AMT 272 Electrical Hardware & Systems **\_\_\_\_\_\_**

Battery Worksheet 16

BACKGROUND DATA

Lead Acid Cells:

2.2V open circuit (no load) voltage

2.0V nominal (loaded) working voltage

1.67V minimum working (loaded) voltage, considered discharged

Typical internal resistance (loaded) is .035Ω average

Example: 12V Lead Acid battery (6 cells)

13.2V open circuit voltage

12V loaded voltage

10V discharged/dead battery - needs to be recharged

Nickel Cadmium Cells:

1.3V open circuit (no load) voltage

1.25V nominal (loaded) working voltage

1.0V minimum working (loaded) voltage, considered discharged

Typical internal resistance (loaded) is .0125Ω average

Example: 24V Ni-Cad battery (20 cells)

26V open circuit voltage

25V nominal (loaded) working voltage

20V discharged/dead battery - needs to be recharged

Amp-Hour Capacity:

Ahr = current draw (in amps) X time (in hours)

Time is measured from when current draw is initiated to when the battery reaches its minimum working voltage.

Example: 12V Lead Acid battery

Current draw of 15A

Time to reach 10V is 2 hours

Ahr = 15A X 2 hrs equals 30 Ahr capacity

Example: 24V Ni-Cad battery 40 Ahr capacity

Current draw of 17.5A

Time = 40 Ahr/17.5A equals 2.2 hours of operating time (meets 30 minute rule).

BATTERY PROBLEMS

NAME:\_\_**KEY**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE:\_\_\_\_\_\_\_\_\_\_\_\_\_

1) If a 24V battery, 35 Ahr, in a Cessna 206 will run the 250W landing light for 108 minutes before reaching the 20V battery discharged limit; is the battery operating within its rated capacity? = 1.8 hrs. → = 10.42 amps. → 1.8 hrs. × 10.42A = 18.75 Ahrs.

Calculated Ahr:\_18.75 Ahrs., NO\_

2) A 12V battery, 25 Ahr, is installed in a Cessna 150. The electrical system draws 42 amps; how long would it take to discharge the battery down to 10V? = .6 hr. = 36 min.

Calculated discharge time:\_36 min.\_\_\_\_\_\_

Does this battery meet the capacity requirements found in AC 43.13-2B, Ch. 10, Sect. 5?

Yes, it meets the capacity requirements of 30 minutes.

NOTE: For questions 3, 4, and 5, 1 horsepower is equal to 746 watts.

3) A Cessna 180 has an O-470 engine and a 12V battery. It takes 1.25 hp to turn the engine over at 150 rpm. The voltage across the starter is 8V when the starter is engaged.

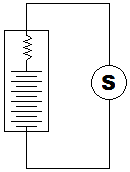
Determine the following:

Power of starter in Watts:\_932.5W \_\_\_\_\_\_\_\_\_\_ 1.25 hp × 746W = 932.5W

Current draw of the starter:\_116.56A\_\_\_\_\_\_\_\_\_ = 116.56A

Internal resistance of the battery:\_.034Ω\_\_\_\_\_\_ = .034Ω

Draw a schematic diagram of the starter system, include the internal resistance of the battery, in the space below:



.034Ω Int.

4V

8V

932.5W [1.25 hp]

116.56A

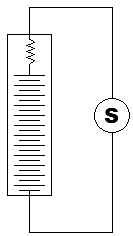
.069Ω

BATTERY PROBLEMS (continued)

4) A 24V lead-acid battery, with an internal resistance of .035Ω, is used to start a turbine engine that has a starter generator with a resistance of .02Ω. How much power is supplied to the starter? Draw a schematic of the starter circuit properly labeled with values.

RT: .035Ω + .02Ω = .055 Ω → = 436.36A →

Power:\_3809.42W\_\_\_\_\_ 436.36A × .02Ω = 8.73V → 436.36A × 8.73V = 3809.42W

Horsepower:\_5.11 hp \_\_ = 5.11 hp

.035Ω Int.

15.27V

8.73V

3809.42W [5.11 hp]

436.36A

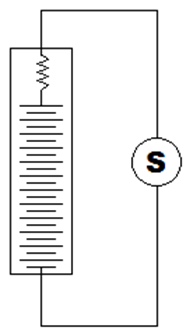
.02Ω

5) When a 24V Ni-Cad battery, with an internal resistance .0125Ω, is used to start the same turbine engine with the same starter. How much power is supplied to the starter? Draw a schematic of the starter circuit properly labeled with values.

RT: .0125Ω + .02Ω = .0325 Ω → = 738.46A →

Power:\_10907.1W\_\_\_\_\_ 738.46A × .02Ω = 14.77V → 738.46A × 14.77V = 10907.1W

Horsepower:\_14.62 hp\_\_ = 14.62 hp



.0125Ω Int.

9.23V

14.77V

10907.1W [14.62 hp]

738.46A

.02Ω

6) Which 24V battery would turn-over the turbine engine faster? NiCAD

7) What would be internal resistance of the turbine starter need to be to obtain the maximum transfer of power with the 24V Ni-Cad battery? .0125Ω [R Int. = R Load]