Straight Talk

on Canon Analog Copier Drum Unit/Cartridges (DU/Cs)

June 1999

Topic: Wide Range of Failure Points for New Canon (OEM) DU/Cs Is Directly Influenced by Machine Usage Conditions

Q Is it true that new Canon (OEM) analog copier DU/Cs almost always reach or surpass OEM-stated life, and that premature failures are rare exceptions?

A ***No***. This is a misconception held by many dealers. In reality, OEM-stated life is an average. **It is common and normal for some OEM DU/Cs to fail before reaching OEM-stated life, and for others to surpass OEM-stated life.** In fact, based on data supplied by several large North American and European Canon dealers, only approximately 60% of these products actually achieve or surpass OEM-stated life; the rest fail prematurely over a very wide range of copy counts, for a variety of reasons.

Introduction: Actual DU/C Life Data

Several large, authorized, North American and European Canon dealerships tracked and recorded the actual failure points of nearly 2,000 new (non-refurbished) OEM DU/Cs installed and run to life in Canon NP-2020, NP-6030*, and NP-3050 copiers, and shared this information with Katun in 1997. The data provided clearly demonstrates that, when installed in the field and subjected to real-world machine usage and operating conditions, new OEM DU/Cs fail over a very wide range of copy counts.

OEM DU/C Type	OEM-stated Life (copies)	Failure Range (copies)
2020	50,000	0–105,000
6030	50,000/60,000**	0–142,000
3050	100,000	0–320,000

Figure 1. *OEM-stated life and actual failure range for new DU/Cs.*

When this data is plotted on graphs, the failure points for these new OEM DU/Cs generally form classic bell-shaped curves, with a considerable percentage of failures occurring near OEM-stated life, but many others occurring substantially earlier or later *(see Figures 2–4).*

Similar actual-life data for new OEM DU/Cs used in other Canon copier models has been obtained from several other Canon dealers. In-field failure-point ranges for these other OEM DU/C types were comparable to those shown for the 2020, 6030, and 3050 DU/Cs. Consequently, Katun believes that the wide range of DU/C failure points revealed in this sample accurately represents the typical range for all Canon analog copier DU/Cs.

Whereas OEM-stated DU/C life is a single data point, actual OEM DU/C life can only be represented by a range, and is influenced by many factors including specific machine usage and operating conditions. **The two most significant factors that impact the life of a DU/C are average run length (ARL) and paper quality.** Poor-quality paper can be extremely abrasive, which accelerates OPC coating wear and abrasion. Likewise, shorter ARLs require more frequent machine start-up cycles and frequent spikes in rotational torque, which also substantially accelerate OPC coating wear and abrasion. As its coating thickness decreases, so does the OPC drum's ability to accept and hold a sufficient charge. At some point, this results in unacceptably light copies, necessitating DU/C replacement.

*The vast majority of OEM "6030" DU/Cs tracked were post-"gold-dot" DU/Cs; that is, they were the latest and most reliable of numerous modified DU/C versions for this copier.

**Varies by market.

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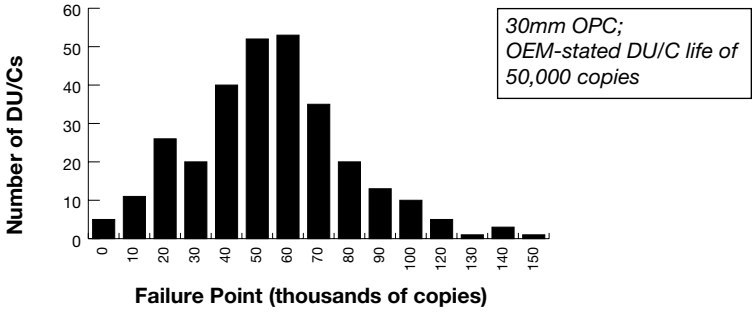
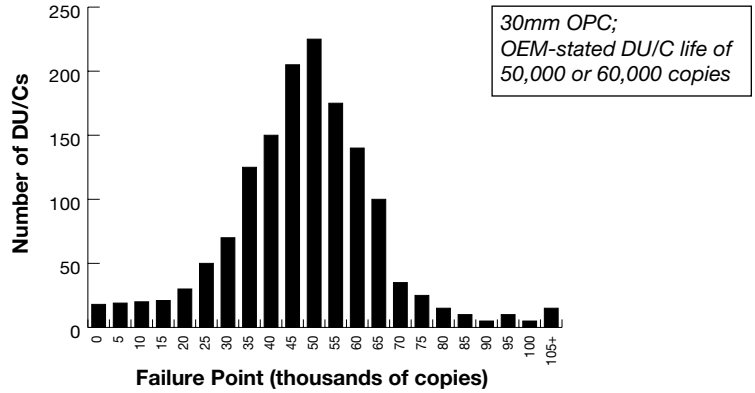
New OEM 2020 DU/C Failure Points
– Sample size: 287 DU/Cs

