

# Generator coil Tests

with 10k Ohm load

V1.0

2021-01-23

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**Appendix 1.1** Reed - Voltage over coil

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**Appendix 2.1** Hall - Voltage over Gate-Source MOSFET circuit

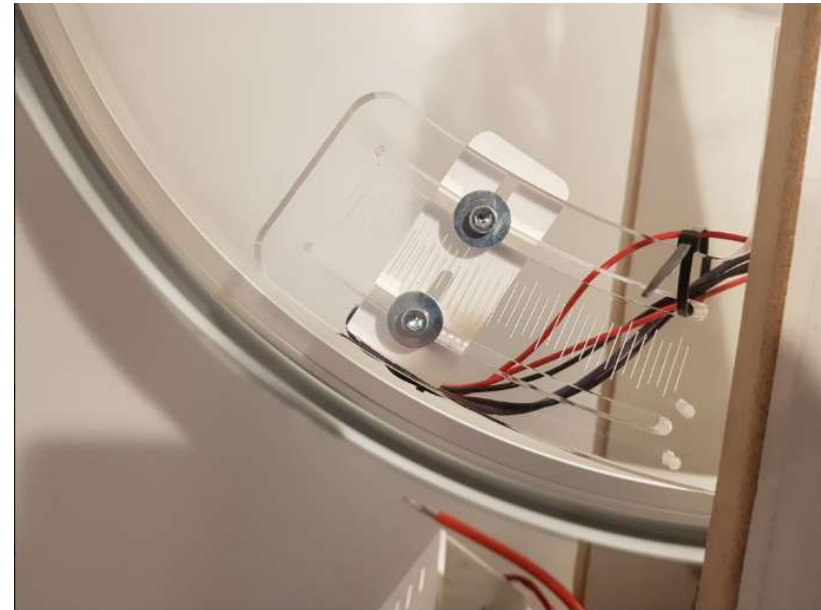
**Appendix 2.2** Hall - Voltage over resistor in MOSFET circuit

## Generator coil specs

- Coil wire AWG 16
- 4x Coil 291 windings, in series
- Total 1164 windings
- Total inductance +/-1.35H
- Core = welding rods, DIN 8554:G1 (=R45)



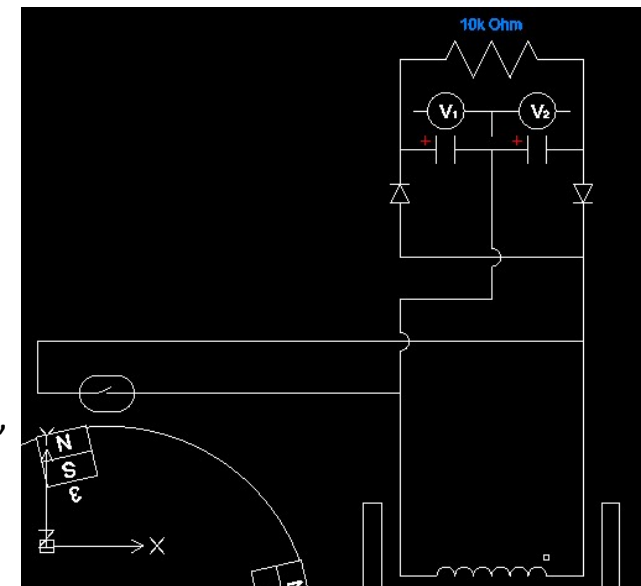
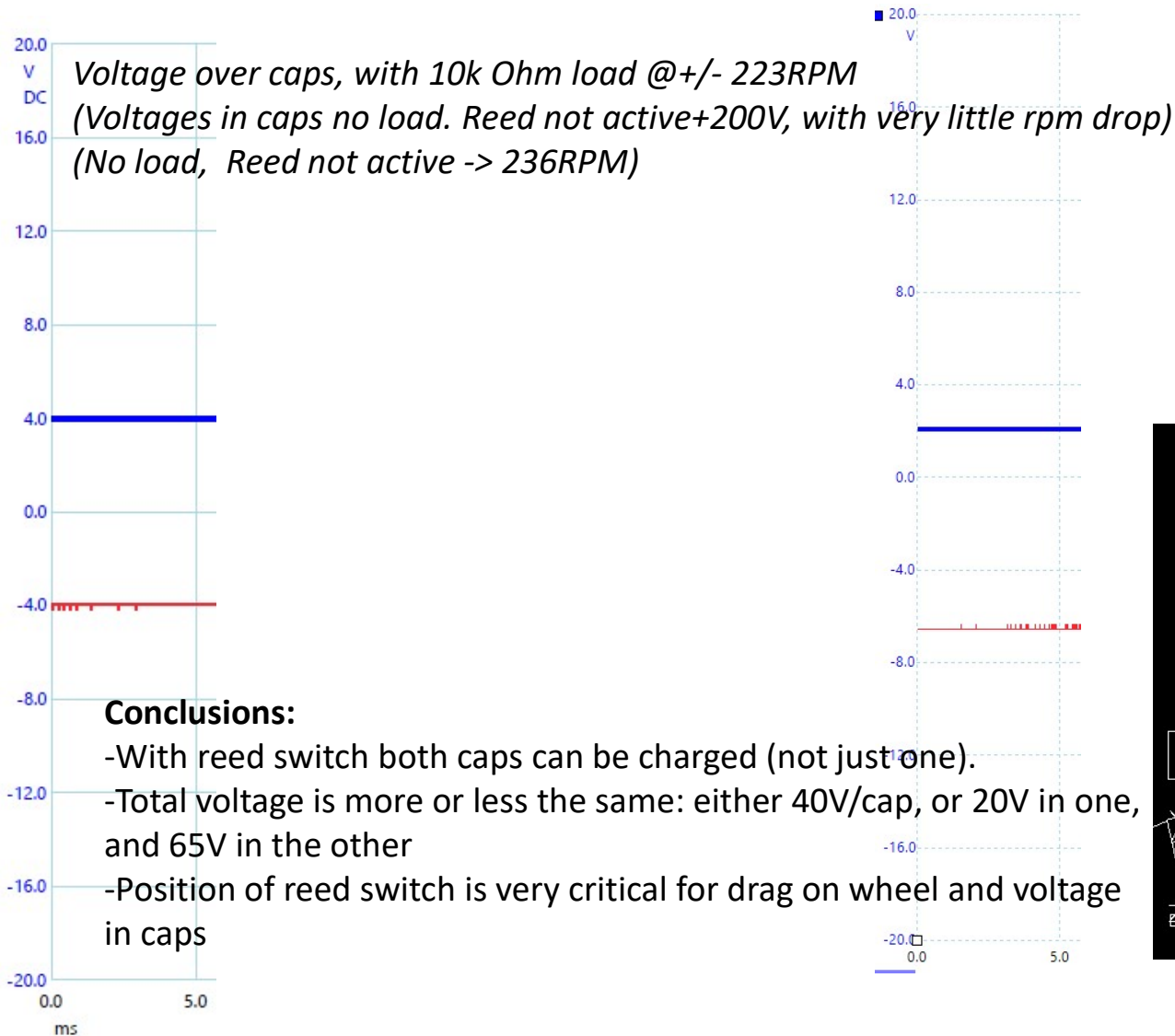
*Adjustable Reed switch / Hall sensor brackets*



