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Restoration Worksheets

Zenith Model A Ford Carburetor Restoration Worksheet

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These worksheets are evolving as a sequential guide to help Model A Ford owners restore their Zenith carburetors. These sequential steps are intended to keep the restorer on track but, not necessarily provide the details on how to do each step. Some good sources, which provide information on theory of operation, specifications, and how-to restoration details, are identified at the end of these worksheets as "References and Acknowledgements". Provider welcomes reader suggestions for improvements.

What is known about the specific carburetor being restored?

Vehicle: _____

Owner: _____

_____

Owners experience driving with this carburetor:

Why do they think this Carburetor may have a problem? _____

Starting: _____

Gas Mileage: _____

Idle - Slow Speed: _____

Idle - High Speed: _____

Leaks: _____

Not Recently Used: _____

Other: _____

Remind owner that no carburetor can perform well on an engine without a good ignition system that is timed correctly. If possible, verify that carburetor is likely a problem by running a known good carburetor on the vehicle.

Carburetor Description:

Lower Casting Markings: _____

_____

Upper Casting Markings: _____

_____

Do castings match year of vehicle manufacturer? _____

_____

Paint & Rust Conditions: _____

_____

Do external parts appear to be compatible with casting manufacturer and timing? _____

_____

_____

Attached tags or labels: _____

_____

Completely Disassemble Carburetor For Reconditioning:

- If carburetor is badly rusted and corroded, it may need to be thermal shocked to loosen parts and threads.
- After making sure that gasoline is completely evaporated from carburetor, try heating with torch.
- Need to get to nearly red and then quinch in cold water.
- Be careful with small brass parts and soft metal Venturi.
- Click here to view the "Venturi Extraction Tool" from the Special Tools section.

Dig out all old gaskets. Discard all old gaskets. _____

Don't forget to remove hidden, brass Gas Adjusting Valve seat if there is one. _____

Drill out brass passage plugs from both castings. _____

Soak castings and components in solvent. _____

Castings: (Cleaning, Inspection, Repair, and Painting)

Verify all parts have been removed. _____

Clean off and dig out remains of all gaskets. _____

Brush Castings with wire brush.

Carefully bead blast castings, including internals surfaces, passages, vents, etc.

Thoroughly clean out ALL passages and vents.

Very important step! Make sure none were missed.

Click here to view the "Fiber Optic Light" from the Special Tools section.

Chase threads with correct taps, watching for stripped and cross threads.

Thread Tap Size	Location	Tapped Hole
1/2 20 UNF (SAE)	Upper Casting	Fuel Line Input Port
1/2 20 UNF (SAE)	Upper Casting	Fuel Screen Assembly
1/2 20 UNF (SAE)	Upper Casting	Float Valve
3/8-24 UNF (SAE)	Upper Casting	Bolt, Hex
3/8-24 UNF (SAE)	Lower Casting	Drain Plug
3/8-24 UNF (SAE)	Lower Casting	Secondary Well
5/16-18 UNC (SAE)	Upper Casting	Carb Mount Bolts (2 Places)

(Most likely to be stripped or cross threaded)
Click here to view the "Heli-Coil Thread Repair Kits" from the Special Tools section.

1/8-27 NPT (Pipe)	Lower Casting	Gas Adjust Valve

(Use caution not to cut threads deeper, as it is a pipe thread)

M5 x .75 (Metric)	Upper Casting	Air Adjust Screw
M5 x .75 (Metric)	Lower Casting	Main Jet
M5 x .75 (Metric)	Lower Casting	Cap Jet
M5 x .75 (Metric)	Lower Casting	Compensator Jet
M5 x .75 (Metric)	Upper Casting	Idle Jet

Verify that this tapped hole, for Idle Jet, provides for taper fit.

Idle Air & Secondary Well vent hole was 9/32" to mid 1929 ____ & then 3/8"

1/8" bowl vent was added in mid 1930 to improve hot weather performance.

Upper Casting modified to adapt sidebowl filter assembly in early 1931.

