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OPERATOR'S
Technical Manual

SUBMARINE PERISCOPE
TYPE 2E
DESIGN DESIGNATION
124KA 36/HA

KOLLMORGEN CORPORATION
NORTHAMPTON, MASS.

BUREAU OF SHIPS • NAVY DEPARTMENT • WASHINGTON, D. C.

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Type III OPERATOR'S Technical Manual

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KOLLMORGEN CORPORATION
NORTHAMPTON, MASS.
CONTRACT NObs-84157 (FBM)

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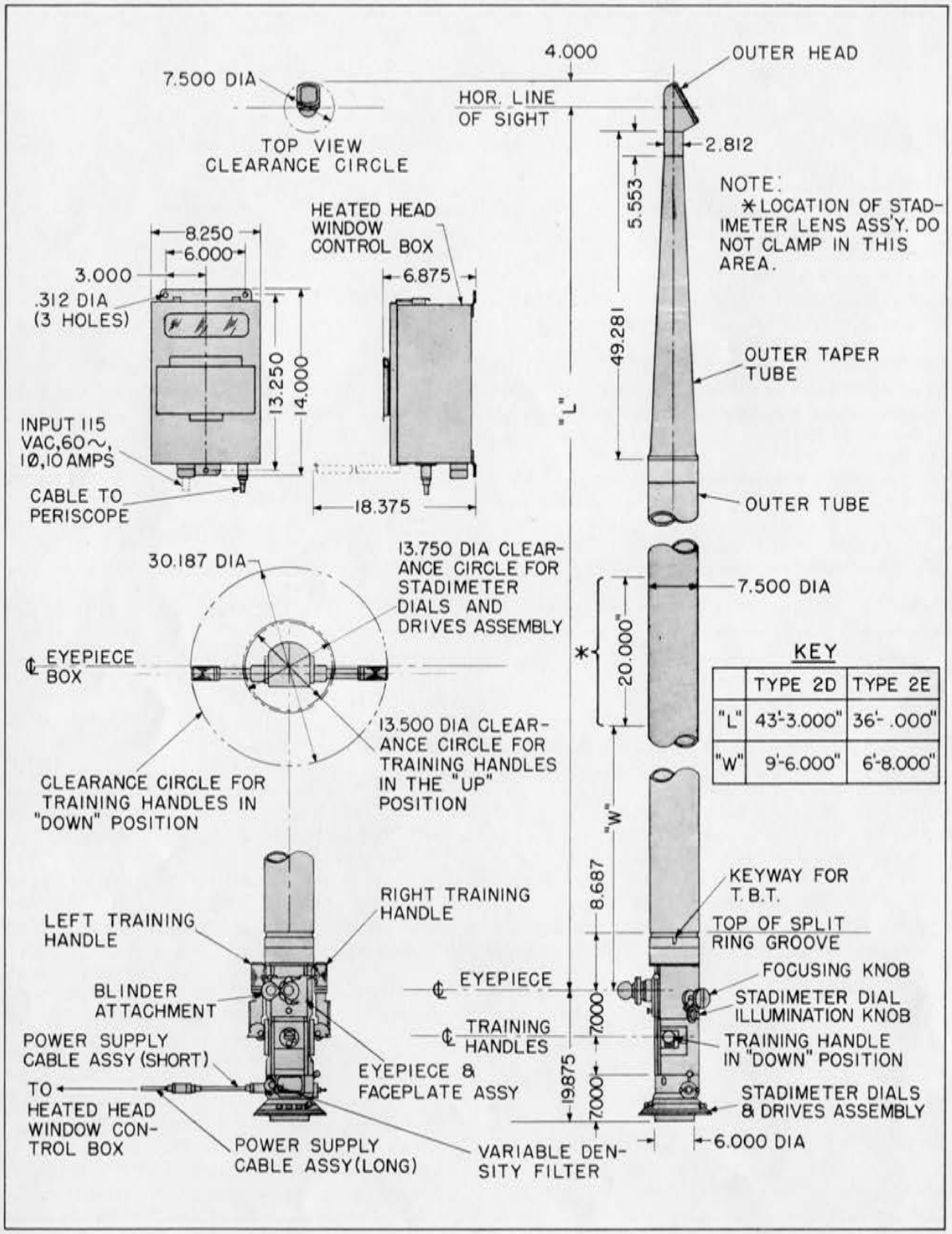


Figure 1-1 Type 2E Periscope, General Arrangement

SECTION 1

GENERAL INFORMATION

1-1 GENERAL DATA

This manual provides operation, installation and maintenance instructions for the Type 2E Periscope, Design Designation 124KA36/HA as manufactured by Kollmorgen Corporation, Northampton, Massachusetts. The corrective maintenance instructions included herein are limited to replacement of repair parts outside the hermetic seal of the periscope.

