

FAA-APPROVED  
AIRPLANE FLIGHT MANUAL SUPPLEMENT  
TO THE  
DIAMOND DA 40  
AIRPLANE FLIGHT MANUAL

STC SA02688LA

Registration No.: \_\_\_\_\_  
Serial No: \_\_\_\_\_

This supplement must be attached to the Airplane Flight Manual, document 6.01.01-E, when the airplane is modified by the installation of a SBARS supercharging system in accordance with Supplemental Type Certificate STC SA02688LA.

The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the Airplane Flight Manual.

FAA APPROVED

  
*Acting* Manager, West Flight Test Section, AIR-716  
Federal Aviation Administration  
Los Angeles, CA

Date: November 29, 2018

## **FORWARD**


This airplane is now equipped with a belt driven supercharger system to boost the manifold pressure that enables the engine to operate at constant manifold pressure up to an altitude of approximately 7,000 feet. As the aircraft climbs above 7,000 feet the manifold pressure decreases at the same rate as a normally aspirated engine climbing from sea level. The result is significantly increased climb and cruise performance when operating above approximately 3,000 feet.

This supplement to the Airplane Flight Manual should be read carefully by the owner and operator in order to become familiar with the operation of the airplane. It contains limitations, operating procedures, performance information, and systems descriptions that are essential information for the pilot to properly operate the airplane. As specified, this supplement must accompany the basic Airplane Flight Manual and be available to the pilot at any time during flight. See the basic Airplane Flight Manual for information not contained in this supplement.

This supplement is applicable to airplanes equipped with Garmin G1000 avionics.

**0.2 LOG**

The table below lists the current effective date of each page of this document. When updating this supplement to a later FAA Approved revision level, remove the old RECORD OF REVISIONS, this page and the pages to be replaced and insert the new RECORD OF REVISIONS, LIST OF EFFECTIVE PAGES and subsequent revised pages.

REV	PAGE	DATE	DESCRIPTION	FAA APPROVED
IR	Cover ii iii iv v 5 - 28	29 Nov, 2018	Installation of a SBARS Super Charging System	 Manager, West Flight Test, AIR-716 Federal Aviation Administration Los Angeles, CA  DATE <u>11/29/2018</u>

**0.3 TABLE OF CONTENTS**

This supplement is divided into the following Chapters:

Chapter 1 ..... GENERAL  
Chapter 2 ..... OPERATING LIMITATIONS  
Chapter 3 ..... EMERGENCY PROCEDURES  
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Chapter 4B ..... ABNORMAL OPERATING PROCEDURES  
Chapter 5 ..... PERFORMANCE  
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Chapter 8 ..... AIRPLANE, HANDLING, CARE AND MAINTENANCE

**CHAPTER 1 GENERAL**

No Change.

**CHAPTER 2 OPERATING LIMITATIONS**

**2.4 POWERPLANT LIMITATIONS**

- c) RPM limitations
  - Max. take-off RPM : 2700 RPM
  - Max. continuous RPM : 2400 RPM
- d) Manifold pressure limitations
  - Maximum (MAX PWR) : 30 inHg or full throttle,  
 whichever comes first.
- k) –m) Propeller

Hartzell two-blade HC-C2YR-1BFP/F7497 (Aluminum blade)  
 Hartzell two-blade HC-C2YR-1N/N7605 (Composite blade)  
 Installed by STC SA02476CH-D except Max. continuous  
 RPM is now 2400 RPM.

**2.5 ENGINE INSTRUMENT MARKINGS**

Indi- cation	Red arc/bar = lower prohibited Range	Yellow arc/bar = caution Range	Green arc/bar = normal operating range	Yell arc/bar = caution range	Red arc/bar = upper prohibited range
Manifold Pressure	--	--	13-30 inHg	--	>30 - 31 inHg

Note: When > 30 inHg the manifold pressure gage label "MAN IN HG XX.X" flashes inverse red and the needle turns red.

## 2.6 WARNING, CAUTION, AND STATUS MESSAGES

### Color and Significance of the Warning Messages (Red)

Warning Messages (Red)		
Message	Meaning	Cause
<b>MAN OVERBOOST</b>	Manifold pressure to high	Manifold pressures at or above 30.5 inHg due to excessive throttle lever settings with an associated and continuous chime.

