Aviation Service Manual AV6-T

Leads/Igniters

$3.00

CHAMPION®

AVIATION PRODUCTS

Bringing Power to Flight ®

Purpose

This service manual presents recommended service, handling and reconditioning practices to assure economic, satisfactory operation from Champion aviation leads and igniters. Proper service and handling can help improve performance and reliability between replacement periods, while reducing unscheduled or emergency replacements. Included are useful references to supplemental Champion publications.

FAA/PMA-Approved

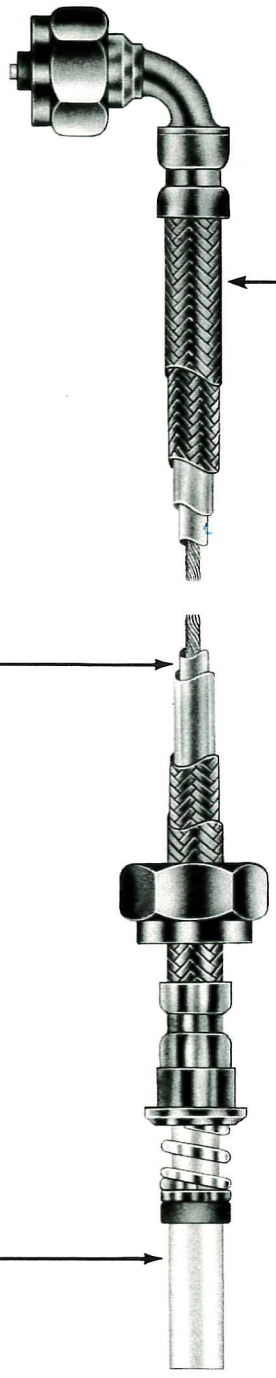
Champion aviation products are manufactured in accordance with standards established by the Federal Aviation Administration.

Table of Contents

Leads

Product Features

Contact assembly provides sure sparks and clean, positive contact between lead, igniter and exciter.



Military-grade stainless steel shielding provides positive RFI protection and resists abrasion.

Core assembly meets stringent OEM and military requirements and provides maximum spark efficiency and insulation value.

Lead connections meet ARP (Aerospace Recommended Practices) 670 standards. Contact assemblies are gold or silver plated to prevent welding of the lead socket to the ignition connector pin.

Inspection and Maintenance

Function

The purpose of the turbine ignition lead is to transfer electrical energy from the ignition source, the exciter, to the igniter plug by means of a radio frequency interference (RFI) shielded conductor assembly. Components critical to proper functioning of the ignition system include the internal, center wire of the lead, its outer shielding, contactors and threaded fittings. The lead assembly also provides mechanical and environmental protection for the conducting components.

Regular, preventive maintenance helps avoid costly, unscheduled maintenance caused by worn turbine ignition leads. Often, cables that do not appear worn – but may have poor connections or weak shielding – can actually be about to fail. Champion supplies the turbine aftermarket with top-quality, cost-effective replacement leads, as well as offering a lead overhaul program, a unique maintenance alternative. Whether you choose overhauled leads or new FAA/PMA-approved replacement leads, you're assured of prompt delivery and maximum reliability.

Inspection

Visual inspection of the ignition lead assembly will usually reveal the need for functional testing, more detailed examination or outright replacement.

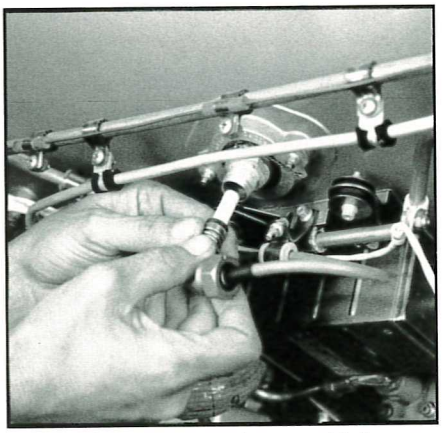
First, inspect the shielding while the lead is in place on the engine with ends connected. This examination may reveal clues to functional problems, such as areas where the lead has been chafed or pinched. Also take note of missing or improperly located lead support clamps and any evidence of heat damage.

After completing your in-place inspection, uncouple the lead at the igniter plug end, observing any unusual disconnection force. The exciter end should then be uncoupled and inspection accomplished as recommended for the igniter end.

