



CAPF 70-5 Training Module 3: Aircraft Limitations

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Operating Limitations: Topics for Discussion

- POH (C182T) – Section 2
 - CFR – Required Placards
 - Airspeed Limitations
 - Power Plant Instrument Markings
 - Fuel Limitations
 - Oil Specs
- KOEL
- Review CAPT 70-5Q-A homework



CFR Required Placards

- “The following information must be displayed in the form of composite or individual placards...”

The markings and placards installed in this airplane contain operating limitations which must be complied with when operating this airplane in the Normal Category. Other operating limitations which must be complied with when operating this airplane in this category are contained in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

No acrobatic maneuvers, including spins, approved.

Flight into known icing conditions prohibited.

This airplane is certified for the following flight operations as of date of original airworthiness certificate:

DAY - NIGHT - VFR -IFR



CFR Required Placards

- Does “required” mean that they have to be there or that you are required to comply with them?



MANEUVERING SPEED: 110 KIAS



Airspeed Limitations

- Airspeed indicator markings
- Other airspeed limitations



AIRSPEED INDICATOR MARKINGS

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
Red Arc*	20 - 41	Low airspeed warning.
White Arc	41 -100	Full Flap Operating Range. Lower limit is maximum weight V_{SO} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	51 - 140	Normal Operating Range. Lower limit is maximum weight V_S at most forward C.G. with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	140 - 175	Operations must be conducted with caution and only in smooth air.
Red Line	175	Maximum speed for all operations.

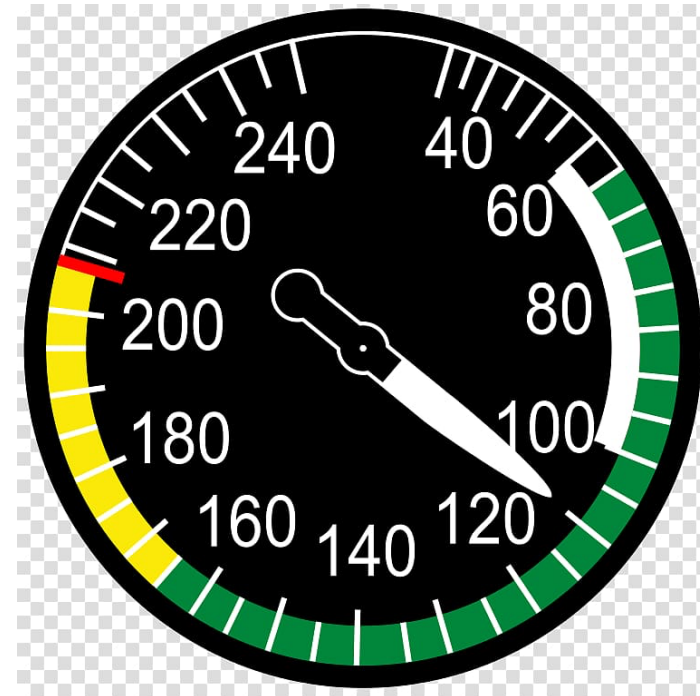
*G1000 airspeed indicator only.

Figure 2-2



Airspeed Limitations

- Cfr. placards
- Use V_a for steep turns
 - Varies 91-110 KIAS
- First notch flaps at $V_{fe} = 140$ KIAS





