Operations Specification Document

FOR THE

LTS101 (ALL) Cycle Counters

Revision F – July 15th, 2025
- Added note 3 Pg. 2

This document describes in detail the operation of the AKV LTS101 AS350 Single and BK117 Dual Engine Cycle Counters. The cycle counter's primary objective is to accurately monitor and record both the Ng (Gas Producer) and Np (Power Turbine) engine cycles in accordance with the Honeywell Service Bulletin (SB) LT 101-71-00-0002. The cycle counter utilizes Method II of the SB.

WARNING: Prior to resetting the cycle counter, a "Daily Coherence" check of the accumulated cycles must be completed by the pilot. Reference the BK117 Rotorcraft Flight Manual Supplement (RFMS) Rev D (or later FAA /CASA Approved revisions) and Section GENERAL: MANUFACTURER'S DATA. In the case of the AS350 LTS101 cycle counters, reference the Instructions for Continued Airworthiness (ICA).

AKV Cycle Counter part number(s) and model applicability:

- **P/N 350NGLTSD** for the LTS101-600 Series single engine AS350
- **P/N 350NGLTSB2** for the LTS101-700D-2 single engine AS350
- **Kit P/N BK1172XCC** (BK117A1-B2) for the LTS101-650, 750 & 850 series BK117

For earlier Cycle Counters without the collective micro switch interface (see table 1 below), use the following software. Refer to Screen Layout Fig. 1, Pg 3.

- **Software Rev 2c or earlier** revision for the LTS101-600 Series
- **Software Rev 2d or earlier** revision for the LTS101-700D-2
- **Software Rev 1 or earlier** revision for the LTS101-650/750 or 850

For newer Cycle Counters with the collective micro switch interface (see table 1 below), use the following software. Refer to Screen Layout Fig 2, Pg. 4.

- **Software Rev 3 or later** revision is installed for the LTS101-600 Series
- **Software Rev 3 or later** revision is installed for the LTS101-700D-2
- **Software Rev 2 or later** revision is installed for the LTS101-650/750 or 850

Part Number	Earlier Rev without Collective micro	Newer Rev with Collective micro
350NGLTSD	Rev C and earlier	Rev D and later
350NGLTSB2	Rev C and earlier	Rev D and later
Kit BK1172XCC (MBB)	Rev F and earlier	Rev G and later
Kit BK1172XCC (JBK)	Rev D and earlier	Rev E and later

Table 1 - Cycle Counter Revision Table as marked on the part number label

Each numbered **ITEM** below identifies the recorded and displayed values on the cycle counter screens. See following Fig. 1 and 2.

1. Engine Model Applicability
2. Honeywell SB Revision Number
3. AKV Software Version Number
4. Cycle Counter (CC) Software Revision Number
5. Ng and Np real-time speeds, & Nr (Rotor RPM) or Ng Max

   NOTE: If shown, Nr is derived from the Np RPM and is for reference only.
6. Accumulated Ng (Gas Producer) flight cycles (Flt)
7. Accumulated Np (Free Turbine) flight cycles (Flt)
8. Ng Operations / Excursions Counter (Ops)
9. Np Operations / Excursions Counter (Ops)
10. Engine Starts
11. Ng and Np totals
12. Mt Maintenance Time or Flight Time
13. Rt (Revenue) or Run Time

WARNING: Per item 5, if Nr is displayed, do not use the Nr indication for calibration purposes. It is there for reference only.

NOTE 1: When a "reset" is referred to in this document it is accomplished with the red button on the side of the cycle counter. When activated (pressed and released), it adds the accumulated "Flt" cycles to the totals on the second data screen. The daily "Flt" values are then reset to zero for the next flight period. In addition, it also resets the Ng and Np "Ops" and Max Ng to zero.

The "Reset" pushbutton is de-activated when the engine is running.

NOTE 2: The graphs in Table 2 and 3 at the back of this document are an example of the LTS101-600 engine. Although the cycle counting procedure (algorithm) is the same between LTS101 models, the penalty factors are different. Refer to the Honeywell Service Bulletin (SB) LT 101-71-00-0002 and the graphs in the back pertaining to your engine model for the penalty factors the AKV Cycle Counter uses.

NOTE 3: With the collective interface installed, the cycle counter uses a single computer input for both the red "reset" button and the collective up signal functions. When the engine is running, the input controls the flight time with the collective up signal via our supplied external relay as part of the installed kit. When N1 is < 30% it reverts to a reset function. If the collective micro switch is out of adjustment and still produces a signal