CAUTION: Before uncoupling lead, remember that a dangerous electrical charge may be stored in the ignition exciter; , therefore, ground the conductor carefully when disconnecting the lead.

Turbine Lead Connectors

Pin-and-socket connectors such as those used on Pratt & Whitney-Canada or Garrett engines require special attention when connecting or disconnecting leads. The connector assembly must be inserted or removed in a straight line to ensure that the pin and socket are not distorted. In addition, hold the shielding in place when tightening or loosening the coupling nut to prevent the lead from kinking or twisting. Be sure to check for stripped or damaged threads.



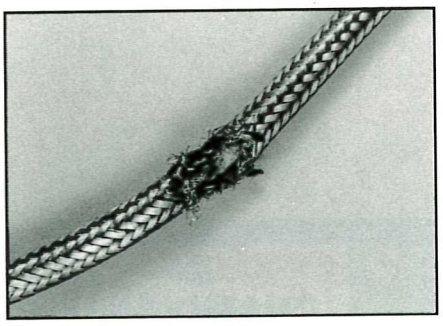
Insert/remove connector assembly in a straight line, and avoid twisting or kinking the lead during uncoupling.

Cleaning

Clean the contact assembly as required using a paper towel with isopropyl alcohol and/or a low-pressure air gun. Cleaning solvents such as MEK, acetone and wood alcohol may be incompatible with the contact assembly insulators or metal surfaces and are not recommended.

Key Rejection Criteria

Certain conditions observed during lead inspection are cause for rejecting the lead and replacing it with a new or overhauled Champion/Livingston lead. Note the condition of the shielding at the coupling ferrule joint. Broken or frayed wire strands can degrade the ground-return path necessary to the ignition function and can increase RFI emission levels. A lead with more than four broken shielding wire strands should be replaced.

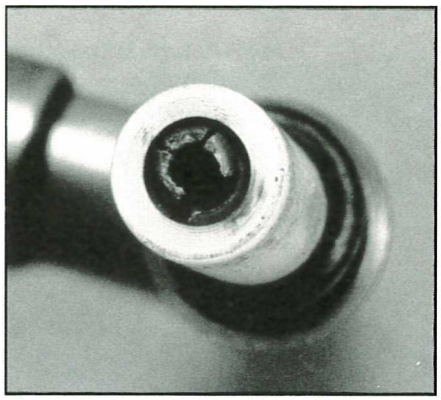


Frayed shielding with more than four broken wire strands indicates the lead should be replaced.

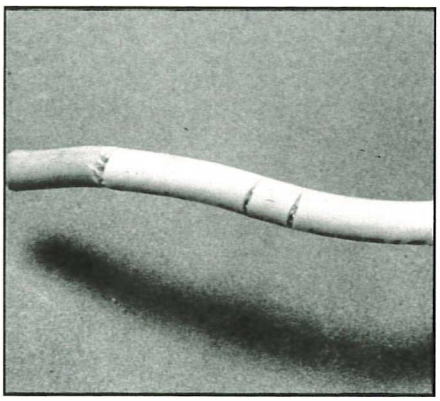
Inspection and Maintenance

Contact Socket Condition

The contact socket should be inspected for evidence of corrosion or electrical arcing. Examine resilient seals and insulators for dielectric breakdown or physical deterioration. Aircraft recommended practice (ARP) 670-2M and ARP-3M terminal assemblies should be tested for contact socket tension and seal integrity by using the appropriate lead tension gauge. CT496 is used for 2M terminal contact and seal integrity. CT497 is used to verify contact pressure for the 3M Terminal.



Socket arcing.



Cracked inner core.

Removal and Installation

CAUTION: When working with turbine ignition leads, always handle with care.

The proper installation and removal of ignition leads is important to the long-term life and coupling ability of the cable.

Never install or remove a lead by holding the cable and nut rigid while rotating the igniter or exciter. This action will result in a twisting of the inner conductor until the insulation is separated. This type of separation will result in a dielectric failure.

The use of a petrolatum product (grease, etc.) to reduce contact sticking is not recommended, as it will further deteriorate the silicone wire insulation, resulting in reduced strength and life of the insulating material. We suggest the following procedure for lead removal/installation.

Removal

Always disconnect the lead from the igniter first, using caution to prevent twisting of the lead assembly. Remove lead connector from igniter or exciter in a straight line, avoiding any side load pressure on ceramic igniter components.

