48155 -DESKTOP BREATHING EFFORT TESTER (photo of product at end of bulletin)

This instrument consists of a 4.0" Magnehelic gauge housed in a black, ABS plastic case that is almost identical to the one used on our Desktop Intermediate Pressure Tester (GMC #48160). In fact, the units are designed to be used side-by-side, in tandem, for complete analysis of important regulator functions. Attached to the Magnehelic gauge is a plastic tube with a gray-rubber Regulator Probe that allows both the inhalation and exhalation efforts (also called breathing resistances) of a dive regulator to be tested.

Before testing any second stage, be sure that the regulator's first stage is working properly by measuring its Intermediate Pressure (IP) and Lockup. This can be done with a simple hand gauge tool (GMC #43390 / #43275) or a more elaborate apparatus such as a Flowbench, Workstation, or Desktop IP Tester. (See the Section on the #48160 – Desktop IP Tester that follows). Obviously, if the first stage is malfunctioning, the second stage performance may be affected and will often give false readings.

Testing Breathing Efforts: If the first stage is operating properly and no second stage air seepage is occurring, the breathing parameters of the regulator can be tested. This is accomplished by attaching the Magnehelic gauge to the regulator's second stage by means of the plastic tube and gray-rubber Regulator Probe. This system is highly accurate and can measure breathing resistances within a range of two inches of water pressure with excellent precision. This very sensitive measurement is tantamount to the suction pressure required to draw water two inches up a soda straw. Negative (suction) pressure is read on the left scale, while positive pressure is noted on the right scale. Of course, inhalation involves negative pressure, whereas exhalation is a positive force. Overall accuracy of about 0.2" of water column can be achieved.

The gray mouthpiece probe is designed to work on a wide number of regulators: the small end fits and seals directly into the rubber mouthpiece of many regulators; otherwise, if the regulator's mouthpiece is removed, the large end of the probe will stretch over the exposed flange on most models. Thus by using one end or the other of this adapter, a great variety of regulators can be easily probed and tested. Always be sure that an airtight seal is achieved; leakage past the probe during testing will lead to a bogus reading!

With the regulator pressurized, very slowly inhale and exhale through the open end of the probe, noting the respective – and + readings that occur. These readings represent the initial inhalation and exhalation resistances of the second stage (also called "cracking efforts"), that is, the amount of respiratory work required to initiate air flow into or out of the regulator. These are extremely important values, which are often the peak respiratory efforts experienced by the diver in each and every breathing cycle. Slow, deliberate inhaling and exhaling will give you highly accurate measurements. Remember that the Magnehelic gauge cannot sense airflow rates; moreover, the long tube from the gauge to the mouthpiece produces a high resistance if rapid, fast breathing is attempted. Therefore, such breathing will usually pin the gauge at the extremes of its range and produce only meaningless readings. Bottom line: breathing slowly and softly for accurate results!

For most regulators, the inhalation resistance should be 1.5" or less; values under 0.6" suggest hair-trigger second stage calibrations, and those in excess of 1.7" indicate very hard breathing, probably due to contamination, improper calibrations, or insufficient intermediate pressure. A workable average cracking resistance for most modern, well-turned regulators is a little over or under one inch of water (0.8 – 1.2"). Octopus rigs should usually test on the high side of the stated range; this somewhat reduced sensitivity will often prevent unwanted leaks or sudden free flows in octopus units. Some manufacturers engineer their octopus rigs so that "cracking resistances" under 1.7" of water cannot be achieved by any means.

While the stated values might seem small to the point of being insignificant, remember that a regulator with a inhalation resistance of 1.6” of water is breathing 100% harder than one with a resistance of 0.8”. In another way of looking at it, that regulator is probably operating at only one half of its potential, and the owner must do twice the respiratory work to dive with it in this condition. All this could have paramount importance in an arduous dive or underwater emergency!

Exhalation resistance will be a positive (+) pressure ranging from about 0.4” to 1.5” of water, depending on the age of regulator and condition of the exhaust valve. Take this reading by softly exhaling through the probe until you feel air exit the second stage; holding your hand near the exhaust tube to feel the venting air sometimes helps. For more exact measurements, the second stage can be immersed in a bowl of water just deep enough to cover the exhaling valve. Excessively high exhaling pressure suggests a sticky (perhaps rotten) rubber valve or bent support spiders in those older units with metallic cases. Very low resistance usually indicates a rotted, warped valve or debris under its sealing edge. Clean or replace the valve to correct this situation…exhalation valves cannot be calibrated!

The #48155 tester does not require any special maintenance other than to keep it reasonably clean and dry. However, occasionally the needle on the Magnehelic gauge may wander slightly off dead center. To re-zero the unit, simply use a small screwdriver on the adjustment screw located on the lower center of the dial face.

Using the GMC Breathing Effort Tester with the Intermediate Pressure Tester (GMC #48160): One final Q & A – is there some preferred way to obtain the most accurate breathing resistance measurements? Indeed there is! This method utilizes both the Breathing Effort Tester and a gauge that can monitor the regulator’s Intermediate Pressure (IP). A number of available devices do this by simply attaching to the regulator’s BC hose. GMC’s desktop unit (#48160) has an IP Gauge mounted in a plastic housing which matches that of the Breathing Effort Tester. The two cases can sit side by side for use in tandem.

The test method: Install the gray probe (from #48155) into the mouthpiece of the regulator to be tested and attach its BC hose to the Intermediate Pressure Gauge in the #48160. Watch the pressure gauge as you slowly inhale. The needle on the gauge will dip slightly the instant that air begins flowing from the second stage; at the moment this dip occurs, note the negative (-) pressure reading on the Magnehelic. This is the initial inhalation effort, or “cracking resistance,” of the 2nd stage. The common way to take this measurement is to read the Magnehelic when you hear or feel air flowing in the second stage; this method is not as accurate as the one just described.