## 2020-01-20.1

Reed Switch, with 10k Ohm load, 2mm coil gap, x10 probes

Test: *Is total voltage higher if voltage is maximized in both caps, or maximized in just one cap?*



## 2020-01-20.2

Reed Switch, with 10k Ohm load, 2mm coil gap, x10 probes

Test: *Is there less drag if voltage is optimized in just one cap?*



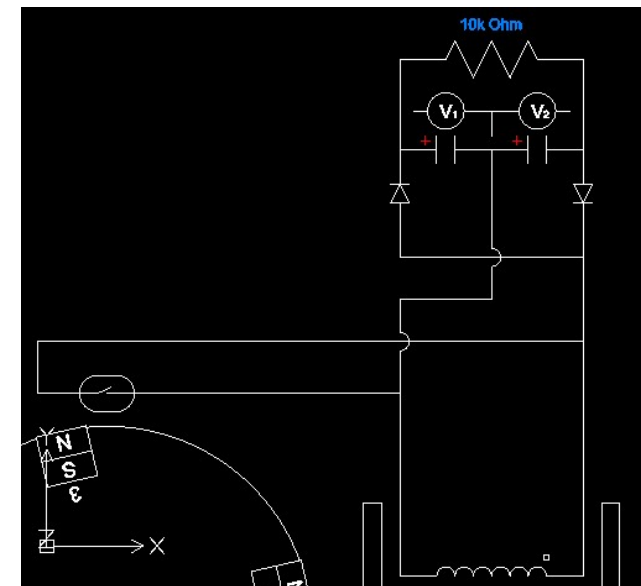
*Voltage over caps, with 10k Ohm load @ +/- 213RPM*

*Reed Switch positioned for max voltage in 1 Cap*

*(10k Ohm load, Reed not active -> @ +/- 224RPM)*

### Conclusions:

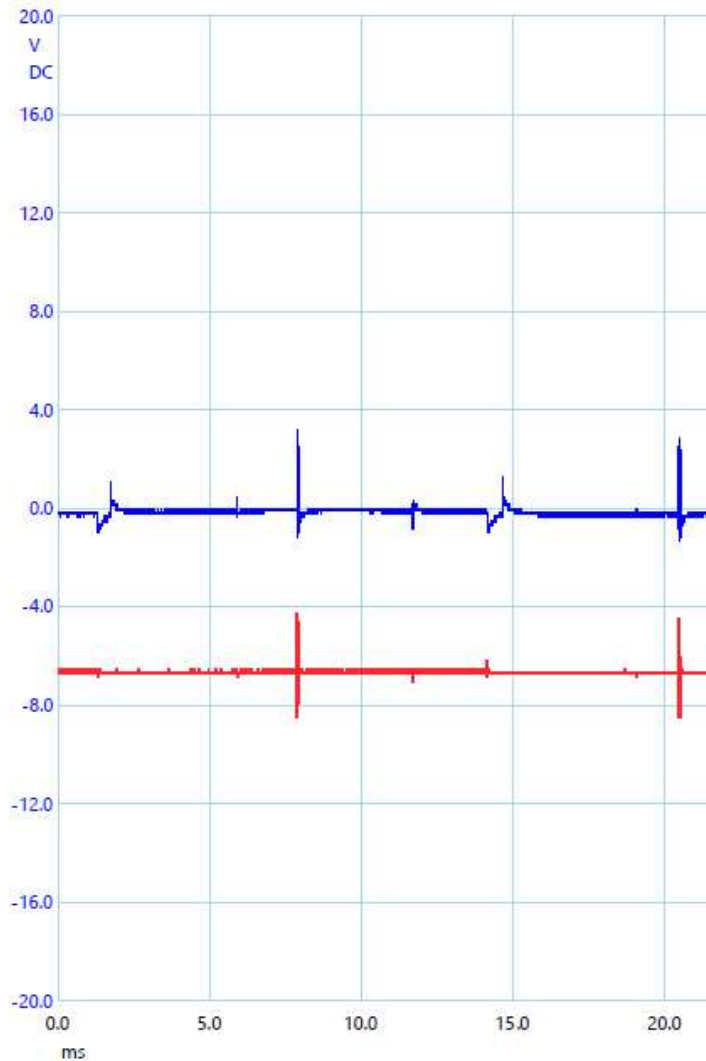
-Drag is not less if reed switch is positioned for max voltage in just one cap