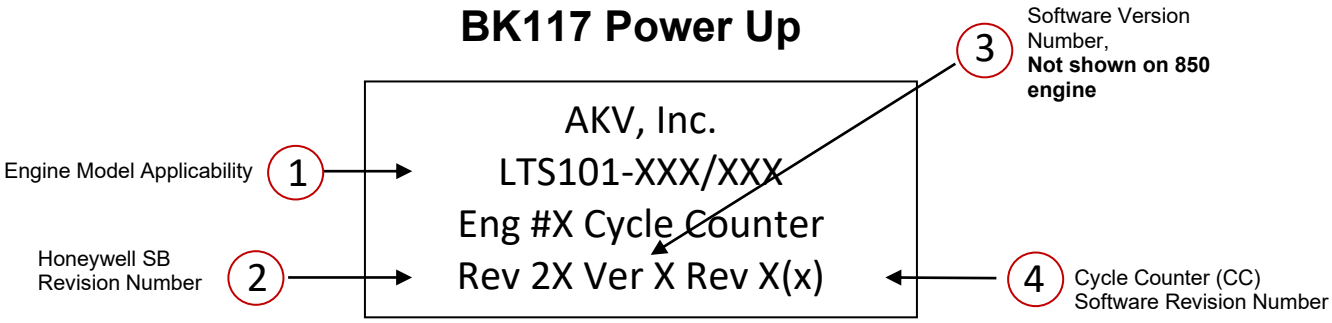
when the collective is down, then when N1 < 30% it immediately resets the counter. You might notice the second screen totals increasing in cycles with nothing showing on the first screen.

When running the engine and the collective is full down, check the Flight time on the second screen totals shows (OFF). Raise the collective and confirm it then shows (ON). If it does not, then the collective micro switch needs to be looked at.

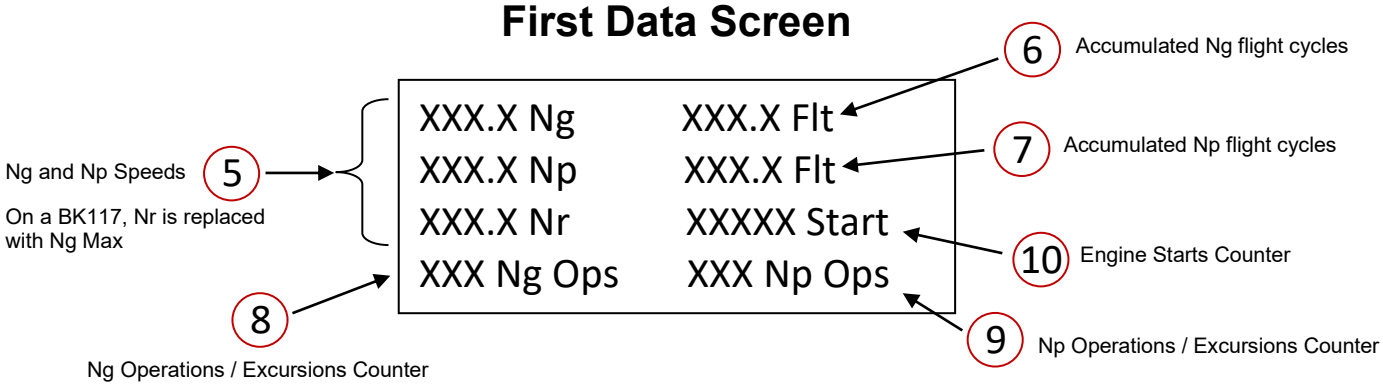
Screen Layout - *earlier software installed (**without** collective interface)*

AS350 Power Up

BK117 Power Up



First Data Screen



Second Data Screen

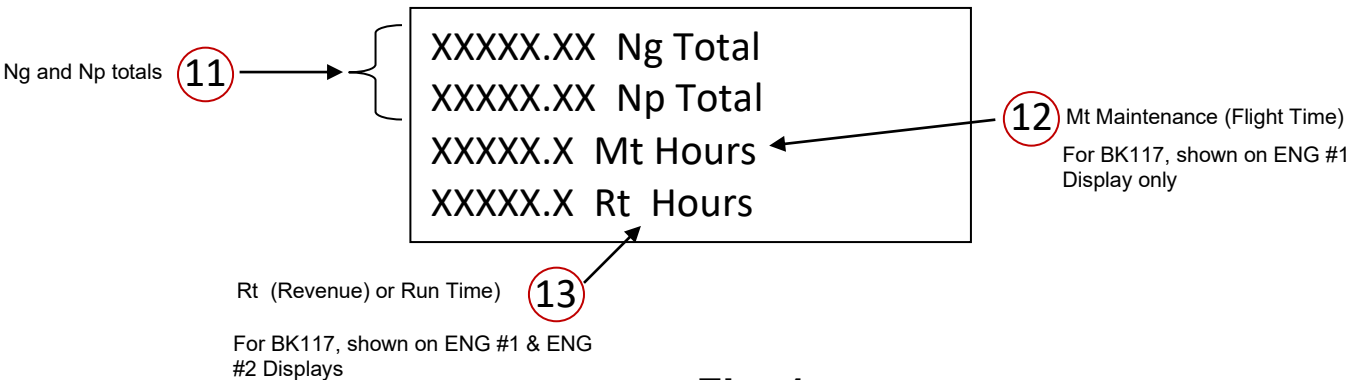
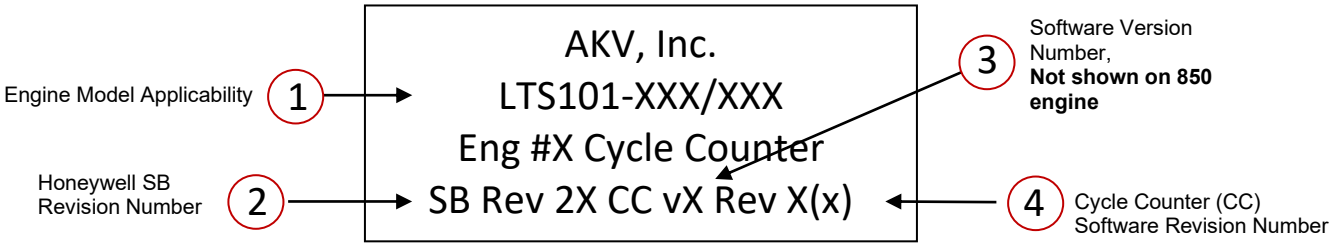