Installation

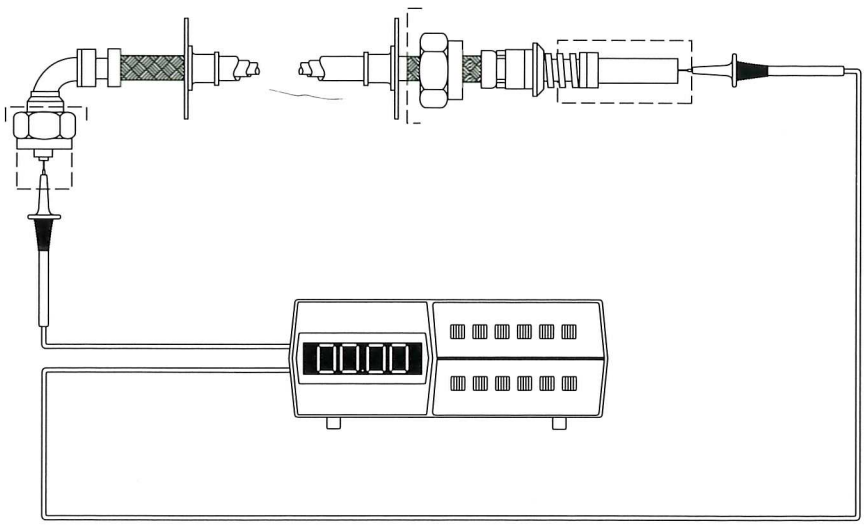
Install igniter and/or exciter first. Never install igniter on a lead by holding the cable rigid while rotating the igniter. Install lead connections in a straight line.

Testing

Leads that appear to be in marginal condition as a result of the visual procedures should be tested for continuity using an ohmmeter capable of measuring low resistance. A typical ignition wire in acceptable condition will have a resistance of less than 0.005 ohm per foot.

An insulation breakdown test should also be made on the lead using a high-potential leakage tester. An instrument capable of applying a 10kVdc potential to low-tension ignition system leads and 20kVdc to high-tension ignition system leads is required for this test procedure. A low-tension ignition uses semiconductor igniter gaps such as Champion CH-34055, while a high-tension ignition has surface gap igniters like Champion CH-31547C.

Test Probes



A resistance reading greater than 0.005 ohm per foot indicates the lead should be replaced.

Inspection and Maintenance

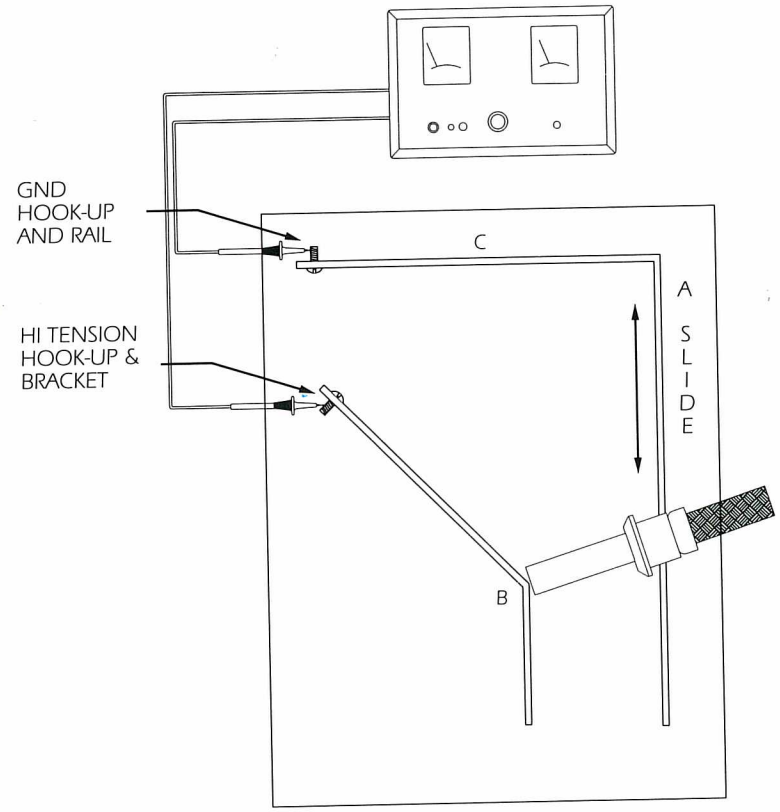
Corrective Action

Ignition leads which exhibit external deterioration or any of the faulty conditions described, or which fail the continuity or leakage tests, require corrective action. Replacement of individual lead components or patching of outer shielding is not recommended. Lead rewiring kits are usually available through the manufacturer and should be used only in accordance with the appropriate service manuals.