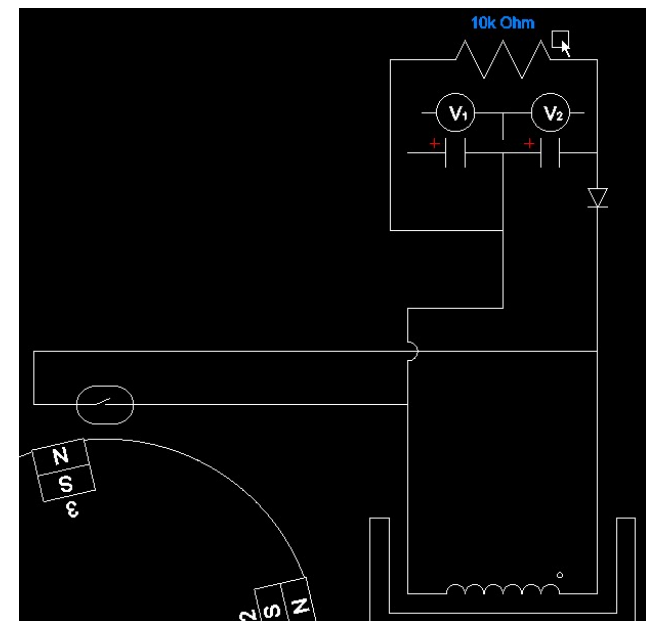
## 2020-01-20.3 sheet 1 of 2

Reed Switch, with 10k Ohm load, 2mm coil gap, x10 probes

Test: *Is there less drag if only 1 cap is connected/used (instead of 2)?*



*Voltage over 1 cap, with 10k Ohm load @ +/- 223RPM  
Reed Switch positioned for max voltage in 1 Cap  
(10k Ohm load, Reed not active -> @ +/- 230RPM)*



2020-01-20.3 sheet 2 of 2

Reed Switch, with 10k Ohm load, 2mm coil gap, x10 probes

Test: *Is there less drag if only 1 cap is connected/used (instead of 2)?*

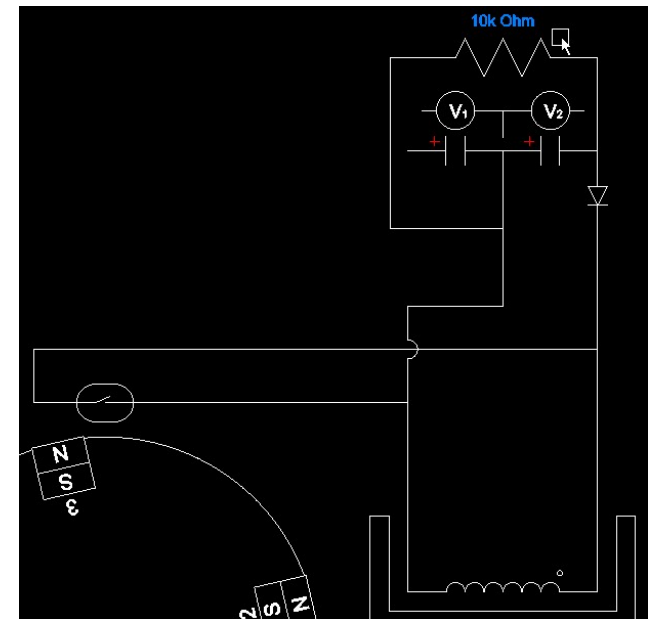
**Conclusions:**

- Drag doesn't seem to be significantly less if only 1 cap is used
- Spikes occur
- Spikes interfered with RPM signal since the reed switch wires are alongside the RPM sensor wires
- At the end of the test the Reed Switch didn't open anymore, was permanently closed. This was an anticipated issue with mechanical switching like a Reed Switch