Check mating gasket surfaces for flatness and parallel between two castings.

When held together by hand, an .008" pin gauge should not be able to be inserted in any gap.

Use stone to remove any high spots.

Blow all dust off of castings and out of passages.

Painting of Castings:

Mask all openings to internal carburetor areas.

Paint with: POR-15 Black for compatability with high temperature and gasoline.

Allow plenty of time to dry well. This may take 12 hours in some climates.

It is recommended that a little Loctite or thread locker be applied on plug just before inserting.

Press in brass plugs. A9593

Testing Lower Casting Internal Passages Using "Passage Testing Kit":

Click here to view the "Passage Testing Kit" from the Special Tools section.

1. Plug Compensator Jet / Cap Jet / Secondary Well.
2. Replace GAV with Air GAV Tester (a GAV with Tubing Attached to help blow through)
3. Blow air in Air GAV Tester - Should get air flow between GAV and Float Bowl.
4. Plug Compensator Jet / Cap Jet / Float Bowl hole.
5. Blow air in Air GAV Tester - Should get air flow between GAV and Secondary Well.
6. Plug Compensator Jet / Secondary Well / Float Bowl hole.
7. Blow air in Air GAV Tester - Should get air flow between GAV and Cap Jet.
8. Plug Secondary Well, Cap Jet, and Float Bowl hole.
9. Blow air in Air GAV Tester and get airflow between GAV well and Compensator Jet.
10. Install Main Jet, plug drain, and Get air Flow between Main Jet and float Bowl outlet.

Testing Gas Adjusting Valve Seat Using "Passage Testing Kit":

Click here to view the "Passage Testing Kit" from the Special Tools section.

1. Assemble "Test Hardware" in Lower casting
    1. Cap jet with o-ring and vinyl tubing
    2. Main jet with o-ring

3. Compensating jet (Solder closed old jet) with o-ring
4. 3/8-24 Bolt, with o-ring, to seal secondary well hole
5. Drain plug with o-Ring
6. GAV Seat (if needed), Needle, Housing, and Choke Driver, that will be used in carburetor

2. Fill bowl about half full with water.
3. Blow air into cap jet vinyl tubing while adjusting GAV.

When GAV is open air should bubble out thru the water in bowl. _____

With the GAV closed no air should bubble out. _____

4. If air bubbles out when the GAV is closed, the seat needs to be honed smooth for a tight seal.

   Click here to view the "Gas Adjusting Valve Seat Honing Tool & Guide" from the Special Tools section.

5. Remove water from Float Well, Secondary Well, etc. _____
6. Remove all Test Hardware and parts. _____
7. Dry water out of Casting immediately, bake in oven or heat up with torch, to minimize rusting. _____

Testing Upper Castings Internal Passages:

1. Blow air thru Fuel input, Strainer, and Float Valve holes.
   (Make sure old strainer tip isn't left inside)
2. Install an Idling Jet and Air Adjust Screw Assembly
3. Blow through Idling jet to verify passage is open between idling jet and idling port. _____
4. Block idling port in throat, and blow in Idling Jet.

   Verify that Air Adjusting screw assembly can actually shut off all air flow.

When Air adjusting screw is all the way in, No air should flow out air input passage. _____

Throttle Assembly: (Inspect, Clean With Solvent, Repair, and Assemble)

Plate:	20 degree to June 1928, after 18 1/2 degree; Check for fit and motion.	A9585	_____
Lever / Shaft:	Check for rotational motion and slop in bearing areas.	A9581	_____