New or factory-overhauled leads are available through Champion aviation distributors for many engine applications and offer the preferred corrective action.

High-Potential Leakage Tester (Insulation Resistance)

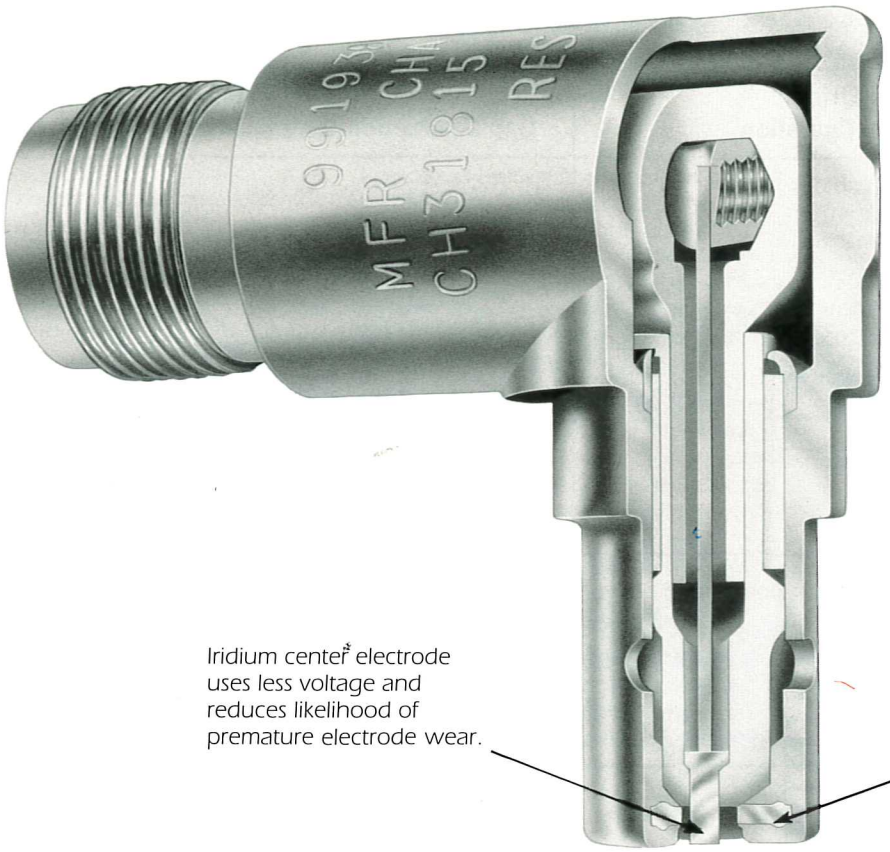
The measured leakage should not exceed 10 microamperes for leads in either system, measured in 5-second increments. Typical instruments include the Peschel high-voltage tester MOD S-30Y.



1. Hook up fixture to test instrument.
2. Set instrument to required potential.
3. Place ferrule or shield of lead assembly against GND rail at point 'A'.
4. Slide lead assembly towards point 'B' until conductor contact is made with hi-tension bracket.
5. Check indication on meter for specified requirement.
6. Slide lead back to point 'A' tilting conductor towards point 'C'.

Igniters

Product Features



The longer life Champion iridium igniter used in the Garrett TFE731 series engine.

Iridium center electrode uses less voltage and reduces likelihood of premature electrode wear.

Four iridium pins provide maximum resistance to spark and heat erosion.

Function

Unlike spark plugs, relatively little standardization of igniters exists in the aviation industry. Basically, igniters are functionally designed for a particular burner configuration and are not suitable for other burner designs. Champion turbine igniters cover over 300 different engine designs and are OE on: Allison, Garrett, General Electric, Pratt & Whitney, Sundstrand/Turbomach, Teledyne, Textron Lycoming, Williams International, Westinghouse, Rolls-Royce, CFM International and SOLAR.

Servicing procedures for turbine igniters also vary considerably, so we have not attempted to cover all specifics of each type. For example, cleaning the firing end on some igniters is a practical function, while on others, cleaning the firing end will make the igniter completely unusable. Also, carbon deposits which cause misfiring in piston engines actually improve the firing capability of certain igniters. With these and other prevalent differences, servicing must be tailored to meet the specific igniter configuration.

