SERVICE MANUAL

MERLIN MARK VI

DEMAND VALVE REGULATOR

SIEBE GORMAN

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INTRODUCTION

This manual has been compiled to enable users of Siebe Gorman Merlin Mark VI demand valves to carry out routine maintenance and repairs. Read carefully before dismantling any part of the equipment.

IMPORTANT: Before reassembling, thoroughly clean all parts, rinse in clean water and replace all worn or damaged parts; also make sure that your tools and your workshop are clean, and work in a dust-free atmosphere to avoid introducing any foreign matter into the valve mechanism. On no account must oil be used for lubrication purposes. Lanolin may be used only where indicated in manual.

It cannot be emphasized too strongly that the safe and proper use of any underwater equipment requires a certain amount of training and practice.

Attention is drawn to the British Standard 4001

'Recommendations for the care and maintenance of underwater breathing apparatus. Part I: Compressed air open circuit underwater breathing apparatus'

Users of Siebe Gorman equipment are advised to join a reputable Underwater Swimming Club where instructional courses are arranged, and where progressive experience can be gained under expert supervision.

DESCRIPTION

(1) General

The Merlin Mark VI demand valve regulator is of the two-stage reduction type with venturi-jet breathing action. The function of the valve is three-fold.

(i) to reduce the pressure of air supplied from a high-pressure cylinder.

(ii) to conserve the supply of high-pressure air by providing the diver with the precise amount of free air demanded by each inhalation of breath.

(iii) to compensate for variation in cylinder pressure and for changes in the ambient pressure experienced by a diver during descent and ascent, so that he may breathe safely and effortlessly in any attitude and at all depths within the prudent range of the equipment.

The Merlin Mark VI valve performs these three functions continuously and automatically.

Provision is made for a Mechanical Air Reserve Valve to warn the diver when his high-pressure air supply is nearing exhaustion. This valve is incorporated in the body of the Merlin valve, and ensures an adequate reserve of air to enable the diver to return to the surface at a safe rate of ascent. Connections are also provided for a Cylinder Contents Gauge and for a Diving Air Pipe (Surface Demand Attachment).

An emergency valve for use in conjunction with the Surface Air Line is also available.

Whenever these additional facilities are not required, blank plugs are fitted to the demand valve to replace them.

(2) 1st Stage (Regulator)

The Regulator is a hydrostatically balanced reducing valve which stabilises the varying pressure of the cylinder to a constant pressure of 80-90 pounds per square inch (p.s.i.) in the 1st Stage Reduction Chamber. This control ensures that the breathing characteristics of the valve are kept constant.

(3) 2nd Stage (Demand Valve and Venturi)

This diaphragm-operated valve is sensitive to water pressure and to lung pressure. The diver's inhalation tube is connected to the 2nd Stage Reduction Chamber, one wall of which is formed by a flexible diaphragm. Each inhalation of breath tends to lower the pressure in this chamber so that the diaphragm moves inwards; a very small movement of the diaphragm is sufficient to operate the sensitive 2nd Stage Reduction Valve which allows air from the 1st Stage to pass into the 2nd Stage Chamber. This inrush of air is directed through a jet into the inhalation tube, and the resulting venturi action assists in creating a partial vacuum in the 2nd Stage Reduction Chamber whilst all the free air demanded by the diver's lungs passes directly into the inhalation tube. The valve action which is initiated by the lungs is thus maintained by the venturi action until the inhalation is complete; the Merlin Mark VI valve is therefore extremely light in operation and will provide large flows of air with little extra effort.

(4) Mechanical Air Reserve Valve

This safety device is an independent unit, fitted in a special housing in the Demand Valve. It is designed to apply a gradual restriction to the air supply when the pressure in the cylinder(s) drops to 300 p.s.i., thus giving positive warning to the diver. A manually-operated release pin unloads the Reserve Valve Spring, allowing normal breathing during the return to the surface.

All Merlin valves can be supplied with or without the Mechanical Air Reserve Valve unit.

(5) Mouthpiece and Breathing Tubes

Air is delivered from the Demand Valve through a corrugated rubber tube passing over the diver's right shoulder to the mouthpiece fitting. Exhaled air is carried by a similar tube over the left shoulder to the non-return exhaust valve. The mouthpiece is of moulded rubber and incorporates two non-return valves to ensure against flooding. The volume of the mouthpiece has been reduced to a minimum in order to restrict build-up of carbon dioxide; and the shape has been carefully designed for maximum comfort with minimum breathing resistance.

(6) Fitting Demand Valve Regulator

Always give a short blow from the cylinder(s) before connecting the Demand Valve to clear any foreign matter from the orifice, and check that the seating washer is squarely bedded in place.