	Lever forged steel, nickle finish to mid 28, forged brass, nickle or plain finish to early 30, then Stamped steel , cadmium or plain finish. It may be desirable to salvage original shafts, versus replace, by building them up with solder and then file / emroy cloth them down to size. When shaft holes get worn, they leak vacuum, and may need to be drilled out for bushings.		
Bushings:	Carefully locate and drill or mill hole using 5/16" drill. Tap in using soft hammer or piloted drift with knurl end facing out. If a heavier press fit is used, the hole may have to be ground or resized using 9/32" drill or reamer. To install by bonding using a proxy or superbonder, use "0" (.316) size drill. The inside blind hole is not normally rebushed and, if done, bushing may have to be shortened.	A9581-S	
Plate Screws:	Oval 5-40 UNF (SAE) Thread x 19/64 (2 Places)	A20042-S7	
Fillister Screw:	1/2" long until early 30, then 5/8" 8-36 UNF(SAE)	A20108-S7	
	Check for head and slot damage		
Adjustment:	Off engine, initial screw setting should slightly open throttle plate.		

Click here for more information on the Throttle Assembly.

Air Adjusting Screw Assembly: (Inspect, Clean With Solvent, Repair, and Assemble)
Function is to introduce air into fuel stream, metered by the idling Jet.

Needle:		A9577	
Shaft Length:	Minus head = 1 & 3/16" or 1.1875" Including head = 1 & 11/32" or 1.344"		
Head Diameter:	1927-29 = 3/8" or .375"; 1930-End = 5/16" or .3125"		
Cap:		A9579	
Spring:		A9578	
	(Off Engine initial setting should be 1 & 1/2 turns from full clockwise)		

Click here for more information on the Air Adjusting Screw.

Strainer: (Inspect, Clean With Solvent, and Assemble)

Strainer:	A9559	
Washer:	A2233 (1/2")	

Float and Valve Assembly: (Inspect, Clean With Solvent, Repair, and Assemble)
Controls the level of fuel allowed into the bowl

Valve:	Valves can be intermittent: Leak when they should be closed or stick partly open when they should be open. Push in hard and twist valve	A9564A	

	stem a few times to seat it.		
	Consider replacing with gas resistant rubber tip or "Gross Jet" designs.	A9564-M	_____
		A9564-Z	_____
Float:	Test for Leaks.	A9550	_____
Float Hinge Pin:		A9558	_____
Hinge:	Check for damage and security. If hinge rivets are a problem, either replace rivets or drill out, tap, and insert 6/32" screws.	A9554	_____
Washer:		A9502Z	_____
	Inspect Float for a small dimple worn into the top of the float by the valve needle. The effect of this dimple is a lateral bind on the valve needle that prevents it from closing completely and sealing.		_____
	To get float to close valve at proper level, gasket thickness may need to be varied.		_____
	Float Tab may need to be bent so that float does not drop too far down.		_____
	Click here for more information on the Float Valve and Float.		_____

Idling Jet: (Inspect, Clean With Solvent, Adjust, Test, and Assemble)
Delivers fuel (from the Secondary Well) to the engine at idle (effect only at low speed).

This jet's orifice is very small and is easily clogged by dirt or sediment. If jet is too large, the adjustment screw will need to be turned out very far (>4 turns). If jet is too small, it will be impossible to obtain a satisfactory mixture except by turning idling adjustment screw in all the way.

Inspect for fractures / breaks along the shaft and stems that turn in its base. A9542 _____

Orifice Size recommendations:

Altitude	Drill	Diameter in Inches
For Zero to 3000 Foot	# 75	.021
For 3000 to 5000 Foot	# 75	.021
For 5000 Plus Foot	# 76	.020

Recommended Flow (measured at desired altitude) 44 to 48 milliliters per minute.
(Some Carburetor to Engine combinations require +/- 5 milliliter from this)

Orifice Size Measured:	_____	Adjusted To:	_____
Flow Measure at Altitude:	_____	Adjusted To:	_____

No washer is used with this jet because it is a tapper fit.

Click here for more information on the Idling Jet.

Main Jet: (Inspect, Clean With Solvent, Adjust, Test, and Assemble)
Delivers the major portion of the fuel to the engine at over 30 miles per hour.

Usually is the cause of high speed carburetor problems. If the jet is too large, it will make the mixture rich, give low mileage, sooty plugs, smell of gas, and irregular running. If the jet is too small, it will make

the mixture lean, the car won't go very fast, and might even backfire at high speed.