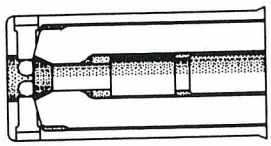
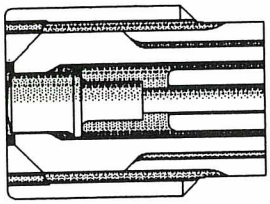
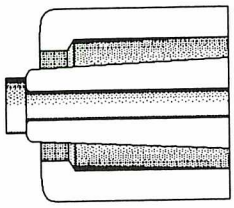
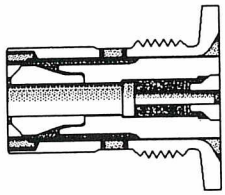
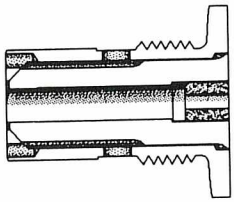
In general, igniters are used only for starting fuel combustion. The combustion process is self-sustaining, and the igniter is normally at rest during engine operation. However, some engines use continuous ignition to provide flameout protection under specific operating conditions such as take-off and climbing. This practice subjects the igniter to severe electrical stress and accelerated erosion, adversely affecting the useful life of the igniter and increasing frequency of service required.

Specific operational, maintenance and inspection procedures for igniters and ignition systems are available in aircraft and engine manuals. Champion highly recommends their use to obtain specific details that apply to the particular requirements of any given model engine or aircraft.

The instructions that follow are generally confined to igniter servicing once the igniter has been removed from the engine. However, we have included some cautionary notes and guidelines on igniter removal, installation and operational checks which should be emphasized.

Basic Igniter Types

Illustrated below are six basic igniter firing end configurations used on current commercial aircraft igniters. Specific Champion igniter types shown correspond to a particular firing end type.

Gap Description	Typical Firing End Configuration
High-Voltage Recessed Surface Gap (Long Life)	
High-Voltage Surface Gap	
High-Voltage Air Gap	
Low-Voltage Surface Gap (Solid Semiconductor)	
Low-Voltage Shunted Surface Gap	
Low-Voltage Glow Coil Element	

Igniter Replacement Gaskets

M-677 -	FS118-1, FS153-1, CH31547C, CH31615 (6800087)	**CH63038 -**	CH31753A, CH31773 (6800848) (nickel)
CH63008 -	FHE205, FHE267-2A (6800148)	**6800847 -**	CH31753A, CH31773 (cemented)
CH63037 -	AA138S (6800158) (copper)	**6800948 -**	CH31772A, CH31785, CH31806

General Servicing Information

Operational Check

All igniters except the glow plug variety emit a sharp, snapping noise when firing. The higher the energy of the ignition system, the louder the spark, although engine cowling suppresses the noise level considerably.

When performing operational checks, the cockpit attendant should turn on the ignition while the mechanic stands to one side of the tail pipe. If steady pulse firing is heard from both igniters, they are operating satisfactorily.

Removal Precautions

Exercise extreme care when removing igniters for visual inspection, servicing or replacement. The electrical charge which may be stored in the condenser of high-energy ignition units is potentially lethal. It is essential that you follow the safety precautions exactly as presented in the engine manual. For example, some manuals recommend disconnecting the low-voltage primary lead from the ignition exciter unit and waiting at least one minute before disconnecting the high-voltage cable to permit the stored energy to dissipate.

Inspection

Remove all residue from the exterior shell before inspection, using a dry cloth or fiber bristle brush. Do not, under any circumstances, remove any deposits or residue from the firing end of low-voltage igniters. The firing end can be cleaned to aid inspection only on glow plugs and high-voltage igniters.

Visually inspect the igniter for mechanical damage. Reject the igniter if it shows thread damage, cracked or loose ceramic in the terminal well, or chipped, cracked or grooved ceramic in the firing end insulator. Also discard the igniter if wrench hex or mount flange is physically damaged, or if the electrode or shell end is severely burned or eroded.