Fully unscrew the clamp bolt of the Demand Valve so that its point is clear of the inside of the swivel clamp. Pass the swivel clamp over the cylinder valve (in the case of the Single set) or over the Demand Valve Stem on the manifold (in the case of the Twin set) and locate the Demand Valve in the appropriate seating. Before tightening the bolt of the swivel clamp, make sure that:

(i) the seating on the Demand Valve is in line with the seating washer

(ii) the point of the toggle clamp bolt is in line with the indentation into which it is to be screwed

(iii) the breathing tube connections are aligned symmetrically about the centre line.

NEVER TRY TO TWIST THE VALVE TO ALIGN THESE AFTER THE SWIVEL CLAMP HAS BEEN SCREWED UP.

If a cylinder contents gauge is not used, make sure that the blank cap is fully tightened on the Demand Valve connection and on the manifold connection on twin-cylinder sets.

(7) Fitting Air Reserve Valve and Cylinder Contents Gauge

If a Reserve Valve is fitted to the Merlin Demand Valve, this should be checked after the Demand Valve has been firmly clamped in position. Check that the release pin is correctly located in the Reserve Valve body and then pass the leather strap and cord over the right shoulder strap on the harness, and secure the leather strap to the shoulder strap. Proper adjustment of this must take place after dressing to ensure that the ball attached to the release cord can be readily found by the diver, and that the leather strap will not interfere with the pulling of the release pin.

If a cylinder contents gauge is used, check that it is properly screwed to the high-pressure flexible tube. Remove the blank cap from the connection on the Demand Valve (or manifold) and attach the nut of the high pressure flexible tube to this connection.

(8) Tests Before Diving

(i) Check the cylinder pressure by a test gauge or by the cylinder contents gauge if fitted.

(ii) Check that the breathing tubes and gauge tube (if fitted) are arranged correctly without twist or strain, and that the gauge tube connection is tight.

(iii) Check that the reserve valve pin is correctly located in the reserve valve body.

(iv) Open the cylinder valve(s) and look for high pressure leaks by immersing the set in water.

(v) With the pressure still on, immerse the mouthpiece only in water and check that there is no constant leak from the Demand Valve.

MAINTENANCE

(9) Rinsing off

Siebe Gorman equipment is constructed of non-corrosive material to resist sea water corrosion, but the performance of the Demand Valve could be affected, however, by the build-up of salt crystals in the air passages and around valve seatings.

To avoid this, rinse thoroughly in fresh water immediately after every dive, drain out the valve carefully after rinsing.

(10) Mouthpiece and Breathing Tubes

Wash these thoroughly with fresh water after each dive. Disinfect the mouthpiece with a weak solution (5%) of Dettol, ~~Lysol~~ or similar disinfectant, and rinse off again in fresh water.

Examine the breathing tubes for small punctures, particularly in the vicinity of metal fittings.

(11) Dismantling Breathing Tubes

Loosen the breathing tube clips at the connections to the Demand Valve Regulator and pull off the breathing tubes.

Loosen the large clips at the mouthpiece and pull off the tubes.

Remove the non-return valve assemblies from the mouthpiece by withdrawing them complete.

Stretch the stems of the rubber mushroom valves and withdraw by gently pulling on valve heads.

(12) Reassembling Breathing Tubes

Clean and rinse the breathing tubes and mouthpiece, disinfect with a weak solution (5%) of Dettol ~~Lysol~~ or similar disinfectant, and rinse again in clear water.

Examine tubes, mouthpiece and valves and renew all worn or damaged parts. Lubricate the valve stems with clean water and reassemble each valve by pushing the stem through the central hole in the housing and then pulling the projecting end until the cone on the stem passes right through the housing and fits snugly against the other end of the hole.

The mushroom valves are identical, but the housings are not. The central hole and supporting ribs of the exhalation valve are flush with the end of the valve housing, and the head of the mushroom should be within the shell with the stem protruding through the flush end. The central hole and supporting ribs of the inhalation valve are set in slightly from one end, and the head of the mushroom should be in the recessed end with the stem projecting into the shell.

Fit the inhalation valve housing into the mouthpiece with the mushroom head inwards.

Fit the exhalation valve housing into the mouthpiece with the mushroom head outwards.

Make sure that both housings are fitted flush with the ends of the mouthpiece. Fit the breathing tubes to the mouthpiece and tighten the clips.

For fittings breathing tubes to Demand Valve Regulator - see Section 22.

(13) Dismantling Demand Valve Regulator (2nd Stage)

Unscrew and remove the eight round-headed screws (4 BA) which hold the styrene rubber outlet valve cover in position.

Pull off the cover and retaining ring.

Gently extract the spear valve and metal tube from the spout of the outlet valve cover, taking care not to damage the anti-kink wire.

Remove the diaphragm carefully.

Unscrew and remove the two cheese-headed (6BA) screws holding the venturi-jet valve, and remove the valve assembly complete.

Remove the rubber sealing washer and the valve from the jet.

With a small hexagon wrench, unscrew and remove the relief valve adjusting plug, and shake out the spring and the valve.