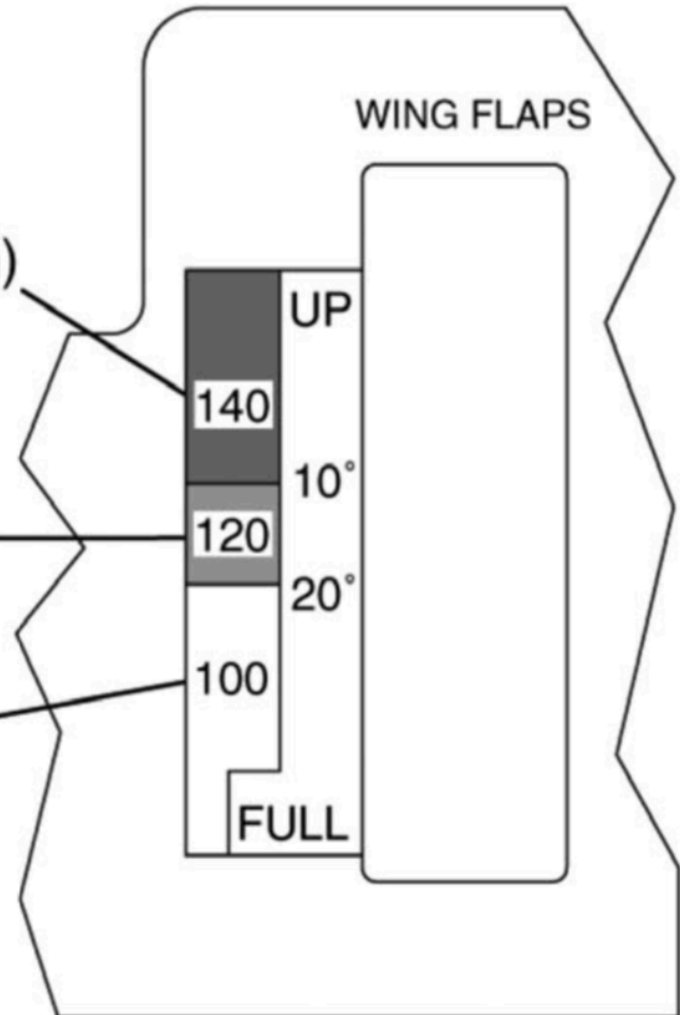
Airspeed Limitations: Flaps

B6146

UP to 10° **140 KIAS**
(Initial flap range with Dark Blue color code; mechanical detent at 10° position)

10° to 20° **120 KIAS**
(Intermediate flap range with Light Blue color code; mechanical detent at 20° position)

20° to FULL **100 KIAS**
(Full flap range with White color code; mechanical stop at FULL position)