Reed Switch OFF



Reed Switch ON

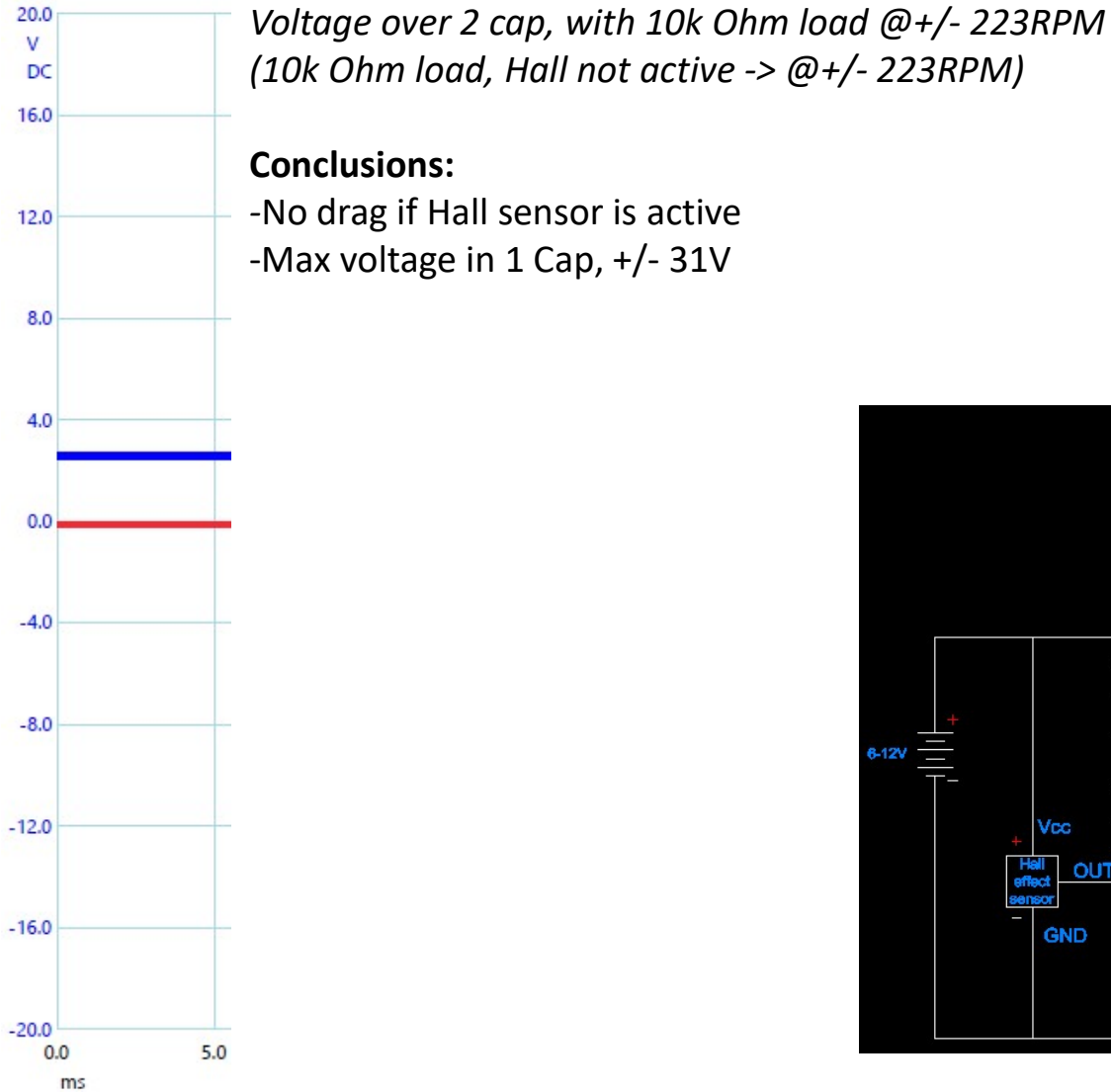




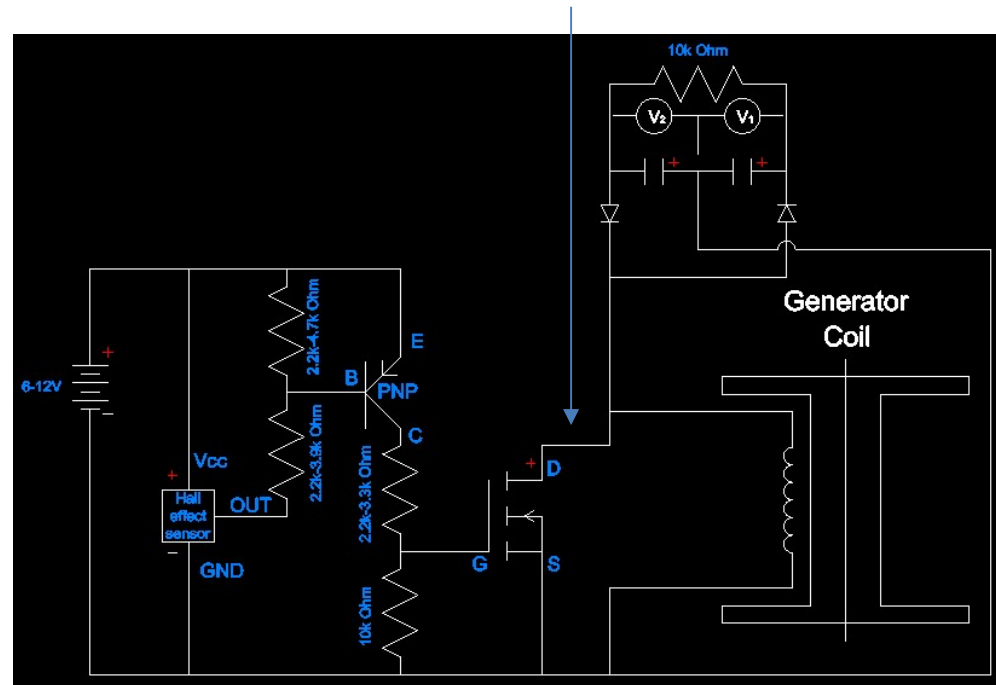
**2020-01-21.1**

Hall Sensor, with 10k Ohm load, 2mm coil gap, x10 probes

Test: *What voltage can cap be charged to without MOSFET diode, and is there drag?*



Location of MOSFET diode (1N4007)  
left out for this test





**2020-01-21.2**

Hall Sensor, with 10k Ohm load, 2mm coil gap, x10 probes

Test: *What voltage can cap be charged to with MOSFET diode, when Hall sensor is left in the same position as previous test and is there drag?*



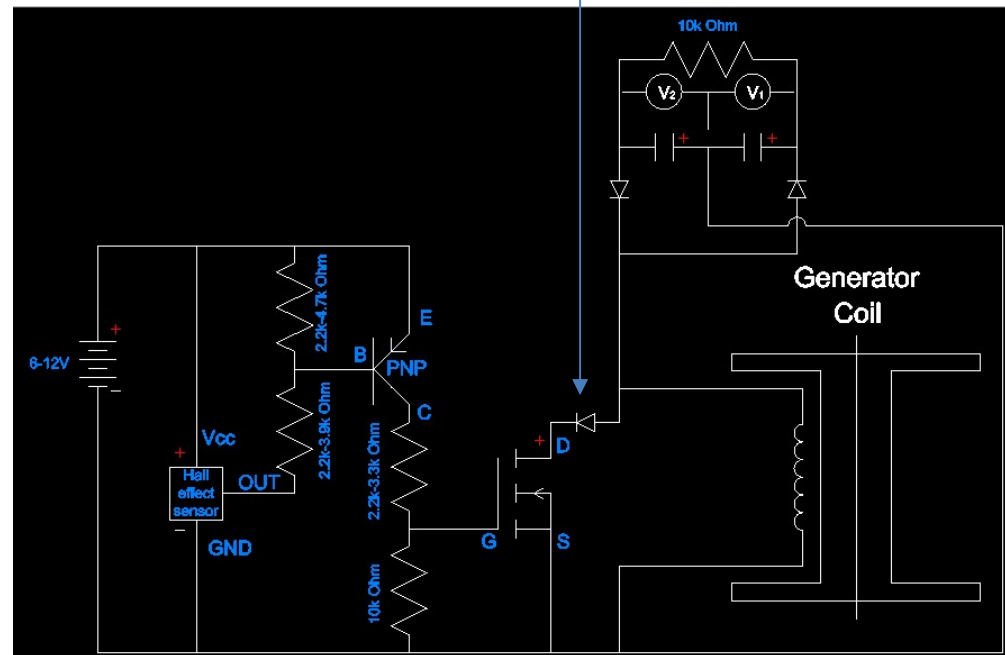
*Voltage over 2 cap, with 10k Ohm load, MOSFET diode, @ +/- 230RPM  
Hall left in same positioned as in previous test, voltage +/- 31V  
(10k Ohm load, Hall not active -> @ +/- 230RPM)*