Figure 2. *Distribution of failure points for new (non-refurbished) Canon "**2020**" DU/Cs. Note that while 65 percent reached their full OEM-stated life or beyond,* ***35 percent failed before reaching the OEM-stated life of 50,000 copies.***



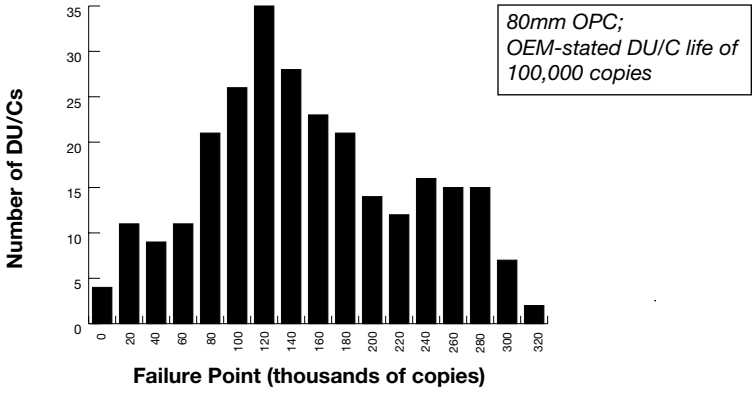
New OEM 6030 DU/C Failure Points
– Sample size: 1,442 DU/Cs

Figure 3. *Distribution of failure points for new (non-refurbished) Canon "**6030**" DU/Cs. Note that* ***49 percent failed before reaching 50,000 copies,and 77 percent failed before reaching 60,000 copies.*** (OEM-stated life varies, by market, between these two copy counts.)



New OEM 3050 DU/C Failure Points
– Sample size: 270 DU/Cs

Figure 4. *Distribution of failure points for new (non-refurbished) Canon "**3050**" DU/Cs. Note that while 80 percent reached their full OEM-stated life or beyond,* ***20 percent failed before reaching the OEM-stated life of 100,000 copies.***



Stop-and-Go Copying, Like Stop-and-Go Driving, Increases Wear on Critical Parts

Consider the following situation:

You and a co-worker both live exactly 10 miles from your office. You both drive the same model and year automobile. *You* live in the suburbs and take an interstate highway to and from work every day; *your co-worker* lives in the city and must take a much more congested route. You have never replaced your car's brakes or tires. On the other hand, your co-worker had to replace his vehicle's brakes and tires many thousand miles sooner than expected.

Why the difference? Your co-worker's route to and from work through the city requires navigating through stop-and-go traffic. You, on the other hand, typically drive on the interstate highway at a steady speed, accelerating and decelerating only as you enter and exit the highway. Your co-worker puts significantly more wear on his car's brakes and tires than you do.

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Just as stop-and-go driving wears a vehicle's brakes and tires more quickly, *short copy runs have a significant negative impact on DU/C life*. Whenever an end-user begins a new copy run, the copier initiates a start-up cycle that creates an extreme increase, or spike, in OPC rotational torque (referred to as Initial Rotations or INTR). OPC drum rotational cycles during these high-torque start-up spikes cause substantially increased wear and abrasion of the OPC coating, which ultimately decreases OPC coating thickness.

In addition, whenever copies are produced, regardless of the length of the run, the OPC continues rotating a short time *after* the specified number of copies are produced (referred to as Last Rotations or LSTR). Because of INTR and LSTR, *the OPC completes more rotations than the number of copies produced.* When spread over long copy runs, the number of "extra" rotations per copy remains low and the impact on OPC drum life is minimal. However, **when these additional rotations are added to frequent, numerous short copy runs, the average number of rotations per copy is much higher and can significantly reduce the life of the OPC drum.**

As Figure 5 illustrates, additional rotations (INTR and LSTR) per copy have a significant impact in very short copy runs. To make a single copy, a Canon NP-1215 copier requires 11 drum rotations; thus it takes *110 rotations to make 10 single copies*. In contrast, to make 10 copies in *one continuous run* requires just *50 rotations,* or 5 drum rotations per copy on average.

