

Instructions for Continued Airworthiness

Howell Engine Indicators In
Beechcraft King Air 90, 200, 300 and
Piper Cheyenne Series Aircraft
Installed Per STC SA01946LA

Document Number: 201406-30
Revision: IR

Notice

This document must be referenced on Block 8 of FAA form 337 and added to the aircraft permanent record as required by 14 CFR Part 91, §91.417 (a)(2)(vi) when the reference FAA-STC modification is accomplished on eligible aircraft. This document complies with the requirements of 14 CFR Part 23, §23.1529, in accordance with 14 CFR Part 23, Appendix G.

Model Number: _____
Aircraft Serial Number: _____
Aircraft Registration Number: _____



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Table of Contents

Record of Revisions.....	2
List of Effective Pages.....	2
Table of Contents.....	3
1. Introduction.....	4
2. Revisions.....	4
3. Description.....	4
3.1 Instrument Initialization.....	6
3.2 Normal Operation.....	7
3.3 Exceedance.....	7
4. Special Procedures.....	8
5. Servicing.....	8
6. Maintenance.....	8
6.1 Cleaning.....	8
6.2 Removal and Installation.....	8
6.3 Accuracy Checks.....	9
7. Inspection.....	10
8. Troubleshooting.....	10
9. References.....	14
10. Airworthiness Limitations.....	15
11. Assistance.....	15

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1. Introduction

This document provides instructions for the continued airworthiness (ICA) for Blackhawk Modifications, Inc. STC Number ST01946LA which approves the installation of the following types of Howell engine indicators as an entire stack or individual pairs on Beechcraft King Air Model C90, C90A, E90, F90 equipped with PT6A-135(A) engines; Super King Air Model 200, 200C, 200T, 200CT, A200, A200C, A200CT, B200, B200C, B200T, and B200CT airplanes equipped with either PT6A-42, -52, or -61 engines; Piper Cheyenne Model PA-31T, PA-31T1, and PA-31T2 airplanes equipped with PT6A-135(A) engines:

- Interstage Turbine Temperature (ITT)
- Torque
- Gas Generator Tachometers
- Propeller Tachometers
- Fuel Flow (not installed on Cheyenne Series Airplanes)
- Oil Pressure/Oil Temperature

This document supplements or supersedes the basic and applicable King Air Model C90, E90, F90, 200, A200, or B200 Series Maintenance Manual and the applicable Piper Cheyenne Series Maintenance Manual, only in those areas listed therein for the appropriate aircraft model and serial number.

2. Revisions

Each time this ICA is revised or reissued, the revised ICA will be distributed to Owners/Operators using a Service Letter/Bulletin by Blackhawk Modifications, Inc. The revision will include a new Log of Revision page along with the revised pages. The lower left hand corner of each revised page will reflect the revision letter. That portion of text or an illustration, which has been revised by the addition of or change in, information is denoted by a solid revision bar located adjacent to the area of change, and placed along the inside margin of a page. Revision bars show only the information changed within the latest revision.

3. Description

Each original indicator or electronic indicator has been replaced by a two-inch round electronic, micro-processor based single or dual pointer indicator (see Figures 1 and 2).

Each indicator:

- is electrically powered by the DC electrical bus for the engine instruments through a maximum 5 amp circuit breaker.
- indicates the engine parameter based upon a signal from the engine transducers. If originally AC powered, the transducer on the engine has been replaced and is now DC.
- displays the indication via the familiar rotating pointer showing power trends and limitations against a fixed scale plate, but now also provides better accuracy via a digital display.
- includes a two-color (green/red) status LED.

- is backlit and dimmable using the existing engine indicator lighting rheostats. The originally equipped post lights have been removed.