Should have indented tip to prevent capillary action leaks when engine is off. A9534B _____

Critical Length should be: 1 and 15/32" or 1.46875" Measured Length: _____

Orifice Size recommendations:

Altitude	Drill	Diameter in Inches
For Zero to 3000 Foot	# 63	.037
For 3000 to 5000 Foot	# 64	.036
For 5000 Plus Foot	# 65	.035

Recommended Flow (measured at desired altitude) 150 to 160 milliliters per minute.

Orifice Size Measured: _____ Adjusted To: _____

Flow Measure at Altitude: _____ Adjusted To: _____

Washer (One Only!): A22086 _____

When installed with a washer, its tip should be level with the Lower Casting shelf that the Venturi sits on.

Click here for more information on the Main Jet.

Drain Plug: (Inspect, Clean With Solvent, and Assemble)

Plug: A9590 (3/8 - 24) _____ Washer: A22256 _____

Plug was brass unfinished to early 1930, then steel, cadmium, and plain finish were used.

Cap Jet: (Inspect, Clean With Solvent, Adjust, Test, and Assemble)
Delivers the fuel provided by the Compensator jet and the Gas Adjusting Valve.

If the jet is too large, gives low mileage, sooty plugs, smell of gas, and irregular running only at low speeds. If the jet is too small, it will give a lean mixture & miss / jerk on hard pulls (at low speeds).

Should have indented tip to prevent capillary action leaks when engine is off. A9538B _____

Critical Length should be: 1 and 3/32" or 1.09375" Measured Length: _____

Orifice Size recomendations:

Altitude	Drill	Diameter in Inches
For Zero to 3000 Foot	# 63	.037
For 3000 to 5000 Foot	# 64	.036
For 5000 Plus Foot	# 65	.035

Recommended Flow (measured at desired altitude) 150 to 185 milliliters per minute.

Orifice Size Measured: _____ Adjusted To: _____

Flow Measure at Altitude: _____ Adjusted To: _____

Washer (One Only!): A22086 _____

When installed with a washer, its tip should be level with (to 1/16" below) the Lower Casting shelf that the Venturi sits on. _____

Click here for more information on the Cap Jet.

Secondary Well: (Inspect, Clean With Solvent, Dig Dirt and Rust From Holes and Assemble)

Integral well was used until mid 1928, then the brass Secondary Well was used: A9545 _____

There were several variations of brass Secondary Well designs, with the undercut in different places. In some castings, the secondary well restricted gasoline flow from the Compensator Jet. The undercut area needs to be matched with the Compensator Jet. To determine this, remove compensator jet, insert a sharp pencil in the compensator jet hole, and mark the secondary well. Then remove the well from the bowl and if the undercut section of the well is not at the point marked by pencil, the well needs to be exchanged with one that does.

Click here for more information on the Secondary Well.

Compensator Jet: (Inspect, Clean With Solvent, Adjust, Test, and Assemble)
Compensates for the enriching effect of the Main Jet as airflow increases and it thus provides a more constant air / fuel ratio mixture.

If the jet is too large, gives low mileage, sooty plugs, smells of gas, and irregular running only at low speeds. If jet is too small, it will give a lean mixture and miss / jerk on hard pulls (at low speeds).

A hard slow pull uses this jet the most and is its best test. A9575 _____

Orifice Size recomendations:

Altitude	Drill	Diameter in Inches
For Zero to 3000 Foot	# 65	.035
For 3000 to 5000 Foot	# 65	.035
For 5000 Plus Foot	# 65	.035

Recommended Flow (measured at desired altitude) 138 to 142 milliliters per minute.

Orifice Size Measured: _____ Adjusted To: _____

Flow Measure at Altitude: _____ Adjusted To: _____

Washer (One Only!): A22086 _____

Click here for more information on the Compensator Jet.

