SS750-AA-MMA-010/850FT

0910-LP-711-1900

REVISION 1

TECHNICAL MANUAL

FOR

MODERNIZED 850 FOOT SUBMARINE RESCUE CHAMBER

OPERATION AND MAINTENANCE

PREPARED BY
THE DEEP SUBMERGENCE SYSTEMS PROGRAMS OFFICE
AT PORTSMOUTH NAVAL SHIPYARD

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PAGE NO. A.	PARA-GRAPH B.	C. RECOMMENDED CHANGES AND REASONS
1-1	1-1	DELETE SRC-19
1-1	1-3	RESCUE OCCURED 25 MAY 1939. SQUALUS SUNK 23 MAY 1939
1-2	1-3	THE ADDITIONAL TENDING LINE IS CALLED AN ANTI SPIN LINE AND IT IS CONNECTED TO THE TOP OF THE SRC TO PREVENT POSSIBLE FOULING WITH THE DOWN HAUL WIRE.
1-2	1-4	DELETE SEVERAL. THERE ARE THREE METHODS OF MAKING A SEAL: PRIMARY, ALTERNATE, AND ANGLED SEAT.
1-2	1-4	OPERATING PROCEDURES HAVE CHANGED THE PRIMARY METHOD OF OBTAING A SEAL IS THE HYDRAULIC. IT WORKS WELL AT PIER. DURING ALTERNATE METHOD SRC BECOMES APPROX 2000 LBS NEGATIVE. REQUEST PARAGRAPH MORE ACCURATLY DESCRIBE OPERATING AND EMERGENCY PROCEDURES
1-3	1-4	ASCENT PROCEDURES HAVE CHANGED. CHANGE VALVE A TO VALVE F (AIR MOTOR THROTTLE.
2-1	2-1	ANTI SPIN LINE IS ATTACHED TOTHE STAPLE ON TOP OF THE SRC.
2-1	2-1	THE BACKHAUL LINE IS ATTACHED TO THE LIFTING PENDANT NOT THE STAPLE ON TOP OF THE SRC.

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PAGE NO. A.	PARA GRAPH B.	C. RECOMMENDED CHANGES AND REASONS
2-1	2-1	THE UMBILICAL STRENGHT MEMBER IS ALSO THE BACKHAUL LINE. REQUEST THIS BE CLARIFIED WITH THE UMBILICAL'S STRENGHT MEMBER, IT LEADS THE SRC BY 50 TO 100 FEET.
2-1	2-1-1	EXPLAIN WHY THE BREAKING STRENGHT MUST BE 134,00 LBS. IE RECOVER SRC AND FALSE SEAT WITH SAFTEY FACTOR OF ?
2-1	2-1-1	WHEN THE BACK HAUL LINE IS USED AS THE STRENGHT MEMBER, THE LINE WILL NOT FLOAT ON THE SURFACE.
2-1	2-1-2	HOSES ARE BOTH 100 FEET AND 50 FEET. HOSES ARE NO LONGER EXTERNALLY TESTED.
2-2	2-1-6	ANTI SPIN LINE IS ATTACHED TO THE TOP OF THE SRC TO PREVENT FOULING WITH DOWN HAUL WIRE.
2-3	2-2-1	DEFINE THE INTERNAL PRESSURE OVER AMBIENT THAT UPPER HATCH FAILS. DEFINE FAIL PRESSURE FOR LOWER HATCH. THIS INFORMATION COULD BE USEFUL IF USING THE SRC TO DECOMPRESS PERSONNEL.
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47.	DISABLED SUB; Requirements for Employment of US Navy Submarine Rescue Systems	NAVSEA S9594-AE-GTP-010/DISABLED SUB
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CHAPTER 1

INTRODUCTION

1-1 SCOPE OF MANUAL

This Technical manual is applicable to Submarine Rescue Chambers (SRC-8), ~~(SRC-19)~~ and (SRC-21). Included in this manual are detailed descriptions of the various systems and components, operating and emergency procedures, Scope of Certification (SOC) boundaries and items. Also included is an overview of the ancillary support equipment that comprises the Fly-Away Kit configuration.

1-2 SUBMARINE RESCUE OPERATIONS

Operations and conditions affecting submarine rescue operations are described in detail in references 47 and 48.

1-3 SUBMARINE RESCUE CHAMBER - GENERAL DESCRIPTION

The Submarine Rescue Chamber of today is based on the design of its predecessor, the McCann Rescue Chamber which was named after its principle designer, Commander Allen R. McCann. On May 23, 1939 the McCann Rescue Chamber successfully rescued 33 crew members from the USS Squalus trapped at a depth of 240 feet. Although the SRC is over 50 years old, the simplicity of the design and fabrication have proven it to be reliable and it is still capable of performing rescue operations in a great percentage of the worlds rescuable waters. The SRC's have undergone various changes and modernization throughout the years and this manual covers the latest SRC configuration. The SRC is designed to carry two operators and six passengers from a disabled submarine (DISSUB) in waters up to 850 feet deep. Rescue chambers are certified for use and maintained in accordance with NAVSEA P9290.1A - System Certification Procedures and Criteria Manual for Deep Submergence Systems.

The SRC is a steel cylinder with an elliptical head. The SRC measures about 12 feet high and weighs approximately 21,000 pounds. The upper compartment measures 7 feet in diameter and about 7 1/2 high. The remainder of the SRC tapers from 7 feet to 5 feet in diameter and is comprised of the lower compartment and the ballast tank. See Figure 4-1 for an outline of the SRC. The SRC is divided into three sections; an upper compartment, a lower compartment and the ballast tank which surrounds the lower compartment. The upper compartment houses all the controls, communication equipment, personnel and mission essential tools. The lower compartment is open to sea and contains high intensity underwater lights, a downhaul cable cutter and the downhaul equipment. The ballast tank provides buoyancy and aids in making a seal with the DISSUB.

1-3 (cont.)

The SRC and surface support ship are connected by a backhaul line that is kept slack during the dive and an umbilical that provides fresh air, air exhaust, electrical power and communications to the SRC. The ascent and descent of the SRC is controlled by the SRC operators.

The SRC is also connected to the submarine escape hatch by a downhaul cable that has been previously attached by a diver or remotely operated vehicle. An additional tending line is also connected from the surface ship to the bottom of the SRC to prevent rotation during operations and is referred to as the anti-spin line.

1-4 OPERATING PROCEDURES - GENERAL

During rescue operations an internal air motor winches the chamber along the downhaul cable to a mating seat around the escape hatch of the disabled submarine. A fairlead assembly keeps the downhaul cable centered in the lower compartment during decent.

Once the SRC is on the mating seat around the submarine's escape hatch. a seal is made by using one of several procedures given in Operating Procedure OP-102 of DSUINST 9000.3, depending on the water depth and sea conditions. For shallow dives (less than 200 feet) a seal is made by flooding the ballast tank, jacking down, blowing the water out of the flooded lower compartment and then venting the lower compartment. Sea pressure acting on the SRC and rubber gasket at the base of the lower compartment forces the chamber down on the mating seat to create the seal. This sealing method results in the SRC being in a negatively buoyant mode for a short time.

For deep dives (greater than 200 feet) a hydraulic seal is made by rapidly transferring water from the lower compartment to the ballast tank. This transfer is accomplished due to the hydrostatic pressure differential between the lower compartment, at sea pressure. and the ballast tank at one atmosphere. The sudden drop in lower compartment pressure. as the water is transferred, results in a pressure differential between the lower compartment and sea pressure which forces the chamber tightly to the mating seat to create a seal. If the seal attempt is successful, only a small amount of water is transferred from the lower compartment to the ballast tank. Once the seal is made the remaining water in the lower compartment is then blown into the ballast tank. The hydraulic seal does not use as large a volume of air as the shallow dive seal and it allows the SRC to remain positively buoyant. The shallow dive method may be used at depths in excess of 200 feet if the hydraulic seal is unsuccessful. The shallow dive method should only be used as an alternative because it requires the SRC to become negatively buoyant for a period of time.

1-4 (cont.)

After equalizing pressure between the upper and lower compartments of the SRC, the hatch connecting these compartments is removed. SRC operators can then enter the lower compartment and prepare for the submarine hatch to be opened.

Once the submarine hatch is opened, emergency supplies and medical equipment can be transferred to the DISSUB crew. Ventilation of the DISSUB through the SRC umbilical to the surface can begin at this time, if required. To maintain sufficient buoyancy for the assent after taking the submarine crew aboard, an equivalent weight of water from the variable ballast containers is transferred from the SRC to the submarine via the hatch cavity drain. After this is accomplished, the selected submarine crew members may enter the SRC.

Ascent to the surface is basically the reverse of decent. The downhaul cable unwinds as the buoyant SRC rises. Rate of ascent of the SRC is controlled by throttling valve "A" (air motor pressure regulator).

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CHAPTER 2

DETAILED EQUIPMENT DESCRIPTION

2-1 RESCUE SUPPORT SHIP SUPPORT EQUIPMENT

All SRC services are provided from the surface support ship to the SRC through an umbilical (also referred to as the hose bundle). The umbilical is composed of an air supply hose, air exhaust hose, an electrical communications cable, an electrical power cable and a three inch circumference 8-strand nylon plaited line used as the umbilical strength member. To allow freedom of operation for the SRC, the umbilical is normally kept slack, leading the SRC depth by approximately fifty to one hundred feet.

Tending and emergency recovery is handled by a nylon anti-spin tending line and a ~~synthetic~~ fiber rope backhaul line. The anti-spin tending line is attached to a staple on the side of the SRC to aid in tending the SRC over the side of the support ship and to prevent fouling of the umbilical caused by rotation of the SRC during the dive. A light strain is normally maintained on the anti-spin line. The backhaul line is attached to the lifting eye on top of the SRC and is used only for emergency recovery. The backhaul line is kept slack during the dive to allow the SRC to freely descend and to prevent stalling the air motor.

2-1-1 Backhaul Line (Reference 11)

The backhaul line must have a minimum ~~ultimate~~ breaking strength of 134,000 pounds and be at least 1300 feet long. At present, a 1-1/2 inch diameter high strength, ultra-high molecular weight polyethylene fiber rope called Spectra-12 is used to fulfill the requirement. This line is fitted with a heavy duty Crosby, model G-414, thimble on the end that is attached to the SRC. The advantage of using this rope over conventional synthetic fiber ropes or wire rope is the ease of handling by the surface support ship crew. Additionally, with a specific gravity of .98, it floats, allowing topside personnel visible confirmation that sufficient line has been let out.