(14) Dismantling Demand Valve Regulator (1st Stage)

Do not dismantle this stage unless you are prepared to reset and check the 1st Stage pressure. To do this you will require a separate test gauge assembly and if this additional equipment is not available it is better not to interfere with the 1st Stage Reduction Valve. If a test gauge assembly is available, proceed as follows:

Place the Demand Valve Regulator on a flat surface with the flange face downwards.

Remove the six cheese-headed (6BA) stainless steel screws holding the reserve valve (or the blank plug) to the body of the Demand Valve Regulator.

Pull out the reserve valve or the blank plug.

Insert a screwdriver into the slot in the head of the 1st Stage valve, which will now be accessible through the hole left by the removal of the reserve valve or plug, and unscrew the valve until it is free from its thread.

Unscrew the large hexagon cap diametrically opposite the hole through which the 1st Stage valve was reached, and unscrew the adjusting sleeve from inside the cap, using a square key.

Remove the slip ring and 1st Stage spring and lightly lever out diaphragm assembly. Check when doing this that the 1st Stage valve is completely free from thread.

Insert a slim brass drift and push or tap out the 1st Stage valve through hexagon hole and valve seating.

Using a hexagon wrench, unscrew the lock ring and tap or shake out the backing washer, O-ring seal and nylon seating of the 1st Stage Valve.

Dismantle the diaphragm assembly already removed from the valve by gripping the diaphragm plate in a vice and unscrewing the hexagon-headed bolt. Remove the washer.

Unscrew and remove the restrictor screw from the centre hole of the cylinder contents gauge connection.

Unscrew and remove the hexagon-headed blank plug and washer from the Diving Air Pipe (Airline-Lung) connecting hole.

Unscrew and remove the swivel clamp toggle screw.

To remove the filter disc, unscrew the locking ring and shake out the disc and spacing washer beneath it.

The Demand Valve Regulator is now completely dismantled.

(15) Dismantling Reserve Valve

Pull out the release pin attached to the lanyard.

Punch out the small retaining pin which passes through the body of the valve at right angles to the release pin, and shake out the plunger and spring.

Push out the valve and remove the small 'O' seal.

Remove the two larger 'O' seals from the reserve valve body.

(16) Reassembling Reserve Valve

Fit new small 'O' seal to conical valve, smear it lightly with lanolin, and insert valve into bore of the reserve valve body (conical end first) and push to bottom of bore.

Insert the spring and then the plunger (flat face first) and make sure that they are free to move up and down the bore.

Use a slim drift or similar instrument to push in the plunger so that the spring is compressed, and replace the small pin which retains them. Make sure that the pin is tight, and renew it if necessary.

Fit new 'O' seals to R.V. body, smear them lightly with lanolin.

Release pin need not be fitted at this stage.

(17) Reassembling Demand Valve Regulator (1st Stage)

Renew all worn or damaged parts.

Fit swivel clamp toggle screw.

Replace the filter spacer ring, and the sintered disc and lock in place by means of the slotted screwed ring.

Inspect the nylon seating of the first stage valve and make sure that the edge of the hole is smooth, clean and free from flaws. This is important: the seating should be renewed if there is any sign of roughening.

Place the O-ring seal and the nylon seating in position in the 1st Stage bore and see that they lay flat. Place the backing washer on top of the seating and screw in the lock ring.

Tighten the lock ring with a hexagon key. No positive stop will be felt because the nylon valve seating offers a springy resistance, but the lock nut should be screwed up firmly without using undue force.

Reassemble the 1st Stage diaphragm unit and renew the diaphragm if necessary. If the used diaphragm is replaced, clean off all traces of old jointing compound. Do not use petrol or any similar solvent to clean the diaphragm.

Inspect the diaphragm washer and note that one face is plain, while the other has a rounded edge. Smear a thin film of gold size or jointing compound on the plain face, and slip the washer onto the hexagonal-headed bolt with the plain face towards the head of the bolt. Press the jointed surface of the washer firmly against the head of the bolt.

Pass the bolt through the diaphragm and screw it into the backing plate until the washer is pressed against the diaphragm. Grip the diaphragm backing plate in a vice and continue to tighten the bolt until the washer sinks into the diaphragm, but do not overtighten or the fibres of the fabric insertion may be snapped.

Ease the assembled diaphragm unit into the recess in the Demand Valve Regulator body, with the hexagonal bolt head inwards, and ensure that the edge of the diaphragm is pressed down flat. Then insert 1st Stage valve (conical-headed valve with slotted head) into the body through the reserve valve housing; push the valve through the hole in the nylon seating, and engage thread into diaphragm bolt head. Screw down lightly until fully home. Care should be taken not to get the valve stem cross-threaded. Do not fully tighten at this stage.