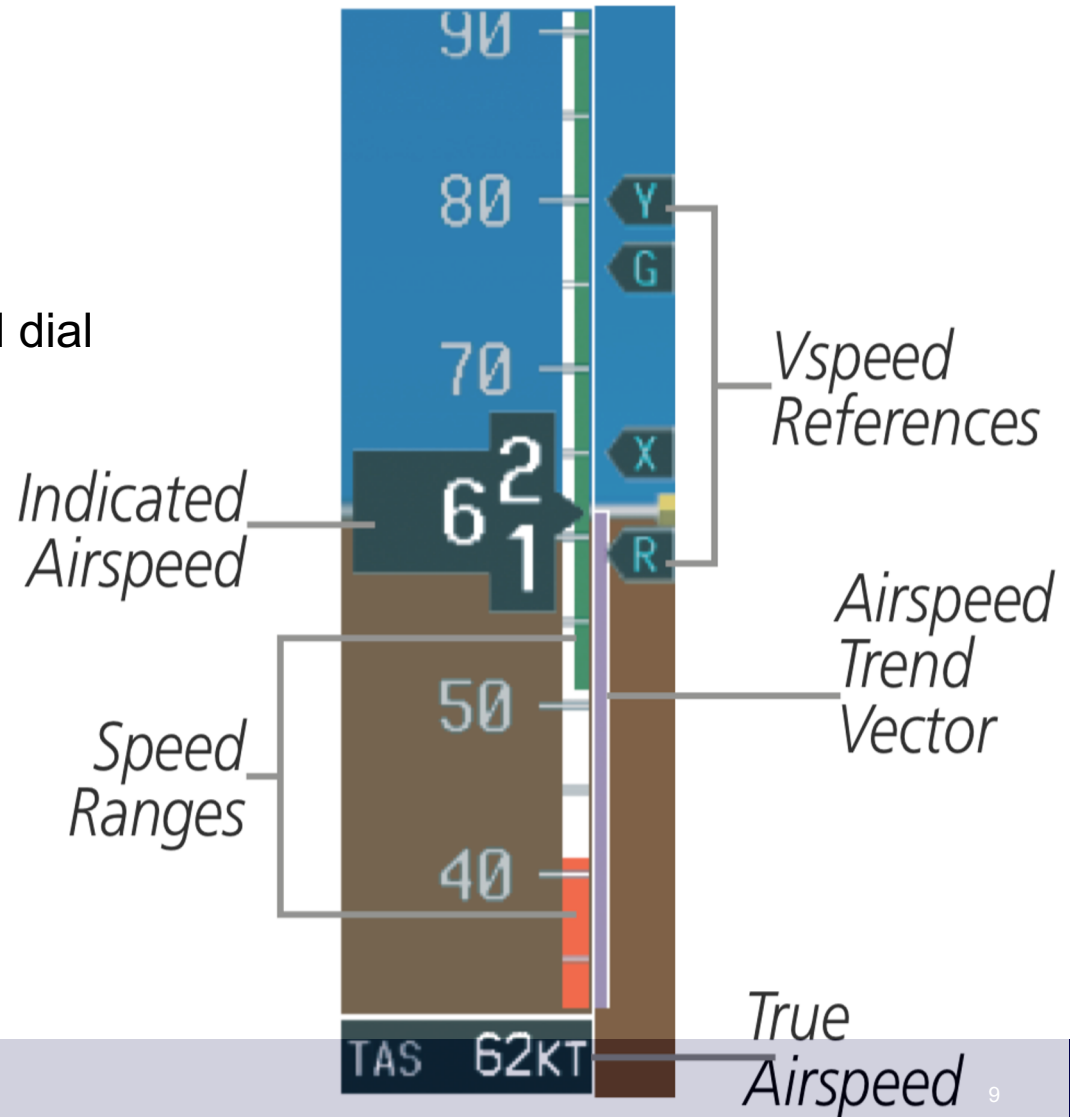




Airspeed Indicator Markings: G1000

Note:

- Some values are fixed
- Others variable
- G1000 indicators vs. round dial





Airspeed Indicator Markings: G1000



Indicated
Airspeed

Speed
Ranges

Vspeed
References

Airspeed
Trend
Vector

True
Airspeed¹⁰



Power Plant Instrument Markings

G1000 182T

INSTRUMENT	RED LINE (MIN)	RED ARC (LWR)	YELLOW ARC	GREEN ARC (NORMAL OPERATING RANGE)	RED ARC (UPR)	RED LINE (MAX)
Tachometer	----	----	----	2000 to 2400 RPM	2400* to 2700 RPM	---
Manifold Pressure	---	---	---	15 to 23 in.hg.	---	---
Cylinder Head Temperature	----	----	----	200 to 500°F	----	500°F
Oil Temperature	----	----	----	100 to 245°F	245* to 250°F	---
Oil Pressure	----	0 to 20 PSI	----	50 to 90 PSI	115* to 120 PSI	---
Fuel Quantity	0 (2.5 Gallons Unusable Each Tank)	----	0 to 8 Gallons	8 to 35 Gallons	----	---
Fuel Flow	----	----	----	0 to 18 GPH 24 GPH	----	---
Vacuum Gage	----	----	----	4.5 to 5.5 in.hg.	----	---

*Maximum operating limit is lower end of red arc.



Engine Operating Limits

Engine Manufacturer: Textron Lycoming

Engine Model Number: IO-540-AB1A5

Engine Operating Limits for Takeoff and Continuous Operations:

Maximum Continuous Power: 230 rated BHP at 2400 RPM

Maximum Cylinder Head Temperature: 500°F (260°C)

Maximum Oil Temperature: 245°F (118°C)