2-1-2 Air Supply Hose (References 43 & 51)

Air is supplied to the SRC through twenty six, 50 foot lengths of 1-inch ID synthetic rubber, wire reinforced hose. The hoses are coupled together to form a total length of 1300 feet. Normal air supply pressure is 50 psig above anticipated bottom pressure or 200 psig whichever is greater. In-service testing of the hoses, internally and externally, is periodically accomplished by the fleet per MRC requirements. If the supply hose fails during operations, the air exhaust hose may be used intermittently to supply air to the SRC (see EP-102 of DSUINST 9000.3).

2-1-3 Air Exhaust Hoses (Reference 43 & 51)

Exhaust air is removed from the SRC through twenty six, 50 foot lengths of 1-1/4 inch ID rubber wire reinforced hose. The hoses are coupled together to form a total length of 1300 feet. The normal purpose of this hose assembly is to provide a direct means to exhaust the air motor to the surface and to ventilate the upper compartment, preventing carbon dioxide buildup. Testing of this hose is identical to the air supply hose. If the exhaust hose fails during operations, the supply hose may be used to intermittently exhaust the SRC.

2-1-4 Electrical Power Cable (Reference 29)

The electrical power cable is a 1300 foot long twin conductor cable (DHOF-23), which connects to the fuse panel in the SRC through an electrical hull fitting (ref. 44) in the top of the SRC. The end of the cable on the surface support ship is connected to a power supply receptacle on the flyaway equipment control console that is fused for 25 amperes.

2-1-5 Communications Cable (Reference 29)

The communications cable is a 1300 foot long 3 conductor cable (TSS-4) which connects to the communications equipment inside the SRC through a multiple connector electrical hull fitting (ref. 44). The end of the cable on the surface support ship plugs into a communications system receptacle in the flyaway equipment control console. The safety ground (red conductor) of the communications cable is to be grounded to the structure of the surface support ship.

2-1-6 Anti-Spin Tending Line (Reference 11)

The anti-spin tending line is a 1500 foot length of 1-1/4 inch diameter 3 strand nylon line. The line is attached to a handling staple near the bottom of the SRC to prevent rotation of the SRC during descent and ascent.

top (to prevent tangling w DH wire)

2-2 SUBMARINE RESCUE CHAMBER - GENERAL

References 2 through 7 provide the structural details of the SRC. The hull of the upper compartment is fabricated from 3/4" HTS steel plate. The ballast tank and lower compartment hulls are fabricated from 3/4" HY-80 steel plate. The upper compartment hull penetrations are comprised of: upper and lower hatches for access; piping penetrations for air intake; exhaust; venting; flooding; draining; the cable cutter; a mechanical penetration for the downhaul equipment operating shaft and electrical hull fittings for lighting and communication.

2-2 (cont.)

A thick rubber gasket on the base of the chamber allows a differential pressure seal to be made with the mating seat around the submarine escape hatch. Hold down devices are manually installed as a safety precaution to help maintain the seal by clamping the SRC to the disabled submarine. Hold down devices, when not in use, are stowed in the upper compartment. The upper compartment also provides stowage for the lower hatch lifting tackle, ballast weight and other equipment and tools. Major items associated with the basic chamber operating systems are discussed under the system headings in later paragraphs.

2-2-1 Hatches (References 24 through 28)

The access hatch at the top of the upper compartment is a standard 25-inch diameter, 3-dog submarine hatch cover that is hinged to swing up when open. The hatch cover is fitted with a double lip gasket held in place with a retaining ring. The lower hatch is an oval, manhole type cover that seats against the underside of the upper compartment and is held in place by a bolted strongback. This cover is opened by attaching the hatch lifting tackle to the staple on the strongback wingnut then unbolting the strongback. . The hatch cover is then lowered it into the lower compartment and turned sideways so that it can be lifted into the upper compartment for storage. The lower hatch cover gasket is a single lip design which is held in place by a dovetailed groove that is machined into the hatch cover.

2-2-1-1 Hatch Lifting Tackle

The lower hatch lifting tackle consists of a double sheave luff tackle, a single sheave lifting block, and 125 feet of 5/8 inch diameter double braided nylon line. The upper block (double sheave) is secured to an attachment point on the structural strongback welded to the elliptical head in the overhead of the upper compartment. The primary uses of the lifting tackle are to handle the lower hatch of the SRC and remove the DISSUB hatch cover fairing sections, but it can also be used to transfer injured personnel from the submarine to the SRC.

2-2-2 Compartments (Reference 3)

The SRC is divided into three compartments: the upper compartment which is normally at atmospheric pressure; the lower compartment which is open to the sea except when sealed to a submarine; and the ballast tank which may be either at atmospheric or at sea pressure, depending upon SRC operations..

2-2-2-1 Upper Compartment

The upper compartment, also referred to as the personnel compartment, is a ringed stiffened cylinder with an elliptical head on top and a dished plate on bottom. This compartment houses the SRC operators, passengers and potential rescuees through all the normal operations of the dive and ascent.

2-2-2-1 (cont.)

The pressure in this compartment is maintained between atmospheric pressure and 12 psig by periodically venting excess pressure to the surface through the umbilical exhaust hose. Throughout this manual, wherever 12 psig is cited for this compartment it refers to the upper limit of exposure that personnel may receive without decompression complications. Fresh air is delivered to the SRC personnel through the umbilical supply hose. This compartment also contains all of the controls necessary to operate the SRC. Mission essential tools and variable passenger ballast are stored in the personnel compartment.

2-2-2-2 Lower Compartment

The lower compartment is normally flooded and at ambient sea pressure. When blown the lower compartment increases the SRC buoyancy by approximately three thousand pounds. This compartment contains the downhaul gear, cable cutter, spooling device, fairlead assembly, two high intensity underwater pressure proof lights and the hold down device foundation. Access to the disabled submarine from the upper compartment is through the lower hatch and the lower compartment.

2-2-2-3 Ballast Tank

The ballast tank surrounds the lower compartment and is capable of changing the SRC buoyancy by approximately three thousand pounds. The ballast tank is normally dry and at atmospheric pressure except when making a seat on the submarine. Ten inspection and maintenance covers are provided around the outside of the tank which are designed for full submergence pressure.

2-2-3 Ballast (Reference 42)

Two types of ballast are carried aboard the SRC fixed ballast and variable passenger ballast. The SRC is normally ballasted to be 1000 pounds positively buoyant as determined by the inclining experiment and listed on the weight data plate that is located on the hull inside the personnel compartment.

2-2-3-1 Fixed Ballast

Fixed ballast (if required) is installed to provide the proper amount of reserve buoyancy and stability control. The fixed ballast is installed high in the upper compartment. either in racks or on mounting studs. This ballast will vary in size, weight and location from one SRC to another due to the differences in hull length and weight. This ballast is considered permanent and should not be modified unless there is a significant change in the SRC weight. The fixed ballast includes compensation for the two operators and mission essential tools.

2-2-3-2 Variable Passenger Ballast (Reference 9)

Variable ballast is carried to compensate for the weight of passengers taken on board. Note that the weight of the two operators is compensated for by the fixed ballast and is not included in the variable ballast required. Water ballast is carried in twelve cans or reusable rubber bladders which line the upper compartment bilge area. The variable passenger ballast is loaded into the SRC from the support ship prior to the dive. When the SRC mates with a submarine and passengers are taken aboard, variable ballast is drained into the submarine hatch cavity drain. A full complement of passengers on an SRC with the water ballast removed will result in a positive buoyancy of about 1000 pounds, as noted on the individual weight data plate. The variable ballast must be replenished after each ascent.

2-3 SRC PIPING SYSTEM (Reference 33 through 40)

The SRC piping is composed of the following systems: Air system; flood and drain system; spill and vent; hydraulic system; and emergency breathing system. References 33, 34 and 35 provide details of the piping systems. Reference 37 is the system diagram and provides system test requirements.

2-3-1 Air System (References 33 & 34)

The air system provides air for operation of the downhaul motor, to blow the ballast tank and lower compartment, to transfer water and to supply the emergency breathing system. The air service manifold, the spill and vent manifold, numerous valves and piping make up the system. A valve list and specific operating procedures are provided in chapter three.

2-3-1-1 Air Service Manifold (Reference 38)

The air service (AS) manifold, Figure 2-1, governs control and distribution of air through the SRC air piping, valves, and associated component. Manifold air valves are designated as AS-1 through AS-8. Valves AS-1 through AS-6 control the supply of compressed air to various SRC systems. Valves AS-7 and AS-8 are used to vent air from the ballast tank and lower compartment to the SRC exhaust system.

2-3-1-1 (cont.)

AS-1 is the main stop between the air supply and the manifold.
AS-2 supplies air to, or vents air from the upper compartment.
AS-3 blows the ballast tank.
AS-4 blows the lower compartment.
AS-5 supplies air directly to the air motor, bypassing a pressure reducer used for normal supply.

NOTE

AS-5 is used only when the air reducer V-2 is inoperative.

AS-6 (Normal air motor supply) supplies air through a reducer (V-2) and air strainer for normal operation of the air motor.
AS-7 vents air from the ballast tank to the exhaust line.
AS-8 vents air from the lower compartment to the exhaust line.

Normally, air supply to the air motor is from the manifold valve AS-6 then through the reducer (V-2) where it is reduced to between 125 and 135 psig, then through the isolation valve (Valve C), a strainer, a pressure regulator (Valve A) and air motor throttle (Valve F).

In case of malfunction, the reducer and/or regulator in the air motor system can be bypassed to ensure a continued air supply to the motor as follows:

(1) With Pressure Regulator (Valve A) Inoperative: Air supply bypasses the regulator through Valve E to the air motor throttle (Valve F).

WARNING

Air motor pressure must be manually regulated with valve H, observing the air pressure on gage D. Relief valve V-8, set at 145 psig, protects the motor from excessive pressure by bleeding air to the upper compartment. Pressurization of SRC occupants must be strictly in accordance with current diving regulations to avoid injury or death from decompression complications.

(2) With Reducing Valve (V-2) Inoperative: Air supply bypasses the reducer through AS-5 and Valve H to the air motor throttle (Valve F).

2-3-1-2 Exhaust and Vent (Reference 37)

The SRC piping provides exhaust and venting in the following manner:

(1) Normal operating procedures (contained in Chapter 3) exhaust air motor discharge and stale breathing air through the exhaust hose in the umbilical to the surface.

(2) Three 1/4-inch bleeder valves (V-9, V-27, and V-28) and associated piping provide final (top-off) venting for the ballast tank.