Lay the slip ring on the diaphragm, place the spring in position (pressing on the diaphragm backing plate) replace the adjusting sleeve in the hexagon cap and screw in as far as possible. Pressing the cap down on to the spring, screw cap into the Demand Valve Regulator body. Tighten with a spanner, but do not use undue force. Finally use screwdriver to tighten 1st Stage valve, taking care not to overtighten and strip thread or bend valve stem.

Insert the reserve valve assembly into its housing in the Demand Valve Regulator body, with the release pin hole in line with the axis of the swivel clamp. Secure the reserve valve with the six 4 BA stainless steel cheese-headed screws. RENEW THESE SCREWS IF THE THREADS OR HEADS HAVE BEEN DAMAGED.

If a reserve valve is not fitted, the blank plug should be replaced in the same way, except that the 'position' does not matter in this case.

Fit the rubber relief valve into the relief valve spring, small end first, and push valve and spring into the relief valve housing. Screw the adjusting plug into the housing to compress the spring until the plug is flush with the body of the Demand Valve Regulator, and then tighten it one more turn with a hexagon wrench.

(18) Reassembling Demand Valve Regulator (2nd Stage)

Renew all worn or damaged parts.

Fit the venturi locking flange over the venturi tube.

Pass the stem of the rubber-headed 2nd Stage valve into the bore of the venturi tube and through the slot in the curved tube.

Fit the rubber washer into the recess provided for the venturi-tube in the body of the Demand Valve Regulator. Seat the venturi-tube on this washer so that the curved tube is directed down the centre of the inhalation port, and secure it with two (6BA) cheese-headed screws and the venturi locking flange. Screw down carefully so that the locking flange remains horizontal and only tighten enough to ensure that the venturi tube cannot twist out of position.

The Demand Valve Regulator is now ready for testing.

(19) Setting and Checking 1st Stage Pressure.

A Test Gauge Assembly will be required to set and check the 1st Stage pressure and to set the relief valve. This assembly includes a pressure gauge indication 0 to 150 p.s.i., a special adapter and a rubber tube with suitable connectors.

Connect adapter to airline-lung connection hole on Demand Valve Regulator.

Seat the gland at one end of the rubber tube squarely in the recess of the adapter, and tighten the gland nut. Do not strain the gland by overtightening. In the same way, connect the other end of the tube to the pressure gauge.

Replace the restrictor screw in the connection for the cylinder contents gauge on the Demand Valve Regulator, and either connect up the cylinder contents gauge or replace and tighten the blank cap on the gauge connection.

Clamp the Demand Valve Regulator to a fully charged cylinder and open the cylinder valve slowly. If the relief valve leaks, screw in the adjutsing plug until the leak stops. The purpose of the relief valve is to protect the 1st Stage diaphragm, and the pressure should not be allowed to rise above 120 p.s.i.

Screw in on the adjusting sleeve inside the hexagon cap and observe the pressure gauge reading.

The reading on the pressure gauge should rise to 90-100 p.s.i., remain steady, and then settle back to between 80-90 p.s.i. Deflect the pin of the 2nd Stage valve two or three times to check that the pressure is settled, indicating a perfect seal in the 1st Stage valve.

If the pressure does not settle, but continues to rise, and the relief valve continues to leak, then the 1st Stage valve is leaking, allowing a pressure build up in the 1st Stage chamber. This may be caused by a failure of the 1st Stage valve to seat properly, or by an escape of air around the face of the nylon seating. In either case the fault may be due to misalignment of the valve and seating.

To remedy these leaks, turn off the cylinder valve and deflect the 2nd Stage valve pin to discharge the pressure air in the 1st Stage chamber. Remove the Demand Valve Regulator from the cylinder.

Unscrew the hexagonal cap retaining the 1st Stage diaphragm assembly and remove spring, slip ring and diaphragm assembly.

Use a hexagon wrench to tighten the lock nut against the nylon valve seating of the 1st Stage Reduction Valve, and then reassemble the diaphragm, slip ring, spring and hexagonal cap as described in Section 17.

Reconnect the Demand Valve Regulator to the cylinder, reopen the cylinder valve and recheck the the performance of the valve as before. If the pressure still continues to rise with the relief valve leaking, it will be necessary to renew the nylon valve seating and/or the valve. Turn off the cylinder valve as described in Section 14. Renew the faulty parts, reassemble as described in Section 17 and re-test as described in this Section.

If the pressure gauge reading is steady but higher than 90 p.s.i., or lower than 80 p.s.i., adjust by unscrewing the adjusting sleeve to reduce or screwing in to increase.

Deflect the tilt valve pin several times at each adjustment, and re-check the pressure until a settled pressure of 80-90 p.s.i. is obtained.

When the pressure in the 1st Stage chamber is correct, readjust the relief valve to the point where it just does not leak, and then screw it in one turn more. The relief valve will now be set to operate at a pressure of 100-110 p.s.i. Apply soap solution around the relief valve and check for leaks.

The 1st Stage is now correctly adjusted.