Fig. 1

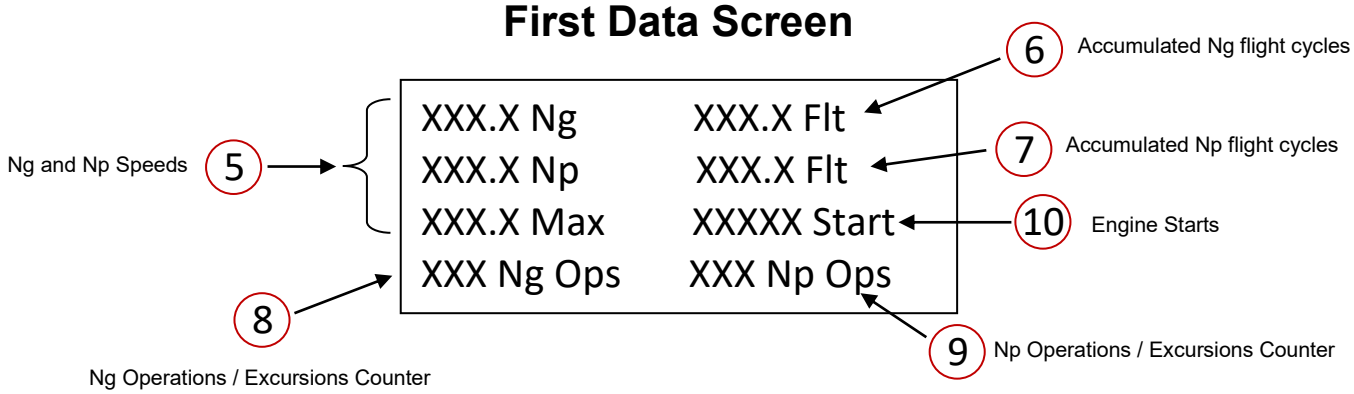
Screen Layout - *newer software installed (**with** collective interface)*

AS350 Power Up

BK117 Power Up



First Data Screen



Second Data Screen

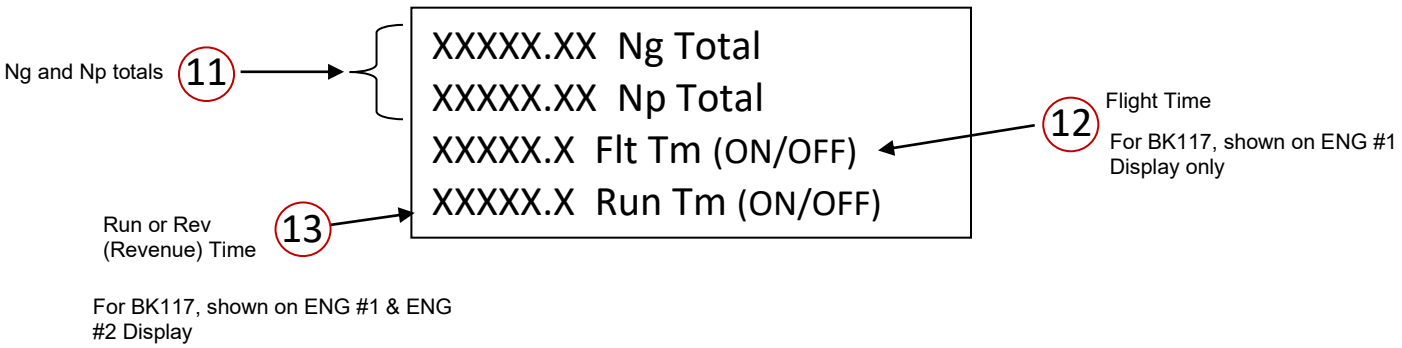


Fig. 2

Power Up Screen

The “Power Up” screen is displayed for 5 seconds after the battery switch is turned on before automatically switching to the first data screen. Pressing the black “Screen” button prior to the expiration of the 5 seconds will switch to the first data screen and then toggle between the First and Second Data Screens. To view the “Power Up” screen again, the battery switch must be recycled.

