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Appendix 3.4 E-engines

Appendix 3.4 E-Engine

1. All classes of IC engine can be replaced with en E-engine power system. Because these have different characteristics, E-engines will have different methods of control from IC power.

2. The most important factor is to limit the accumulator/battery capacity. This makes it possible for the pilot to choose from the many different e-power systems available.

3. To ensure there is no increase in speed and power, we have set these general limitations for all E-systems

3.1 All E-setups must be suitable for a minimum flight time of 450sec in combat. Remember that this is different from normal flight. You will consume more power when flying with a streamer and you must allow for RPM testing at the start of your heat.

3.2 All E-power systems will be limited by the maximum rpm and the pitch of the propeller. This **"prop-stream-sum" (PSS)** will help limit the maximum speed of the model. The "prop-stream-sum" is calculated by multiplying the maximum RPM by the pitch of the propeller in inches. The current limit of the PSS is set at 72000. This system of control allows for a wide variety of power systems to be used without restrictions other than those based on performance.

Examples:

PSS	pitch	max RPM, rounded
72000	7	10.300
72000	6,5	11.100
72000	6	12.000
72000	5,5	13.100
72000	5	14.400
72000	4,5	16.000

4. In general terms, E-engines will not be the fastest in the field, they have better performance during start and tight turns.

5. Replacement of IC-engines:

engine class	max. Wh	max. prop diameter	min weight	max. weight
.10	28 Wh	9 inch	500g	1500g
.15	38 Wh	9 inch	700g	1500g
.21	50 Wh	10 inch	1000g	1700g ; from 01.01.2010 on: 1500g
.25	67 Wh	11 inch	1200g	1700g ; from 01.01.2010 on: 1500g
normal twin	twice .10 or .15 setups	9 inch	2x see above	1700g
all other multiengine A/C	67 Wh	11 inch	1200g	1700g

6. Penalties:

At large events all models will be RPM tested before the heat starts. Your motor, battery and propeller must be of similar/same specifications as the time the model was booked into the contest. If you have changed your system from this you need to ask the contest director for permission to continue. Your allowed rpm and prop size needs to be documented on your score sheet (it helps the judge).

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6.1 According the § 3.4.2 Engine over rpm limit
Check your maximum allowed RPM. If your rpm exceeds the allowed limit by more than 100rpm you will receive a penalty for trying to compete with excessive power. Remember the max rpm figure is regulated by the pitch of your propeller.
Example: 72.000 PSS divide 5 inch pitch = 14.400 RPM (max. deviation over the limit is 14.500 RPM)
The RPM measuring shall be done inside 15 sec.

6.2 early landing in case of too much consumed energy
No penalty is given if a forced landing was due to technical damage, streamer in the prop, collision, plane crash or any other unforeseen circumstance.
If the A/C is forced to land **without** a technical problem due to lack of accu/battery power and if the contest judge or organiser has doubts of a correct E-setup they can appoint a "technical control".
(The organisation will have a specialist for this duty. He will check for excessive power consumption.) The pilot can get a penalty of 0 positive points for this round if he is found to be using too much power.
These point is to discourage the E-pilots who go "over the top".

7. Example list of accu compositions
In case of the very fast changing of accu cells in the international market we use the item Wh Watt*hour.
Some possible accu sets: (all LiPo) most used types in **rich** type. Other cell types can also be used, calculate the Wh with the technical data of your cells.

engine class	nominal volt per cell	number of cells, seriel	capacity Ah, possible parallel	result Wh, rounded
.10	**3,7**	**3**	**2,5**	**28**
.10	3,7	4	1,8	27
.15	**3,7**	**3**	**3,4**	**38**
.15	3,7	4	2,5	37
.15	3,7	5	2	37
.21	**3,7**	**3**	**4,5**	**50**
.21	**3,7**	**4**	**3,4**	**50**
.21	3,7	5	2,7	50
.21	3,7	6	2,2	49
.25	3,7	3	6	67
.25	**3,7**	**4**	**4,5**	**67**
.25	3,7	5	3,6	67
.25	3,7	6	3	67

8. Some examples of proven E-setups:

engine class	remark	E-engine	controller	prop	accu producer	accu cells	accu capacity	voltage	Wh
.15 class	cheap class	xx3536xx	30A						
.15 class	middle class	AXI 2814/12	PIX3000	Aeronaut 9x5	KOKAM	3S	3300 Ah	11,1 V	36,63
.21 class	cheap class	xx3542xx	40A						
.21 class	middle class	KORA 10/12	PIX4000	Aeronaut 9,5x5	SAEHAN	3s2p	2100 Ah	11,1 V	46,62
.25 class	cheap class	xx3548xx	40A						
.25 class	middle class	KORA 15/10	PIX4000	APCe 9x4,5	SAEHAN	4s2p	2100 Ah	14,8 V	62,16
.25 class	middle class	KORA 15/12	PIX4000	APCe 11x5,5 (reduc.diameter)	SAEHAN	4s2p	2100 Ah	14,8 V	62,16

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A picture of different accu packs.

If you have questions, please send me a mail, I send you more information.
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