(20) Checking 2nd Stage Valve Seating

With the Demand Valve Regulator connected to a fully charged cylinder and the cylinder valve open, apply soap solution around the edge of the flange on the venturi-tube where it joins the body of the Demand Valve Regulator, and check for leaks arouhd the washer. Deflect the pin of the 2nd Stage valve several times and repeat the soap test. Then immerse the whole unit in clean water and check for leakage anywhere on the valve.

Turn off the cylinder valve, deflect the 2nd Stage valve pin to exhaust air from the 1st Stage chamber, disconnect the Demand Valve Regulator from the cylinder and wipe it dry.

Remove the test gauge and the adapter and replace the washer and the hexagon-headed blank plug in the hole provided for the Diving Air Pipe (Airline-lung) attachment.

(21) Assembling Outlet Valve Cover and Valve

Carefully examine the rubber spear valve by stretching with the fingers and looking for punctures or cracks on both sides particularly near the binding. Renew if necessary.

The metal tube should only extend $\frac{7}{8}$ in. inside the small end of the spear valve.

Reinsert the anti-kink wire through the outlet valve tube in the valve cover and push it and the metal tube through until the edge of the rubber spear valve butts against the side of the cover. Make sure that the spear valve lies flat between the two rubber posts in the moulding.

Turn the cover over so that it lies with the open side downwards. Take the metal flange ring, pass one side of it under the exhalation port and ease the other side over the cover so that the ring lies on the outside face of the cover flange. Line up the holes.

Clamp the body of the Demand Valve Regulator lightly in a vice with the swivel clamp downwards, and lay the 2nd Stage diaphragm in position on the upturned body with the metal disc on the diaphragm facing the 2nd Stage valve pin. Line up the flange holes.

Place the outlet cover on the diaphragm flange with the (exhalation port on the cover at right angles to the inhalation port on the body of the Demand Valve Regulator, and approximately vertically in line with large hexagon top cap. Line up the flange holes and fit the eight (4BA) round-headed screws. Tighten them evenly.

Remove the Demand Valve Regulator from the vice and connect it to the cylinder. Open the cylinder valve and test the inhalation port on the body of the valve for leakage. A leak will indicate incorrect assembly of the diaphragm and cover, causing the diaphragm to hold open the 2nd Stage valve. If there is any trace of leakage, dismantle the outlet cover and reassemble as explained in this Section.

(22) Final Assembly

Fit the breathing tubes to the ports on the Demand Valve Regulator, taking care that THE MOUTHPIECE IS CORRECTLY POSITIONED IN RELATION TO THE DIVER'S MOUTH. Before connecting the tubes to the ports, suck each tube and note that the exhalation tube offers no resistance to suction. This tube should be connected to the port on the outlet valve cover. (See Section 12 for correct method of assembling tubes and mouthpiece.)

(23) Adjusting Restrictor Screw for Cylinder Contents Gauge.

Clamp the Demand Valve Regulator to a fully charged cylinder, open the cylinder valve and check the time taken for the cylinder contents gauge to indicate fully charged (120 atmospheres). The time should be 3 to 5 seconds.

If the time is not correct, turn off the cylinder valve. Then disconnect the high pressure gauge tube from the Demand Valve Regulator, adjust the restrictor screw, reconnect the gauge tube and open the cylinder valve. Recheck the time taken to indicate full charge, and repeat the process until the time interval is correct. Be careful to turn off the cylinder valve before removing the gauge tube on each occasion.

(24) Checking Breathing Characteristics

With the Demand Valve Regulator connected to a fully charged cylinder, and the cylinder valve open, inhale and exhale through the mouthpiece to ensure that the valve is functioning correctly, that there is no undue resistance to breathing, and that the valve will provide all air demanded.

(25) Checking Reserve Valve

Fit the reserve valve release pin with the lanyard towards the outlet valve cover.

Clamp the Demand Valve Regulator to a cylinder which has been discharged to about 25 atmospheres, and turn on the cylinder valve.

Inhale and exhale through the mouthpiece until a restriction is felt in breathing. If this process takes too long, use a pencil or similar blunt instrument to depress the 2nd Stage diaphragm and accelerate the discharge of the cylinder, but do not exhaust air too quickly or ice may form.

When a restriction is felt in breathing, check the reading of the cylinder contents gauge. This restriction should occur at a pressure of 20 atmospheres ($\pm$5 atmospheres).

Pull the release pin out and check that breathing is then unrestricted.

USING A DIVING AIRPIPE WITH MERLIN MARK VI (Surface demand system)

(26) Air Supplies

The Merlin Demand Valve Regulator can be used with surface air supply from either:

(i) a high pressure storage cylinder fitted with a pressure-reducing valve, or

(ii) a low pressure air compressor unit, specially fitted with suitable filters, and reservoir.

(27) Calculating Correct Pressure

The diver's air pressure should be 40 to 60 p.s.i. above the water pressure at the maximum depth of the proposed dive.