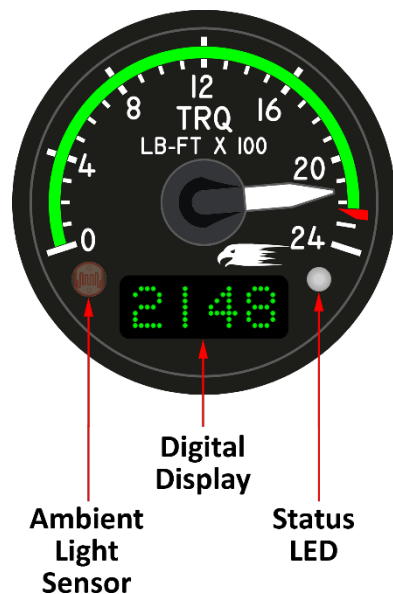


Figure 1 Single Pointer Instrument

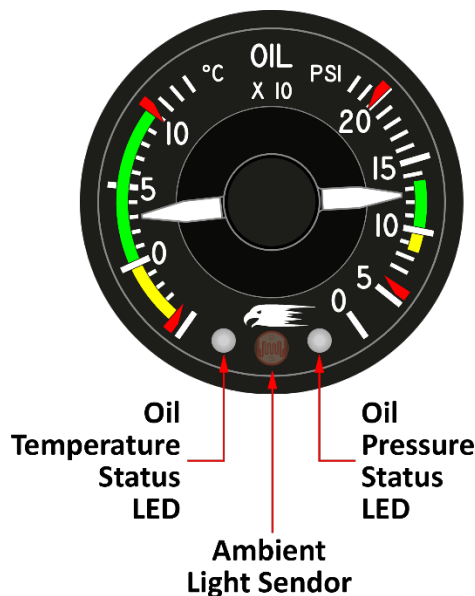


Figure 2 Dual Pointer Instrument

For single pointer instruments, the pointer is powered by a stepper motor, providing fast and accurate instrument response. Likewise, the dual instruments utilize stepper motors to drive the pointers, but drives them through a coaxial shaft arrangement. Because stepper motors are used, the pointers freeze at their current positions when power is removed.

The status LED provides information on fault conditions, engine exceedance for all instruments, and in the case of the dual instruments, operational status. When the dual pointer instrument is not receiving power, the status LED is not lit. When operating, the status LED illuminates GREEN.

When the engine exceeds an established limit (red wedge or red dashed radial), the status LED of all the instruments will flash RED for a period of time then illuminate RED continuously until the engine parameter recedes below (or above if a lower limit has been established) the engine limitation.

All instruments are backlit with cool white LED's and controlled via voltage input from the aircraft lighting system. The backlight is powered via the main instrument power, but the lighting level is controlled or modulated by the input aircraft lighting voltage. If power is removed from the instrument, the backlight will extinguish.

The light level of the digital display and the status LED's is independent of the backlight and is controlled by a photo sensor. The digital display and the status LED's light level respond directly to the ambient light level automatically.

3.1 Instrument Initialization

Upon initial power up, each indicator performs a self-test. During this test and prior to assuming normal operation, the instruments display the following characteristics:

Single Pointer Instrument

Pointer:

- 1) The analog pointer will first find a registration point determined by the internal mechanical stop, and then move to,
- 2) Range/Scale maximum, and then move to,
- 3) Calculated scale zero or range/scale minimum, whichever is lower, and then move to,
- 4) Position according to input signal

Digital Display:

- 1) Displays all pixels for 1 second, then
- 2) Displays parameter code¹ specific to the instrument type for 1 second, then,
- 3) Displays dashes “- - -” for 1 second, then,
- 4) Displays all pixels for the remainder of the test, then displays the primary signal value

Status LED:

- 1) The LED is cycled on red for 1 second, then
- 2) LED is cycled on green for 1 second, then
- 3) The LED is extinguished for the remainder of the test

¹ - The parameter codes for the specific instruments are:

- TORQ – Engine Torque
- ITT – Engine Interstage Turbine Temperature
- NG – Gas Generator Rotational Speed
- NP – Propeller Rotational Speed
- FF – Fuel Flow

Dual Pointer Instrument

Pointer:

- 1) The analog pointer will first find a registration point determined by the internal mechanical stop, and then move to,
- 2) Range/Scale maximum, and then move to,
- 3) Calculated scale zero or range/scale minimum, whichever is lower, and then move to,
- 4) Position according to input signal

Status LED:

- 1) The LED is cycled on red for 1 second, then
- 2) LED is cycled on green for 1 second
- 3) The LED is extinguished for the remainder of the test

If the instrument fails its self-test, one of the following error conditions may be displayed:

Single Pointer Instrument

Status LED:

- 1) Flashes GREEN at a rate of 2 cycles per second.

Digital Display:

The following error codes may be displayed:

- 1) "Err1"
- 2) "Err2"
- 3) "Err3"

Dual Pointer Instrument

- 1) Flashes GREEN at a rate of 2 cycles per second.