(3) The lower compartment can be vented either directly to the upper compartment via V-16 or through the exhaust line to the surface via V-17 and AS-8 in the air service manifold.

2-3-2 Flood and Drain System (Reference 37)

The flood and drain system controls primary flooding and draining of both the ballast tank and the lower compartment. This system consists of three two-inch ball valves; the hull valve V-22; a ballast tank valve, FD-2; and a lower compartment valve FD-3. By aligning the appropriate blow and vent lines, water may be introduced into the ballast tank or lower compartment, transferred from one to the other, or blown to sea. Refer to Chapter 3 for specific valve lineups.

2-3-3 Spill and Vent Manifold (Reference 39)

The spill and vent manifold is installed primarily to insure maximum venting or draining of the ballast tank when the SRC is tilted from the vertical. The flood and drain system can not completely drain or vent the ballast tank when a seal must be made at an angle. Internally, the spill and vent manifold is split into two separate manifolds. The left hand side is the spill side and the right hand side is the vent side. The valves are numbered from right to left, SV-1, 2 and 3 being vents and SV-4, 5 and 6 being spills. Pipes from SV-1, 2 and 3 are located approximately 120 degrees apart and terminate at the top of the ballast tank ensuring a high side vent regardless of the SRC's list direction. Pipes from SV-4, 5 and 6 are located approximately 120 degrees apart and extend to the bottom of the ballast tank to ensure maximum water removal from the low side of the tank. The spill and vent system can also be used to fill the ballast tank the minimum amount of water necessary to attain the angle of the seat (see OP-106 of DSUINST 9000.3).

The vent side of the manifold connects to the SRC exhaust line. The spill side of the manifold connects to sea through V-21.

2-3-4 Hydraulic System (Reference 33 or 34)

The hydraulic system is designed to operate the downhaul cable cutter located in the lower compartment. The system consists of a hand operated pump, system gage, associated isolation valves and piping in the upper compartment that leads to a hydraulic cylinder that penetrates the upper to lower compartment. The hydraulic cylinder acts as an actuator which severs the downhaul cable in case of an emergency. This forms the jettison system for emergency surfacing.

2-3-5 Emergency Breathing System (Reference 33 or 34)

The emergency breathing system provides breathing air from the support ship to the SRC personnel in the event that the compartment air becomes contaminated. Eight breathing masks with demand flow regulators plug into two manifolds located on either side of the SRC upper hatch. As air is exhaled, the pressure in the upper compartment will slowly build up, requiring periodic venting to the surface. The upper compartment pressure should not be allowed to build up in excess of 12 psig, except in an extreme emergency.

2-4 SRC DOWNHAUL EQUIPMENT

The SRC downhaul equipment is used to winch the SRC from the surface to the disabled submarine and to regulate ascent speed back to the surface. The equipment consists of an air motor, a drive-train assembly with a friction clutch, a downhaul mechanism, a fairlead assembly, a hydraulic cable cutter, and air motor lubricator.

2-4-1 Air Motor (Reference 33 or 34)

The air motor (appendix A), which powers the downhaul mechanism, is an Ingersoll-Rand reversible, multivane drill type, size 551SM. Air pressure to the motor is controlled by a reducing valve, V-2, normally set between 125 and 135 psig with normal exhausting through piping and exhaust hose in the umbilical to the surface. The regulator valve "A" ,normally wide open, is throttled to reduce air pressure to the motor during ascent or surfaced operations only. A relief valve, V-8 (145 +5 -0 psig), provides overpressure protection for the air motor. An air strainer prevents passage of foreign materials and possible damage to valve "A" and the air motor. Motor drive direction is controlled by the air motor throttle valve, valve "F": Clockwise rotation of the hand grip, as viewed from "A" valve looking towards the motor, will reel in the downhaul cable causing the SRC to descend. For further information see the manufactures instructions and parts list in appendix A.

NOTE

The normal operating pressure of the air motor is between 125 and 135 psig, indicated on gage "D" with the motor stopped. (Pressure at "D" gage will read approximately 90 psig when running).

2-4-2 Drive Train Assembly (Reference 18)

The drive train assembly consists of the jaw clutch, friction clutch, handbrake, driveshaft, handwheel and jacking bar. This assembly is located in the upper compartment and is used to transmit power from the air motor to the downhaul mechanism.

2-4-2-1 Jaw Clutch (Reference 18)

The jaw clutch transmits power from the air motor to the friction clutch and provides a method for disengaging the air motor to allow the downhaul mechanism to operate independently in the event of a motor seizure. The lower jaw of the clutch is fixed to the friction clutch disks. The upper jaw slides vertically on the air motor spindle and is secured in the engaged or disengaged position by a spring loaded pin.

2-4-2-2 Friction Clutch (Reference 18)

The friction clutch continues the drive train from the jaw clutch. It consists of twelve discs compressed by six springs located inside the clutch collar. Six friction discs are splined to the jaw clutch assembly and six are splined to the handbrake/driveshaft assembly.

The friction clutch also provides a safety release feature which prevents the downhaul cable from parting due to overstress. The clutch is adjusted using the clutch collar to slip with a 5000 (±600) pound load on the downhaul cable. Tightening the clutch collar will increase the spring tension on the clutch discs which increases the load at which the clutch slips. The clutch discs are designed to work without lubrication and should be kept free of oil and grease. A threaded pipe plug located in the handbrake assembly should never be used to provide oil or grease.

NOTE

The friction clutch provides no overstress protection when using the handwheel or jacking bar to move the drive train.

2-4-2-3 Handbrake (Reference 18)

The friction brake surrounds the friction clutch. It is used to slow the rate of ascent when the air motor is inoperative or disengaged. The brake is set by applying pressure to a handle fitted with a ratchet-pawl locking device. With the brake fully engaged, the pawl should be between the first and last tooth of the ratchet. Adjustment is accomplished by relining the brakeband. The handbrake should be kept free of oil and grease.

2-4-2-4 Drive Shaft (Reference 18)

The drive shaft couples the friction clutch to the gear box in the lower compartment. The shaft passes through a stuffing box in the bottom dish plate of the upper compartment and must be removed prior to removing the downhaul mechanism bevel gear box.

2-2-4-5 Handwheel and Jacking Bar

WARNING

The jacking bar must be removed prior to operating the air motor. The jacking bar can swing and may injure personnel.

The handwheel or jacking bar may be attached to a worm shaft coupled to the drive train if the cable reel must be turned manually. The jacking bar is also used to increase the tension in the downhaul cable during seating operations or when performing seating on an angle.

2-4-3 Downhaul Mechanism (References 14 through 21)

The downhaul mechanism consists of a bevel gearbox, cable drum, spooling device and the fairlead assembly. The entire mechanism is located in the lower compartment of the SRC.

2-4-3-1 Bevel Gearbox (Reference 21)

The bevel gearbox connects the driveshaft to the cable drum with a six to one reduction ratio. To remove the lower half of the gearcase, the driveshaft must be removed to free the pinion gear.

2-4-3-2 Cable Drum (Reference 19)

The cable drum is two feet in diameter and is designed to hold about 1300 feet of 7/16" diameter galvanized steel (IWRC) wire rope. It rotates at one sixth the speed of the air motor to reel cable on or off.

2-4-3-2 (Cont)

For attachment of the cable to the cable drum, set the spooling pawl at it's extreme position of travel on the side of the drum which has a filler piece for the cable. Loop the cable over the top of the drum and make one complete wrap around the drum, placing the cable in the hole in the hub of the drum. Secure the cable end with two setscrews. Maintain a 80-100 pound tension on the cable while reeling the cable on the drum.

2-4-3-3 Spooling Device (References 15 & 16)

The automatic spooling device evenly distributes the downhaul wire on the drum, with an action similar to a level-wind fishing reel. The spooling device advances 7/16 of an inch for each revolution of the drum. Movement of this device is along a double lead reverse cam powered by a set of 2:1 reduction gears attached to the cable drum.

2-4-3-4 Fairlead Assembly (Reference 14)

The fairlead assembly centers the SRC over the submarine hatch and consists of three stays and a fairlead block. The stays are shackled to staples welded to the inside of the lower compartment and to the fairlead block, centering it with respect to the mating gasket. The fairlead block has two four inch brass sheaves, facing each other, four and five-eighths inches apart. The downhaul cable from the submarine passes between the sheaves to the cable cutter roller. All pins in the fairlead assembly shackles must be moused to prevent them from backing out.

2-4-4 Hydraulic Cable Cutter (Jettison System) (References 22 and 23)

The cable cutter is capable of shearing the downhaul cable in case of an unrepairable jam or other emergency. The assembly is comprised of a shear assembly with stationary and moveable Teflon blades, roller and hydraulic piston and cylinder which receives power from a hand pump in the upper compartment. A pump handle lock pin and the isolation valve V-10 prevent inadvertent operation of cable cutter. The roller guides the cable from the fairlead block, through the cable cutter to the automatic spooling device.

2-4-5 Air Motor Lubricator (References 33 or 34)

Lubrication for the air motor is provided by an intermittent drip type lubricator located downstream of valve "E" in the air supply line. The reservoir should be filled with a mixture of 3 parts lubricating oil (Symbol TEP 2190) and 1 part penetrating oil (FEDSPEC VV-P-216 or equal). Set the lubricator to deliver 4-5 drops per minute during air motor operation.

2-5 SRC ELECTRICAL SYSTEM (Reference 29)

The SRC receives 120 volt, 60 cycle power from the Fly-Away support equipment on the support ship, supplied through a hull fitting to a four-circuit distribution box. One switch controls two light fixtures in the upper compartment. Another switch controls a receptacle which may be used to supply backup power to the AN/BQC-1 underwater telephone system. Each of the two remaining switches controls one of two 250 watt pressure proof light fixtures in the lower compartment.

Four battle lanterns provide emergency lighting. The lenses of these lanterns are equipped with a fine wire mesh and have a pressure relief hole covered with rubber tape. The screen and pressure relief hole are necessary due to the possible pressurization of the upper compartment. All replacement lanterns taken aboard should be checked for this relief hole.

2-5-1 Chamber Communications System

The SRC has three means of communication: a divers speaker system, a sound powered telephone and an AN/BQC underwater telephone system.

2-5-2 Divers Speaker System and Sound Powered Telephone (Reference 29)

The divers speaker system is connected from a talk/listen speaker in the SRC to an amplifier on the rescue support ship. A sound powered telephone system is installed in this circuit for use if noise levels require.