**Conclusions:**

When Hall sensor is left in the same position and MOSFET diode is present:

- No drag if Hall sensor is active
- Max voltage in 1 Cap, +/- 31V

Location of MOSFET diode (1N4007)



### 2020-01-21.3

Hall Sensor, with 10k Ohm load, 2mm coil gap, x10 probes

Test: *What voltage can cap be charged to with MOSFET diode, when Hall sensor position is optimized for max. voltage and is there drag?*

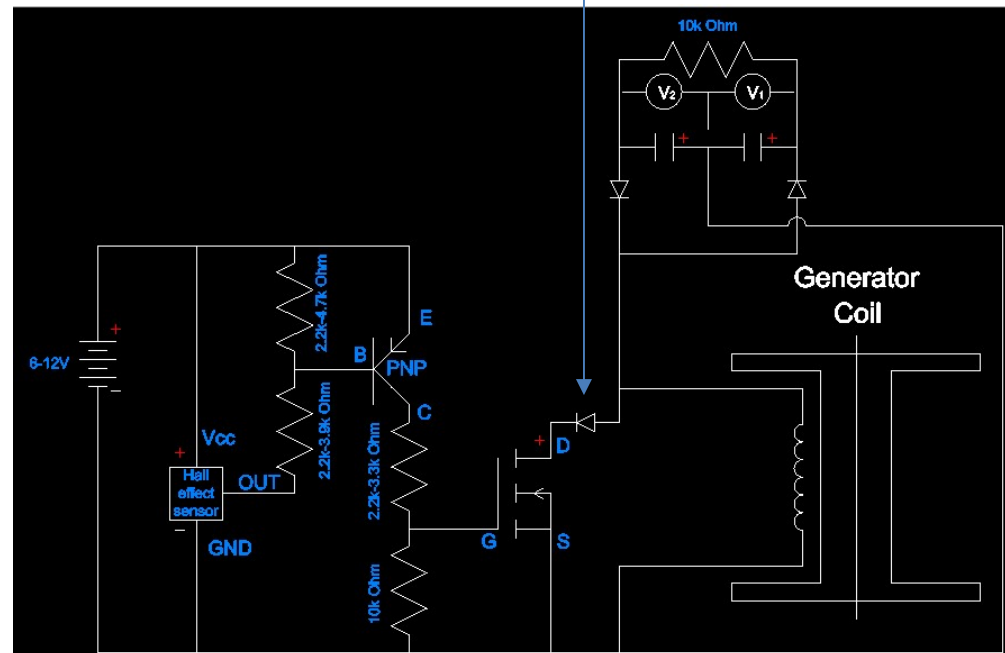


#### Conclusions:

When Hall sensor position is optimized for max voltage and MOSFET diode is present:

- Drag if Hall sensor is active
- Max voltage in 1 Cap, +/- 83V
- MOSFET diode has a significant effect. This diode was initially just placed with the intention to protect the MOSFET in case the reverse voltage over the Source-Drain would exceed 200V

Location of MOSFET diode (1N4007)





## Overall conclusions

Reed switch circuit yields +/-80V with little drag

Reed switch position is very critical for drag on wheel and voltage in caps

Reed switch (mechanical) is anticipated to yield problems/failure when used for prolonged time

HALL circuit with MOSFET diode yields +/- 80V with drag

HALL circuit without MOSFET diode yields +/- 31V no drag

The effects of the MOSFET diode on the circuit are peculiar and were discovered accidentally: the diode was only placed for protection in the (unlikely) case that the generator coil would be able to yield a +200V over the Source-Drain in reverse direction. It was not anticipated that leaving this diode out would have an effect since the MOSFET by itself only forwards current in one direction normally (with voltages below 200V). This phenomenon should be further investigated.

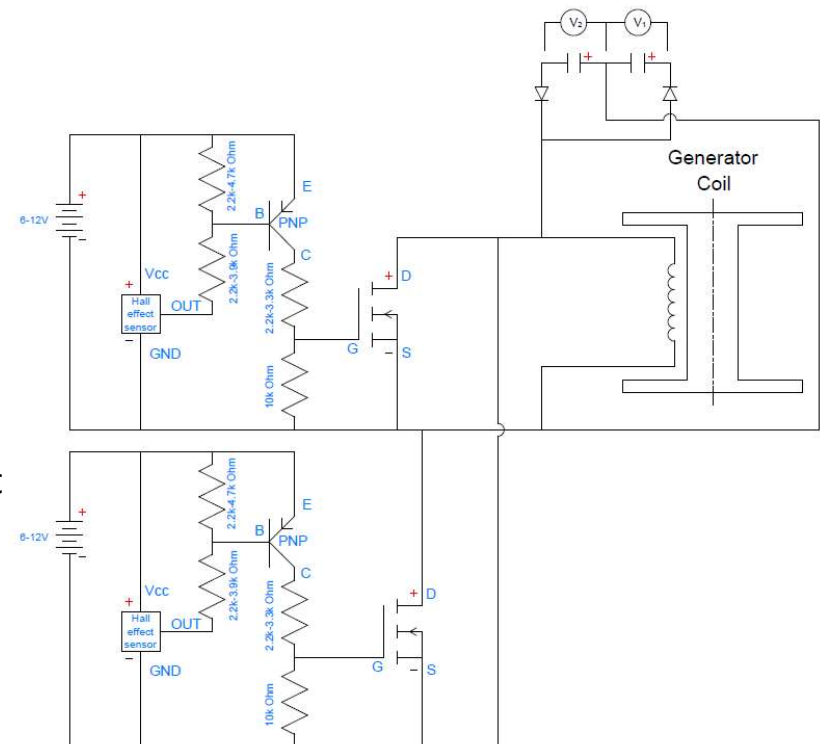
## Suggested future tests

### Hall sensor circuit

- Test with double hall sensor circuit, so both sides of the wave can be caught (see image) *Planned for next test set*
- Include a timer circuit in the circuit, so the 'on-time' of the MOSFET can be adjusted (shortened), or even be changed to an intermitted signal *Planned for next test set*
- Test with different types of output diode for the MOSFET diode (now 1N4007), e.g. super fast/super slow diodes

