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## Tech talk #1: “Frankenstein’s” AKA the hybrid regulator set-up, a good or bad practice?

Once in a while we get regulators on the workbench which is a ‘cross-breed’ between brands. Take for example a Scubapro MK2 1<sup>st</sup> stage with a Mares Rover primary second stage. Let’s put this configuration to the test bench for a little experiment and find out what’s wrong.

A couple of issues:

1/ Regulators, both the 1<sup>st</sup> stage and the 2<sup>nd</sup> stage are designed to operate within a narrow band of pressures. In the above example the Mares Rover should be paired for instance with a Mares R2S 1<sup>st</sup> stage.

- As per manufacturer’s specifications, the intermediate pressure for the Mares R2S @ 200 bar supply pressure is 142 to 152 PSI, whilst the MK2’s intermediate pressure should be set between 125 and 145 PSI. The cracking effort for a Mares Rover should be between 1 – 1.3” of H<sub>2</sub>O.
- If using now a properly set up Mares R2S first stage and a properly tuned Mares Rover second stage @ 200 bar supply pressure, the static intermediate pressure for the first stage was 143 PSI and the static cracking effort for the second stage was 1.1” of H<sub>2</sub>O, well within the manufacturer’s spec. Putting this properly tunes Mares Rover onto a properly tuned MK2 1<sup>st</sup> stage again @ 200 bar supply pressure, the static intermediate pressure was 135 PSI (within manufacturer’s spec for the 1<sup>st</sup> stage) and the static cracking effort was 1.6” of H<sub>2</sub>O. To the latter, the static cracking effort is no longer within the manufacturer’s spec. practically speaking: this set-up is harder to breathe.
- We have put both configurations on the flow bench and tested the dynamic cracking effort under different flow conditions. See the results in the graphs attached. The green graph is the Mares R2S and Rover combination and the red graph is the Scubapro MK2 and Mares Rover combination. For this comparison test, we were able to get a maximum flow of 18 SCFM / 510 lpm through the 2<sup>nd</sup> stage. Note that the dynamic cracking effort (breathing resistance) is higher for the hybrid set-up.

- How about 'de-tuning' the 2<sup>nd</sup> stage for the hybrid configuration so that the static cracking effort of the 2<sup>nd</sup> stage matched the manufacturer's specifications? We de-tuned the 2<sup>nd</sup> stage so the static cracking effort of the stage would be 1.1" of H<sub>2</sub>O in combination with the Scubapro MK2 1<sup>st</sup> stage. At a supply pressure of 200 bar, the dynamic cracking effort is overall lower than the reference (Mares R2S and Mares Rover) and even drops below 1.1" of H<sub>2</sub>O, which could result in a free-flow if used in the water. Note as well that we were no longer able to reach a flow of 18 SCFM through the 2<sup>nd</sup> stage. So here as well the performance of the 2<sup>nd</sup> stage is compromised. The result can be found in the graph, illustrated as the blue line.
- Out of curiosity we put the detuned 2<sup>nd</sup> stage back onto the Mares R2S regulator to see what would happen to the static cracking effort @ a supply pressure of 200 bar. This revealed a static cracking effort of 0.9" of H<sub>2</sub>O which is below the manufacturer's settings and would likely result in a free-flow if used in the water.
- Finally, note as well that with low supply pressures (50 bar in this case), the dynamic cracking effort of the hybrid set-up (tuned for Mares R2S or tuned for the Scubapro MK2) both revealed higher dynamic cracking efforts at high flows. In other words, harder breathing. Add to this a potential 'out of air situation' in which 2 divers would breathe from the 1<sup>st</sup> stage, this more than likely would drop the intermediate pressure more, resulting again in higher breathing efforts on the 2<sup>nd</sup> stage.

2/ Even within the same brand of regulators, not all first stage and second stages are compatible. Example a Poseidon X-Stream second stage is only compatible with the X-stream 1<sup>st</sup> stage, as this second stage is designed to work with an intermediate pressure of 8.5 bar (what the X-Stream first stage delivers).

3/ Hybrid combinations could expose you to legal and liability issues in case something goes terribly wrong. This is especially important to understand for the dive professionals under us. Manufacturer's test their OWN regulators and have them compatible to EN250 – if applicable -, however they do NOT experiment and certify their regulators cross branded. In other words, if you decide yourself to set-up a hybrid configuration, you become the manufacturer as a figure of speech with all consequences her off.

Conclusion: this experiment showed that hybrid set-ups change the characteristics and performance of the 2<sup>nd</sup> stage. In the end, the choice is yours, we're not the 'Scuba Police', but each one of you can surely make informed decisions.