2-5-3 AN/BQC-1 Underwater Telephone System (References 29 & 45)

The AN/BQC-1 underwater telephone is a self contained, either battery operated or AC powered system used to communicate with either the submarine or the rescue support ship. It's control unit connects to a transducer outside the hull.

2-5-4 Emergency Signaling

If normal communication fails, the rescue support ship can alert the SRC by switching the lights on and off. The SRC crew can signal the surface support ship by hammering on the SRC hull, which can be picked up by the rescue support ship's AN/UQC. Replies can be sent from the surface support ship by blinking the chamber lights or by keying the AN/WQC in the CW mode. The AN/WQC transmits sound that can be heard through the hull of the SRC. Emergency procedure EP-105 (of DSUINST 9000.3) provides a code which should be used for hammering on the hull if all electrical communication fails.

2-6 MISCELLANEOUS SRC EQUIPMENT

The following paragraphs discuss miscellaneous auxiliary equipment for the submarine rescue chamber.

2-6-1 Deadlight Viewing Ports (Reference 28)

Two acrylic plastic deadlights are recessed into the bottom dish plate of the upper compartment. They are used to view the condition of the submarine seating surface, the cable reel and to assure that the water has been blown from the lower compartment. Each deadlight is covered by a screw type cover for protection of the plastic surfaces. While the covers are not part of the pressure boundary, they should remain installed except during viewing to prevent accidental damage to the lenses.

CAUTION

Use only a mild solution of non-ionic detergent (MIL-D-16791, Type 1) mixed at 0.1 to 0.5 ounces of detergent per gallon of fresh water and a soft cotton lint free cloth to clean the deadlights.

2-6-2 Holddown Devices (Reference 51)

Two sets of holddown devices exist for fastening the SRC securely to the rescue seat of a disabled submarine after the seal has been made. This securing hardware must be installed prior to any personnel transfer between the SRC and the submarine. The description of each holddown device set is as follows:

a) For pre- SSN-688 class and pre- SSBN 726 class submarines, four holddown rods 1-1/8 inch in diameter, and 2 feet long are provided for securing the rescue chamber to the disabled submarine. These rods have an eye and shackle on one end, with the other end threaded for a special nut.

b) For SSN 688 class , SSBN 726 class and later classes of submarines, four wire rope holddown device assemblies are provided. The device consists of a clevis jaw swaged on one end of the wire rope and a closed eye and a threaded clevis jaw swaged to the other end. The flexibility of the 5/8 inch diameter wire rope allows additional securing positions to be achieved.

2-6-2 (Continued)

When in place, one end is secured to the disabled submarine escape trunk structure (padeyes or staples), and the other end is engaged into the SRC holddown device securing ring and tightened to take a strain on the device. A stowage rack is provided for storing the holddown devices in the upper compartment of the SRC.

2-6-3 Holddown Securing Ring (Reference 3)

A securing ring with 16 slots, six inches apart encircles the lower compartment. The 16 slots ensure that the four padeyes or staples on the submarine will always line up with four of the slots on the securing ring to ensure proper alignment of the holddown devices.

2-6-4 Mating Gasket and Retainer Ring (Reference 3)

The mating gasket is made from MIL-R-15624, CL 1, Neoprene rubber. The cross section is 1-3/4 X 1-3/4 inches square and has a pitch diameter of 4 feet, 7 inches. It is fitted into a machined, dovetail groove in the bottom of the SRC to form a watertight seal between the chamber and the seating surface on the submarine escape trunk.

The gasket retaining ring is fabricated from Monel or CRES and is held in place with 56 flat head, countersunk self-locking machine screws. When properly tightened around the inner edge of the gasket, it deforms the gasket slightly, holding it firmly in place.

The Fly-Away stand is configured to protect the gasket aboard the rescue support ship.

2-6-5 On-Board Tools (Reference 42)

On-board tools are carried to allow for emergency repairs or adjustments during the dive as follows:

a) Mission essential tools required for emergency repairs and equipment adjustments during the dive.

b) Fairing cover removal tools used to remove the escape hatch fairing cover on SSN 688 class, SSBN 726 class and later submarines

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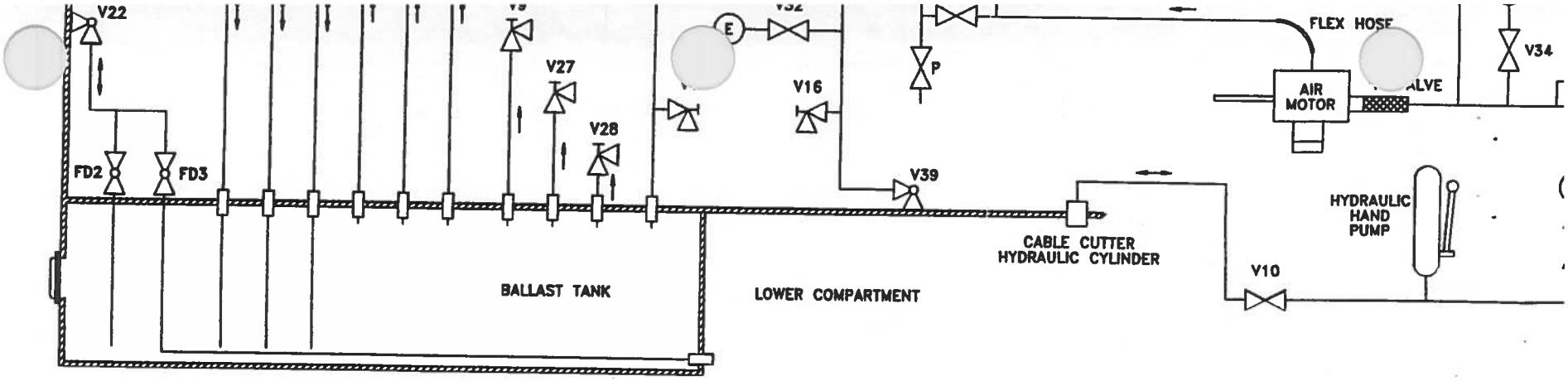
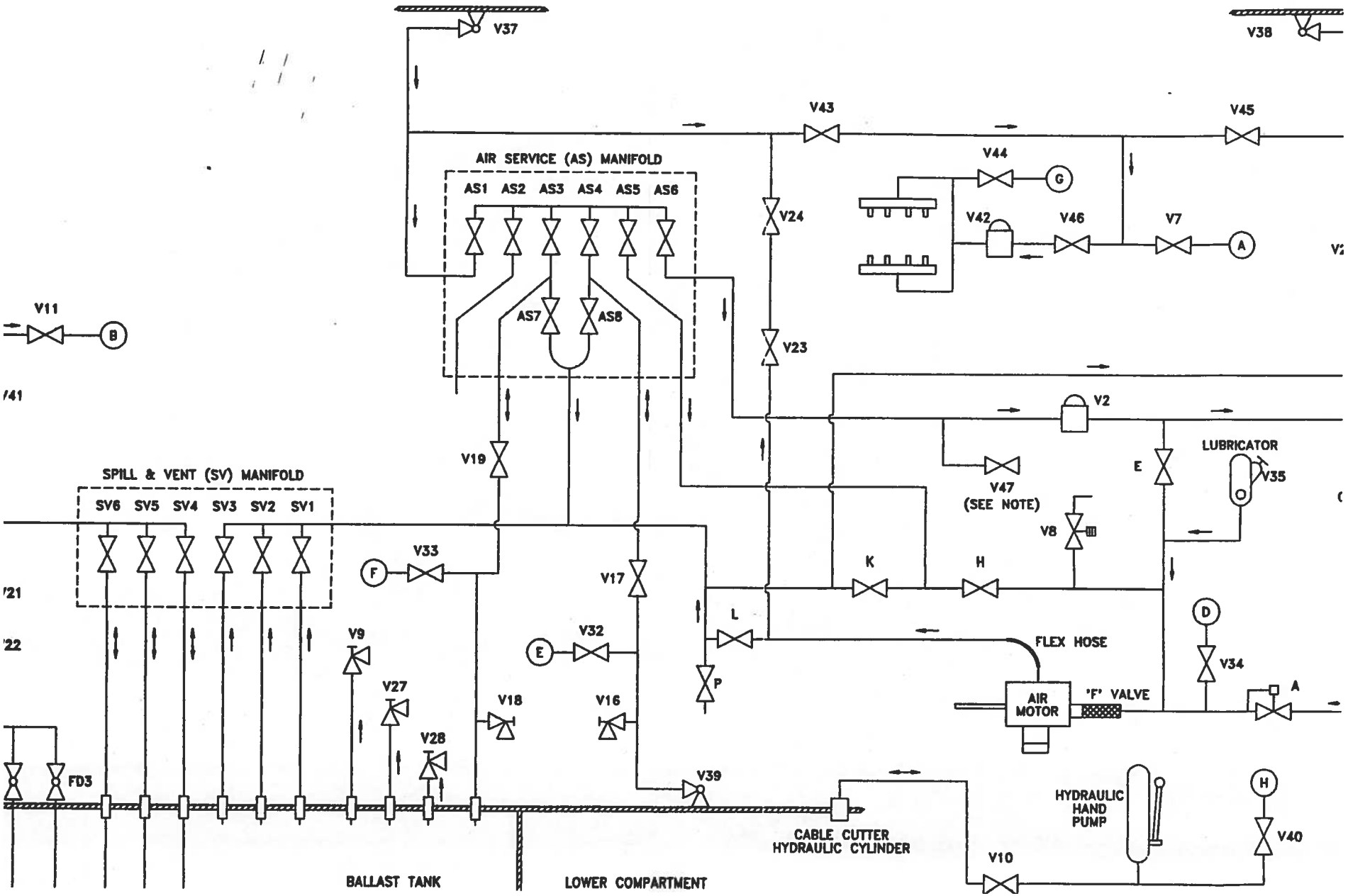
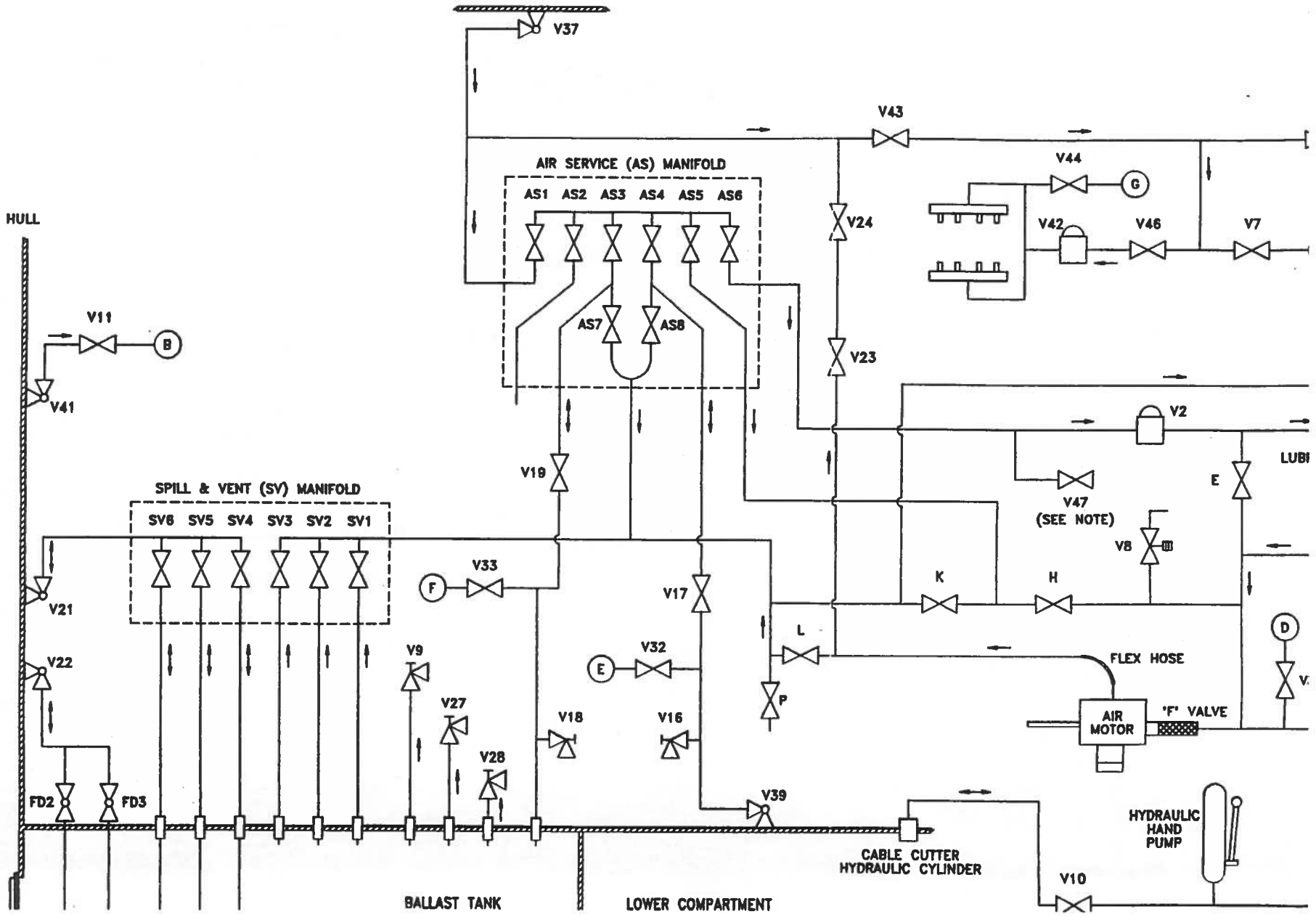