## **CHAPTER 3 EMERGENCY PROCEDURES**

No Change

## **CHAPTER 4A NORMAL OPERATING PROCEDURES**

### **4A.3.6 BEFORE TAKE-OFF**

#### **CAUTION**

Before take-off, the engine must run on each tank for at least 1 minute at 1500 RPM.

For take-off the adjustable backrests (if installed) must be fixed in the upright position.

1. Position airplane into wind if possible
2. Parking brake ..... set
3. Adjustable backrests (if installed) ..... verify upright position and proper fixation
4. Safety harnesses ..... on and fastened
5. Rear door ..... check closed and locked
6. Front canopy..... closed and locked

#### **CAUTION**

When operating the canopy, ensure that there are no obstructions in between the canopy and the mating frame, for example seat belts, clothing, etc. When operating the locking handle do NOT apply undue force.

A slight downward pressure on the canopy may be required to ease handle operation.

7. Door warning light (DOOR OPEN) ..... Extinguished
8. Fuel tank selector ..... fullest tank
9. Engine ..... in green sector
10. Circuit breakers ..... pressed in
11. Fuel pressure indicator ..... check (approx. 14-35 PSI)

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12. Electrical fuel pump ..... ON

**CONTINUED**

13. Mixture control lever ..... RICH (below 8500 ft)

**NOTE**

At density altitudes at or above 8500 ft a fully rich mixture can cause rough running of the engine or a loss of performance. The mixture should be set for smooth running of the engine.

- 14. Flaps ..... check T/O
- 15. Trim ..... check T/O
- 16. Flight controls ..... free movement, correct sense
- 17. Throttle ..... 2000 RPM
- 18. RPM lever ..... pull back until a drop of 250 to 500 RPM is reached - HIGH RPM; cycle 3 times
- 19. Magneto check ..... L - BOTH - R - BOTH  
Max. RPM drop . . 175 RPM  
Max. difference . . . 50 RPM  
If the electronic ignition control unit is installed, the ignition status light must illuminate and extinguish after approximately 20 to 30 sec.

**CAUTION**

The lack of an RPM drop suggests a faulty grounding or incorrect ignition timing. In case of doubt the magneto check can be repeated with a leaner mixture, in order to confirm a problem. Even when running on only one magneto the engine should not run unduly roughly.

- 20. Voltmeter ..... check in green range
- 21. Throttle ..... IDLE
- 22. Flight Plan ..... entered



- 23. Altimeter Setting ..... checked/set
- 24. Altitude preselectors ..... set
- 25. Radios ..... set and checked

**CONTINUED**

- 20. Transponder..... code set
- 21. Standby attitude gyro ..... erect and no flag
- 22. Parking brake ..... release
- 23. Alternate air ..... check CLOSED
- 24. Landing light ..... ON as required
- 25. Pitot heating ..... ON as required

**END OF CHECKLIST**

**4A.3.8 CLIMB**

Procedure for Maximum Performance (Best Rate) Climb

- 1. Flaps ..... T/O
- 2. Airspeed ..... 67 KIAS (1200 kg, 2646 lb)  
66 KIAS (1150 kg, 2535 lb)  
60 KIAS (1000 kg, 2205 lb)  
54 KIAS (850 kg, 1874 lb)
- 3. RPM lever ..... 2400 RPM
- 1. Throttle ..... MAX PWR
- 5. Mixture control lever ..... RICH, above 8500 ft hold  
EGT constant
- 6. Engine instruments ..... in green sector
- 7. Trim ..... as required
- 8. Electrical fuel pump ..... ON at high altitudes

**CAUTION**

Operation at high altitudes with the electrical fuel pump OFF may cause vapor bubbles, resulting in intermittent low fuel pressure indications, sometimes followed by high fuel flow indications.

**END OF CHECKLIST**

Cruise Climb

- 1. Flaps ..... UP
- 2. Airspeed ..... 76 KIAS (1200 kg, 2646 lb)  
73 KIAS (1150 kg, 2535 lb)  
68 KIAS (1000 kg, 2205 lb)  
60 KIAS (850 kg, 1874 lb)
- 3. RPM lever ..... 2400 RPM
- 4. Throttle ..... MAX PWR
- 5. Mixture control lever ..... RICH, above 8500 ft hold  
EGT constant
- 6. Engine instruments ..... in green sector
- 7. Trim ..... as required
- 8. Electrical fuel pump ..... ON at high altitudes

**CAUTION**

Operation at high altitudes with the electrical fuel pump OFF may cause vapor bubbles, resulting in intermittent low fuel pressure indications, sometimes followed by high fuel flow indications.

