

Kirby Morgan Helmets and Full Face Masks Differences and Similarities

Dive Lab Inc.,

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Models Discussed:

SuperLite-17A (SL-17A)
SuperLite-17B (SL-17B)
US Navy MK-21, MOD 1
SuperLite-17C (SL-17C)
SuperLite-17K (SL-17K)
SuperLite-27 (SL-27)
KM-37 Helmet
KM-57 Helmet
Band Mask KMB-18
Band Mask KMB-28
EXO 26 Original
EXO 26 BR
EXO 26 Standard
KM-47
KM-57
KM-67
KM-77

The Kirby Morgan helmets and masks manufactured by Kirby Morgan Dive Systems, Inc., (KMDSI) share many similarities. Currently, there are two band masks and four helmet models being produced and sold, and most share common parts and components. All of the KMDSI helmets and masks are designed and intended primarily for demand mode diving and utilize simple, reliable, and fully adjustable demand valve systems of both balance and non balance design. The purpose of this document is to explain the basic differences and similarities of the KMDSI Helmets and Masks.

SUPERLITE-17 DEMAND HELMET

The designation 17 signifies the 17th design of masks and helmets by Kirby Morgan. The term “standard 17” is often used to describe the SL-17B, which is the most well known, and most widely used Helmet in the world. The 17A was the first model, and was introduced in 1976. The “A” model used a side block assembly that receives the incoming breathing gas umbilical from up the front of the diver and the demand regulator is supplied from the side block via a short flexible hose. The 17B uses a side block assembly that receives the umbilical from over the shoulder from the rear of the diver and the supply to the demand regulator is through a chrome plated brass tube known as the “bent tube”. With the exception of these two differences, both models are the same. The main purpose for two configurations is to accommodate the divers preference in the orientation of the gas supply umbilical against the body.

The SL-17 was produced in four models; the 17A, 17B, 17C and in May 1999 the 17K was introduced. The 17A/B and Navy MK-21 use the yoke and neck clamp while the 17C, K and 37 use

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the SL-27 style neck ring system. In 2006, the SL-17A/B had its 30th anniversary and in that same year SL-17 "A" model was discontinued leaving the 17B and the MK-21 as the only model produced using the neck clamp and yoke assembly and the only KMDSI product to still use the standard small bore SuperFlow regulator.

SuperLite -27

The SuperLite 27 introduced in 1987 is the smallest and lightest (27lbs) of the KMDSI helmets. The helmet appearance is very similar to the SL-17 series, but in reality, the helmet shell is physically smaller and the face port angle is slightly straighter. Because the actual physical displacement of the helmet is smaller than the original SL-17, less weighting is required to achieve the desired buoyancy and balance characteristics making the overall weight of the helmet slightly less than that of the SL-17 and 37 series. One major draw back of the SL-27 is the ability to fit persons with large heads. Those with smaller heads generally prefer it to the slightly larger SL-17 and KM-17K/37. Component wise, the SL-27 shares the same basic hardware as the 17K/37 including the big bore (7/8"dia) inlet tube on the SuperFlow 350 regulator. The headliner in the 27 is the same. The weighting is slightly different and the 27 does not use a top weight like the 17-K, KM-37. In addition, the front side-weight is slightly smaller than the SL-17C. All major gas train components are the same as the KM-37, MK-21 and SL-17C. The SL-27 now comes standard with the Quad - Valve exhaust system.

The SL-27 old style double exhaust used a slightly different exhaust shroud arrangement than that of the standard SL-17A/B/C/K due to the shorter helmet height and the water dump valve position. This required installing the dewatering valve on the right side of the helmet. The overall performance of the SL-27 is very similar to that of the SL-17 series, however, exhalation effort was/is slightly higher with the double exhaust shroud. Installing the new Tri-Valve significantly reduces exhalation resistance. The new Quad -Valve with side valve dewatering cover provides excellent double valve protection while maintaining low exhalation resistance. The SL-27 continues to be one of the most popular demand helmets in the industry.