Types of OPC Rotations	OPC Rotations to make a single (1) copy	OPC Rotations to make three (3) copies	OPC Rotations to make ten (10) copies
OPC Initial Rotations (INTR)	← 3 →		
OPC Copy Rotations (Actual Copies)	3	11*	42*
OPC Last Rotations (LSTR)	← 5 →		
TOTAL OPC ROTATIONS ***OPC Rotations per Copy***	11 ***11***	19 ***6.3***	50 ***5.0***

Figure 5. *Total OPC rotation "experience" for a Canon NP-1215 copier producing 8.5 x 11-inch copies in different run lengths.*

** These figures include Scanner Reverse Rotations (SCRV).*

As seen in Figure 6, which outlines results of life tests conducted by Katun Technical Operations, when rotations-per-copy differences are extrapolated over the life of a DU/C, the impact is significant. In order to produce 30,000 copies in 3-copy runs using a Canon NP-1215 copier, **a DU/C requires 62,320 more drum rotations than a DU/C using much longer runs of 99 copies each to produce the same total number of copies.**

30,000-Copy Test Protocol	Copy Runs (Starts & Stops)	Actual OPC Copy Rotations per Run	TOTAL OPC Copy Rotations	INTR & LSTR Rotations per Run	TOTAL INTR & LSTR Rotations	TOTAL OPC Rotations per Run	**TOTAL OPC Rotations During Test**
Start/Stop (3-copy runs)	10,000	11	110,000	8	80,000	19	***190,000***
Continuous (99-copy runs)	304*	412	125,248	8	2,432	420	***127,680***

Figure 6. *Results of 30,000-copy Canon 1215 DU/C tests using "start/stop" and "continuous" copy modes to simulate real-world differences in ARL.*

*** This number results from the need to reset the copier every 99 copies (and add paper to the tray at every other 99 copy reset).*

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OPC Drum Wear and Failure

In a well-maintained copier where ARLs are normal-to-high and excessive contaminants (i.e., high levels of paper dust) are not present, the OPC will likely achieve or surpass its OEM-stated life and eventually fail electrically due to normal wear having gradually reduced its OPC coating thickness.

When ARLs are low, however, and the drum is subjected to many more high-torque, minimal-lubrication start-ups, contaminants can be driven between the drum cleaning blade and the OPC drum surface, and accelerated abrasion –or even more severe surface damage– will result. The OPC is less likely to achieve its OEM-stated life, and mechanical failure will most likely be the cause. In summary, there are simple guidelines for the probable failure mode of a Canon DU/C:

- Normal-to-High ARL = Electrical failure of OPC at or beyond stated life.
- Low ARL = Mechanical, often premature, failure of OPC.

[***NOTE:*** Generally speaking, a copier with a higher ARL has a correspondingly higher average monthly copy volume (AMCV). Therefore, higher AMCV also usually corresponds to longer DU/C life, and vice versa.]

Newer Alkaline-Based Papers Produce More Paper Dust

A little-known but widespread industry change has also had a significant adverse effect on many DU/Cs. Over the past several years most U.S. and European paper manufacturers have gradually switched from production of acid-based to alkaline-based xerographic papers. Alkaline-based papers require greater amounts of calcium carbonate and other types of fillers/whiteners that detach from the paper sheet more readily than the fillers used in acid-based papers. These alkaline-based papers can generate two-to-three times as much paper dust as acid-based papers of an equivalent grade. Increased paper dust that becomes trapped between the OPC drum and the urethane drum cleaning blade can substantially accelerate OPC coating wear.

Summary

Just as your vehicle's long-term maintenance requirements are directly related to your driving patterns, the life expectancy of any Canon (new OEM) or Katun-refurbished DU/C is directly related to machine usage conditions (plus paper quality, etc.). Other factors being equal, **the longer the copier's ARL, the longer the probable life of the DU/C**. Every OPC drum rotation gradually wears down the OPC coating thickness, so the more often an OPC drum rotates without actually making copies, the shorter its life.

Most importantly, these results apply *equally* to new OEM and Katun-refurbished Canon DU/Cs: **average failure points for Katun-refurbished DU/Cs are equivalent to those for new OEM DU/Cs. A similar percentage of Katun-refurbished DU/Cs will last the OEM-stated life or beyond, and a similar percentage will fail prematurely—both of which are *common and normal* for these products**. To ensure this equivalence, Katun utilizes extensive quality control procedures and conducts equally extensive in-machine testing. **Since Katun-refurbished DU/Cs are available at substantial cost savings vs. new OEM DU/Cs, they enable dealers/distributors to reduce their service expenses and increase profits while maintaining current levels of end-user customer satisfaction**.

When you choose between OEM DU/Cs and Katun-refurbished Canon DU/Cs, consider the overall value you'll receive. Providing the quality, performance, and life you require –at highly competitive prices– **Katun-refurbished DU/Cs represent the best value for Canon dealers and distributors worldwide**.