Oil Pressure, Minimum: 20 PSI

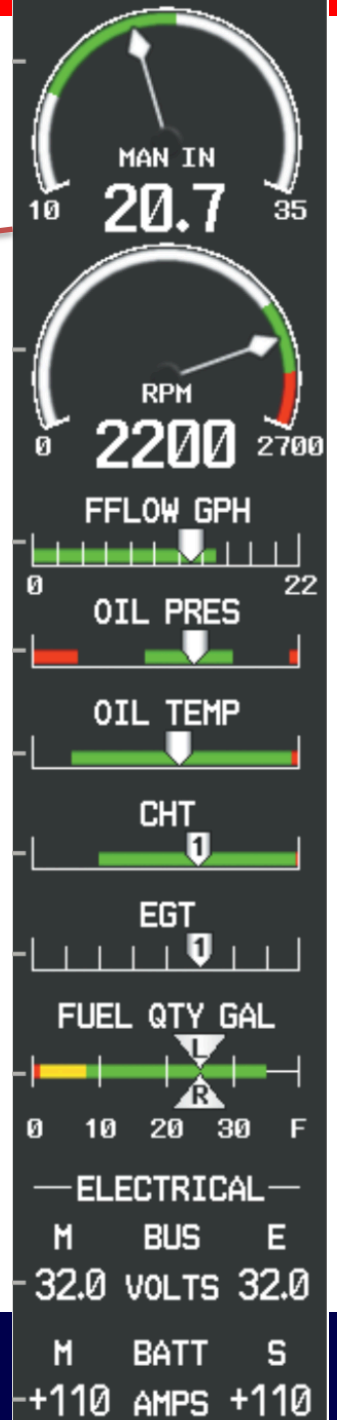
Oil Pressure, Maximum: 115 PSI

CAUTION

ENGINE OPERATION WITH INDICATED OIL PRESSURE BELOW THE GREEN BAND RANGE WHILE IN CRUISE OR CLIMB CONFIGURATION IS CONSIDERED ABNORMAL AND SHOULD BE INSPECTED BY QUALIFIED MAINTENANCE PERSONNEL BEFORE NEXT FLIGHT.

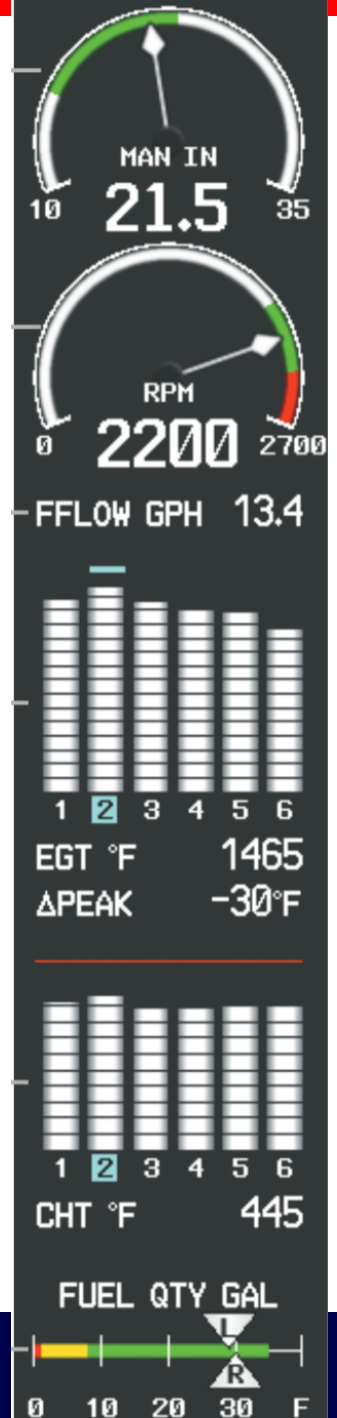
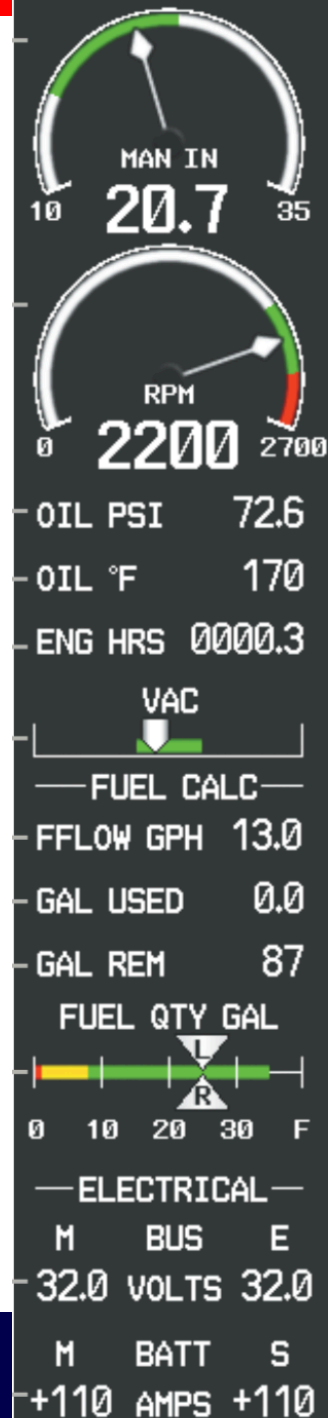
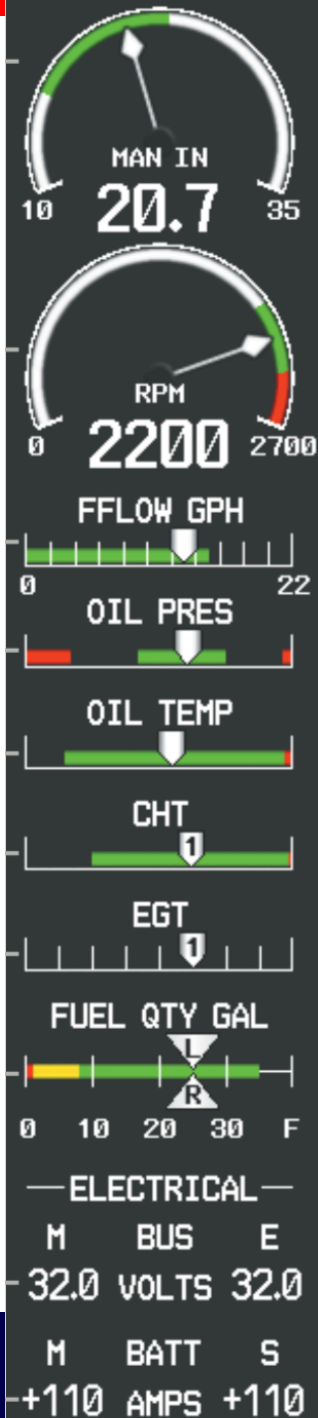