SuperLite 17C

The SuperLite-17C has the same mechanical features and functions as the SL-17B, uses the same major components, and is virtually identical with the exception of the neck clamp arrangement and weighting. The 17C uses the SL-27 advance neck-ring securing system. The physical arrangement and placement of the breathing and faceplate components are identical to that of the 17B and the weighting in the lower portion of the neck ring arrangement on the 17C allows for more uniform distribution of helmet weight. Unlike the SL-27, the SL-17C helmet shell is slightly larger requiring additional weighting, which is accomplished in the form of a rear handle and left side weight resulting in a weight of 31 lbs. The machined brass helmet ring houses two pull type latch pins and provides protection for the bottom end of the helmet when not in use. This advanced neck ring arrangement provides excellent watertight integrity and allows for easy integration with most dive suits. The 17C is primarily sold in Europe, and is favored by the North Sea divers for use with the DIVEX return line systems.

SuperLite-17K/37

The SL-17K was introduced in 2000 and combines the features found on the 17C with refined weighting, the big bore SuperFlow 350 regulator and removable communications module as used on the SL-27.

In 2003, the KM-37 was introduced which was basically a renaming 17K after the installation of the new Quad Exhaust Whisker Assembly. The 37 with the new Quad -Valve has lower exhalation resistance than all previous KMDSI Helmets. The exhalation effort with the Quad Exhaust is even

lower than the old standard single exhaust in use for over 30 years. Like the 17 K, the 37 shares all the new improvements found on the SL-27. The 37 has become the most popular model.

SuperFlow 350 Regulator

The SuperFlow 350 regulator body has the larger 7/8th inch inlet bore breathing tube. The regulator is used on the Navy MK-21 mod 1, SL-17K, KM-37 and 18/28 band masks vise the 3/4" bore breathing tube as found on the standard SuperFlow regulator employed on the SL-17A/B, and previously on the KMB-28 band mask. The larger diameter bore, lack of a swirl plate and deletion of the inlet valve spring p/n 535-804 and the washer p/n 530-540 inside the regulator body are the only things that differentiate the SuperFlow 350 from the standard SuperFlow. The spring and washer that is normally used in the SL-17 A/B series and KMB-28 pre-2004 masks has been left out. This spring, KMDSI #535-804 and washer KMDSI #530-505 normally is installed on the inlet valve shaft of the demand regulator and was formerly used to aid in assembly of the regulator parts and to limit the travel of the inlet valve. The use of the spring also adds to the biasing potential of the demand regulator. When the SL-27 was introduced it too did not have the spring and washer.

U.S. Navy Mk-21 Mod 1

The MK-21, formerly called the DSI SL-17 NS is a helmet produced by KMDSI primarily for the U.S. Navy. The MK-21 mod-1 is a modified version of the SL-17B. In 1987 the Navy mandated certain modifications that they thought would make the SL-17 more suitable for their particular application. The modifications included the change of the demand regulator body inlet breathing tube from 3/4" to 7/8" inside diameter, the addition of a secondary exhaust valve by modifying chin de-watering valve on the MK-21 which changed the chin de-watering valve into what is now, a secondary demand regulator exhaust valve. The later was accomplished by installing a modified oral-nasal mask that connects the oral nasal mask to the chin water dump valve. The standard dewatering flapper valve was replaced with a 510-550 oral nasal valve that would open with only slightly less effort than the regulator exhaust valve. The result was the chin de-watering that now functioned as a secondary exhaust. In theory, the secondary exhaust would open with the regulator exhaust during periods of peak heavy exhalation. However, this system proved to be extremely sensitive to the physical attitude changes of the diver when bending over or changing work position. As the physical location of the demand regulator in relation to the chin valve changed by looking down, the demand regulator exhaust sensing would cause the demand valve to add gas resulting in a regulator free flow. Testing on the breathing simulator in a face forward position showed reduced exhalation effort over the standard SL-17A/B due to the second valve. Unfortunately NEDU unmanned testing tested in the face forward position only and did not include comprehensive attitude testing. The free flow when face down went unnoticed before delivery to the fleet because the helmet never underwent an extensive operational technical evaluation (OPTECEVAL) by Fleet Divers.

Because the chin dewatering valve was now being used as an exhaust valve, a new de-watering valve was added to the left side of the helmet to retain dewatering capability. In addition to the above modifications, the balance hole and the gas ramp were removed from the demand regulator body and the inlet valve spring and washer was removed because it was deemed unnecessary.