ITEM 1 – Engine Model Applicability

Indicates which engine model software has been installed on the cycle counter.

After the A/C Battery Switch is turned on, the “Power Up” display screen provides the engine model by indicating, for example, “**LTS101-600 Series**” for the Honeywell 600 series, which includes the A-2, A-3, and A3-A.

ITEM 2 – Honeywell Service Bulletin (SB) Revision Number

Displays the Honeywell Service Bulletin (SB) revision number for which the Cycle Counter software has been designed.

ITEM 3 – Version Number

For the LTS101-600 series and LTS101-650 and 750 engines, there will be a “Ver” or “v” (Version) number displayed here that is applicable to the software installed for a particular model engine. This is based on part numbers used in the Gas Generator (GG) and Gas Producer (GP) of a particular engine build. AKV will install the most conservative “Ver 1” from the factory. With use of the Ground Support Programming Kit P/N CC-GSE, the end user may install other versions available for their LTS101 model once the GG and GP part numbers are known.

Reference the LTS101-600 Series and LTS101-650 and 750 Software Version documents supplied with the GSE to install the appropriate software.

The LTS101-700D-2 and LTS101-850 engine software is only available in a single version; therefore the “Ver X” or “vX” will not be displayed.

NOTE: The optional Ground Support Programming Kit P/N CC-GSE allows for maintenance personnel to install different version of the software, update the cycle counter with current engine cycles from the engine log book and install future software updates. It is most useful when the cycle counter has been initially installed or when an engine change is made and the cycles need to be updated.

The Programming Kit includes a serial programming cable, a USB adapter cable, and a software CD with programming instructions. It allows for specific values (items 10, 11, 12, & 13) to be changed and can be password protected by the end-user to prevent unauthorized changes.

ITEM 4 – AKV Software Revision Number

The Cycle Counter (CC) Software Revision number is identified as Rev X(x) and is the AKV software revision installed in the cycle counter. Any revisions released for use and installed in the cycle counter using the programming kit P/N CC-GSE will be displayed on this screen.

Major changes in the cycle counting algorithm due to a Honeywell SB change or change in operation of the cycle counter are identified with the larger (X). Minor change requirements for basic bug fixes identified with the smaller (x)

First Data Screen

ITEM 5 – Ng, Np speeds and Nr (or Ng Max)

Real time engine speeds in percentage (%) for Ng and Np that will match the tachometer indicators on the instrument panel any time the helicopter is running.

The speed signals for Ng and Np are connected to the cycle counter microprocessor via individual 2-conductor, twisted and shielded wires. These wires are connected in parallel to the tachometer indicator signal wires located behind the instrument panel.

Each signal wire is connected to separate channels on the microprocessor. The analog speed signals from the engine are converted to a digital signal which is scaled to the same designed frequency as the tachometer generators on the engine.

When the aircraft is started, the processor waits for a speed ≥ 50% N1, plus an additional 15 second delay before the speed is considered an actual engine start. After the delay, both Ng and Np speeds are indicated and the cycle counter is in an operational state.

The frequency is continuously monitored for change by the processor and changes linearly as the speed changes.

The cycle counter speeds correspond directly with the tachometer indicator on the instrument panel within +/– 0.5%. The operator can confirm that the cycle counter is operating correctly by observing and comparing the displayed cycle counter Ng and Np speeds with the tachometer indicators.

If displayed in place of Nr, the “Max” indication in percentage (%) is the maximum Ng speed recorded by the cycle counter between manual resets. It is useful for determination of the major penalty count value accrued by the cycle counter “Flt” cycles. However, it is the max Ng between resets which could include multiple flights.

WARNING: If Nr is displayed, do not use the Nr indication for calibration purposes. It is there for reference only.

ITEM 6 – Ng Flt

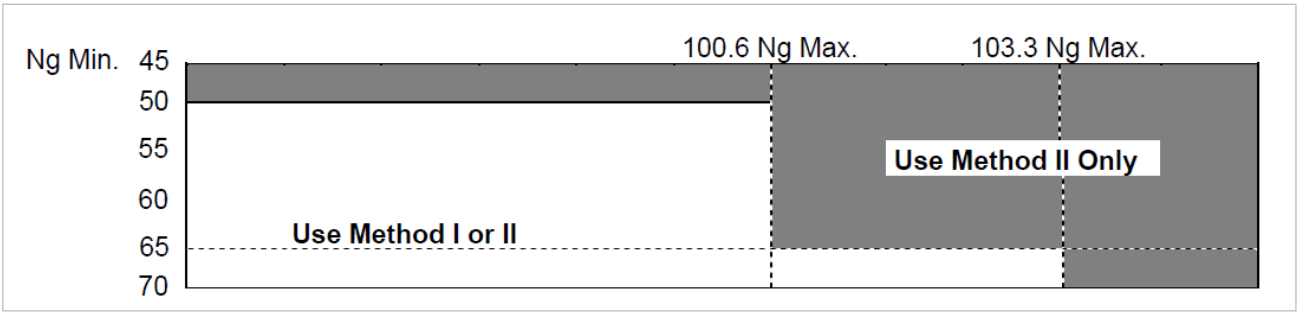
This is the total accumulated Ng (Gas Producer) flight “Flt” cycles between resets. This value will be made up of the total major and minor counts between resets.