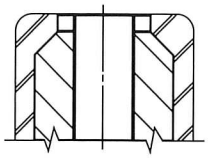
Igniters that are permitted to remain in service after exceeding recommended wear limits may cause problems, even though they appear to be firing reliably. If worn beyond recommended limits, igniters exceed their ability to retain internal parts, therefore allowing the combustor or combustor liner to apply excessive side loads or chafing pressure upon them. Such loading and pressure could fracture the insulator and discharge fragments into the combustion chamber, causing costly engine damage.

Igniters that may be firing reliably for engine starting might not be capable of firing when required to relight the engine after a flameout at altitude, because of higher voltage demands. Also, voltage demands will be much higher to fire a worn igniter, thus placing far greater stress on the total igniter system and leading to premature lead or exciter failure.

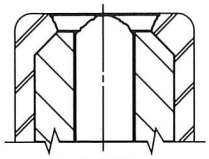
Check the engine manual or applicable Champion technical bulletins for limits on acceptable electrode erosion. Dispose of any igniter that exceeds wear limits or, in your judgment, would exceed these limits before completion of an additional scheduled operating period.

Electrode Erosion

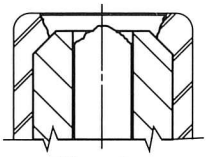
Low-Voltage Series Igniters



New Igniter



Partial Wear



Worn Out

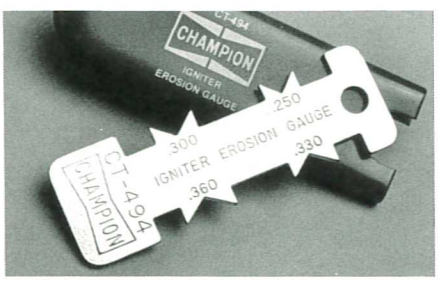
AA Series Igniters

Ground electrode wear on certain AA Series igniters used in Pratt & Whitney engines can be accurately determined by using Champion measuring tool part no. CT-492 shown below.

Insert the feelers just within the firing end opening and expand by depressing the handles. Then position the feelers against the underside of the ground electrode. The amount of movement will provide an accurate wear indication on the telescoping stem scale located between the handles. The ratio of movement between the feelers and stem scale is 3.5:1. Thus, a 0.010 wear multiplies to 0.035 on the indicator scale.

Graduated index markings on the stem scale show percentage of wear according to the following table. Discard any igniters at maximum wear limit.

With Tool Handles Depressed and Stem Scale at:	% of Electrode Wear	
	AA33S Igniter	AA63S, AA72S, AA134S Igniters
Green Index	50% Wear	33-1/3% Wear
Yellow Index	Maximum Wear Limit (Discard)	50% Wear
Red Index	—	Maximum Wear Limit (Discard)



Surface Gap Igniters

Electrode or gap wear on most popular Champion general aviation-type igniters can be accurately determined by using the Champion CT-494 igniter erosion gauge shown below. Determine the maximum wear limit for the igniter by referring to the table which appears on the gauge's protective sleeve. If the appropriate tab fits the inside diameter of the firing end shell, the igniter has exceeded its maximum recommended wear limit and should be replaced.

Replacement within recommended wear limits ensures that the igniter will retain its structural integrity, preventing potential damage to major engine components. Additionally, regular igniter replacement guarantees the capability of a normally functioning ignition system to relight after experiencing flameout.

CT-492 Erosion Measuring Tool.

Reconditioning

Terminal end insulator wells should be cleaned with a cotton or felt swab approximately 5/8" x 3/16" in size, saturated with Stoddard Solvent, wood alcohol or methylethylketone. Do not use carbon tetrachloride. Grasp the swab with a slotted wood or plastic holder to clean the terminal well and contact, with the swab projecting slightly beyond the end of the holder for safety.

If you cannot remove the stains from the terminal well insulator with solvent, we recommend abrasives such as Kennecott Company's Aloxite at approximately 325-mesh sieve fineness, Bon Ami, or finely powdered flint. Dip the swab in solvent and then in the abrasive. Scrub the terminal well insulator wall with a twisting motion until the stain has been removed. Wet a second swab with solvent only and clean out all residue. Then, blow the terminal well dry with an air blast.

Clean the connector seat at the top of the shielding barrel to assure a satisfactory seal and shield bond on the ignition lead when installed. If solvent alone does not remove the dirt and corrosion from the beveled edge, use a fine-grained sandpaper to do so. Do not use emery cloth or paper. When sanding, hold the igniter upside down to keep abrasive particles out of the terminal well. After cleaning, thoroughly blow out the terminal well with an air blast.