Power Plant: What About Current Values?





Current Values, Cont'd





Fuel Limitations

- Type of fuel?
- How much (or little) fuel?
- Under which circumstances?
- FAA and CAP



Fuel Limitations

- Type of fuel
 - 100LL grade aviation BLUE
 - 100 grade aviation GREEN

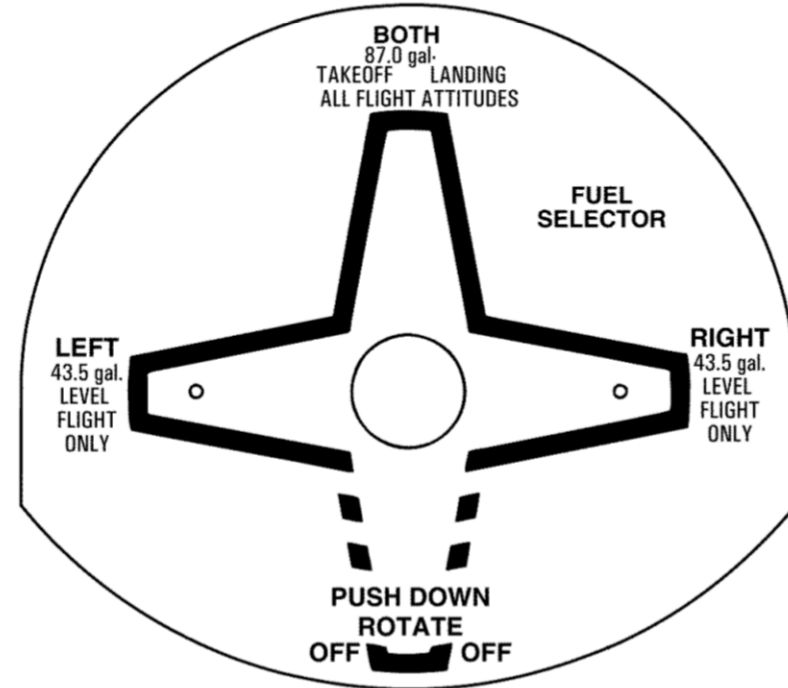
FUEL
100LL / 100 MIN. GRADE AVIATION GASOLINE
CAP. 43.5 U.S. GAL. (164 LITERS) USABLE
CAP. 37 U.S. GAL. (140 LITERS) USABLE TO LINE
OF HOLES INSIDE FILLER INDICATOR TAB.
CAP. 32 U.S. GAL. (121 LITERS) USABLE TO BOTTOM
OF FILLER INDICATOR TAB.