This article does not favour any brands nor claims performance comparisons between brands or condemns brands, it's just an experiment.



Test set-up Mares R2S and Mares Rover.

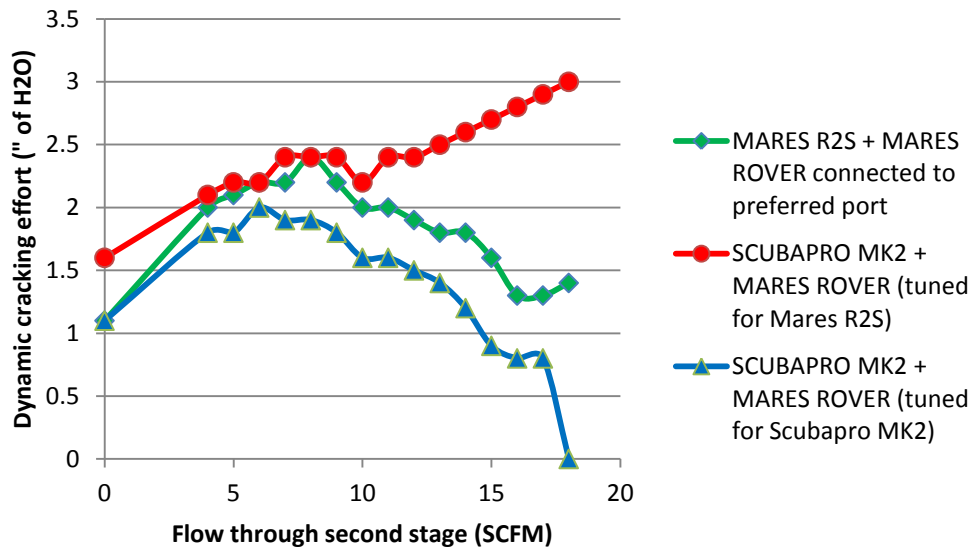


Test set-up Scubapro MK2 and Mares Rover.

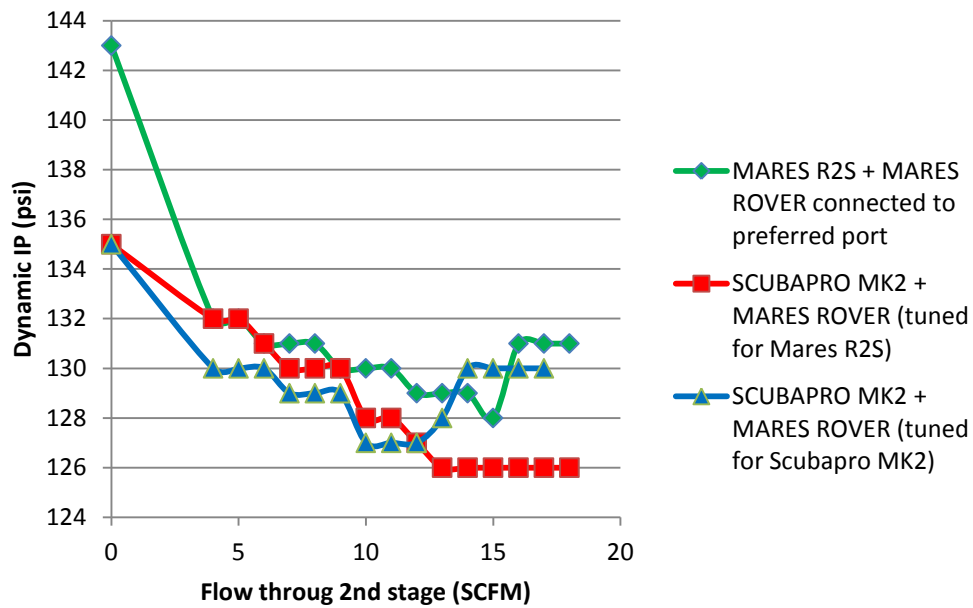
Supply pressure 200 bar							
FLOW		MARES R2S + MARES ROVER connected to preferred port		SCUBAPRO MK2 + MARES ROVER (tuned for Mares R2S)		SCUBAPRO MK2 + MARES ROVER (tuned for Scubapro MK2)	
FLOW SCFM	FLOW LPM	IP (psi) @ 200 bar supply pressure	CRACKING EFFORT ("H <sub>2</sub> O) @ 200 bar supply pressure	IP (psi) @ 200 bar supply pressure	CRACKING EFFORT ("H <sub>2</sub> O) @ 200 bar supply pressure	IP (psi) @ 200 bar supply pressure	CRACKING EFFORT ("H <sub>2</sub> O) @ 200 bar supply pressure
0	0	143	1.1	135	1.6	135	1.1
4	113	132	2	132	2.1	130	1.8
5	142	132	2.1	132	2.2	130	1.8
6	170	131	2.2	131	2.2	130	2
7	198	131	2.2	130	2.4	129	1.9
8	227	131	2.4	130	2.4	129	1.9
9	255	130	2.2	130	2.4	129	1.8
10	283	130	2	128	2.2	127	1.6
11	312	130	2	128	2.4	127	1.6
12	340	129	1.9	127	2.4	127	1.5
13	368	129	1.8	126	2.5	128	1.4
14	396	129	1.8	126	2.6	130	1.2
15	425	128	1.6	126	2.7	130	0.9
16	453	131	1.3	126	2.8	130	0.8
17	481	131	1.3	126	2.9	130	0.8
18	510	131	1.4	126	3	n.a	n.a