The Navy modifications showed a slight overall reduction in work of breathing when tested on the breathing simulator at NEDU, however because most US Navy air supply systems at that time employed high volume low pressure compressor systems with volume tanks and automatic loading and unloading valves, supply pressures varied as much as 40 PSIG which at times resulted in spontaneous demand regulator free flow when used in real working dive scenarios. As a result, in

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1993 the demand regulator was modified to be more similar to the original SuperLite 17 B SuperFlow. The main modification made was the drilling the demand regulator body and re-instituting the original balance hole. The most important modification, turning the chin exhaust back into a dewatering valve, was never made, however the balance hole did help civilize the demand regulator and helped the helmet behave more like the original SuperLight-17. There were still conditions that could cause the demand regulator to free flow when the divers physical attitude was quickly changed because the chin valve was attached to the oral nasal.

A recommendation to return the chin and water dump valve back to the original SL-17 was submitted to the Navy by DSI however the recommendation was deemed unnecessary by the Navy because very few complaints were received after the balance hole was reestablished and the Navy Divers had time to get used to the system. In 1997, the Navy re-instituted the use of the inlet valve spring and washer with the MK-21 in order to gain addition demand regulator bias capability when conducting very deep (190fsw) air dives. The main advantage is demonstrated when the gas supply system in use is supplying the divers at depth, and standby diver. The addition of the inlet valve spring allows the standby helmet, which is on the surface, to be biased on average about 15-20 psig greater than without the spring. The washer was originally installed in the old KMB band masks and early SL-17 helmets to prevent the lever from being dislodged in the event the supply system was suddenly over-pressurized. This washer has not been needed since the mid 1980's because the regulator body lever land is now longer, which will not allow the lever to dislodge. The use of the washer has been retained in the small bore SuperFlow regulator to help avoid confusion. The MK-21 continues to serve the US Navy well. The MK-21 has never been a commercial success but can be purchased by special order.

In 1999 the US Army replaced their 17B helmets with SL-17K/37 and has praised the helmet as a great improvement over the 17B. Many of the Worlds Militaries currently using the SuperLite 17 B have added the 17K/37 to their inventory.

KIRBY MORGAN BAND MASKS KMB-18 AND 28

The KMB-18 and 28 share many common parts and components. At first glance it appears as though the two masks are identical, however, there are some major differences in construction.

The first and foremost difference that must be noted is the construction material used in making the mask frame. On the KMB-18 the mask frame is made of hand laid fiberglass and uses a removable comfort insert. The KMB-28 uses a molded plastic Xenoy™ material and does not employ the comfort insert like the KMB-18. The shape of both Band Mask frames are basically the same with the exception of face port sealing area of the KMB-28 which is slightly different and because of this, a slightly different shaped face port is used. The KMB 28 mask frame is made of high impact plastic which reduces initial cost, however, if the frame gets broken or the face port threaded inserts need to be replaced, repairs cannot be made. The KMB-18 is made of hand laid fiberglass and can be repaired if damaged. All gas train components are the same. The demand regulator used on the KMB-18 prior to May of 2002 was the small bore (3/4" inlet tube) SuperFlow, this has now been changed to the standard big bore 7/8" SuperFlow 350. The KMB 18 uses a molded comfort insert around the interior of the frame. All other parts of these band masks are identical and overall breathing performance is the same. The fiberglass frame of the KMB 18 remains more popular with the commercial offshore divers because the shell is made of fiberglass and can be repaired when damaged, and the face port inserts can be changed if the user does extensive welding. The less expensive Xenoy™ plastic used for construction of the KMB-28 seems to appeal more to the coastal and search and rescue divers and commercial divers that do not engage in cutting and welding. The

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KMB 28 uses a different view port and is not interchangeable with the KMB 18. The most recent change is the creation of the "Band Keeper System". The band keeper system is a quick simple modification that adds a back up securing system for the hood to mask, virtually eliminating the possibility of the mask separating from the hood due to damage or improper assembly. Both band masks continue to be in demand.

Superlite-17A (SL-17A), Superlite-17B (SL-17B), Superlite-17C (SL-17C), Superlite-17K (SL-17K), Superlite-27 (SL-27), Band Mask KMB-18, Band Mask KMB-28, and SuperFlow are registered trademarks of Kirby Morgan Dive Systems, Inc.

EXO 26 Original, Standard, and Balanced

The EXO Full Face Mask is designed to be used with open circuit SCUBA, or as part of a surface supplied diving system. The EXO 26 incorporates a unique EXO^{thermic}™ exhaust system in the demand regulator assembly whereby the divers own breath assists in reducing thermal drain by warming certain areas of the regulator. This helps to reduce the possibility of second stage freeze-up during cold exposures.