NOTE: V47 (DRAIN VALVE) FOR SRC-21 ONLY

Figure 2-1


V37
V38
V43
V45
AIR SERVICE (AS) MANIFOLD
AS1 AS2 AS3 AS4 AS5 AS6
AS7 AS8
V24
V23
V44
G
V42
V46
V7
A
V11
B
V2
V19
V47
(SEE NOTE)
LUBRICATOR
V35
E
SPILL & VENT (SV) MANIFOLD
SV6 SV5 SV4 SV3 SV2 SV1
V33
F
V17
K
H
V8
L
V32
E
V9
V27
V18
V16
P
FLEX HOSE
AIR MOTOR
'F' VALVE
D
V34
A
V28
FD3
V39
CABLE CUTTER
HYDRAULIC CYLINDER
HYDRAULIC
HAND
PUMP
H
V40
V10
BALLAST TANK
LOWER COMPARTMENT


V37
V43
AIR SERVICE (AS) MANIFOLD
AS1 AS2 AS3 AS4 AS5 AS6
AS7 AS8
V24
V23
V44
G
V42
V46
V7
HULL
V11
B
V41
V2
V19
SPILL & VENT (SV) MANIFOLD
SV6 SV5 SV4 SV3 SV2 SV1
V47
(SEE NOTE)
V8
E
K
H
V21
F
V33
V17
L
V22
V9
V32
E
FLEX HOSE
P
V27
V18
V16
AIR MOTOR
'F' VALVE
V28
FD2
FD3
V39
HYDRAULIC HAND PUMP
CABLE CUTTER HYDRAULIC CYLINDER
V10
BALLAST TANK
LOWER COMPARTMENT

CHAPTER 3

MAINTENANCE

3-1 INTRODUCTION

This chapter contains information for use in maintaining the SRC. The Deep Submergence Unit is required to maintain the SRC in accordance with this manual, the SRC Planned Maintenance Catalog and the latest set of Planned Maintenance System (PMS). Maintenance Requirement Cards (MRC).

A list of Scope of Certification (SOC) items is provided in section 3-2. In addition. pages 3-4 and 3-5 provide graphical descriptions of the SOC items.

3-1-1 GENERAL

Maintenance is based on the prevention or correction of routine degradation which can normally be expected due to the effects of exposure as well as through normal use of the SRC's. The maintenance instructions are not expected to cover major repairs. such as structural work on the pressure hull, or replacement of sections of sea water piping, or replacement of penetrators. Work of this nature is not considered routine, and should only be performed after consultation with NAVSEA and receipt of technical information developed for the specific problem. Repairs of this magnitude may indicate that a material casualty or mal-operation has occurred, or that there may be an inherent defect. In these cases NAVSEA review is required to determine if the problem is an isolated case or if it is applicable to other SRC's.

All work and testing performed on SOC items shall be recorded with Re-Entry Control (REC) documentation unless specific written authorization is obtained from NAVSEA. This applies regardless of whether the work resulted from PMS or was required to correct a deficiency. REC documentation shall be in accordance with reference 54.

3-2 LIST OF SRC SCOPE OF CERTIFICATION ITEMS

ITEM NO.

I A. Pressure Hull

B. Ballast Tank

C. Appurtenances
1. Deadlights
2. Hatches
3. Hull Inserts
4. Padeyes

II Sea Water Ballast System

III Jettison System - Downhaul Cable Cutter

IV Life Support System - Air Supply and Exhaust System
(to certification boundary at Control Shelter connections)

V Non Compensated Equipment Subject to Implosion - Lower Compartment Lights

VI Downhaul Winch

VII Communications System
A Sound Powered Telephone
B. Underwater Telephone (BQC)

VIII Depth Detectors
A Depth Gage
B. Compartment Pressure Gage
C. Secondary Depth Detection (ASR Fathometer, Umbilical Payout markings)

Note: Two of the three depth detectors shall be operable for certification purposes.

IX Accessibility to Vital Equipment

X SRC Stability and Buoyancy

XI Electrical Power System

A. Normal Power System (to certification boundary at the Control Shelter Connections)

3-2 (Continued)

ITEM NO.

XI Continued

B. Battle Lanterns

XII Operating Procedures and Emergency Procedures (NAVSEA SS750-AA-MMA-010/850FT SRC Tech Manual).

XIII Lifting Pendant

Figure 3-1

SRC SCOPE OF CERTIFICATION (SOC) ITEMS
DIAGRAM
(PIPING AND STRUCTURAL)