It is recommended that the operator record the daily “Flt” values in the flight log at the end of each flight day prior to resetting the cycle counter for the next flight day. If the operator neglects to do this, any subsequent recorded flight cycles are added to the prior values.

Refer to the example flight in **Table 2** for the LTS101-600 series; Each Major cycle count is based on the maximum gas generator speed (Ng) attained between each start and subsequent shutdown. An Ng operation, or Minor cycle count is defined as when the gas generator speed transitions from above 90% Ng to below 80% Ng, with a subsequent rise back up above 90% Ng without shutting down. Penalty values are specified by the appropriate Major and Minor table in the Honeywell Service Bulletin.

WARNING: If you have Gas Generator rotor disc part no. 4-101-015-04/-09, then you will need to **manually multiply the Ng Total on screen 2 by a value of 1.06** to obtain the correct Ng Total. Reference the note at the bottom of table 7, page 25 of the Honeywell SB LT 101-71-00-0002.

The diagram below indicates which Methods must be applied when counting manually; based on Ng minimum and maximum Operational speeds. The AKV Cycle Counter only uses Method II.



SAVINGS COMPARISON BETWEEN METHOD I and II FOR NG (GAS PRODUCER)

This is an example of how the manual Method I compares to using Method II with the AKV Cycle Counter. Refer to Honeywell Service Bulletin (SB) LT 101-71-00-0002.

Example Operations		**Manual Counting** Method I	**AKV Cycle Counter** Method II
10x Starts and Operations up to	96.6%	10 X 1.1 = 11.0	10 X 0.6 = 6.0
10x Ng Operations from 96.6% to	70.0%	10 X 0.2 = 2.0	10 X 0.2 = 2.0
Total Ng Cycles Counted:		**13.0**	**8.0**
Median cycles saved with Cycle Counter = **5.0 or Approx. 40%**			

ITEM 7 – Np Flt

This is the total accumulated Np (Free Turbine) flight "Flt" cycles between resets. This value will be made up of the total major and minor counts between resets.

It is recommended that the operator record the daily "Flt" values in the flight log at the end of each flight day prior to resetting the cycle counter for the next flight day. If the operator neglects to do this, any subsequent recorded flight cycles are added to the prior values.

Refer to the example flight in **Table 3** for the LTS101-600 series; Each Major cycle count is based on the maximum power turbine speed (Np) attained between each start and subsequent shutdown. An Np operation or Minor cycle count is defined as a power turbine speed operation from above 85% Np to below 85% Np with a subsequent rise back up above 85% Np without shutting down. Penalty values are specified by the appropriate Major and Minor table in the Honeywell Service Bulletin.

ITEM 8 – Ng "Ops"

The Ng "Ops" counter corresponds to the Ng partial operations accumulated between resets. This occurs any time the Ng speed transitions from above 90% Ng to below 70 or 75% Ng (depending on the engine software version installed), with a subsequent rise back up above 90% Ng without shutting down. The counter increments by a value of 1 whenever an Ng partial cycle event is recorded. This counter is reset to zero when the red reset button is pressed.

NOTE: It is recommended that the operator record the daily Ng "Ops" values in the flight log at the end of each flight day prior to resetting the cycle counter for the next flight day.

ITEM 9 – Np "Ops"

The Np "Ops" counter corresponds to the Np partial operations accumulated between resets. This occurs any time the Np speed changes from above 85% Np to below 85% Np with a subsequent rise back up above 85% Np without shutting down. The counter increments by a value of 1 whenever an Np partial cycle event is recorded. This counter is reset to zero when the red reset button is pressed.

NOTE: It is recommended that the operator record the daily Ng "Ops" values in the flight log at the end of each flight day prior to resetting the cycle counter for the next flight day.

ITEM 10 – Engine Starts

An engine start is recorded when the Ng speed is ≥50% +15 sec delay. It increments by a value of 1 after each engine start. This value does not reset when the reset button is pressed but continues to accumulate all engine starts.

Second Data Screen

ITEM 11 – Ng and Np Totals

Ng and Np totals are updated when the red reset button is pressed and released and the flight “Flt” values on screen one are added. The “Flt” values are then reset to zero for the next flight.

ITEM 12 – Flight (Mt) Time

This is a timer representing flight time which is also used for determining maintenance intervals. It accumulates time in 0.1 hour (6 minute) increments.

When the earlier software is installed **without** the collective interface (see Pg.1), the Flight “Mt” time starts counting when Ng is ≥91% N1 at which point the A/C is light on the skids and approaching flight. When N1 <75% (idle position) the timer stops counting.