In the event that the self-test fails and one of these indications is displayed, the instrument must be considered non-functional and returned to the manufacturer for diagnosis. Record and provide the indication to the manufacturer. Otherwise, the instrument may be considered operational.

3.2 Normal Operation

Upon the successful completion of the system self-test the instruments will display the current engine parameters. On single pointer instruments, the pointer and digital display will display the current engine information. The status LED will not illuminate unless an exceedance condition occurs.

On dual pointer systems, the pointers will display the current engine parameters and the status LED will illuminate GREEN. If the instrument has power and is operational, the status LED will be illuminated, providing a quick visual check of its operational status.

3.3 Exceedance

Caution

When an exceedance indication is observed, take immediate action to return the engine to within the prescribed limits.

An exceedance occurs when an engine parameter exceeds a defined engine limitation. For the single pointer instruments, the limitation is defined as the red wedge or red dashed radial.

When the limitation is exceeded, the status LED will flash RED for a period of time, then turn solid RED until the engine parameter falls below the limitation.

The dual pointer instruments operate identically to the single pointer units, but also provide a lower red wedge. The status LED will follow the same sequence as the upper limitations, but will extinguish when the parameter rises above the lower limitation.

The lower limitation on oil pressure provides a functional verification of its exceedance feature prior to engine start. With the engine not running, the exceedance function should initiate immediately after test. When the engine starts, the exceedance display should extinguish as soon as oil pressure rises above the lower red line.

4. Special Procedures

Refer to the following sections of the approved aircraft flight manual supplement (AFMS) for information on Normal and Emergency operating procedures. The AFMS document number is AFMS 201406, Revision IR, dated 19 February 2015, or later FAA approved revision:

- Section 3: Emergency Procedures
- Section 4: Normal Procedures

5. Servicing

None required.

6. Maintenance

Keep the Howell instruments clean, dry, and away from solvents and fuel.

6.1 Cleaning

The Howell indicator lenses are treated with an anti-reflective coating. Care should be taken when cleaning the lenses to avoid scratches and damage to the coating.

The lenses may be cleaned with the following approved material.

- Mild dishwashing soap (avoid types with hand crème)
- Microfiber cloth

Deviation from these materials is not allowed.

Caution

Avoid using caustic chemicals and sprays such as bleach, acetone, ammonia, chlorine, and other aerosols for cleaning the indicator lenses. The use of unapproved cleaners could damage the anti-reflective coating.

6.2 Removal and Installation

The indicators are either removed or installed identically in accordance with the basic aircraft maintenance manual.

Caution

Do not exceed 8 in-lb of torque when installing the indicators. Excess torque can break the seal of the indicator. If damage to the seal has occurred or is suspected, the indicator should be returned to Blackhawk Modifications for repair.

6.3 Accuracy Checks

Use the procedures outlined in the aircraft maintenance manual to test the display accuracy of each indicator. The display accuracy of each type of Howell indicator is:

Indicator Symbol	Indicator Type	Digital Display Accuracy	Pointer Accuracy
TRQ	Torque	<ol style="list-style-type: none"> ±3 LB-FT from +20°C to +30°C ambient temperature ±7 LB-FT from -40°C to +70°C ambient temperature 	±1 angular degree of the digital indication
ITT	Interstage Turbine Temperature (ITT)	<ol style="list-style-type: none"> ±2°C from +20°C to +30°C ambient temperature ±3°C from -40°C to +70°C ambient temperature 	±1 angular degree of the digital indication
NP	Propeller Rotational Speed	<ol style="list-style-type: none"> ±2 RPM from +20°C to +30°C ambient temperature ±4 RPM from -40°C to +70°C ambient temperature 	±1 angular degree of the digital indication
NG	Gas Generator Rotational Speed	<ol style="list-style-type: none"> ±0.1 % RPM from +20°C to +30°C ambient temperature ±0.3 % RPM from -40°C to +70°C ambient temperature 	±1 angular degree of the digital indication
OIL	Oil Temperature	-----N/A-----	±2°C from +20°C to +30°C ambient temperature
	Oil Pressure	-----N/A-----	±2 psig from +20°C to +30 °C ambient temperature
FF	Fuel Flow	<ol style="list-style-type: none"> ±1 lb/hr from +20°C to +30°C ambient temperature ±2 lb/hr from -40°C to +70°C ambient temperature 	±1 angular degree of the digital indication

If the engine indication accuracy is not within limits always suspect the transmitter first. Check the transmitter for proper signal.