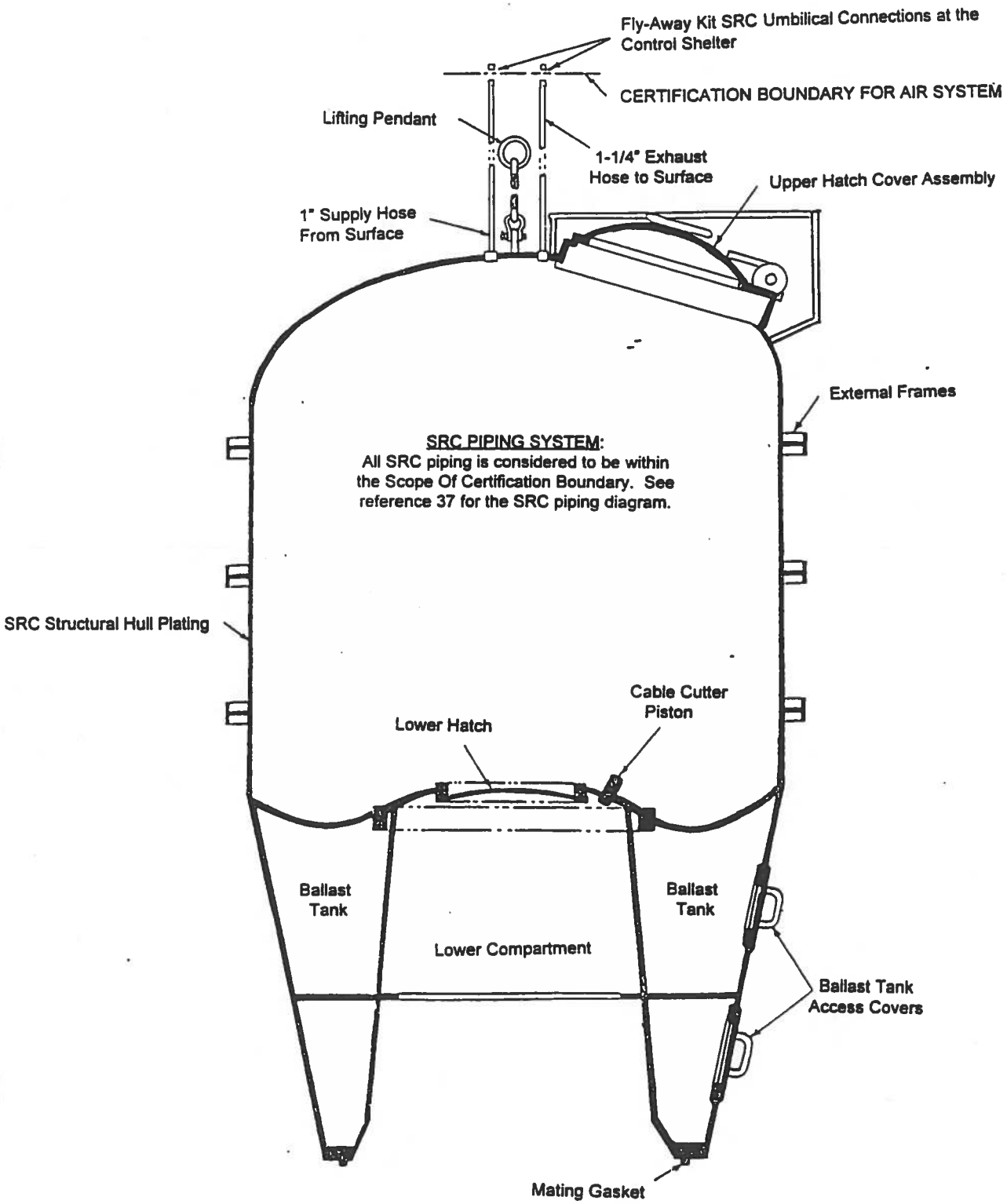
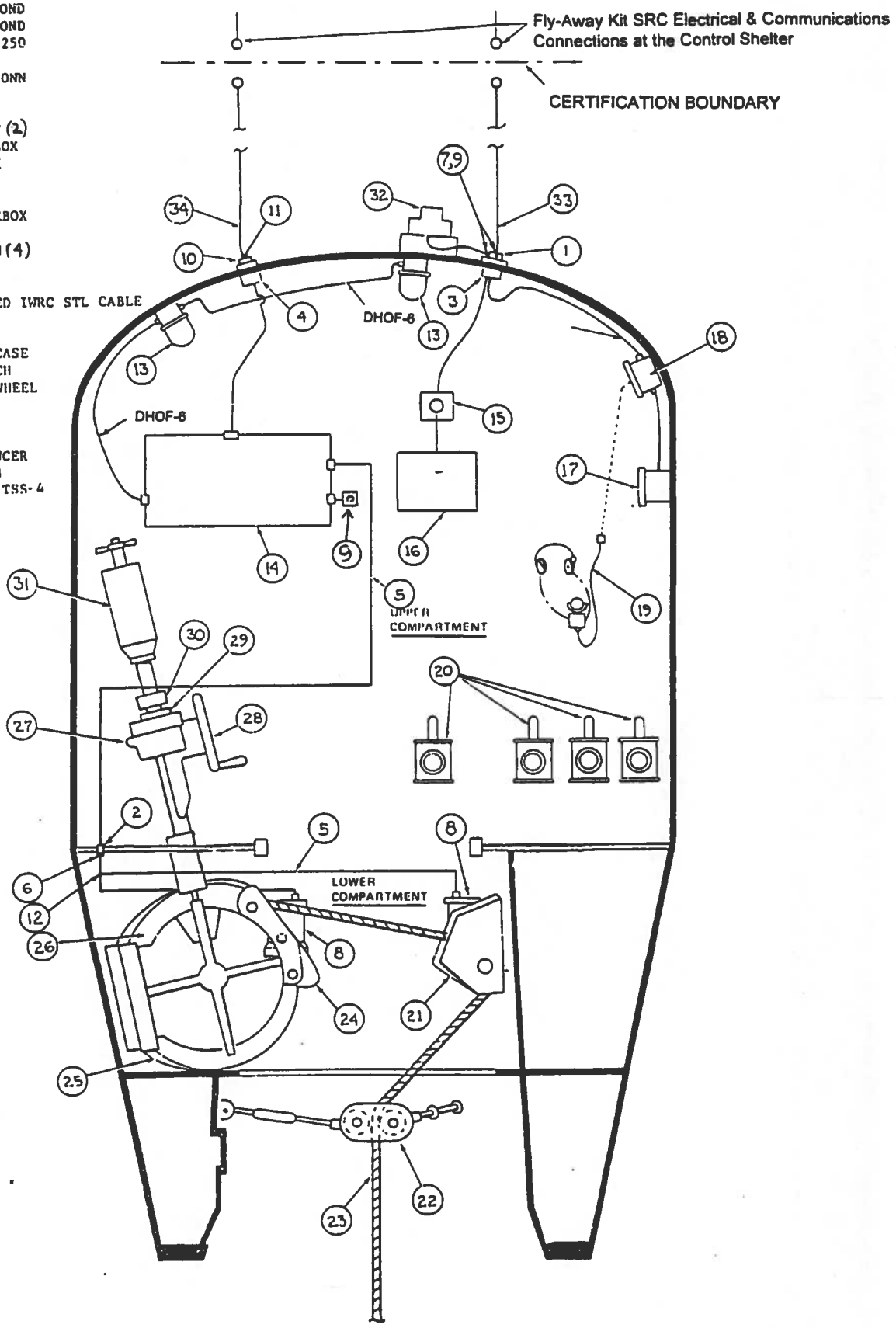


Figure 3-2

1 MULTIPLE CABLE CONN
2 SINGLE CABLE CONN
3 HULL INSERT
4 HULL INSERT
5 CABLE, FSS-2
6 MOLDED PLUG-7 COND
7 MOLDED PLUG-3 COND
8 INCAND LAMP HQ-250
9 RECEPTACLE
10 SINGLE CABLE CONN
11 MOLDED PLUG
12 Y-SPLICE
13 OVERHEAD LIGHT (2)
14 DISTRIBUTION BOX
15 AN/BQC JACKBOX
16 AN/BQC
17 LOUDSPEAKER
18 TELEPHONE JACKBOX
19 HEADSET
20 BATTLE LANTERN (4)
21 CABLE CUTTER
22 FAIRLEAD
23 6X37 GALVANIZED IWRC STL CABLE
24 LEVELWIND
25 DOWNHAUL DRUM
26 DOWNHAUL GEARCASE
27 DOWNHAUL CLUTCH
28 DOWNHAUL HANDWHEEL
29 BANDBRAKE
30 JAW CLUTCH
31 AIR MOTOR
32 AN/BQC TRANSDUCER
33 CABLE, DHOF-23
34 CABLE, DLT OR TSS-4

SRC SCOPE OF CERTIFICATION (SOC) ITEMS
DIAGRAM
(ELECTRICAL AND MECHANICAL ITEMS)



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CHAPTER 4

ANCILLARY EQUIPMENT

4-1 SRC FLY AWAY KIT

The development of the Yard Rescue Chambers (YRC's) followed the McCann rescue chambers and were located at the various Navy Yards. Later, the name of the YRC's was changed to Submarine Rescue Chambers (SRC) and they were relocated onboard Auxiliary Submarine and Rescue (ASR) class surface ships that deployed from Naval Bases at Pearl Harbor, HI, Charleston, SC, Norfolk, VA and New London, CT. An additional SRC and the necessary ancillary support equipment was located at the Naval Air Station on North Island in San Diego, CA. This equipment was named the Submarine Personnel Rescue Fly-Away (SPRFA) Kit.

The decommissioning of all the ASR's again shifted the program. A second SRC was placed at North Island and the current philosophy is that all rescues performed by the SRC will be by using the SPRFA Kit. In addition to the SRC's; the SPRFA Kit consists of two diesel powered high pressure air compressors, high pressure air storage banks, a control shelter, complete SRC umbilical, a diesel powered electrical generator with light towers, a spare parts shelter, a rescue cable reels and sufficient mooring lines and anchors to accomplish a four-point moor.

The SRC is placed horizontally in a cradle and transported to a surface ship of availability or aircraft by trailer. The remainder of the Kit is palletized and ready for shipment at all times. Aircraft that can transport the Kit to an airport near the scene of the submarine incident are the C-141, C-17 or C-5A.

4-1-1 Air Compressors

The two separately mounted high pressure air compressors in the Fly-Away kit are 6 cylinder, 5 stage Ingersoll-Rand Model 6R80 air compressors. Each compressor is capable of providing a minimum of 80 CFM of 3000 psi air and is driven by a four cylinder Detroit Model 453 diesel engine. The compressed air is filtered and is used to charge the 48 air flasks that comprise the air banks. This air is used to independently operate the SRC and provide the SRC operators with fresh air. The compressed air is tested regularly to assure contamination is below acceptable limits.

4-1-2 Air Banks

The air banks consist of 48 air storage flasks mounted in 6 banks of 8 flasks each. Each flask has a capacity of 1-1/2 cubic feet floodable volume and is rated for a maximum pressure of 3000 psi at 311 standard cubic feet per flask. Each air bank also includes isolation valves, air bank pressure gauges, piping manifolds and flex hoses to interconnect the air banks. A SCUBA charging station is also included with the air banks.

4-1-3 Control Shelter

The control shelter houses the control console, topside communication equipment, electrical distribution equipment and a public address (PA) system. The status of the SRC is monitored here at all times during rescue or diving operations. The Diving Supervisor communicates with the SRC using the HELLE or AN/BQC equipment. The control console is the interconnection between the air banks and the SRC.

4-1-4 Electrical Generator

All the electrical requirements are supplied by an Onan diesel engine powered electrical generator that is rated at 5KW. The SPRFA Kit requires 35 amps of 120v, 60hz, single phase power. Electrical loads include the SRC upper and lower compartment lights, SRC HELLE and AN/BQC communication equipment, topside control shelter lighting, the portable external light towers, the PA system and a utility circuit. A 50 foot length of 3 conductor 14 AWG cable connects from the generator to the shelter load distribution center.

4-1-5 Spare Parts Shelter

The spare parts shelter provides a transportable storage area for the tools and spare parts of the maintenance personnel. This shelter also contains reference material, drawings and manuals for repair, maintenance and support of the SRC and support equipment.

4-1-6 SRC Fly-Away Stand

The SRC Fly-Away Stand is provided to prevent damage to the DISSUB mating gasket that is on the bottom of the SRC. It also provides access into the SRC for pre-dive check-out, through the lower compartment, when it is on the deck of the rescue support ship.

4-1-7 Submarine Rescue Cable Reel

The submarine rescue cable reel provides the downhaul cable for attaching the SRC to the escape hatch of the disabled submarine. The cable reel and float assembly measures 34 inches in diameter by 86 inches high and weighs 1520 pounds in the air. The unit is divided into three major components.

The lower section houses the cable reel containing approximately 1300 feet of SRC galvanized steel (IWRC) downhaul cable. The center section houses the primary and secondary waterbrakes used in governing ascent. The upper section is made of syntactic foam that provides buoyancy for the cable reel.

The cable reel, when submerged, is slightly negatively buoyant (about 10 pounds) and is delivered to the DISSUB by divers or a Remotely Operated Vehicle (ROV). The bitter end of the cable is then attached to an anchor shackle that is permanently mounted on the escape hatch cover. After attaching the downhaul cable a release pin is pulled from the reel which releases ballast and allows the cable to pay out. On the ascent the waterbrakes control the rate of ascent of the cable reel. At the surface the downhaul cable is removed from the cable reel and attached to the downhaul equipment located in the lower compartment of the SRC.

