	665	664	650	640	670.6	559.2
3	686	685	670	660	692.2	578.4
4	707	706	691	681	714.2	598.2
5	729	728	712	702	736.8	618.4
6	751	751	734	724	760.0	639.1
7	774	774	757	746	783.6	660.4
8	798	797	780	769	807.8	682.2
9	822	821	803	792	832.6	704.6
10	846	845	827	816	857.9	727.5
11	871	870	852	840	883.8	750.9
12	897	896	877	865	910.3	775.0
13	923	922	902	890	937.3	799.6
14	949	949	928	916	965.0	824.8
15	977	976	955	943	993.3	850.6
16	1004	1004	982	970	1022.2	877.0
17	1033	1032	1010	998	1051.7	904.0
18	1062	1061	1039	1026	1081.8	931.7
19	1092	1091	1068	1055	1112.5	959.9
20	1122	1121	1097	1084	1144.0	988.9
21	1153	1152	1127	1115	1176.0	1018.4
22	1184	1183	1158	1145	1208.8	1048.7
23	1216	1215	1190	1177	1242.2	1079.6
24	1249	1248	1222	1209	1276.3	1111.2
25	1283	1281	1255	1241	1311.0	1143.5
26	1317	1316	1288	1274	1346.5	1176.6
27	1351	1350	1322	1308	1382.7	1210.3
28	1387	1386	1357	1343	1419.6	1244.8
29	1423	1422	1392	1378	1457.2	1280.0

Temperature (°C)	R-507 (AZ-50)		R-404A		R-407F	
	Bubble Pressure (kPa)	Dew Pressure (kPa)	Bubble Pressure (kPa)	Dew Pressure (kPa)	Bubble Pressure (kPa)	Dew Pressure (kPa)
30	1460	1459	1428	1414	1495.5	1315.9
31	1498	1496	1465	1451	1534.6	1352.6
32	1536	1535	1503	1489	1574.5	1390.1
33	1575	1574	1541	1527	1615.1	1428.4
34	1615	1613	1580	1566	1656.5	1467.5
35	1655	1654	1620	1605	1698.6	1507.3
36	1697	1695	1660	1645	1741.6	1548.0
37	1739	1737	1701	1687	1785.3	1589.6
38	1781	1780	1743	1728	1829.9	1631.9
39	1825	1824	1786	1771	1875.2	1675.2
40	1870	1868	1829	1815	1921.4	1719.3
41	1915	1913	1874	1859	1968.4	1764.3
42	1961	1959	1919	1904	2016.3	1810.2
43	2008	2006	1965	1950	2065.0	1856.9
44	2056	2054	2012	1997	2114.6	1904.7
45	2104	2103	2059	2044	2165.1	1953.3
46	2154	2152	2108	2093	2216.5	2002.9
47	2204	2203	2157	2142	2268.7	2053.5
48	2256	2254	2207	2192	2321.9	2105.1
49	2308	2306	2259	2244	2376.0	2157.6
50	2361	2359	2311	2296	2431.0	2211.2
51	2415	2413	2364	2349	2486.9	2265.8
52	2470	2469	2418	2403	2543.8	2321.5
53	2527	2525	2472	2458	2601.7	2378.2
54	2584	2582	2528	2514	2660.5	2436.1
55	2642	2640	2585	2571	2720.3	2495.0
56	2701	2699	2643	2629	2781.2	2555.0
57	2761	2759	2702	2688	2843.0	2616.2
58	2823	2821	2762	2748	2905.8	2678.6
59	2885	2883	2823	2809	2969.7	2742.2
60	2949	2947	2885	2871	3034.6	2807.0
61	3013	3011	2948	2934	3100.5	2873.0
62	3079	3077	3012	2999	3167.5	2940.3
63	3146	3145	3078	3065	3235.6	3008.9
64	3215	3213	3145	3132	3304.8	3078.8
65	3285	3283	3213	3200	3375.1	3150.1

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