TECHNICAL SPOTLIGHT

Subject: GE CF34 Family of Engines- Igniter Competitive Comparison

Part Numbers by Application:

CF34-3A/3B:	**Champion P/N CH31858-2; Unison P/N 9044740-3 (GE P/N 4096T38P10)**
CF34-8:	**Champion P/N CH31926 (GE P/N 4096T33PO7); Unison P/N 508593-1 (GE P/N 4096T38P15)**
CF34-10:	**Champion P/N CH31900-6 (GE P/N 1374M12P11) or CH31965 (Preferred); Unison P/N 9072215-1* (GE P/N 1374M12P10)**

*** See Champion Competitive Evaluation for CFM56 to compare the CH31900-6 and 9077215-1**

Purpose: To provide design and experienced based evaluation of Champion to Unison Igniters on all CF34 family of engines.

GE CF34-3/-8 Program Background: Champion Aerospace igniters have a long performance history on GE TF34 and CF34 (TF34 Derivative) engine platforms achieving more than 30 years of reliable service experience. The Champion CH31858-1 design utilized significant pedigree/commonality of the sealing features, materials and long life igniter tip design of the Champion CH31900 Series CFM56 igniter. Champion's superior design was called upon to address Unison 9044740-3 competitive part tip liberation that caused GE to implement a 400 hour inspection requirement. The Champion CF34-3A/3B, CH31858-1, design was re-introduced to the fleet in 2003 to eliminate the need for a 400 hour inspection on the competitive product. The Champion design quickly displaced the CF34-3A/3B competitive design as the preferred igniter allowing removal of the 400 hour inspection period. Not only was the inspection interval removed on the Champion design, the installed life capability for CRJ Operators increased to 5,000 hour capability in airlines operating on-condition.

Champion introduced an improved installation/maintainability design with the CH31858-2 igniter in 2005 to address operator concerns with the OEM igniter design configuration (Ref: TB CH31858-2-07-002-R1).

The Champion CH31926 igniter is the longstanding igniter design for -8C/8E engines. This OEM approved design has 90% part and process commonality with the high performing Champion CF34-3 igniter design. The main differences account for baulking requirements between applications. It also realizes the significantly longer service life over the competitive design.

Champion CF34-3/-8 Family of Engines Igniter Advantages: The Champion igniter designs for the CF34 family of engines are based on more than 30 years of experience in CFM56-2, -3, -5, and -7 applications.

Design advantages include:

- Highly Pedigreed Design; 90% Common Parts between CF34-3 and -8 igniters
- Advanced Outer Shell Sealing Feature Used on GE CFM56 and CF6 Igniter Designs
- Predictable wear and erosion pattern without tip loss due to electrical erosion (See **Figure 1** & **2**)
- No floating installation nut (-3A/3B) to cause assembly issues/igniter damage

Operational advantages include:

- Demonstrated extended on-wing life (5,000 hours) well beyond OEM requirements
- Reliable inspection procedures and techniques
- Reduced maintenance costs thru extension of inspection intervals
- Lower igniter consumption/usage rates- Predictable Maintenance

Competitive CF34-3/-8 Igniter Design/Operational Disadvantages: The Unison CF34 family of engines igniter design has exhibited legacy unit issues such as:

- Variable on-wing life expectancy
- Unpredictable wear and erosion pattern
- Complex and unreliable inspection procedures
- Inherent side wall erosion and burn-thru design (See **Figure 3** & **4**; Same issue on CFM56)
- Recurring inspection intervals due to possible tip loss / turbine blade damage.
- Additional maintenance costs for inspections
- Calibration requirements for inspection pliers
- Potential turbine blade damage
- Wear / reject criteria confusing and costly
- Required tooling at additional cost; Tooling damage easy and frequent
- Higher igniter consumption/usage rates