Choke Air Shutter Assembly: (Inspect, Clean With Solvent, Repair, and Assemble)
The Choke provides vehicle driver a manual control for closing the Air Shuttle plate.

Plate:	Check for fit and motion.	A9549	_____
Shaft:	Check for motion and slop in bearing.	A9547	_____
Choke Arm Lever:	(Lower leg added in early 1928)	A9548	_____
Screws:		A20042-S7	_____
Nut:	Check for fit and motion. (8-36 UNF (SAE) Thread)	34078-S7 and 34902-S (5/32)	_____

Washer:	34902-S (5/32)	

Click here for more information on the Choke Arm.

Gas Adjusting Valve Assembly: (Inspect, Clean With Solvent, and Assemble)
Provides vehicle driver a manual fuel adjustment to increase the flow of gas thru Cap jet.

Choke:	(Check for bends, twist and damage at control end and for in and out choke motion)	A9570	
Needle:	(Check length, condition of tip, and smoothness of thread action in housing)	9525	
Housing:	(Check wrench nut condition and internal & external thread conditions)	A9528	
	Note: Housing hex nut may be either 7/16 or 13/32.		
	Click here to view the "Gas Adjusting Valve Wrench" from the Special Tools section.		
Seat:	(Must provide a smooth, tight fitting seal for Needle - Brass insert used until Jan 1930)	A9532	

Click here for more information on the Gas Adjusting Valve.

Large Gaskets:

Glue tack manifold Gasket to carburetor.	A9447-A	
Install Large Gasket onto Upper Casting	A9592-A	

Click here for more information on Gaskets.

Venturi: (Inspect, Clean With Solvent, and Assemble)

Double Verturi:	To Mid 1928	A9586-A	
Single Venturi:	Started in June 1928	A9586-B	
	Inside diameter should be .843 +/- .005"	Measured:	
	And not oval shape.		

Bolt holding two castings together: (Inspect, Clean With Solvent, and Assemble)

Bolt:	A209233-S7 (3/8 - 24X3 3/16)	Lock Washer:	A22257-S2

Variations in Hex Head Sizes

	1928	1929 to mid 1930	Mid 1930 to End
Width:	1/2"	9/16"	9/16"
Height:	5/16"	5/16"	1/4"

Sidebowl Filter Assembly :

(Only on models made after early 1931) _____

Bench Reconditioning and Testing Completed **Date:** _____

Final checks and adjustments, once carburetor is installed on vehicle:

Carburetor is being installed, checked and adjusted on: _____

Check that fuel filter on vehicle firewall is clean. _____

Install carburetor and check for fuel leaks. _____

Leaks and Float Level are best tested with a full tank of fuel. **Fuel Tank Level:** _____

Verify Bowl Float Level with a float tube. **Measured Level:** _____

Click here to view the "Fuel Level Sight Tube" from the Special Tools section.

(Should be 1/2 to 5/8" below top of lower casting)

Fine Tune Throttle, Idle Adjusting Fillister Screw and Air Idle Adjusting screw on Vehicle.

1. Start the engine and let run at a fast idle until normal operating temperature is reached. _____
2. Full retard the Spark Advance Control Rod (Up). _____
3. Turn the Fuel Mixture Control (On passenger side) full CW to its seat position then back 1/4 turn.

   Check that Fuel Mixture Control turns and pulls smoothly. _____

   At higher altitudes adjust control back to full clockwise. _____
4. Set throttle, Idle Adjusting, Fillister screw for a slow idle.

   It's important that idle speed is slow enough to make the idle circuit be in effect. (500 or less RPM) _____
5. Slowly turn the Air Adjustment Screw CW until engine begins to stall. Note the screw slot position. _____
6. Slowly turn the Air Adjustment Screw counter clockwise until engine begins to stall.

   Note the position. _____

   Turn the screw half way between the two positions. _____

   As screw is opened, it leans out the mixture being fed to the idle port in

the side of the carburetor throat.

As Screw is closed, it reduces the amount of air mixed with fuel coming from the idling jet.