Examine the clean terminal well thoroughly for insulator cracks or terminal damage and reject those with physical faults. A lighted magnifier is recommended for accurate inspection.

Firing End High-Voltage Series) Reconditioning

To clean the firing end and lower shell assembly, use any standard dry or wet abrasive cleaner. If the entire igniter will be exposed to the abrasive blast, make sure the terminal end is plugged with a rubber stopper before abrasive cleaning.

If you don't close the terminal end, trapped abrasive could cause flashover failure.

If the igniters were cleaned with liquid abrasive, wash thoroughly in clean running water. Then bake igniters at 200°F for two hours to remove all traces of moisture. If dry abrasive was used, blow off loose abrasive with an air blast.

Firing End (Glow Plug) Reconditioning

If glow plug element has carbon deposit buildup, proceed as follows.

- Immerse element end of glow plug in cold carbon remover as required to loosen carbon deposit.
- Brush off loosened carbon with a soft nylon or fiber brush. Never use a metal brush – it will damage the oxide insulation coating on the element coils.
- Rinse element thoroughly in hot running water. Blow dry with an air blast.

After reconditioning, visually inspect the element for possible fused areas as shown in the following photographs. The fusing of element coils is a random condition caused by combustion-deposit bridging or over-wattage surges.

Initial or early state of fusing. Usually found acceptable by functional testing.

Advanced, more extensive fusing. Likely to be found unacceptable by functional testing.

Firing End (Low-Voltage Series)

Do not, under any circumstances, remove any deposits or residue from the firing end of low-voltage series igniters.

Servicing Information

Electrical Testing

High-Voltage Series Igniters. Subject the igniter to a 20,000-volt source with the firing end pressurized to 20-25 psi. Steady firing across the gap indicates the igniter is satisfactory for use.

Low Voltage Series. Electrically test at normal, open air pressure using standard engine ignition system for the series. Use caution in handling these high-energy systems. Steady firing across the gap indicates the igniter is satisfactory for use providing wear limits haven't been reached.

AGF2 Glow Plug. Attach glow plugs to engine ignition system leads and switch ignition ON. The glow plug element should heat up to a bright yellow color at 8 v at 8 amps for 8 seconds. Acceptable maximum fused area limit is 1/8" x 1/32" (one only). Any plug exceeding this limit should be replaced.

Installation Information

Because igniter installation mountings vary extensively, no standard installation procedures can be applied. Consult the instruction manual for the particular engine model for specific igniter installation instructions.

Installation gaskets come in many sizes and shapes. They are usually available only from the engine manufacturer and are considered an engine part. In a few instances, the igniter manufacturer supplies the gaskets packaged with the igniter.

Some igniters require select fit of the mounting gasket thickness to properly position the firing end of the igniter in the combustor can. The gaskets are usually supplied as a set of several thicknesses. **It is very important to follow the engine manufacturer's instructions for determining the correct gasket.** Fitting the igniter in too deep a position can increase the firing end temperatures considerably, resulting in reduced reliability and overall life of the igniter. The following engines are examples of engines requiring selection of proper gasket thickness.

- Rolls-Royce Avon. FHE176 igniter (gasket set furnished with igniter).
- General Electric Company. CJ610 and CF700-FHE146 igniter (gaskets of varying thickness available from General Electric — use G.E. penetration tool no. 935C6008637002 to determine correct gasket). CF6-6-50-80A (CH31773/AA1385-4B) gasket set furnished with igniter.
- Rolls-Royce Dart. FHE19-6 (CR104) igniter. Some Dart engine models require a spacer and two gaskets in mounting the FHE19-6 (CR104) igniter. This spacer is required on these particular engine models to properly position the firing end of the igniter to the combustor can.

Supplemental Information

Because of the many operating variables encountered with turbine engine leads and igniters, conditions occasionally develop for which there is no answer within existing manuals. Whenever possible, Champion aviation issues technical bulletins, providing more information on such conditions. Copies of these bulletins are available upon request from:

Aviation Service Department
Champion Spark Plug
1230 Old Norris Rd.
P.O. Box 686
Liberty, SC 29657
(803) 843-5400

You are also encouraged to contact this department for assistance on any technical problem that may arise.

CHAMPION
AVIATION PRODUCTS

Aviation Service Manual

AV6-T

Leads
Igniters

Distributed by:

COOPER
Quality from
Cooper Industries

Printed in U.S.A. AV6T49815T