An indication accuracy check may be accomplished for Torque, ITT, or Np. The accuracy test procedures may be found within the appropriate installation procedures documentation for the subject aircraft (see Section 9).

If tolerances are outside of the stated ranges, contact Blackhawk.

7. Inspection

Not required.

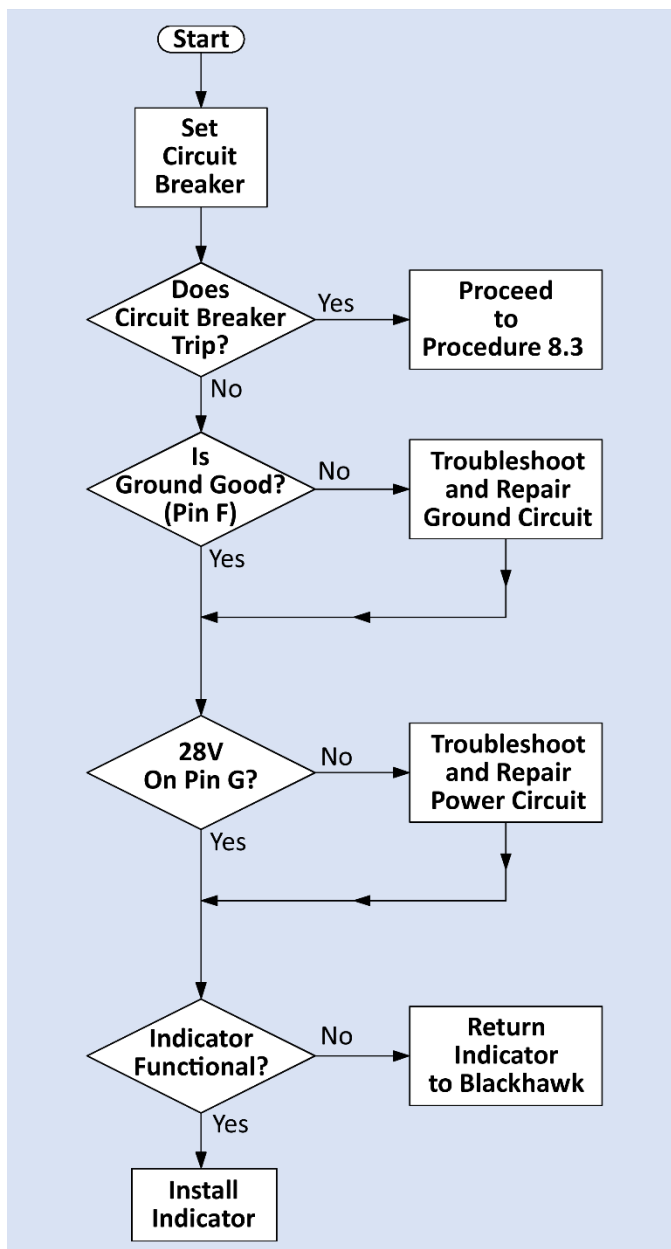
8. Troubleshooting

Note

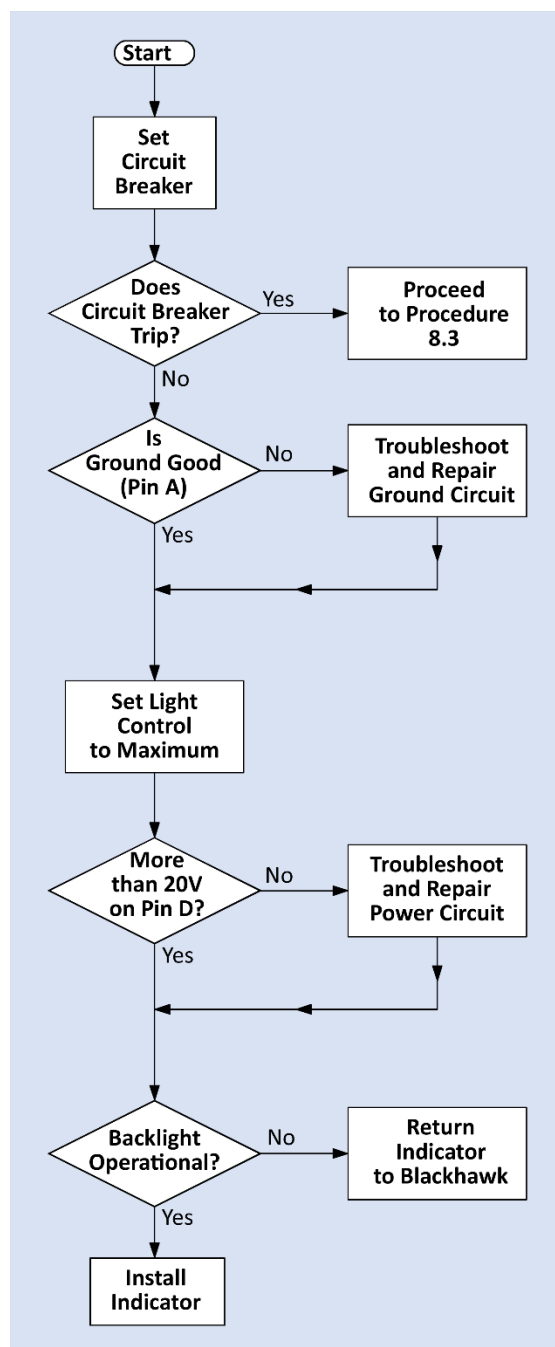
All Howell engine indicators are sealed, cannot be repaired in the field, and should not be opened. If an indicator malfunctions, it should be returned to Blackhawk Modifications for repair and certification. Opening a Howell engine indicator violates and nullifies the component warranty.