### General

- Test with a different generator coil, e.g. more/less windings, thicker/thinner wire *Considered for next test set*
- Test with thicker output wires
- Test with different capacitor diodes (now 1N4007)
- Relative generator coil position to rotor magnets in relation to relative power coil position to rotor magnets, e.g. if in rest position a magnet is right above the power coil, make sure that generator coil positioned so that it sits in between two magnets (now both the generator coil and power coil have a magnet right above them in rest position)
- More accurate magnet placing on rotor (anticipation: will yield higher voltages in caps)





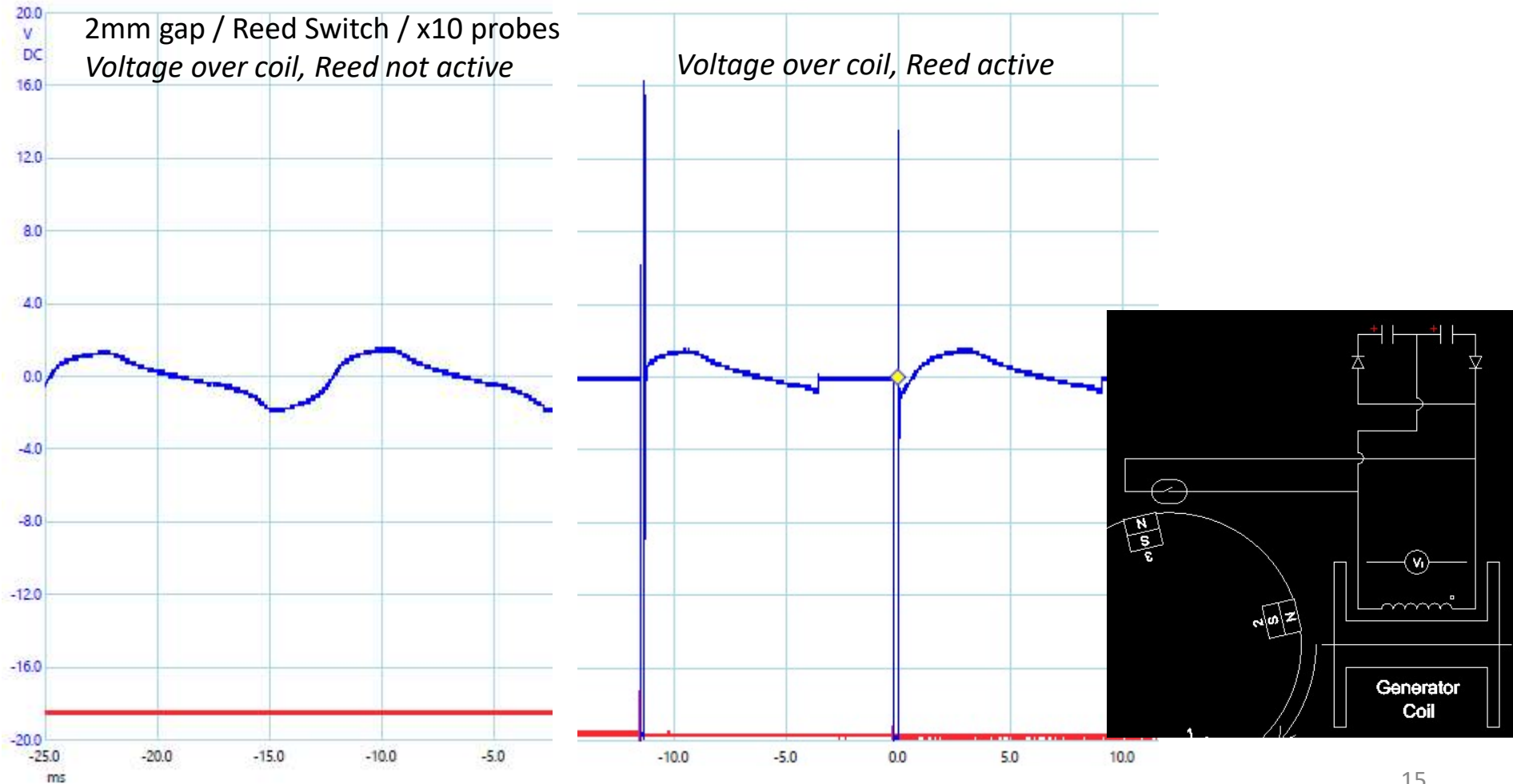
## Appendix 1.1

Reed 2021-01-16

Voltage over coil

### Conclusion:

Looking at the spikes of the coil collapse, it looks like both the caps (instead of just one) should be able to charge to a higher degree as without coil shortening