Assume that two feet of water represents a pressure of one pound per square inch. Then the pressure at 50 feet is 25 p.s.i. and the diver's air pressure for a dive to 50 feet should be 25 p.s.i. plus 40 to 60 p.s.i. that is, 65 to 85 p.s.i. The lower pressure (65 p.s.i.) is adequate for inspection dives, but the higher pressure (85 p.s.i.) should be used for working dives. Similarly, a diver going down to 20 feet would require an air pressure of 10 p.s.i. plus 40 to 60 p.s.i.; that is, 50 p.s.i. for an inspection dive and 70 p.s.i. for a working dive.

(28) Fitting Demand Valve Regulator to Merlin Surface Demand Backpad and Harness

Lay the backpad on a flat surface with the arm for the Demand Valve Regulator uppermost.

Fit the swivel clamp of the Demand Valve Regulator over the arm, and make sure that the breathing tubes follow the line of the shoulder straps. Locate the valve correctly in the seating and tighten the swivel clamp screw.

(29) Fitting Diving Air Pipe and Non-return Valve

Remove the chromium-plated hexagon-headed blank plug from the Surface Demand connection on the Demand Valve Regulator.

Check that the three O-rings of the Merlin Mark VI Surface Demand Adapter (50250) are in place and screw the adapter into the body of the valve.

WARNING: This non-return valve must be fitted whenever the Merlin Demand Valve Regulator is used with a Diving Air Pipe. Failure to do so may be highly dangerous, as without the non-return valve a fractured air pipe would allow air to be evacuated from the diver's lungs, causing the lungs to collapse.

Pass the Diving Air Pipe through the hose clamp on the shoulder strap and connect the end to the non-return valve on the Demand Valve Regulator. If the extension hose (Ref 013864.00) is used the quick release coupling must be above the harness hose clip.

(30) Using High Pressure Storage Cylinder

Fit the pressure reducing valve to the storage cylinder by screwing the fly nut into the cylinder valve.

Screw down the shut-off valve located at the end of the reducer opposite to the cylinder connection.

Open the storage cylinder valve. The cylinder pressure will now be shown on the left hand pressure gauge.

Calculate the pressure required for the projected dive as explained in Section 27; and adjust the round bolt with a bar fixed through it, located in the centre of the reducer. The right hand gauge indicates the diver's air pressure, which is increased by screwing the bolt in, and decreased by screwing the bolt out.

When the correct pressure for the dive is indicated on the right hand pressure gauge, screw the Diving Air Pipe coupling onto the reducer coupling located immediately below and to the right of the shut-off valve.

Open the shut-off valve fully. Check the diver's air pressure on the right hand gauge and readjust if necessary.

Check that the Demand Valve Regulator is functioning correctly by breathing deeply through the mouthpiece.

Keep the cylinder contents gauge and the diver's air pressure gauge under constant observation during the dive, and call up the diver when the left hand gauge reads 500 p.s.i. This will ensure an adequate air supply during the diver's ascent.

(31) Using Low pressure Air Compressor

A suitable compressor must be capable of delivering at least four cubic feet of free air per minute at a pressure of at least 100 p.s.i. It will be driven by a suitable motor; and if an internal combustion engine is used care must be taken that the exhaust gases are not drawn into the compressor intake.

Air delivered by the compressor must be passed into a reservoir in order to provide a reserve for the diver's ascent if the compressor fails. A filter should also be provided to ensure purity of the air supplied.

A control unit, incorporating a pressure gauge, must be provided between the compressor stage and the outlet valve so that the output can be maintained at the correct pressure for the dive (see Section 27)

(32) Putting on Merlin Surface Demand

Pass the shoulder straps over the diver's shoulders so that the Demand Valve Regulator is positioned high up between the shoulder blades.

Fasten the waist strap by folding back the free end and then passing the double portion through the buckle. Adjust straps to suit.

Check that the hose clamp takes the strain and that there is sufficient slack in the Air Pipe leading to the Demand Valve Regulator to prevent strain on the coupling. See that the hose is neatly arranged so that it will not become fouled or kinked during the diver's descent.

Pass the mouthpiece and breathing tubes over the diver's head and check that the tubes are symmetrically arranged and free from twist or strain when the mouthpiece is in position.

When the diver enters the water, he should pause just below the surface to test the functioning of the whole equipment and to check for leaks, especially in the vicinity of the couplings.

(33) Using a Surface Airpipe in conjunction with Aqualung Cylinders

A surface air supply can be used as an auxiliary supply to a single or twin Aqualung. There are two alternative ways of doing this, viz:

(i) To use the surface air supply as the primary supply during the dive and the H.P. air in the cylinder(s) as a reserve in case the surface supply is interrupted for any reason.

(ii) To use the air cylinders as the primary supply and the surface supply as the auxiliary reserve in case the dive takes longer than anticipated, or for carrying out decompression stops.