	Failure Description	Troubleshooting Action or Procedure	Page
1)	Error Codes	If any error code appears with an indicator, as defined in Section 3.1, return the instrument to Blackhawk for evaluation.	-
2)	Power		
	a) Inoperative Indicator	See procedure 8.1	11
	b) Inoperative Indicator Lighting	See procedure 8.2	12
	c) Circuit Breaker Trip	See procedure 8.3	13
3)	Sensor Out of Expected Range Display	Troubleshoot sensor in accordance with original Maintenance Manual procedures. If transducer checks out, return indicator to Blackhawk.	-
4)	Moisture in Indicator	Return the indicator to Blackhawk	-

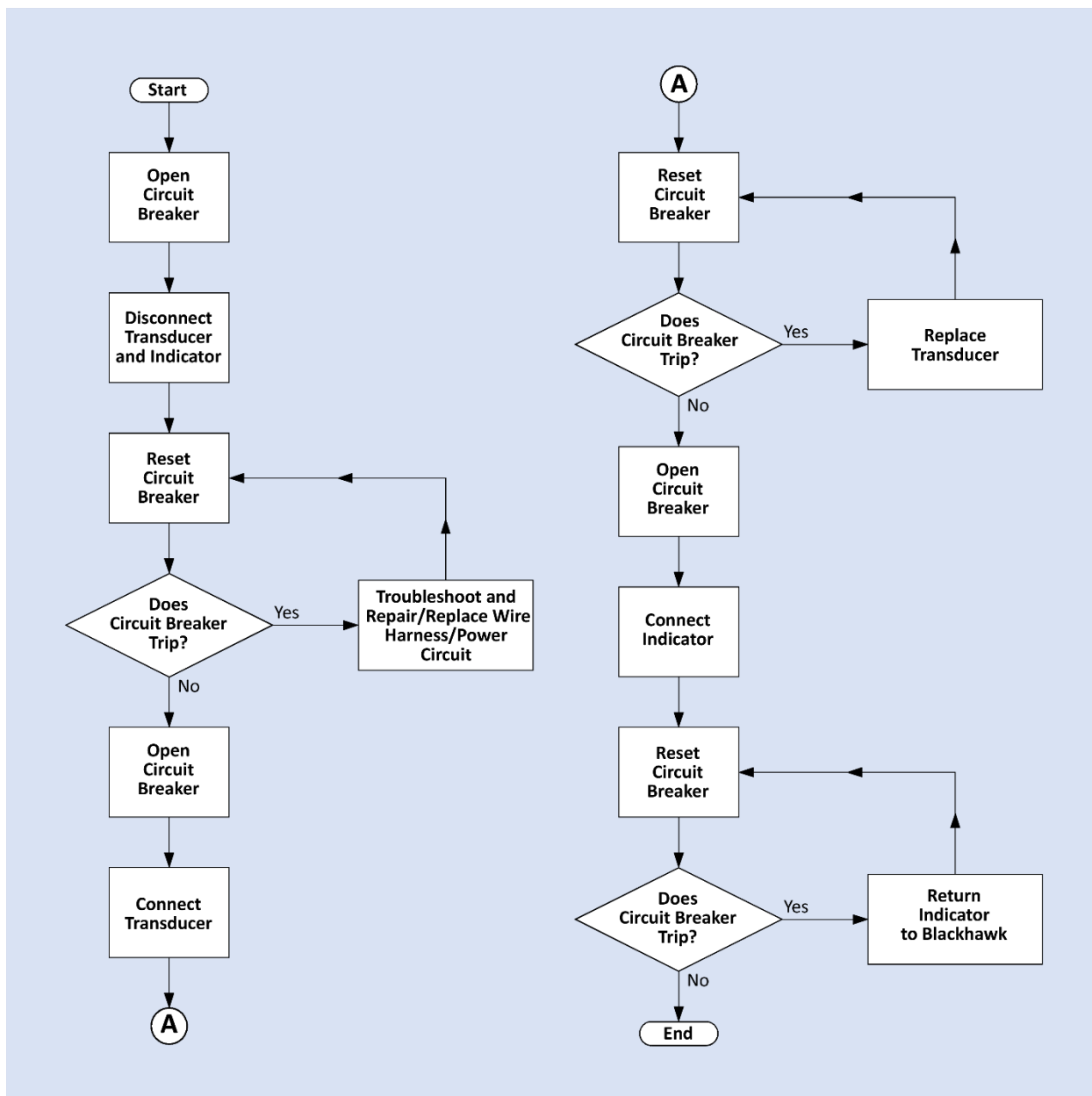
Procedure 8.1 Inoperative Indicator



Procedure 8.2 Inoperative Indicator Lighting



Procedure 8.3 Circuit Breaker Trip



9. References

The following and applicable diagrams should be with the aircraft permanent records. If not, then contact Blackhawk for assistance.

Beechcraft King Air C90, E90, and F90 Series

Drawing Number	Drawing Title
201307-101	Engine Instruments – Acceptable Alternates
90-001	Engine Indicators Installation Procedures (<i>used prior To Sept 30, 2008 installations</i>).
90-002	Placards
90-003	Propeller Tachometer Installation Procedures King Air 90 Series
90-004	Turbine Tachometer Installation Procedures King Air 90 Series
90-005	Torque Indicator Installation Procedures King Air 90 Series
90-006	Interstage Turbine Temperature Indicator Installation Procedures King Air 90 Series
90-007	Fuel Flow Indicator Installation Procedures King Air 90 Series
90-008	Oil Pressure And Temperature Indicator Installation Procedures King Air 90 Series
90-009	Digital Display Monitor Panel Installation Procedures King Air 90 Series

Beechcraft Super King Air 200, A200, and B200 Series