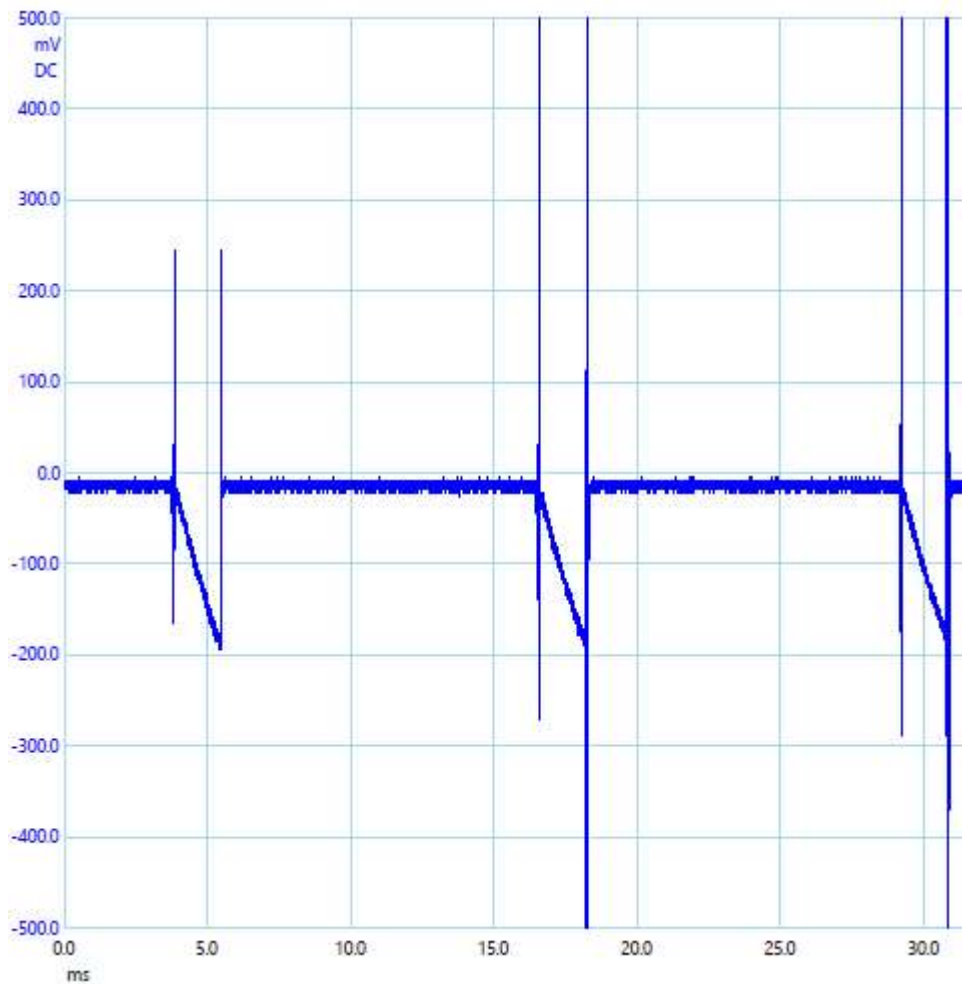
## Appendix 1.2

Reed 2021-01-16

Voltage over resistor in reed circuit

### Conclusion:

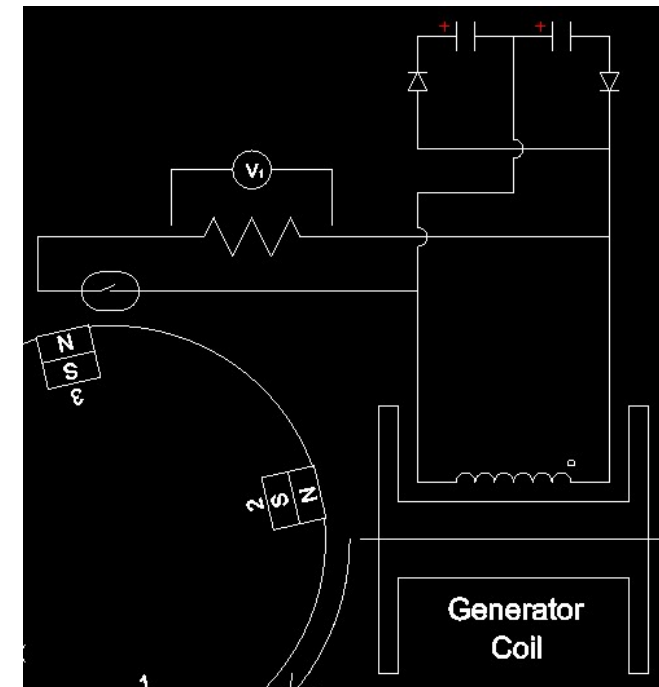
Looking at the spikes of the coil collapse, it looks like both the caps (instead of just one) should be able to charge to a higher degree as without coil shortening