When the newer software installed and **with** the collective interface (see Pg.1), The Flight “Flt” time starts to accumulate when the engine is running and the collective “UP” micro switch is made. When the collective is full-down and the collective micro switch is un-made ie. A/C has landed, the timer stops counting.

Operation of the flight timer and collective up signal can be observed by noting the change from (OFF) to (ON) when the collective switch is made and from (ON) to (OFF) when the collective is full down and the switch is un-made.

NOTE: If the collective micro switch is not installed then install the earlier revision software applicable to your LTS101 model that uses Ng to control the flight time accumulation.

ITEM 13 – Run (Rt) Time

This is a timer representing engine run time. It accumulates time in 0.1 hour (6 minute) increments.

For all software versions installed, the Run “Rt” time starts counting when Ng is ≥50% + 15 seconds (engine started) and stops when Ng < 30% (engine shutdown)

With the newer software installed it will display an ON/OFF indication

End “ITEM” description

Environmental Limitations

The AKV N1 Cycle Counter operating limitations are as follows:
Operating temperature -5 to 50°C
Storage temperature -20 to 70°C

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Engineering

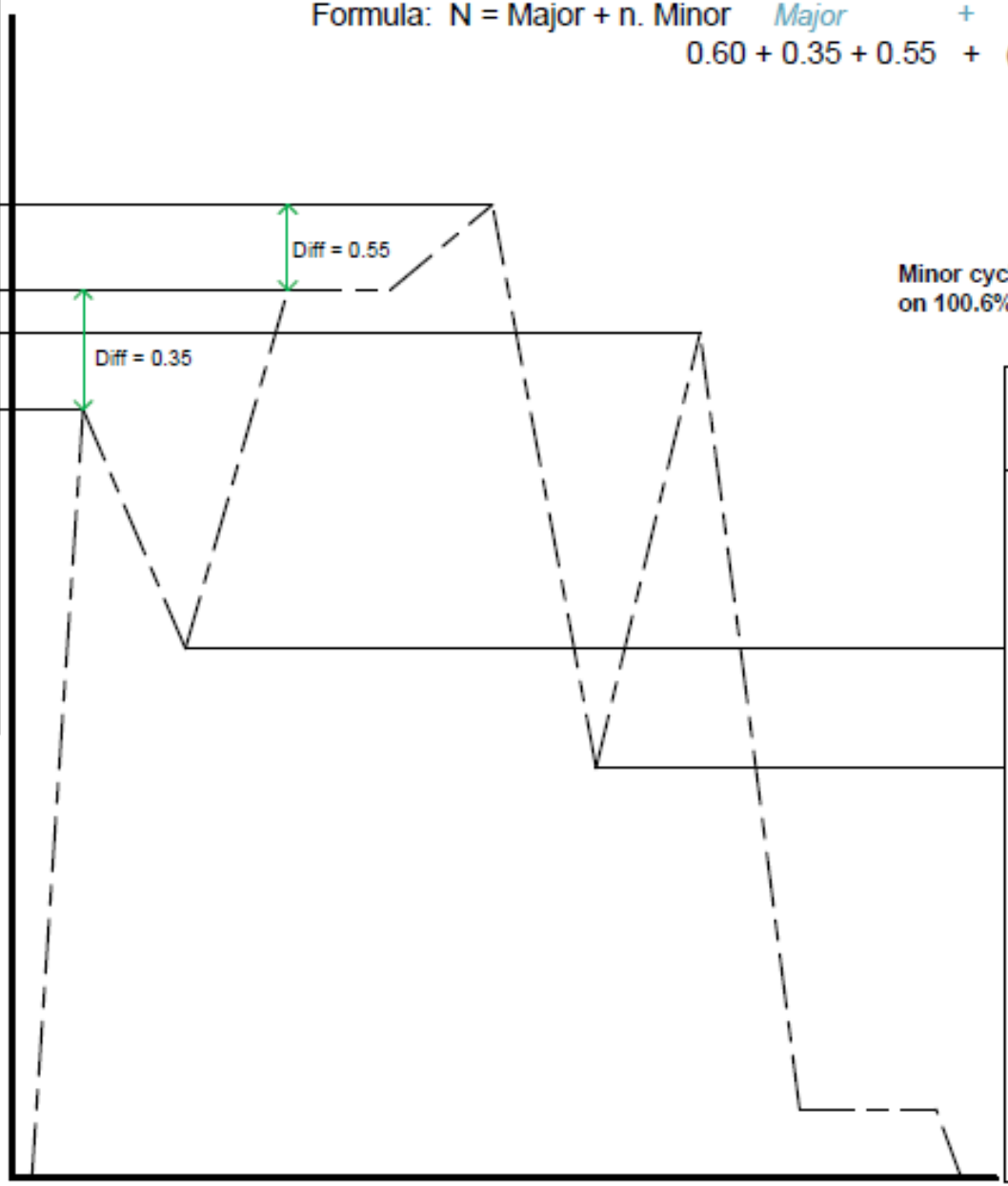
Table 2

(LTS101-600 Series, Major Table 7 and Minor Table 8)