4-1-8 Mooring Equipment

The components required for a four point mooring system are provided with the Fly-Away kit to ensure that the rescue support ship provides stable platform for SRC operations. The mooring system consists of anchors, buoys and mooring lines.

4-2 SYSTEM OPERATION

4-2-1 Readiness and Initial Actions.

The Submarine Rescue Fly-Away Kit is maintained by Submarine Development Group One, Deep Submergence Unit, San Diego, California. Standard procedures have been established to permit rapid deployment. Preparation for deployment commences with the first alert that the system may be required. The palletized Flyaway Kit is transported to the air field runway nearby to on-load the equipment into either four C-141, one C-5A or one C-17 aircraft.

4-2-2 Movement to Disaster Scene.

At the destination airfield, the SRC is placed on a flatbed trailer for transport to the ship. The total weight of the SRC and skid is approximately 23,000 pounds (10,500 kilograms) with a length of 13 feet 6 inches (4.1 meters), a width of 9 feet 2 inches (2.78 meters), and a height of 8 feet 6 inches (2.58 meters). The palletized equipment requires tractor-trailers or trucks.

At the embarkation port, the kit is loaded aboard and secured on the deck of the designated support ship. The surface support ship boom must be capable of handling the approximately 21,000 pound SRC over the side.

The kit equipment will be loaded aboard the ship selected as the surface support ship. Using the mooring system provided in the kit, the ship will independently, or with the assistance of other craft, set up a four-point moor after arriving at the scene. The SRC will be lowered into the water using the ship's booms.

INSTRUCTION AND REPAIR PART LIST
for
REVERSIBLE MULTI-VANE DRILL USED FOR THE
SRC DOWNHAUL AIR MOTOR

NOTE
This appendix is derived from the Ingersoll-Rand Operation and Maintenance Manual for a Model 551SM Reversible Drill.

NOTE
The SRC air motor is within the Scope of Certification and all design changes or alterations must have prior approval from NAVSEA.

LUBRICATION

Lubrication is to be in accordance with the latest approved Maintenance Requirement Cards (MRC) in the Planned Maintenance System (PMS).

HOSE AND HOSE FITTINGS

Use only hoses and fittings that are shown on NAVSEA Approved drawings, references 33, 34 or 35 as applicable.

MAINTENANCE INSTRUCTIONS (SEE APPLICABLE MRC CARDS)

Keep the Throttle Valve Air Strainer (117) clean. Periodically, as experience indicates, unscrew the Air Strainer Body (119) from the Air Strainer Cap (116). Remove the Air Strainer Screen (117) and wash it in kerosene or other solvent. Enter the prongs on the Screen Support (118) into one end of the Screen and insert the Screen, supported end first, into the Body when reassembling.

The external thread on the Outer Feed Screw (76) is **left-hand**; rotate the Feed Screw Cap (207) **clockwise** to remove.

Do not pry the Back Head (19) from the Motor Housing (1 or 254). Grasp the Oil Chamber Plug (20) in a vise and pull on the Motor Housing.

The Rotor (34) is tapped **left-hand**; rotate the Governor Assembly **clockwise** to unscrew.

LIST OF EFFECTIVE PAGES

Date of issue for original pages:

Original.....0.....01 June 1996

The Total number of pages in this publication is 50 consisting of the following:

Page No.	Change No. *	Page No.	Change No. *
Title and A	0	2-1 thru 2-15	0
		2-16 (blank)	0
Cert sht-1	0	2-17	0
Cert sht -2 (blank)	0	2-18 (blank)	0
Change Record-1	0		
Change Record-2 (blank) ..	0	3-1 thru 3-5	0
		3-6 (blank)	0
i thru vii	0		
		4-1 thru 4-4	0
1-1 thru 1-3	0		
1-4 (blank)	0	Appendix A: A-1 thru A-8.	0
		TMDER	NA

* Zero in this column indicates original page.

Never clamp the Cylinder (39) in a vise. When disassembling the Multi-Vane motor, grasp the Cylinder in one hand. Insert a small rod into the rotor bore and drive the hub on the Rotor (34) out of the Rear Rotor Bearing (37). Support the Front End Plate (41) and press the rotor front hub out of the Front Rotor Bearing (42).

Press the Rear Rotor Bearing (37), shielded side first, into the recess in the Rear End Plate (38), with an arbor that will contact only the outer ring of the Bearing. Press on the **inner** ring of the Bearing when installing this assembly on the rear hub of the Rotor (34).

Press the Front Rotor Bearing (42), shielded side first, onto the front hub of the Rotor (34) with a sleeve that will clear the Rotor Pinion (35) and contact only the **inner** ring of the Bearing.

Install the End Plate (38 or 41) on the Rotor (34), and insert a Vane (40) into each vane slot in the Rotor. Place the Cylinder (39) over the Rotor and against the installed End Plate. Make certain the Cylinder is installed properly before proceeding. Check as follows:

There is a 3/4" (19 mm) dia. hole in each of the two cylinder flats. One hole is located about midway between the ends of the Cylinder, and the other is located relatively close to one end. When the Cylinder is properly installed, the hole nearest the end is farthest from the Rotor Pinion (35).

When installing the motor assembly, align the dowel holes through both End Plates (38 and 41) with the dowel hole through both End Plates (38 and 41) with the dowel hole through the Cylinder (39) and insert a 3/16" (5mm) dia. rod at least 10" (254 mm) long through the aligned holes, allowing it to protrude from the pinion end of the motor assembly. Enter the protruding end of the rod into the dowel hole in the bottom of the motor housing bore, and slide the motor assembly squarely into the Housing.

Draw the Back Head (19) evenly against the Back Head Gasket (18) on the face of the Motor Housing (1) by turning each Back Head Cap Screw (84) a little at a time until all are tight.

Remove the Throttle Body Set Screw (95) from the Motor Housing, before withdrawing the Throttle Body (100).

Install the Throttle Sector (97) onto the Throttle Body, and press the Body into the Motor Hosing until the throttle body set screw holes are aligned.

Align the tooth of the Throttle Sector marked with an arrow (↓) with the tooth space of the Reverse Valve Sector (89) marked "X" and mesh the two Sectors.

Unscrew the three Planet Gear Frame Set Screws (48) from the Planet Gear Frame (47) before attempting to press the Spindle (44) out of the Planet Gear Frame. Tighten the Screws after assembling the Gear Frame on the Spindle.

Note the stamping "THRUST HERE" on one side of the Spindle Thrust Bearing (69). Install the Bearing, stamped side first, in the bearing recess in the Motor Housing (1).

Install an Intermediate Gear Bearing (75) at each end of the Intermediate Gear (74). Mesh the large gear on the compound Intermediate Gear with the Rotor Pinion (35) and install the Bearing in this end of the Intermediate Gear. Bearing Stud (3) in the Motor Housing (1). Apply the Gear Case (55) to the Motor Housing. Coat one face of the Spindle Thrust Bearing Spacer (70) with grease and center it on the Spindle Thrust Bearing (69) in the Motor Housing. The grease will hold it in position on the Bearing during assembly. Place the Spindle Gear (73), large end first in the Gear Case, meshing the large gear with the small gear of the compound Intermediate Gear, and centering it on the Bearing Spacer. Coat the spiral-grooved portion of the Spindle (44) ;with grease and insert it through the Spindle Gear, Spindle Bearing Spacer and into the Spindle Thrust Bearing, meshing the Planet Gear (49) contained in the Planet Gear Frame (47) on the Spindle with the small gear on the compound Spindle Gear. Mesh the Internal Gear (72) contained in the Gear Case Cover (59) with the Planet Gears and apply the Gear Case Cover to the Gear Case.

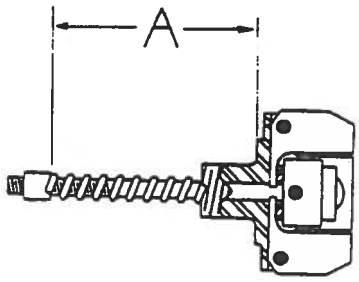
GOVERNOR ADJUSTMENT

The Governor has **left-hand** thread. Turn **clockwise** to remove from Rotor; **counterclockwise** to install Rotor.

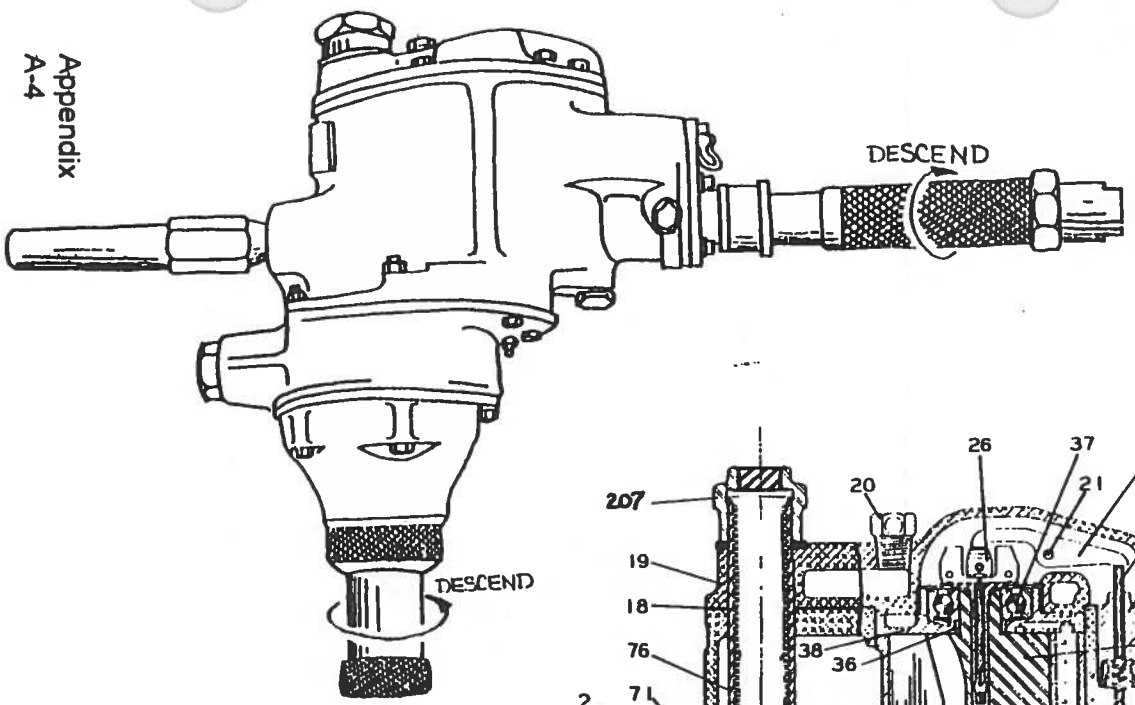
When installing a new Governor Assembly, screw the governor adjusting nut onto the governor stem until the "A" dimension shown in the Illustration A equals 1-7/8" (48 mm). This will usually result in the proper governed free speed. However, this in only an approximate setting and further adjustment may be necessary. Screw the nut farther onto the stem to increase the speed; back it off to decrease the speed.