*Voltage over resistor, Reed active,  
2mm coil gap, x1 probes*

0.19V over 1 Ohm resistor

Short circuit current  $0.19/1=0.19A$

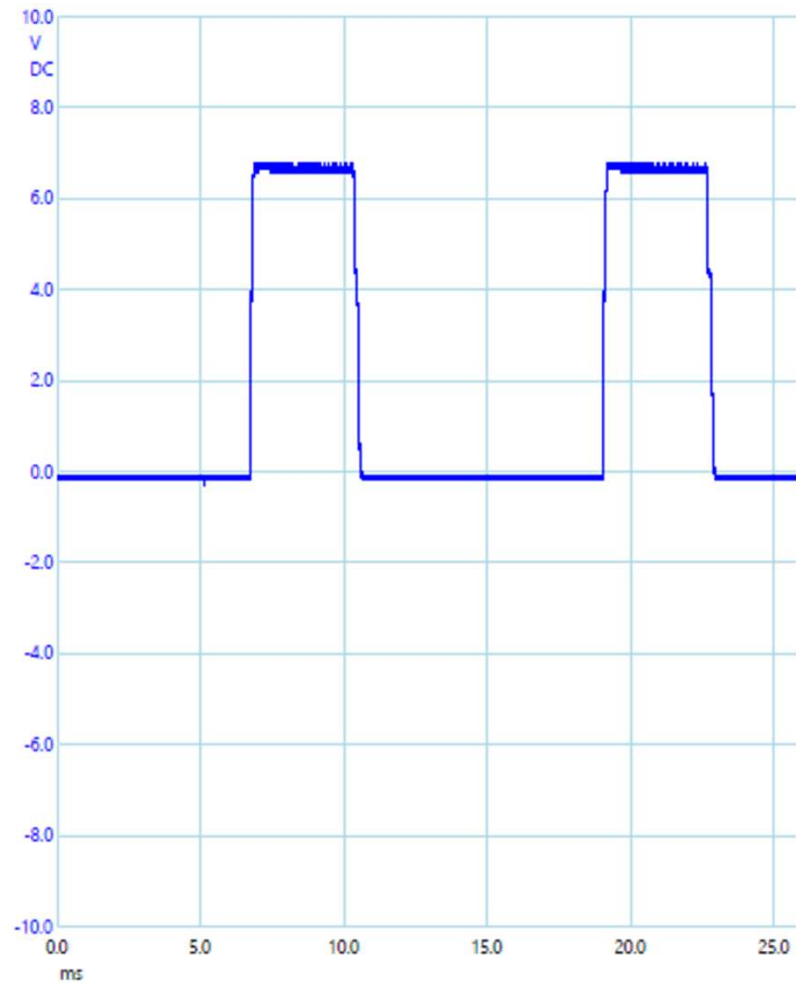




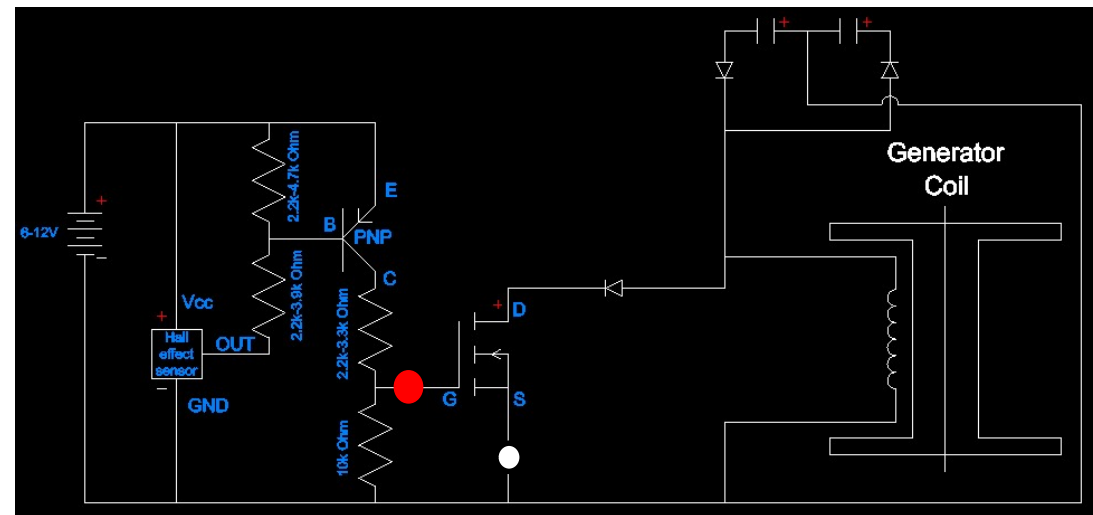
## Appendix 2.1

Hall 2021-01-15

Voltage over Gate-Source MOSFET circuit



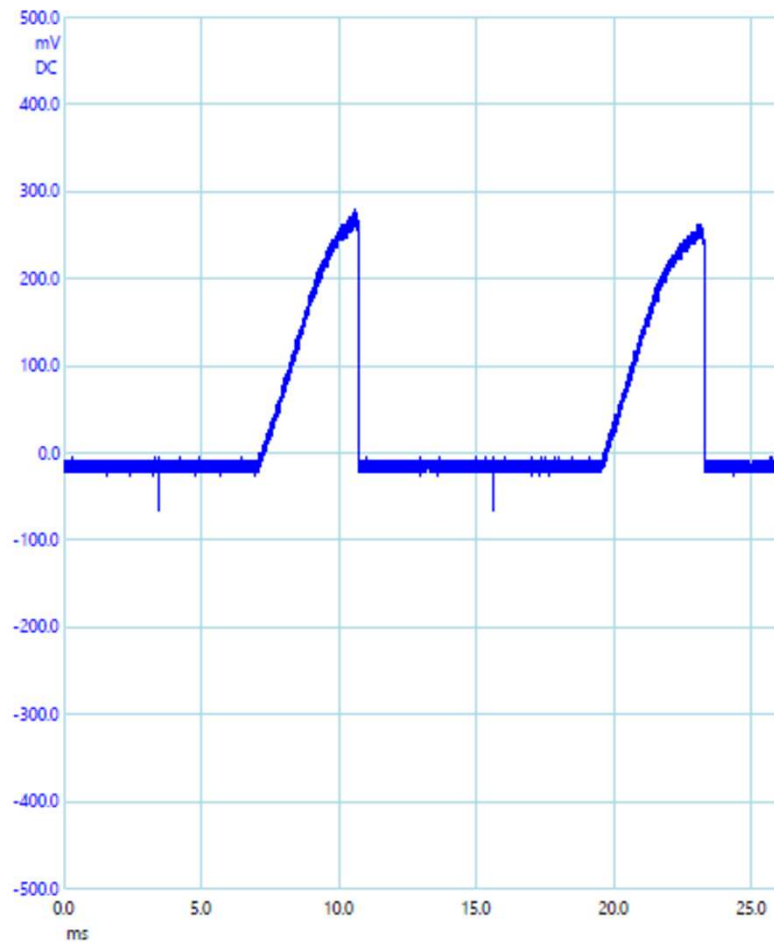
2mm coil gap, x1 probes



## Appendix 2.2

Hall 2021-01-15

Voltage over resistor in MOSFET circuit



*Voltage over resistor, Hall active  
2mm coil gap, x1 probes*

0.28V over 1 Ohm resistor

Short circuit current  $0.28/1=0.28\text{A}$