Max Ng	Major
106.1	5.70
104.8	3.00
104.1	2.50
103.3	2.00
102.5	1.50
101.6	1.10
100.6	0.95
99.5	0.80
98.1	0.70
96.6	0.60
94.9	0.55
≥93.2	0.50

Formula: N = Major + n. Minor *Major* + *n. Minor* = *N*

0.60 + 0.35 + 0.55 + (0.20 + 0.30) = **2.00 Ng Cycles**



Min Ng	Minor (Minor cycle factor based on 100.6% Major Cycle)	Minor (Minor cycle factor based on 102.5% Major Cycle)
≤80	0.00	0.00
75		
70	→ 0.20	0.20
65		
60		→ 0.30
55		
50		
≥45	0.30	0.40

"Recommended Method II" AKV Cycle Counter Ng Example Flight

Last Revision: 9-30-2013

Created by: John Tipton 3/03/2008

Form Title: Table 2 (LTS101-600 Series, Tables 7 and 8) ver 1-1

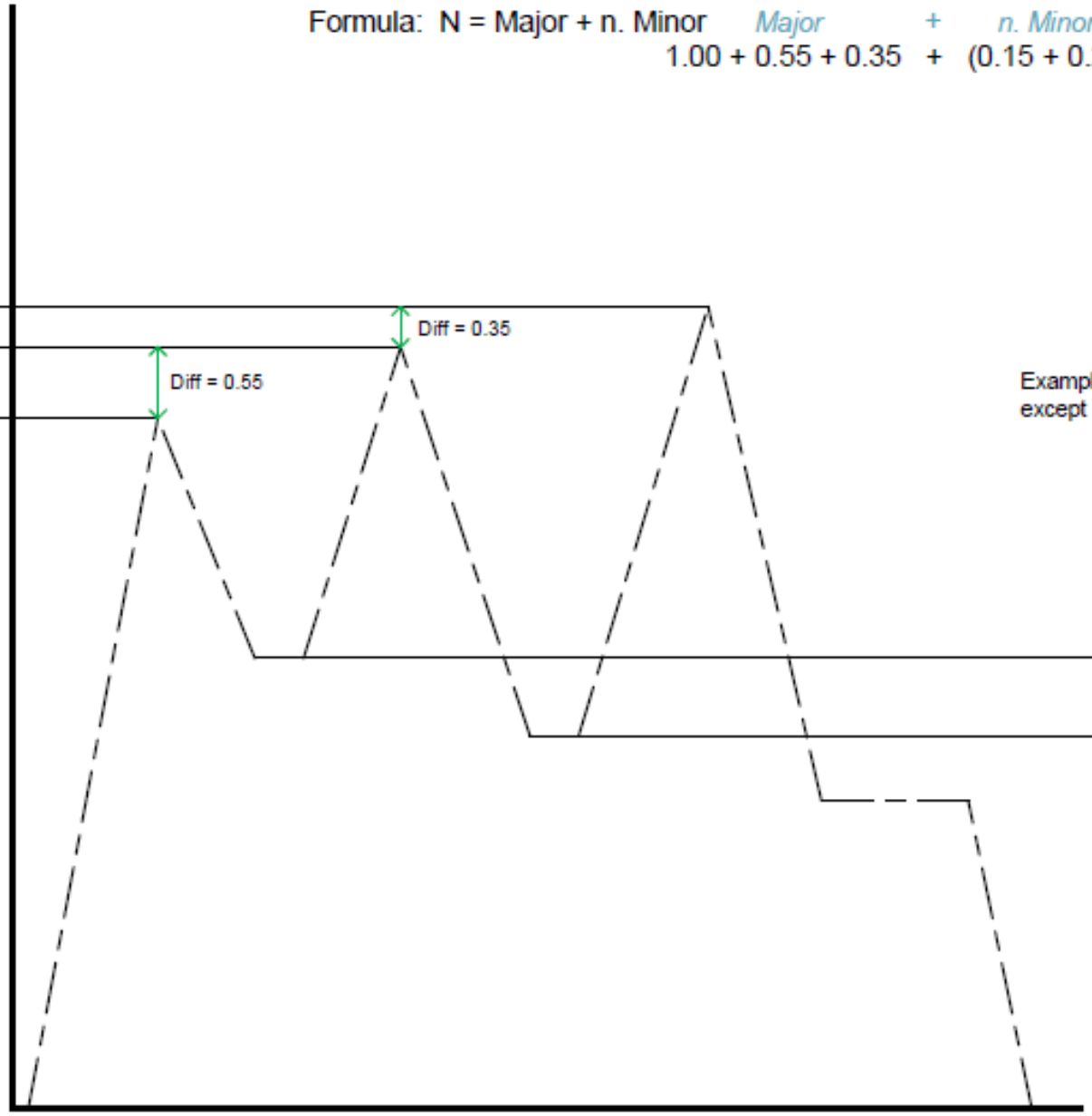
Table 3

(LTS101-600 Series, Major Table 14 and Minor Table 18)