The EXO outer frame or skeleton serves several functions. It protects the face seal and is used to mount external components such as the regulator, lens and communications. The outer frame is made of *Poly Carbonate* plastic.

A suspension face seal is attached to the EXO 26 skeleton by five mounting legs employing this approach, the face seals proportionally against a soft flexible area. This sealing design allows the EXO to fit many different sizes and shapes of faces. The extra area behind the face seal allows a foam pad to be inserted for extra small (narrow) faces.

The EXO 26 Original uses a non-balanced regulator and does not employ an oral nasal mask; instead the face cavity utilizes an air direction tube that is intended to minimize face port fogging. The mask was designed for use where daily maintenance is difficult due to lack of facilities or remote location or logistical support. The mask is best suited for air or enriched gas use to depths of 130 fsw or less.

The EXO 26 Standard is the same as the EXO original, however, with the addition of an oral nasal mask in place of the air direction tube. The mask does not have automatic defogging capability, and uses basically the regulator components as the EXO Original. The mask is also designed for use where minimal maintenance is performed due to remote operations or limited logistical support.

The EXO 26BR (Balanced Regulator) is very similar to the other EXO models, but employs a demand regulator of a balanced inlet valve design. The regulator was designed for use where breathing performance is of primary concern due to deep depths and/or extremely heavy workloads. Like the Original and Standard, the BR is designed for minimal maintenance. The EXO-BR can be used to the limits of air diving (220 FSW United States), (165 FSW Europe). The EXO-BR is currently used by the US Navy, Army, and Coast Guard for both open circuit surface supply and SCUBA and is also used by most Militaries throughout the World. The EXO-BR is either loved or hated. The major complaint by users of the EXO-BR is fogging and a loose fit by persons with narrow

faces. Fogging can be minimized by a thorough cleaning and application of anti fog solution. The loose fit can be minimized by using an optional foam comfort insert that maximizes the seal area. In 2005, a new silicone Oral Nasal Mask and larger mount nut was made to replace the latex oral nasal. The new silicone oral nasal fits and stays in place much better than the old one and allows greater comfort. The EXO continues to be a very popular selling mask, especially with public safety divers operating in black water and swift currents. The EXO probably lends itself best to surface supported diving.

KM-57 Helmet

The KM-57 was introduced in 2005 in limited production. The KM-57 is the same helmet as the KM-37 but is equipped with the new SF-450 stainless steel balanced regulator. The 450 regulator was designed to allow a higher level of performance at the high work rates 62.5-75 RMV or greater, than the old non balanced SF-350 demand regulator. The regulator was primarily built in response to the new EU surfecae supplied standard EN-15333. The body of the regulator cast of stainless steel and is designed for quick easy maintenance and overhaul. The SF-450 will currently fit the SL-27, MK-21, SL-17C / K / 37, KMB-18 / 28. The 17B can be easily modified to accept the SL-450 demand regulator.

KM-47Helmet

The KM-47 was the the precursor to the KM-77 stainless helmet . The shell has the same basic geometry of the KM-37, but the front end and left side was modified to accept the stainless steel EXO-BR type regulator that's used in the KM-77 helmet. The KM-47 helmet was produced originally as a test platform for development of he new all stainless KM-77 and allowed for field testing of the new regulator and "Whisker Wings Exhaust". Response was outstanding and it was decided that it would continue to be produced. In essence the KM-47 is a fiberglass version of the KM-77. Gross weight is 31 lbs. KM-47 sales started in late 2006.

KM-77

the KM- 77 helmet is the first helmet designed and balanced on the computer, The weight is 31 lbs, same as the KM-37. The new helmet has a stainless steel demand regulator engineered from the EXO-26 BR full face mask. This new regulator is the ultimate performance regulator. Sales started in November of 2007. CE testing was conducted in March 08. The helmet is a very strong seller.

"Whisker Wings"

The Quad / Tri-valve whiskers that have become so popular, now have company. Some new side whiskers called "Whisker Wings" improve the job of directing the exhaust gas away from the sides of the helmet allowing for less exhaust noise. The new wings don't have the water inlet scoops and instead use a small grate system. The new side whiskers retrofit the current Quad / Tri-valve systems. Coming soon.