- How much (or how little) fuel (182T)
 - 2x 46.0 gallons = 92.0 total
 - 2x 43.5 gallons = 87.0 total useable
 - CAP “max” (typical re-fuel level) 50.0 gallons
 - How about min values?



Fuel Limitations: Under Which Circumstances

- Level flight
 - LEFT / RIGHT / BOTH
- Takeoff / landing
 - BOTH
- Slip / skid uncoordinated
 - LEFT / RIGHT / prolonged flight prohibited with <math><1/4</math> tank
 - Max slip / skid with dry tank 30 sec
- Refueling
 - LEFT / RIGHT, on flat ground
- Fuel remaining at **red line**





Oil Specs

Oil Grade (Specification):

MIL-L-6082 or SAE J1966 Aviation Grade Straight Mineral Oil or MIL-L-22851 or SAE J1899 Ashless Dispersant Oil. Oil must comply with the latest revision and/or supplement for Textron Lycoming Service Instruction No. 1014, **must be used**.

What does that even mean?



<http://clipart-library.com/clipart/81859.htm>



Oil Specs

- Different types of oil used with brand new engine and “later”
- Use the oil type specified in the AIF
- If you have to buy new oil at another airport, match what’s in the plane

Data Current As Of: 02/18/2021 (Z)

CIVIL AIR PATROL AIRCRAFT INFORMATION FILE				
N <u>N183CP</u> CAP - <u>CAP481</u> TYPE <u>182T</u> HP <u>230</u>		<input type="checkbox"/> Exxon Elite 20W-50 <input type="checkbox"/> Mineral Oil / Other <input checked="" type="checkbox"/> Phillips X/C 20W-50		
FULL FUEL USEFUL LOAD <u>536</u> LBS		OIL		
TIRE PRESSURES: NOSE <u>49</u> PSI		MAINS <u>42</u> PSI		
— MAJOR INSPECTIONS DUE —				
REQUIRED INSPECTIONS	DATE WHEN DONE	HOURS WHEN DONE	NEXT DUE HOURS	NEXT DUE DATE
MID - CYCLE OIL CHANGE	01/21/2021	2144.8	2194.8	07/21/2021
ANNUAL INSPECTION	01/21/2021	2144.8	NA	01/31/2022
100 HR AIR WORTHINESS INSP		2144.8	2244.8	
ENGINE OVERHAUL		0	2200	
PROPELLER OVERHAUL	04/15/2018			04/30/2023
PROP GOVERNOR OVERHAUL	04/15/2018			04/30/2023



Oil Specs: Min/Max Levels

- “total capacity of 9 quarts, with the oil filter accounting for approximately one quart”
- “oil sump has a capacity of 8 quarts”
- “must not be operated on less than 4 quarts”
 - as measured by the dipstick
- “for extended flights, the engine should be filled to capacity”



KOEL

- What is it and why do we care?
- How do we use it?
- How does it fit into our overall airworthiness considerations?
 - FAR 91.213

MEL?

Type Certificate

ADs

KOEL

FAR 91.205

PIC Decision

From an equipment / instrument point of view, are we legal & safe to fly?



KOEL

Kinds of
Operations
Equipment List

System, Instrument, Equipment and/or Function	KIND OF OPERATION				COMMENTS
	V F R D A Y	V F R N I G H T	I F R D A Y	I F R N I G H T	
PLACARDS AND MARKINGS					
182T Nav III - GFC 700 AFCS POH/AFM	1	1	1	1	Accessible to pilot in flight.
Garmin G1000 Cockpit Reference Guide	1	1	1	1	Accessible to pilot in flight.
AIR CONDITIONING					
1 - Forward Avionics Fan	1	1	1	1	
2 - PFD Fan	0	0	0	0	
3 - MFD Fan	0	0	0	0	
4 - Aft Avionics Fan	1	1	1	1	
COMMUNICATIONS					
1 - VHF COM	0	0	1	1	
ELECTRICAL POWER					
1 - 24V Main Battery	1	1	1	1	
2 - 28V Alternator	1	1	1	1	
3 - 24V Standby Battery	0	*	*	*	* Refer to Note 1.
4 - Main Ammeter	1	1	1	1	
5 - Standby Ammeter	0	*	*	*	* Refer to Note 1.