Max Np	Major
110.0	8.00
109.0	6.50
108.0	5.30
107.0	4.35
106.0	3.55
105.0	2.90
104.0	2.35
103.0	1.90
102.0	1.55
101.0	1.25
100.0	1.00
99.0	0.85
98.0	0.65
≥96.0	0.45
<94.0	0.30

Formula: N = Major + n. Minor *Major* + *n. Minor* = *N*

1.00 + 0.55 + 0.35 + (0.15 + 0.20) = **2.20 Np Cycles**



Example uses Table 18, except 700D-2 machines

Min Np	Minor
≤85	0.00
70	0.15
65	0.15
60	0.20
55	0.25
50	0.35
45	0.40
40	0.50
<40	1.00

"Recommended Method II" AKV Cycle Counter Np Example Flight

Last Revision: 9-30-2013 Created by: John Tipton 3/03/2008 Form Title: AKV Table 3 for LTS101-600 Series (Table 14 and 18) ver 1-1

Example Ng Tables Used From Honeywell Service Bulletin

Method II Gas Generator Start and Cycle Counts

Table 7. Major Cycle Factor (Engines With Gas Generator Disc Part No. 4-111-015-XX)

Maximum Ng (Less Than or Equal To)	Major Cycle Factor
93.2	0.50
94.9	0.55
96.6	0.60
98.1	0.70
99.5	0.80
100.6	0.95
101.6	1.10
102.5	1.5
103.3	2.0
104.1	2.5
104.8	3.0
106.1	5.7

NOTE: If the GP turbine rotor disc is Part No. 4–111–015–04/–09, turbine disc cycles are determined by multiplying Ng cycles by 1.06.

Table 7A. Gas Generator Major Cycle Factor
(Engines With Gas Generator Disc Part No. 4-111-062-XX)

Maximum Ng	Major Cycle Factor
93.2	0.3
95.0	0.4
96.0	0.5
97.0	0.6
98.0	0.7
99.0	0.7
100.0	0.8
101.0	1
102.7	1.2
104.1	1.5
104.8	2.2
106.1	4

Table 8. Minor Cycle Factor

GPT Flight/Minor Cycle Factor Matrix
Ng Max. (Less Than or Equal To)

Ng Min (Greater Than or Equal To)	100.6	101.6	102.5	103.3	104.1	104.8
45	0.3	0.3	0.4	0.4	0.5	0.5
50	0.2	0.3	0.4	0.4	0.4	0.4
55	0.2	0.3	0.3	0.4	0.4	0.4
60	0.2	0.3	0.3	0.3	0.3	0.3
65	0.2	0.2	0.2	0.2	0.2	0.2
70*	0.2	0.2	0.2	0.2	0.2	0.2
75*	0.2	0.2	0.2	0.2	0.2	0.2
80	0.0	0.0	0.0	0.0	0.0	0.0

*NOTE: If engine has both Gas Generator Disc Part No. 4-111-062-XX and Titanium Impeller Part No. 4-111-052-64/-65, operator is not required to count minor cycles unless minimum Ng operation is below 70% Ng.

Example Np Tables Used From Honeywell Service Bulletin

Table 14. Insertable Bladed Power Turbine Start and Major Cycle Count
(LTS101-600A-2/-600A-3/-600A-3A/-650B-1A)

Power Turbine Speed % Np	Power Turbine Speed RPM*	Main Rotor Speed RPM*	Operating Cycles
Less than 94.0	34,780	360.8	0.30
96.0	35,520	368.5	0.45
98.0	36,260	376.1	0.65
99.0	36,630	380.0	0.85
100.0	37,000	383.8	1.00
101.0	37,370	387.6	1.25
102.0	37,740	391.5	1.55
103.0	38,111	395.3	1.90
104.0	38,480	399.2	2.35
105.0	38,850	403.0	2.90
106.0	39,220	406.8	3.55
107.0	39,590	410.7	4.35
108.0	39,960	414.5	5.30
109.0	40,330	418.4	6.50
110.0	40,700	422.2	8.00

* For LTS101-600A-2, LTS101-600A-3, and LTS101-600A-3A engines installed in AS 350 aircraft.

Table 18. Insertable Bladed Power Turbine Minor Cycle Count
(LTS101-600A-2/-600A-3/-600A-3A/-650B-1A/-700D-2, LTP101-600A-1A/-700A-1A)

Output Shaft Speed Greater Than or Equal to, % Np (RPM)	Output Shaft Speed Less Than, % Np (RPM)	Minor Cycle Count (Except –700D-2)	Minor Cycle Count (For –700D-2 only)
-	40% (14,800)	1.00	0.80
40% (14,800)	45% (16,650)	0.50	0.60
45% (16,650)	50% (18,500)	0.40	0.40
50% (18,500)	55% (20,350)	0.35	0.30
55% (20,350)	60% (22,200)	0.25	0.20
60% (22,200)	65% (24,050)	0.20	0.15
65% (24,050)	85% (31,450)	0.15	0.05
85% (31,450)	-	0.00	0.00