This latter method pre-supposes adequate communication between diver and surface to ensure that surface air is turned on when needed. It will also be necessary to use the extension hose (Ref 013864. 00) with quick release coupling, so that the diver can plug in the surface hose when required.

To rig for either method assemble the aqualung complete in either single or twin cylinder form, then connect the surface demand adapter and hose to the Demand Valve as described in Section 29. As most aqualung harnesses will not be fitted with a hose clamp, the airhose should be lashed with light line to the waist-strap of the harness, using a rolling hitch round the hose to prevent slipping.

When using method (i) above, the surface air pressure must be maintained at 100 to 110 p.s.i. above sea pressure as calculated in Section 27. This will ensure that the air is drawn from the surface and not from the cylinder(s). If the pressure is allowed to fall below this figure, then air will be drawn unwittingly from the cylinder(s) and the reserve when needed may be found to be seriously reduced.

(34) Surface Demand Shut-off Valve (29417)

To facilitate using method (i), and to avoid any possibility of the situation described in the last sub-paragraph of Section 33, a special Shut-off Valve has been designed. This valve fits on to the Demand Valve in place of the Air Reserve Valve and should be fitted exactly as described in Section 7.

It is differentiated from the Air Reserve Valve by having a hexagon section connecting flange instead of a round one and a green release cord.

The function of the valve is to hold back the full cylinder pressure until it is required in emergency, when it acts as a quick release cylinder valve.

The shut-off valve should be fitted to the Demand Valve and the quick release pin inserted. The Aqualung is rigged with the non-return Surface Airline adapter and Surface Air supply hose as described in Section 33.

Open the cylinder valve of one or both cylinders, supply Surface Air as in Section 30 or 31. Check that the quick release cord is correctly fitted to the harness and rubber ball grip ready to hand.

The diver is now working on surface supply, and pressures should be adjusted as in Section 27. In the event of the surface air supply being interrupted through the hose becoming kinked or damaged, or for any other reason, the diver has only to operate the release cord and pull out the pin, to obtain full cylinder pressure immediately.

The non-return valve in the Surface Airline automatically shuts off and prevents any leakage back through a damaged hose.

When first fitted the release pin will be found slightly loose, but this is held in position by the air pressure as soon as the cylinder valve is opened.

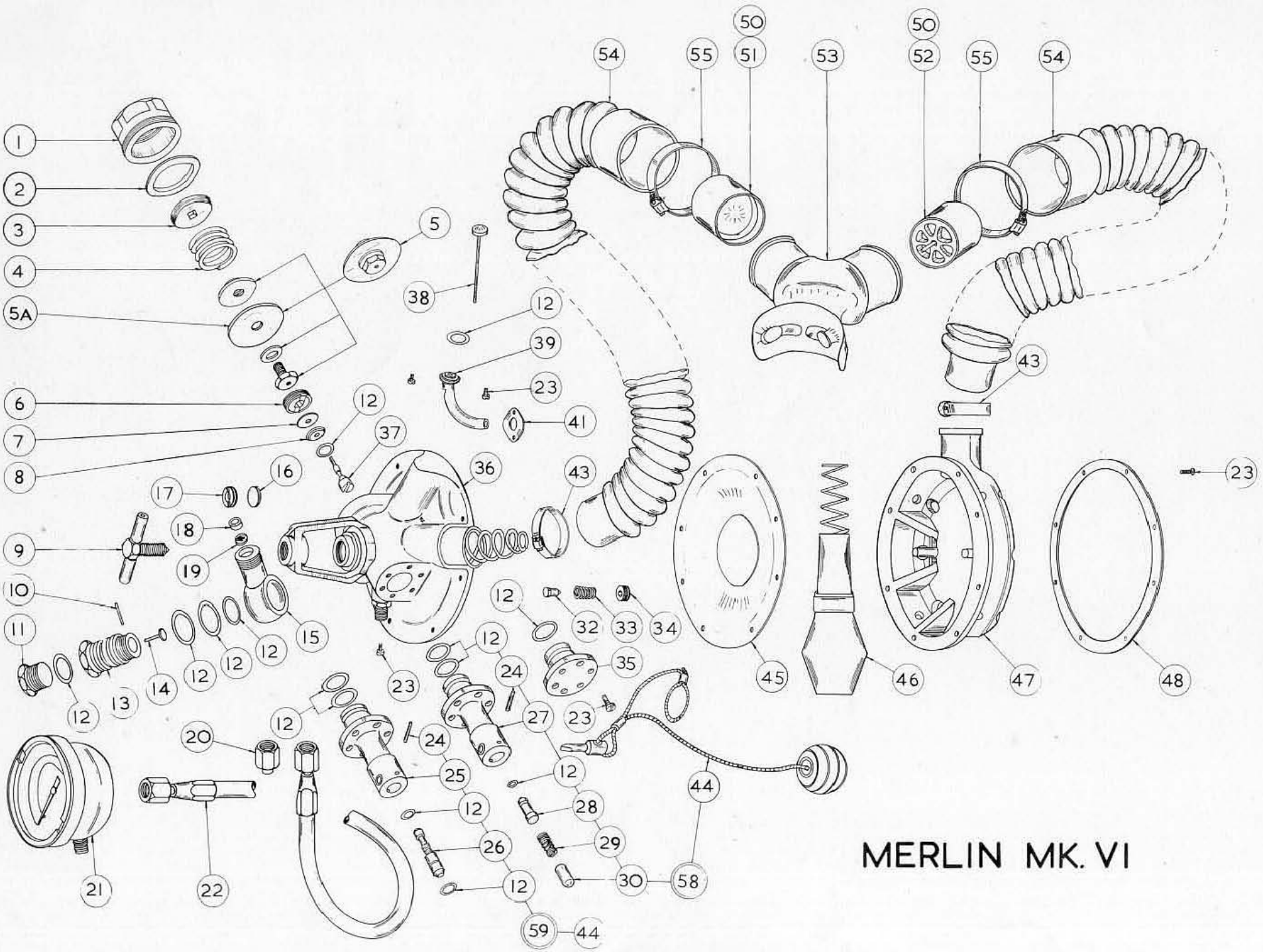
To refit the pin after use, shut the cylinder valve and release all pressure from the Demand Valve, then depress the valve spindle and reinsert the pin.