Drawing Number	Drawing Title
201307-101	Engine Instruments – Acceptable Alternates
200-001	Propeller Tachometer Installation Procedures King Air 200 Series
200-002	Turbine Tachometer Installation Procedures King Air 200 Series
200-003	Torque Indicator Installation Procedures King Air 200 Series
200-004	Interstage Turbine Temperature Indicator Installation Procedures King Air 200 Series
200-005	Oil Pressure And Temperature Indicator Installation Procedures King Air 200 Series
200-006	Fuel Flow Indicator Installation Procedures King Air 200 Series
90-008	Digital Display Monitor Panel Installation Procedures King Air 90 Series

Piper Cheyenne Series

Drawing Number	Drawing Title
201307-101	Engine Instruments – Acceptable Alternates
31T-001	Propeller Tachometer Installation Procedures Piper Cheyenne Series
31T-002	Turbine Tachometer Installation Procedures Piper Cheyenne Series
31T-003	Torque Indicator Installation Procedures Piper Cheyenne
31T-004	Interstage Turbine Temperature Indicator Installation Procedures Piper Cheyenne Series
31T-005	Oil Pressure And Temperature Indicator Installation Procedures Piper Cheyenne Series

10. Airworthiness Limitations

Notice

The Airworthiness Limitations Section is FAA approved and specifies maintenance required under §43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

There are no new (or additional) airworthiness limitations associated with this equipment and/or installation.

11. Assistance

For assistance with ICA issues not addressed herein, contact Blackhawk at the following address:

Blackhawk Modifications, Inc.

7601 Karl May Drive
Waco, Texas 76708

Phone: (254) 755-6711

Email: support@blackhawk.aero

Web Site: www.blackhawk.aero