**END OF CHECKLIST**

## **CHAPTER 4A ABNORMAL OPERATING PROCEDURES**

### **4B.2 INSTRUMENT INDICATIONS OUTSIDE OF GREEN RANGE**

#### (b) High Manifold Pressure

Throttle setting is too high. Indications of this are an inversely flashing manifold pressure gage label and indication and red needle when manifold pressure is exceeding 30.0 inHg that can be followed by red **MAN OVERBOOST** message and continuous and audible chime for manifold pressures at or above 30.5 inHg.

The flashing manifold pressure indication, the red **MAN OVERBOOST** message, and the audible chime will continue until the manifold pressure is reduced below 30.0 inHg.

1. Throttle ..... Reduce

**END OF CHECKLIST**

## **CHAPTER 5 PERFORMANCE**

### **5.3.6 TAKE-OFF DISTANCE**

Conditions:

Throttle .....	MAX PWR (30 inHg or Full Throttle, whichever occurs first)
RPM lever.....	2700 RPM
Flaps.....	T/O
Lift-off speed.....	approx. 59 KIAS
Climb-out speed .....	67 KIAS (1200 kg, 2646 lb) 66 KIAS (1150 kg, 2535 lb) 60 KIAS (1000 kg, 2205 lb)
Runway.....	level, asphalt surface

#### **WARNING**

Poor maintenance condition of the airplane, deviation from the given procedures as well as unfavorable external factors (high temperature, rain, unfavorable wind conditions, including cross-wind) will increase the take-off distance.

#### **CAUTION**

For a safe take-off the take-off run available (TORA) should be at least equal to the take-off distance over a 50 ft (15m) obstacle.

The figures in the following NOTE are typical values. On wet ground or wet soft grass covered runways the take-off roll may become significantly longer than stated below. In any case the pilot must allow for the condition of the runway to ensure a safe take-off.

#### **NOTE**

For take-off from dry, short-cut grass covered runways, the following corrections must be taken into account, compared to paved runways (typical values, see CAUTION above):

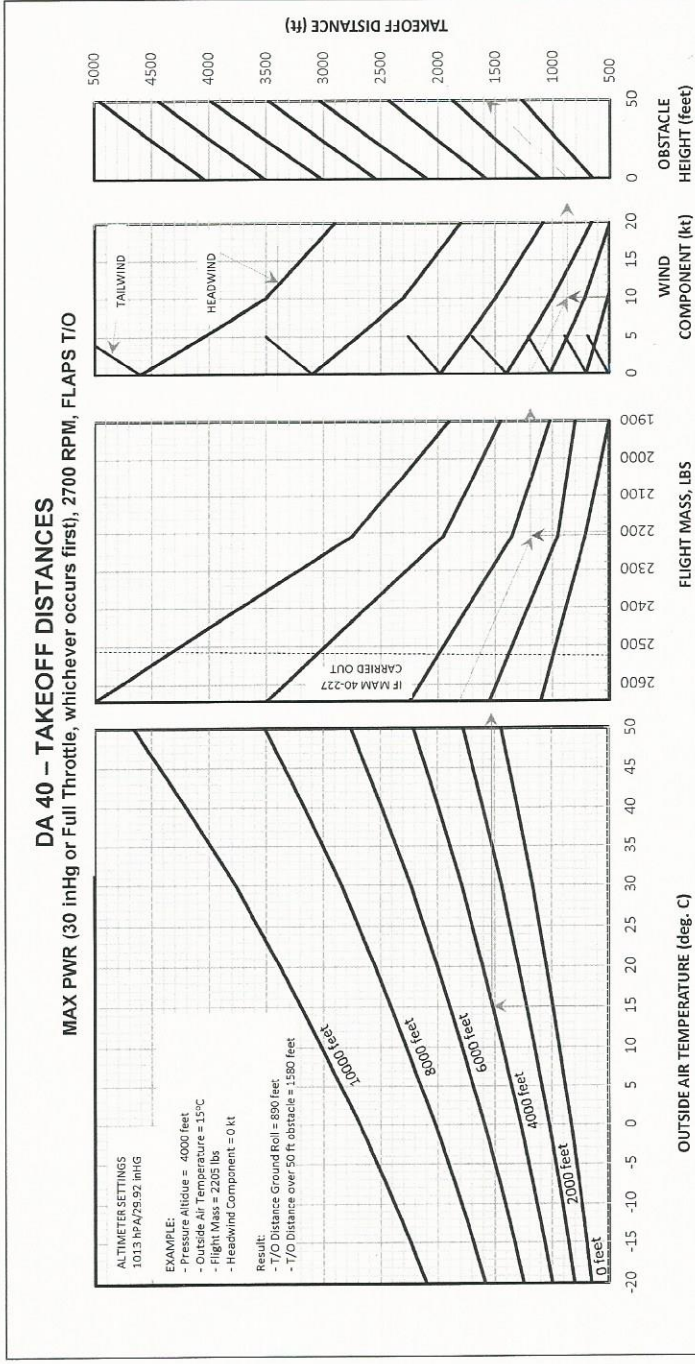
- Grass up to 5 cm (2 in) long: 10 % increase in take-off roll.
- Grass 5 to 10 cm (2 to 4 in) long: 15 % increase in take-off roll.