7. If Adjustment does not cause the engine to stall at some point, it is an indication that the Air Adjust Screw seat in not functioning properly or that there is an air leak in the intake system.
Check for Leaks: Throttle shaft, Manifold to carburetor gasket, manifold to block gasket, and vacuum to wiper. _____

8. If engine runs best with needle closed - Idling Jet may be too small. _____

9. If engine runs best with needle very open - Idling Jet may be too large. _____

10. Advance the Spark Control Rod about 3/4 the way down. _____

11. Adjust Throttle, Idle Adjusting, Fillister Screw for desired idle speed. _____

It's important to remember that changes in the ignition system such as timing, regapping spark plugs, new spark plugs, a change in breaker point gap or a new condenser will all change idle adjustments.

Many so called carburetor troubles can be traced to one or more of these issues.

The idle adjustments of the carburetor should be made after any ignition work or changes.

With a mechanically sound engine and good ignition, the engine should idle smoothly at low speed, accelerate evenly at all speeds and deliver at least 16 miles per gallon of gasoline out on the highway.

Test Drive vehicle around town, at highways speeds, and if possible on a long, slow, steep climb.

Notes on performance, problems and resolution:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Testing and Adjustment on Vehicle Completed **Date:**

Replacement Parts List

Description	Ford Part #	Estimated Price	
Air Adjusting Screw Needle	A9577	$2.75	
Air Adjusting Screw Cap	A9579	$0.00	
Air Adjusting Screw Spring	A9578	$0.00	
Air Shutter Lever	A9548	$2.00	
Air Shutter Nut/Washer	34078-S7 (8-36) & 34902-S(5/32)	$0.40	
Air Shutter Plate Screws	A20042-S7 (Oval 5-40 x 19/64)	$0.25	
Air Shuttle Plate	A9549	$1.75	
Air Shuttle Shaft	A9547	$3.25	
Bolt, Hex Head	A209233-S7 (3/8 - 24X3 3/16)	$1.00	
Cap Jet	A9538B	$3.00	
Choke Driver	A9570	$5.25	
Choke Housing	A9528	$3.50	
Choke Needle	9525	$2.50	
Choke Seat	A9532	$1.00	
Compensator Jet	A9575	$1.00	
Drain Plug	A9590 (3/8 - 24)	$1.25	
Float	A9550	$14.00	
Float Pin	A9558	$0.40	
Float Valve	A9564A	$4.75	
Float Valve, Gas resist tip	A9564-Z	$7.50	
Gasket Set	A9502-Z	$1.50	
Idling Jet	A9542	$3.00	

Main Jet	A9534B	$2.25	
Passage Plugs	A9593	$1.50	
Secondary Well	A9545	$4.00	
Strainer	A9559	$4.50	
Throttle Fillister Screw	A20108-S7 (8-36 x 5/8)	$0.50	
Throttle Plate	A9585	$4.25	
Throttle Plate Screws	A20042-S7 (Oval 5-40 x 19/64)	$0.25	
Throttle Shaft	A9581	$10.25	
Throttle Shaft Bushings	A9581-S	$1.00	
Venturi (Single)	A9586-B	$5.00	
		Total:	

References and Acknowledgements

"Zenith Model "A" Carburetor Restoration Guidelines" by Steve Pargeter (Version 7)

"The Model A Ford Carburetor" by Paul Moller

"Model A Ford Mechanics Handbook" by Les Andrews

"Model A Ford Judging Standards & Restoration Guidelines"

Seminar information and guidance from Steve Pargeter and Bill Lancaster

"Gas Adjusting Valve Seat Leak Testing and Repair" by Bill Cilker

"Carburetors and Carbohydrates" video by Double D Productions

"Model A Ford, Zenith Carburetor Troubleshooting Chart" by Chris Pelikan

Numerous articles in "The Restorer" and "Model A News"

The many Model A Ford Owners who have trusted me to work on their carburetors

The guy who helped me solve my first Model A carburetor problem in my garage, Glenn Wildman

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