KOEL

System, Instrument, Equipment and/or Function	KIND OF OPERATION				COMMENTS
	V F R D A Y	V F R N I G H T	I F R D A Y	I F R N I G H T	
LIGHTING					
1 - PFD Bezel Lighting	0	0	0	1	
2 - PFD Backlighting	*	1	1	1	*Refer to Note 2.
3 - MFD Bezel Lighting	0	0	0	1	
4 - MFD Backlighting	*	1	1	1	*Refer to Note 3.
5 - Switch and Circuit Breaker Panel Lighting	0	1	0	1	
6 - Standby Airspeed Indicator Internal Lighting	0	1	0	1	
7 - Standby Altimeter Internal Lighting	0	1	0	1	
8 - Non-stabilized Magnetic Compass Internal Lighting	0	1	0	1	
9 - Standby Attitude Indicator Internal Lighting	0	1	0	1	
10 - Cockpit Flood Light	0	1	0	1	
11 - Aircraft Position (NAV) Lights	0	1	1	1	
12 - STROBE Light System	1	1	1	1	
13 - BEACON Light	0	0	0	0	
14 - TAXI Light	0	0	0	0	
15 - LAND (Landing) Light	0	1	0	1	Operations for hire only



CAPT 70-5Q-A

Please grab your filled-out questionnaire – we'll review each of the questions in class.

You will need this for your Form 5, so make sure you are clear on all the answers.

CAP PILOT FLIGHT EVALUATION QUESTIONNAIRE			
MEMBER'S NAME & GRADE	CAPID	AIRCRAFT MAKE & MODEL	
CHECK PILOT NAME & GRADE	CAPID	SCORE	DATE

Complete this open book questionnaire using the Flight Manual/Pilot's Operating Handbook/STC. If a question or part of a question is not applicable, write in NA. The check pilot will review and grade the questionnaire. Minimum passing score is 80% corrected to 100%. The completed, scored, and corrected questionnaire will be filed in the pilot's flight records.

- Total fuel capacity _____ gal. Usable fuel _____ gal. Location _____.
- Number of fuel drains _____ Fuel color _____.
- Today's average fuel burn is estimated to be _____ GPH; providing _____ hours of endurance.
- Oil capacity is _____ quarts. Minimum for takeoff is _____ quarts.
- Max takeoff weight _____ Max Landing weight _____.
- Maximum RPM and MP for takeoff are _____ and _____ in/Hg.
- C182/C206/GA8 – Max climb power MP _____ RPM _____.
- White ARC _____ KIAS Range. Green ARC _____ KIAS Range.
- Gliding distance @ 3,500ft AGL, Max Weight, Zero Wind _____.
- This plane operates on a _____ volt electrical system. Main battery _____ volts.
- Magnetos are checked at _____ RPM. RPM drop should not exceed _____ RPM.
- Useful load for today's flight is _____.
- Takeoff & Landing distance for today's flight is T/O: _____ Landing: _____.
- Today's Density Altitude is _____.



Provide the following airspeeds in KIAS at maximum gross weight?

Va (maneuvering speed)		Vx (best angle of climb, sea level)	
Vso (stall, landing config)		Vy (best rate of climb, sea level)	
Vs1 (stall, cruise config)		Best glide Speed	
Vne (never exceed speed)			

Complete the BOLD FACE memory items for the following emergencies.

- Engine failure immediately after takeoff.

- Engine fire during start.

- Engine failure during flight (Restart).

- Autopilot or Electrical Trim Failure (if applicable) otherwise Engine Fire during flight



Other Questions?



Homework Assignment for Module 4

- Watch video “[G1000 Garmin tutorial](#)”
- AXIS module “Garmin G1000 VFR”
- Watch video “[GFC 700 training](#)”
- AXIS module “GFC 700 Autopilot Hazard Alert”