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- Grass longer than 10 cm (4 in): at least 25 % increase in take-off roll.
- Grass longer than 25 cm (10 in): take-off should not be attempted.

On wet grass, a further 10% increase in take-off roll must be expected.

An uphill slope of 2% (2 m per 100 m, or 2 ft per 100 ft) results in an increase in the take-off distance of approximately 10 %. The effect on the take-off roll can be greater.



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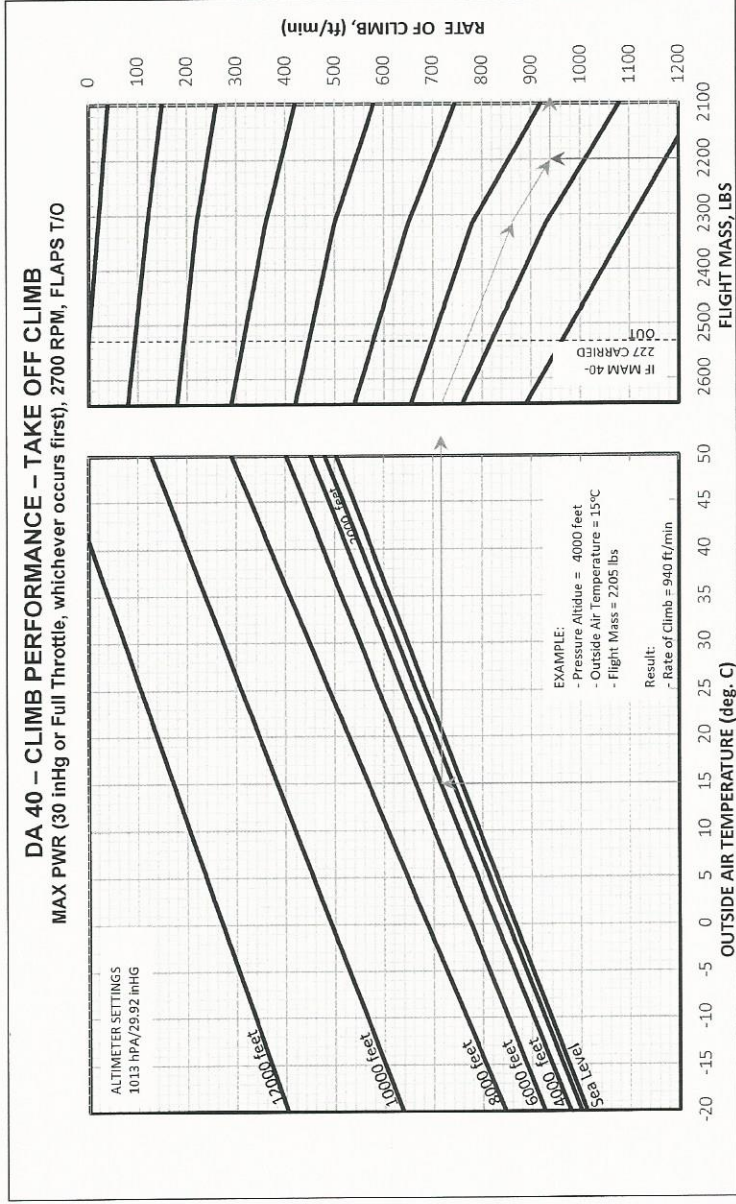
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**5.3.7 CLIMB PERFORMANCE- TAKEOFF CLIMB**

Conditions:

Throttle .....	MAX PWR (30 inHg or Full Throttle, whichever occurs first)
RPM lever.....	2700 RPM
Flaps.....	T/O
Airpseed .....	67 KIAS (1200 kg, 2646 lb) 66 KIAS (1150 kg, 2535 lb) 60 KIAS (1000 kg, 2205 lb) 54 KIAS (850 kg, 1874 lb)





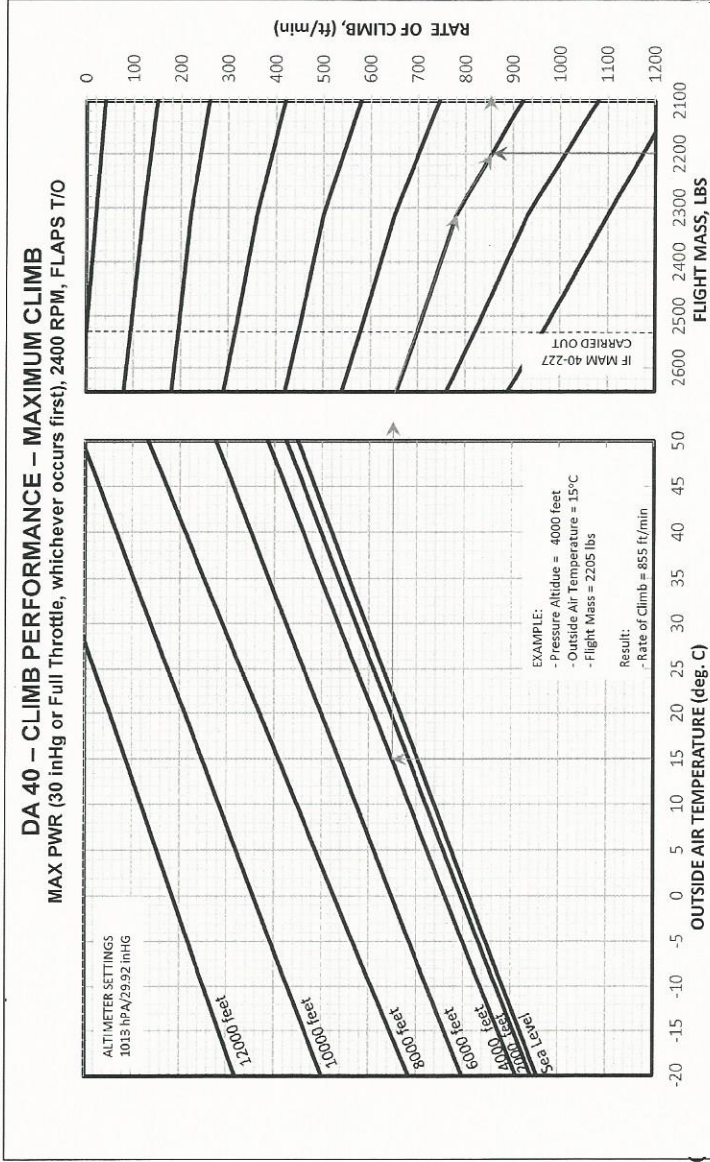
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**5.3.7 CLIMB PERFORMANCE- MAXIMUM (BEST RATE)**  
**CLIMB**

Conditions:

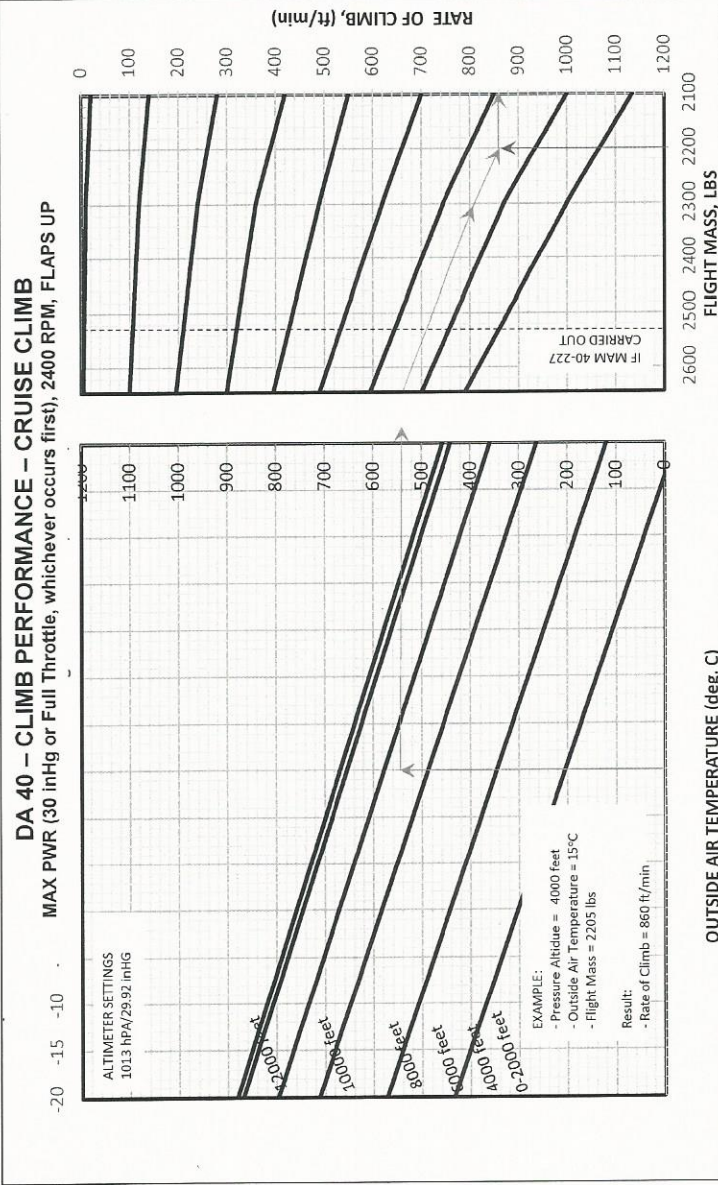
Throttle .....	MAX PWR (30 inHg or Full Throttle, whichever occurs first)
RPM lever.....	2400 RPM
Flaps.....	T/O
Airseed .....	67 KIAS (1200 kg, 2646 lb) 66 KIAS (1150 kg, 2535 lb) 60 KIAS (1000 kg, 2205 lb) 54 KIAS (850 kg, 1874 lb)



**5.3.8 CLIMB PERFORMANCE- CRUISE CLIMB**

Conditions:

Throttle ..... MAX PWR  
(30 inHg or Full Throttle,  
whichever occurs first)  
RPM lever..... 2400 RPM  
Flaps..... UP  
Airseed ..... 76 KIAS (1200 kg, 2646 lb)  
73 KIAS (1150 kg, 2535 lb)  
68 KIAS (1000 kg, 2205 lb)  
60 KIAS (850 kg, 1874 lb)



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**5.3.9 CRUISING (TRUE AIRSPEED TAS)**

Cruise performance and power settings are unchanged from basic AFM.

**5.3.12 GRADIENT OF CLIMB ON GO-AROUND**

The DA 40 reaches a constant gradient of climb of 5.3% (390 feet/min) in the following condition:

- Mass .....max. flight mass (1150 kg, 2535 lb)
- Power setting .....MAX PWR  
(30 inHg or Full Throttle,  
whichever occurs first)
- Flaps.....LDG
- Airspeed .....70 KIAS
- ISA, MSL

If MAM 40-227 is carried out:

The DA 40 reaches a constant gradient of climb of 5.3% (390 feet/min) in the following condition:

- Mass .....max. flight mass (1200 kg, 2646 lb)
- Power setting .....MAX PWR  
(30 inHg or Full Throttle,  
whichever occurs first)
- Flaps .....LDG
- Airspeed .....73 KIAS
- ISA, MSL

**5.3.13 APPROVED NOISE DATA**

The certified noise level, as determined under the provisions of 14 CFR part 36 Appendix G is 78.8 dB(A) at maximum flight mass of 1200 kg (2646 lbs) if MAM 40-227 is carried out. This value is conservative for the 1150 kg (2535 lbs) if MAM-40-227 is not carried out.

## **CHAPTER 6 MASS AND BALANCE/EQUIPMENT LIST**

There are no changes to aircraft weight limits or center of gravity (CG) limits. See basic Airplane Flight Manual for weight and center of gravity information.

The Equipment List / Weight and Balance Record are revised by the STC installer for installation of this supercharger system. For current empty weight and CG, see revised weight and balance record.

## **CHAPTER 7 DESCRIPTION OF THE AIRPLANE AND ITS SYSTEMS**

### **7.9 POWER PLANT**

#### **7.9.1 ENGINE, GENERAL**

The DA 40 is powered by the original Lycoming IO-360-M1A engine that now has a belt-driven supercharger installed. The Time Between Overhaul (TBO) requirements are unchanged.