Supply pressure 50 bar							
FLOW		MARES R2S + MARES ROVER connected to preferred port		SCUBAPRO MK2 + MARES ROVER (tuned for Mares R2S)		SCUBAPRO MK2 + MARES ROVER (tuned for Scubapro MK2)	
FLOW SCFM	FLOW LPM	IP (psi) @ 50 bar supply pressure	CRACKING EFFORT ("H <sub>2</sub> O) @ 50 bar supply pressure	IP (psi) @ 50 bar supply pressure	CRACKING EFFORT ("H <sub>2</sub> O) @ 50 bar supply pressure	IP (psi) @ 50 bar supply pressure	CRACKING EFFORT ("H <sub>2</sub> O) @ 50 bar supply pressure
0	0	122	1.6	120	1.8	120	1.5
4	113	110	2.6	115	2.4	115	2.2
5	142	109	2.7	114	2.6	115	2.4
6	170	108	2.8	113	2.8	115	2.6
7	198	108	2.8	113	2.9	115	2.6
8	227	107	2.8	113	2.9	115	2.4
9	255	108	2.8	113	2.9	115	2.3
10	283	108	2.6	112	2.6	114	2.4
11	312	107	2.6	113	2.8	113	2.4
12	340	106	2.6	113	2.8	113	2.6
13	368	106	2.4	113	2.8	113	2.8
14	396	106	2.3	112	2.8	113	2.8
15	425	106	2	112	2.9	112	2.8
16	453	106	2	112	3	113	2.9
17	481	106	2	111	3.1	112	3
18	510	106	2	110	3.2	n.a	n.a

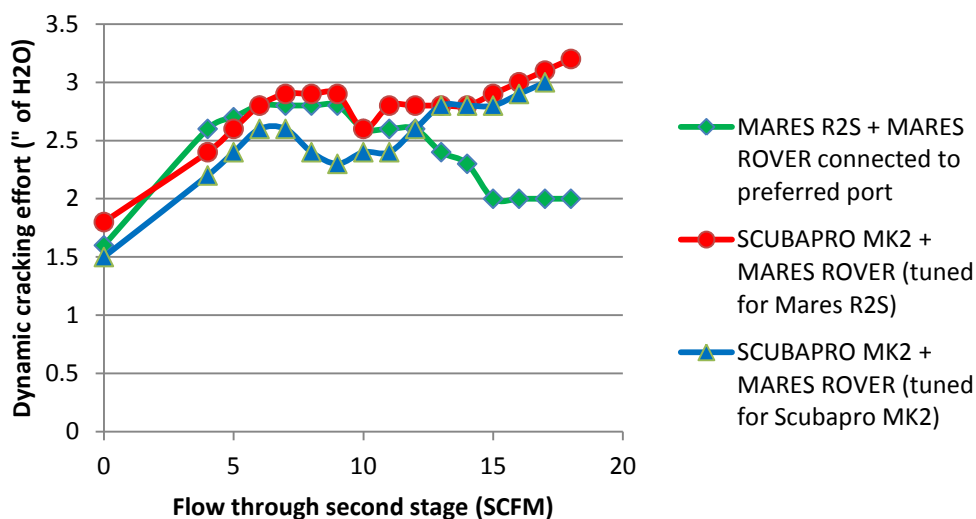
## CRACKING EFFORT ("H<sub>2</sub>O) @ 200 bar supply pressure



## IP (psi) @ 200 bar supply pressure



## CRACKING EFFORT ("H<sub>2</sub>O) @ 50 bar supply pressure



## IP (psi) @ 50 bar supply pressure