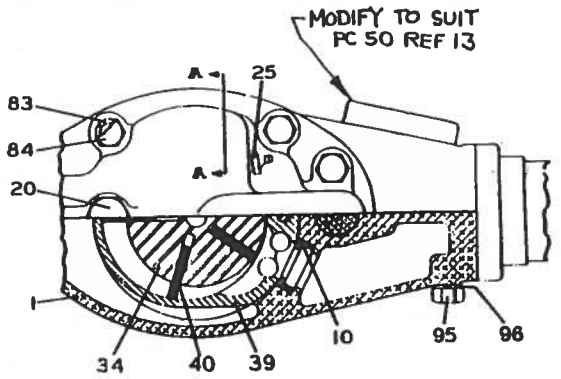
NOTE

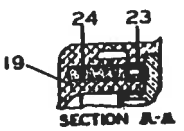
With 135 psig inlet pressure and the air motor exhausting through the exhaust hose, the free speed will be approximately 60 to 75 RPM.

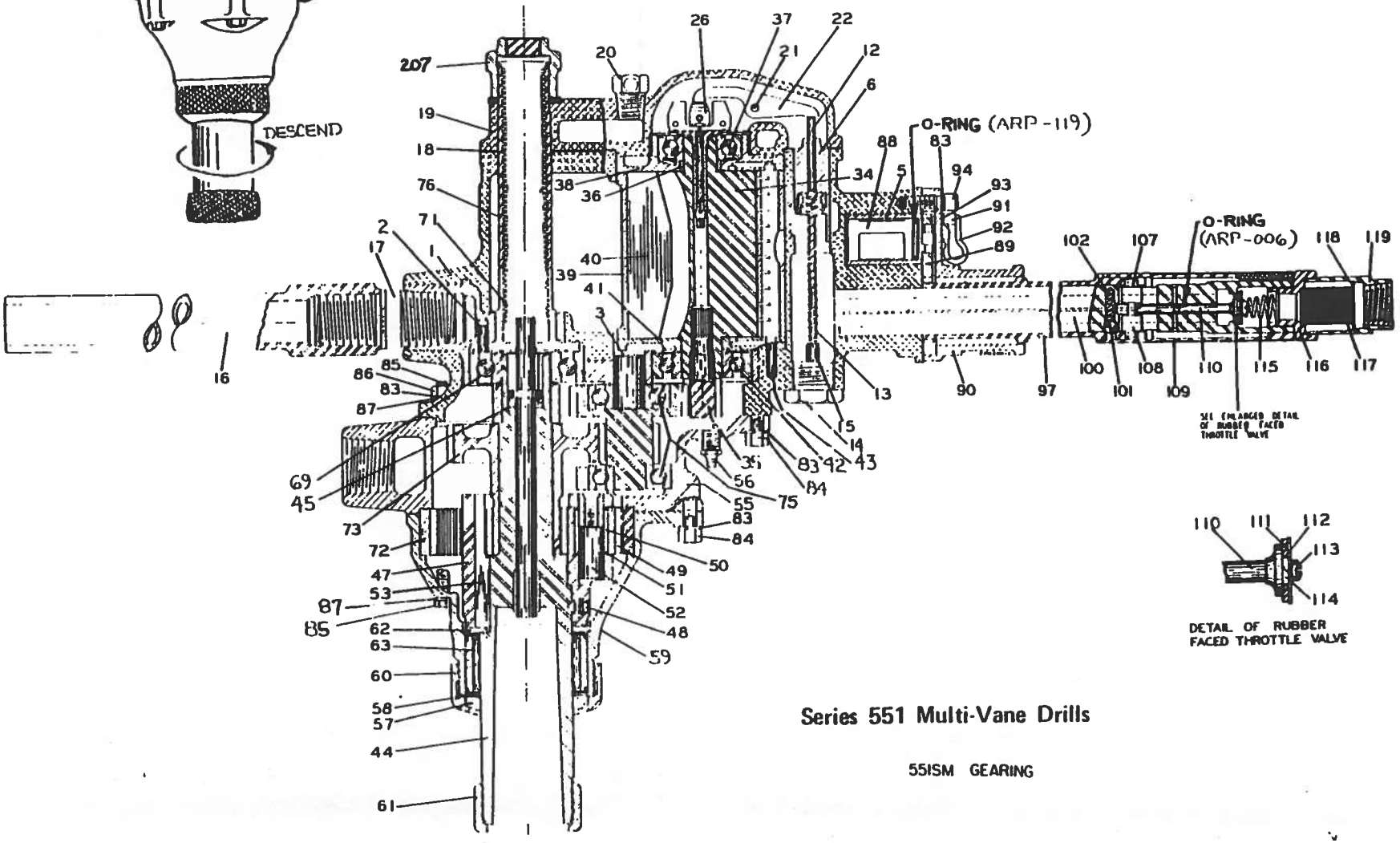


A = 1-7/8"
Illustration A









DETAIL OF RUBBER FACED THROTTLE VALVE

Series 551 Multi-Vane Drills

551SM GEARING

All repair parts for the Model 551SM drill used for the SRC air motor are to be OEM from Ingersoll-Rand.

HOW TO ORDER REPAIR PARTS

Order all parts by the **Name** and **Number** shown in the Repair Part List section. **Do Not** use the illustration numbers which appear in the first column.

Repair Parts List For Model 551SM

ILLUS NO. (Do not use for ordering)	PART NAME FOR ORDERING (Parts indented after an item are included with that item)	PART NO. FOR ORDERING
1	Motor Housing	R551H-40
2	Feed Screw Dowel	R3H-527
3	Intermediate Gear Bearing Stud	R5H-502
5	Reverse Valve Bushing	R551H-330
6	Governor Valve Bushing	R551H-429
7	Exhaust Deflector	R55H-23
	Muffler Screen	R551H-311
8	Exhaust Deflector Screw	R55H-312B
9	Deflector Screw Lock Washer	T11-58
10	Air Port Gasket (2)	R44H-210A
11	1" Pipe Plug	TA-464
12	Governor Valve	R551H-425
13	Governor Valve Spring	R4H-431
14	Governor Valve Cap	R5H-433
15	Governor Valve Spring Spacer	R5H-435
16	Dead Handle	TAAC-48
17	Dead Handle Stud	TISE-364
18	Back Head Gasket	R5H-283
19	Back Head	R5H-102
20	Oil Chamber Plug	P25-227
21	Governor Lever Pin	N00-15
22	Governor Lever	R5H-436
23	Oiler Adjusting Screw (2)	JA4-71
24	Oiler Felt (4)	JA4-75
25	Grease Fitting	23-188

Repair Parts List For Model 551SM (Continued)

ILLUS NO. (Do not use for ordering)	PART NAME FOR ORDERING (Parts indented after an item are included with that item)	PART NO. FOR ORDERING
26	Governor Assembly	R5H-A424B
34	Rotor	9BM-53
35	Rotor Pinion	9BM-17
36	Rotor Bearing Spacer	R5H-65
37	Rear Rotor Bearing	R5H-22
38	Rear End Plate	R55H-12
39	Cylinder	R551H-3 THRU
40	Vane Packet (Set of 5)	R5H-42-5
41	Front End Plate	R55H-11
42	Front Rotor Bearing	R5H-24
43	Cylinder Dowel	R5H-98
	Spindle Assembly	R5SM-B108
44	Spindle	R5SM-108
45	Ejecting Pin Packing	R5SM-408
	Planet Gear Frame Assy	R5SM-A367
47	Planet Gear Frame	R5SM-367
48	Planet Gear Frame Set Screw (3)	R5SM-574
*	Planet Gear Shaft Set Screw (3)	551AMP56-561
49	Planet Gear (3)	R5SM-10
50	Planet Gear Roller (69)	R5SM-152
51	Roller Retaining Plate (6)	R5SM-468
52	Planet Gear Shaft (3)	R5SM-191
53	Planet Gear Frame Key	R5SM-410
55	Gear Case	R5SM-37
56	Grease Fitting	23-188
57	Spindle Packing (2)	R5SM-14
58	Spindle Packing Ring	R5SM-202
59	Gear Case Cover	R5SM-378
60	Spindle Packing Nut	R5SM-15
61	Protection Nut	T1SE-43
62	Spindle Thrust Plate	R5SM-80
63	Spindle Bearing	R5SM-510
69	Spindle Thrust Bearing	TA-105
70	Spindle Thrust Bearing Spacer	R5SM-100
71	Drill Ejecting Pin	R5SM-114

* Not illustrated

Repair Parts List For Model 551SM (Continued)

ILLUS NO. (Do not use for ordering)	PART NAME FOR ORDERING (Parts indented after an item are included with that item)	PART NO. FOR ORDERING
72	Internal Gear	R5SM-406
73	Spindle Gear	R5SM-9
74	Intermediate Gear	R5SM-82
75	Intermediate Gear Bearing (2)	D04-366
76	Outer Feed Screw	R5H-290
83	Lock Washer (18)	T11-58
84	Back Head Cap Screw or Gear Case Cap Screw (9)	B8-240
85	Gear Case Bolt	
	Short (3)	R5SM-103A
	Long	R551P58-103
86	Gear Case Bolt Nut (1 for each Bolt)	D02-428
87	Gear Case Bolt Seal Washer (copper) (8)	D01-504
88	Reverse Valve	R551H-329
89	Reverse Valve Sector	R55H-488
90	Sector Cover	R55H-1489
91	Reverse Stop	R44H-568A
92	Reverse Stop Lever	R44H-569
93	Reverse Stop Washer	R44H-572A
94	Sector Cover Screw(5)	R44H-490A
95	Throttle Body Set Screw	R551H-593
96	Throttle Body Set Screw Lock Washer	D02-537
207	Feed Screw Cover	TA-461