Lycoming IO-360-M1A: Air-cooled four-cylinder four-stroke engine. Horizontally-opposed direct-drive engine with fuel injection and underslung exhaust.

Displacement: 5916 cm<sup>3</sup> (361 in<sup>3</sup>).

Max. rated power: 180 HP (134.2 kW) at 2700  
RPM and 30.0 inHg and ISA.

Max. continuous power: 160 HP (119.3 kW) at 2400  
RPM and 30.0 inHg and ISA.

The principal engine accessories at the front of the engine are the propeller governor, the starter motor, and the alternator. The ignition (optionally controlled by an electronic control unit), the twin magneto system and the mechanical fuel pump are at the rear of the engine. Fuel is supplied via a fuel injection system.

Further information should be obtained from the engine operating manual.

The engine instruments are on the right hand side of the instrument panel.

The ignition switch is designed as a key-operated lock.



The ignition is switched on by moving the switch to the right from the OFF position to the L-R-BOTH positions. A further turn to the right to the START position will operate the starter motor.

### **7.9.1a ENGINE SUPERCHARGING SYSTEM**

The supercharging system provides sea level manifold pressure to approximately 7,000 feet thereby increasing engine power output when operating at higher altitudes. This results in an improved rate of climb and cruise airspeeds at higher altitudes. Unlike a turbocharging system, this system is not exhaust gas driven and has no waste-gate or turbo-controller, therefore, much less potential for engine hazards. The system has no modifications to the exhaust system and requires no cool down periods at engine shutdown.

This system consists of a supercharger and minor fuel injection and air induction alterations. Induction air is drawn through the air filter at the front of the cowling to the supercharger and exits the supercharger on the left side of the engine into the servo. The supercharger oil system is self-contained and utilizes no oil from the engine's oil system for lubrication. Manifold pressure is pilot controlled with the throttle and is limited to 30 inHg.

#### Supercharger

The supercharger is a centrifugal compressor, mounted at the front of the engine on the left side, and is belt-driven from the crankshaft. The amount of boost available is based directly upon engine RPM and ambient air pressure. Higher RPM and higher ambient pressure (limited to 30.0. Hg) results in higher manifold pressures.

#### Induction System

Induction air still enters the engine compartment through the original inlet in the lower cowling and is drawn through the air filter. Air discharged from the supercharger is ducted directly into the engine fuel injection servo.

#### Critical Altitude

The critical altitude is the altitude in which the desired manifold pressure can no longer be maintained. This occurs when the supercharger can no longer boost the ambient air above the desired manifold pressure.

Critical altitude will vary with ambient pressures and engine RPM. The critical altitude for maximum power (30.0 in. Hg. and 2700 RPM) is approximately 7,000 feet pressure altitude.

#### Engine Fuel Injection

Air pressure from the supercharger is supplied to the fuel injection nozzles. This is necessary because manifold pressure will be greater than ambient pressure when operating above sea level. This provides proper fuel atomization and results in smoother engine operation.

#### Alternate Air Control and Door

The alternate air door has been relocated on the supercharger airbox between the air filter and the supercharger. The source of the alternate air is unchanged and operation of the alternate air control is unchanged.

### **7.9.2 OPERATING CONTROLS**

The engine performance is controlled by means of three levers: throttle, RPM lever and mixture control lever, situated together as a group on the large center console (also referred to as the throttle quadrant). Front and rear are defined in relation to the direction of flight.

#### Throttle

- Left hand lever with large, black knob.

This lever is used to set the manifold pressure (MP). When the throttle is furthest forward, the engine is being provided with extra fuel for high performance settings.

Lever forward (MAX PWR)	= 30 inHg or full throttle, whichever comes first, higher MP
Lever to rear (IDLE)	= Idle, low MP

High manifold pressure means that a large quantity of fuel-air mixture is being supplied to the engine or the throttle is too high, while low manifold pressure means a lesser quantity of fuel-air mixture is being supplied.

## **CHAPTER 8 AIRPLANE HANDLING, CARE, AND MAINTENANCE**

There are no additional requirements for the continued safe and efficient operation of your aircraft. For inspection and maintenance requirements pertaining to the supercharger system see SBARS Instructions for Continued Airworthiness, Document No. 20040-30 provided with this installation.