Rubber Knobs

Rubber knobs are being designed to take place of the steady flow, EGS and regulator adjustment knob. The rubber knobs are intended to reduce damage to the valve components during low speed impact while diving in zero visibility.

The Early Years, Before My time, Helmet History and Evolution

KMAH-1 The Kirby Morgan Commercial Air Helmet, manufactured in 1965 by Kirby Morgan Partnership. The breastplate was a Yokohama Diving Apparatus; the helmet was spun from two sheets of copper and the viewports were made of Plexiglas sealed with O-rings eliminating the need for grills to protect the ports, increasing visibility.

KMHeH-2 The Kirby Morgan Commercial Helium Helmet, manufactured in 1965 by Kirby Morgan. The design was the same as the air hat with the addition of a permanently mounted canister and venturi recirculator system. This helmet was the first practical commercial helmet with a venturi. Yokohama Diving Apparatus manufactured the KMHeH-1 and the KMHeH-2 from 1966 to 1990. Kirby Morgan could not economically produce the helmets in the United States. Yokohama Diving Apparatus is no longer in business.

MCSHX-3 The Morgan Clam Shell Helmet was designed to be dry over the entire head; it was not successful and was not used beyond tank testing. The primary problem was leaking in the joint between the front and rear of the hat.

MCSHX-4 The Kirby Morgan Clam Shell Helmet was designed and made in 1966 under contract with the US Navy Experimental Diving Unit. The helmet was designed for use with semi-closed circuit breathing circuits. The rear of the helmet was free flooding. Only one prototype was made and tested.

KMCSHX-5 The Kirby Morgan Clam Shell Helmet was the next progression in clamshell type helmets. This helmet used a demand regulator as a back up breathing system. The primary breathing system employed a back mounted semi-closed recirculator. The helmet was free flooding in the rear; only one was made in 1967.

KMCSHX-6 The final version of the early "clamshell" type helmets, its hinge-point was in the front, it was made of fiberglass and was also free flooding in the rear. Twelve of these helmets were made in 1968 for the US Navy and eight for commercial use. Several dry head versions of this helmet were tested but none were successful, the wet head version had limited success.

KMCSHX-7 Kirby Morgan Semi-Light Helmet was produced the same time the clamshell series was being made. A face seal separated the face area of this helmet from the back. The first of these was sold in 1966; in all 36 units were made and sold. This helmet was the direct forerunner to the SuperLite 17 and is in high demand by collectors.

KMCSHX-8 A modified version of the Semi-Light, one was made and tested the balance was not correct so the helmet was not manufactured.

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MHX-9 An unnamed helmet designed to be used with a rubber mask section inserted into the forward part of the helmet only one was made and tested.

MH-10 Morgan 10 Recirculator Helmet designed in 1971 to be used with the General Electric MK 10 closed circuit breathing system. Tubes were mounted on the sides ran breathing gas to and from the back mounted recirculator.

MH-11 Morgan 11 Recirculator Helmet similar to the M-10 with the addition of a demand regulator used as a backup breathing system. Looks very much like a band mask design. Gas flow tubes used the Westinghouse supplied US Navy Mk-11 breathing system; the divers head was dry in this helmet.

MHX-12 Morgan 12 experimental dry helmet attached to a band mask. A rubber hood liner inside a hard helmet provided a dry environment. Two versions were made the design led to the KMH-16.

KHX-13 The Bucket Hat. This prototype helmet was made as a joke out of a real bucket but several important findings resulted from testing. The hat actually dives quite well and was surprisingly comfortable.

MHX-14 Morgan 14 experimental helmet had a rubber insert in the front, which isolated the divers face to improve the operation of the demand regulator. Water testing was not favorable so work on this hat was halted.

KHX-15 Kirby experimental 15, only one was made and sold to the US Navy. It was made of fiberglass and employed a simple steady flow breathing system. The hat was used as a platform for testing a new neck dam and yoke system in which the neck dam is attached to a metal band that is clamped with a cam lever around the neck area of the helmet.

KHXD-15 Kirby experimental 15 had several features that were new; however a silenced servo demand regulator positioned on the side of the hat and just the overall size required a counterbalancing weight that was heavier than we liked.

KMH-16 Kirby Morgan 16 Helmet was an add-on hat for the KMB-10 band mask. The rubber hood inside the fiberglass helmet provided a dry environment for the diver. The neck seal clamped in place similar to the SL-17.

End for now, 2-20-07

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