SPARE PARTS LIST

ITEM NUMBER	PART NUMBER	DESCRIPTION
1	050247.00	Top cap
2	061167.00	Shim
3	050243.00	1st stage adjusting screw
4	061805.00	Diaphragm spring
5	061811.00	1st stage diaphragm assy
5A	071152.00	Diaphragm
6	061740.00	Nylon seat lock ring
7	061449.00	Back up washer
8	061961.00	Valve seating
9	061165.00	Clamp bolt screw
10	061460.00	Brass rod
11	061744.00	Blank plug
12	050852.00	Spare 'O' ring pack
13	031310.00	Banjo bolt
14	061459.00	Non-return valve
15	031311.00	Banjo
16	061525.00	Sintered bronze disc
17	021490.00	Retaining ring
18	061429.00	Non-return valve filter lock ring
19	071170.00	Filter gauze
20	025315.00	Nut & bull nose
21	031029.05	Pressure gauge
22	061007.00	Pressure gauge tube
23	050853.00	Spare screw pack
24	061747.00	Monel pin
25	031165.00	Reserve valve body (Surface demand)
26	029415.00	Piston
27	061746.00	Reserve valve body
28	061750.00	Valve
29	061073.00	Valve spring
30	061751.00	Plunger
32	071352.00	Valve - Relief valve
33	061292.00	Spring - Relief valve
34	071211.00	Adjusting screw - Relief valve
35	061743.00	Reserve blank plug
36	061964.00	Body
37	071168.00	1st stage valve
38	061026.00	2nd stage valve
39	061511.00	Venturi tube
41	061956.00	Retaining plate
43	192045.00	Small clip
44	050854.01	Reserve valve cord
	050854.02	Reserve valve cord (Surface demand)
45	061534.00	2nd stage diaphragm
46	061958.00	Spear valve
47	061817.00	Outlet valve cover
48	061528.00	Outlet valve clamp ring
50	004806.00	Valve
51	061572.00	Inhale valve base
52	061580.00	Exhale valve base
53	061570.00	Mouthpiece
54	061573.00	Breathing tube
55	192046.00	Large clip
56	028583.00	Protection cap
57	190045.00	1 in. dia. split ring

REFERENCE ASSEMBLIES

58	061820.00	Reserve valve includes Items 12. 24. 27. 28. 29. 30. 44
59	029417.00	Reserve valve surface demand includes Items 12. 24. 25. 26. 44
	050250.00	Banjo assy. surface demand includes Items 10. 12. 13. 14. 15. 18. 19.
	040928.01	Merlin Mark VI Tool Kit
	240086.00	Allen key for 1st stage locking ring
	006702.00	Key for 1st stage spring adjustment
	050873.00	Key for filter locking ring
	240064.00	Small screwdriver for diaphragm securing screws, 2nd stage tilt valve securing screws, 1st stage valve, air reserve valve or blank securing screw and breathing tube clips
		Spanners for:
	240012.00	1st stage spring cap
	240008.00	Surface demand attachment blank and adapter
	240006.00	Pressure gauge tube or blank
	012147.00	Tool bag
	040928.02	Merlin Mark VI Test Kit
	071387.00	Pressure Gauge
	071650.00	Adapter for attachment to surface demand connection
	071339.00	Washer, adapter
	028830.00	Rubber connecting tube
	340013.00	2 oz. tube MS4 (O ring lubricant)
	013864.00	Surface demand extension hose
	050677.00	Service manual


MERLIN MK. VI