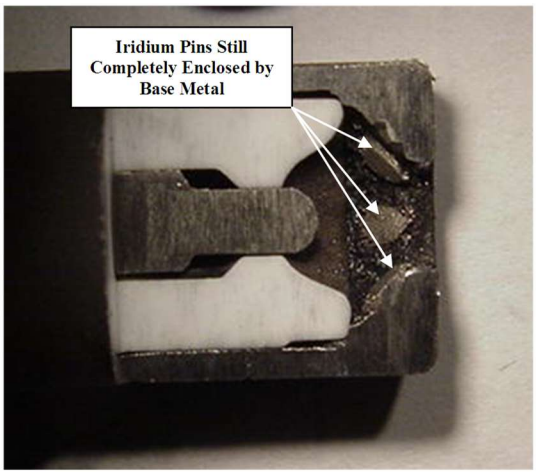

Figure 1: Champion Style Sectioned Tip

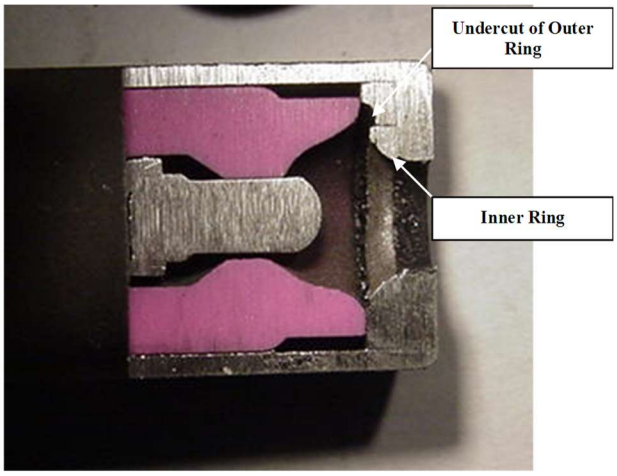

Figure 2: Unison Style Sectioned Tip

Figure 1 above demonstrates the Champion tip design provides consistent sparking to the 6 Iridium Pins embedded in the firing end shell and considerably lower insulator erosion. This leads to lower spark path length and ultimately ensures effective Wet Spark performance at this level of wear. It also ensures continued consumption of the highly erosion resistant Iridium Pins to maximize spark life, and

therefore, Igniter installed life. The Champion CF34-3, -8 and -10 igniters incorporate this design configuration as long life igniters. The Unison Igniter erosion of the insulator permits undercutting of the erosion resistant inner ring and consistently sparks to the outer ring, which is a less erosion resistant feature as shown in **Figure 2**. This limits life in the igniter and can even lead to tip liberation as shown in **Figure 3** and **4** below.

Figure 3: Unison Sidewall Erosion

Figure 4: Unison Tip Loss from Sidewall Erosion

Champion CF34-10 Igniter Advantages: The GE CF34-10 engine uses the same igniter as the CFMI CFM56 Family of Engines. The competitive advantages of the Champion IPC listed CFM56 and disadvantages of the competitive designs are consistent with the -3 and -8 igniters as discussed above. The CF34-10 application in many cases has exhibited higher than expected combustor temperature conditions that cause severe igniter tip thermal distress. This thermal stress has led to tip swelling/flaring in the competitive design requiring use of a special tool to remove the igniter from the engine. Fortunately, Champion has an additional FAA-PMA approved igniter design, **CH31965**, which provides additional temperature capability using an advanced super-alloy to survive extreme engine conditions preventing tip swelling/flaring. This unit is also a lower cost alternative to the IPC listed designs, yet has reliable performance at or above 2,500 cycles. The Champion Sales and Engineering team works with operators to extend the igniter life to optimum levels with consideration for life, reliability, safety and overall cost of ownership.

A 2011 Champion RMA Report, **CH327.I.RMA.27004**, is the best example of the stated Champion igniter capabilities overmatch with side by side performance comparison with a major US operator. Fourteen igniters (6-Champion, 8-Unison) were evaluated. Specific details of the installation are as follows in **Table 1**:

Igniter #	Part Number	Serial Number	Engine Model	Position on Engine	Igniter Hours*	Igniter Cycles*	Comments
1	CH31965	09001068	CF34-10E	#2 engine; O/B igniter	2867	2444	
2	CH31965	08030529	CF34-10E	#2 engine; I/B igniter	2867	2444	
3	CH31965	09001063	CF34-10E	#1 engine; O/B igniter	2891	2463	
4	CH31965	09001062	CF34-10E	#1 engine; I/B igniter	2891	2463	
5	CH31965	10045990	CF34-10E	#1 engine; RT igniter	2891	2529	
6	CH31965	10045949	CF34-10E	#1 engine; LT igniter	2891	2529	
7	9072215-1	JP758	CF34-10E	Left igniter	2966	2469	Exceed Max Tip Dia
8	9072215-1	JP797	CF34-10E	Right engine; I/B igniter	2966	2469	Tip flared. Special tool required for removal.
9	9072215-1	HY709	CF34-10E	Unknown	2649	2304	Exceed Max Tip Dia
10	9072215-1	GW550	CF34-10E	Unknown	2649	2304	Exceed Max Tip Dia
11	9072215-1	M7975	CF34-10E	LH engine; I/B igniter	2759	2417	Tip flared. Special tool required for removal.
12	9072215-1	M7980	CF34-10E	LH engine; O/B igniter	2759	2417	Tip flared. Special tool required for removal.
13	9072215-1	UNJLA126	CF34-10E	Unknown	1318	1109	Oxidation on Tip
14	9072215-1	UNJLA127	CF34-10E	Unknown	1318	1109	Oxidation on Tip

Table 1: CF34-10E Igniter Installation Details

The resulting firing end conditions of the parts at the end of the performance effort are shown in **Figures 5** and **6**. All Unison igniters exceeded the maximum tip diameter of 0.500" allowance by GE Specification due to thermally induced tip swelling.

Figure 5. Champion Igniter Tips Exhibiting No Thermal Distress

Figure 6. Unison Igniter Tips Exhibiting Severe Thermal Distress