1-2 INTRODUCTION (See Figure 1-1)

The Type 2E submarine periscope is an attack type periscope. It contains a tilting head prism capable of elevating the line of sight 74° above the horizontal and 10° below the horizontal. The periscope is bifocal, being designed for both high and low power observation. A stadimeter is provided for estimating target range in either high power or low power. The head window, and eyepiece are electrically heated to reduce external fogging and prevent the formation of ice. The periscope has been designed for use with Kollmorgen Camera Adapter, Model 559. The camera adapter however, is not supplied with the periscope. The principal characteristics of the periscope are as follows:

Magnification

Low Power	1.5X
High Power	6X

True Field of View

High Power	8°
Low Power	32°

Nominal Elevation of Line of Sight above Horizontal	74°
Nominal Depression of Line of Sight below Horizontal	10°

Minimum Elevation of Upper Edge of field above Horizontal

Low Power	90°
High Power	78°

Diameter of Exit Pupil (Both Powers)

For General Viewing	5mm
With Stadimeter in	4.18mm

Overall length	37 ft., 11.875 in.
Optical length	36 feet
Diameter of Outer Tube	7.5 inches
Estimated weight	1900 Lbs.

1-3 DESCRIPTION

1-4 External Casing

The external casing consists of four main sections: the outer head and outer taper, the outer tube, the eyepiece box and the stadimeter assembly. The joint between the outer head and outer taper is brazed permanently. The two joints between the outer taper, outer tube and eyepiece box are of a semi-permanent nature and should not be broken unless special equipment and instructions are available. The stadimeter dial assembly is bolted onto the lower end of the eyepiece box and is not a part of the hermetic seal.

1-5 Internal Framework

The internal framework consists of the head skeleton, the main body skeleton, the eyepiece box components and the stadimeter lens assembly components. All shafts and linkages used to rotate the head prism, change power, focus, actuate the stadimeter split lens, etc. are supported by this framework. The operation and maintenance of the internal framework are not within the scope of this manual.

1-6 Optical System

The optical system consists of the head prism, a Galilean telescope, the upper telescope, two optical relays and the lower telescope. The head prism can be tilted by operation of mechanical linkages from the left training handle.

For low power observation the right training handle is rotated causing the Galilean telescope to pivot into the optical path. The two lenses of the Galilean telescope decrease the magnification and increase the true field. A telemeter lens (or reticle) with standard vertical and horizontal lines is provided for use in range estimation.

Three pairs of unit power erector lenses relay the target image to the eyepiece image plane. The middle pair of erectors is augmented by a symmetrically distributed pair of collector lenses, each near an image plane. Occupying the fifth erector position is either the split lens for stadimetric ranging, or the equivalent solid lens for general viewing and photography. The two lenses are mounted on a common rotatable "cube" so that either one may be selected for use in the optical system. The solid fifth erector works at the same aperture as the other five; however, because of space limitations, the split lens aperture is reduced. Exit pupil diameter is reduced accordingly when the split len is used in the optical system. The sixth and lowest erector is moved up or down by the focusing control mechanism.

1-7 Stadimeter Dial & Drives Assembly

The stadimeter dial and drives assembly, bolted to the bottom of the eyepiece box, provides a means to estimate the range of a target. Dual range and height dials (180° apart) are provided so that range information is available at both front and rear of the periscope. The height dial index marker is illuminated by a small hooded lamp. There are two range indices, one for high power and one for low power. Only one of these is illuminated at a time; the proper lamp is selected automatically by the power change control. The intensity of illumination for all pilot lights on the stadimeter assembly is controlled by a rheostat, with an off position, mounted on the eyepiece box just underneath the focusing control knob.

1-8 Heated Head Window

The heated head window system provides uniform heat distribution across the head window to clear external fogging and prevent ice formation. The inner surface of the head window is coated with a clear film capable of conducting electric current. A silver bus bar borders each side of the film coating providing a positive contact for the leaf of the contact assembly. Power to energize the film is brought up to the head skeleton via a cable assembly secured to the body skeleton. A thermostatic switch, located in the head skeleton above the window, is provided in the heater supply circuit to limit the maximum temperature of the internal atmosphere heated by convection at the window film, thereby indirectly controlling the film temperature.

Associated with the heated head window is its control unit; a bulkhead mounted enclosure which contains the switching, fusing and controls for operation of the heated head window system. The control unit also contains switching and fusing for operation of the eyepiece heater and stadimeter dial illumination. Spare fuses, a spare relay and spare lamps for stadimeter illumination, are provided in the control unit.

1-9 Heated Eyepiece

The eyepiece is electrically heated to prevent moisture condensation when the periscope is raised from a cold well into a warm atmosphere.

SECTION 2

OPERATING INSTRUCTIONS

2-1 FOCUS (See Figure 2-1)

Focus is controlled by a focusing knob on the right side of the eyepiece box just below the level of the eyepiece. Turning the knob raises or lowers the focusing erector lens in the eyepiece box. The observer uses the focusing knob to adjust the instrument for best definition. Within the focusing knob are three separate limit stops; a fixed stop at +1.5 diopters, an intermediate stop just beyond -3.0 diopters which can be disengaged by pulling a spring loaded plunger out of the focusing knob, and an adjustable fixed stop for camera focus. With the plunger engaged the focusing erector lens may be varied from +1.5 to -3.0 diopters. The observer should note or memorize the reading on the diopter scale, attached to the focusing knob shaft, so that future adjustment may be made quickly, even with the periscope partially housed. Refer to Section IV, paragraph 4-24 for camera focus stop adjustments.

2-2 ELEVATION (See Figure 2-1)

Elevation or depression of the line of sight is controlled by rotation of the left training handle grip. Turning the top of the grip towards the observer elevates the line of sight, turning the top of the grip away from the observer depresses the line of sight. A detent mechanism engages when the line of sight is normal to the periscope axis. A graduated ring on the training handle indicates the elevation angle relative to a line normal to the periscope axis.

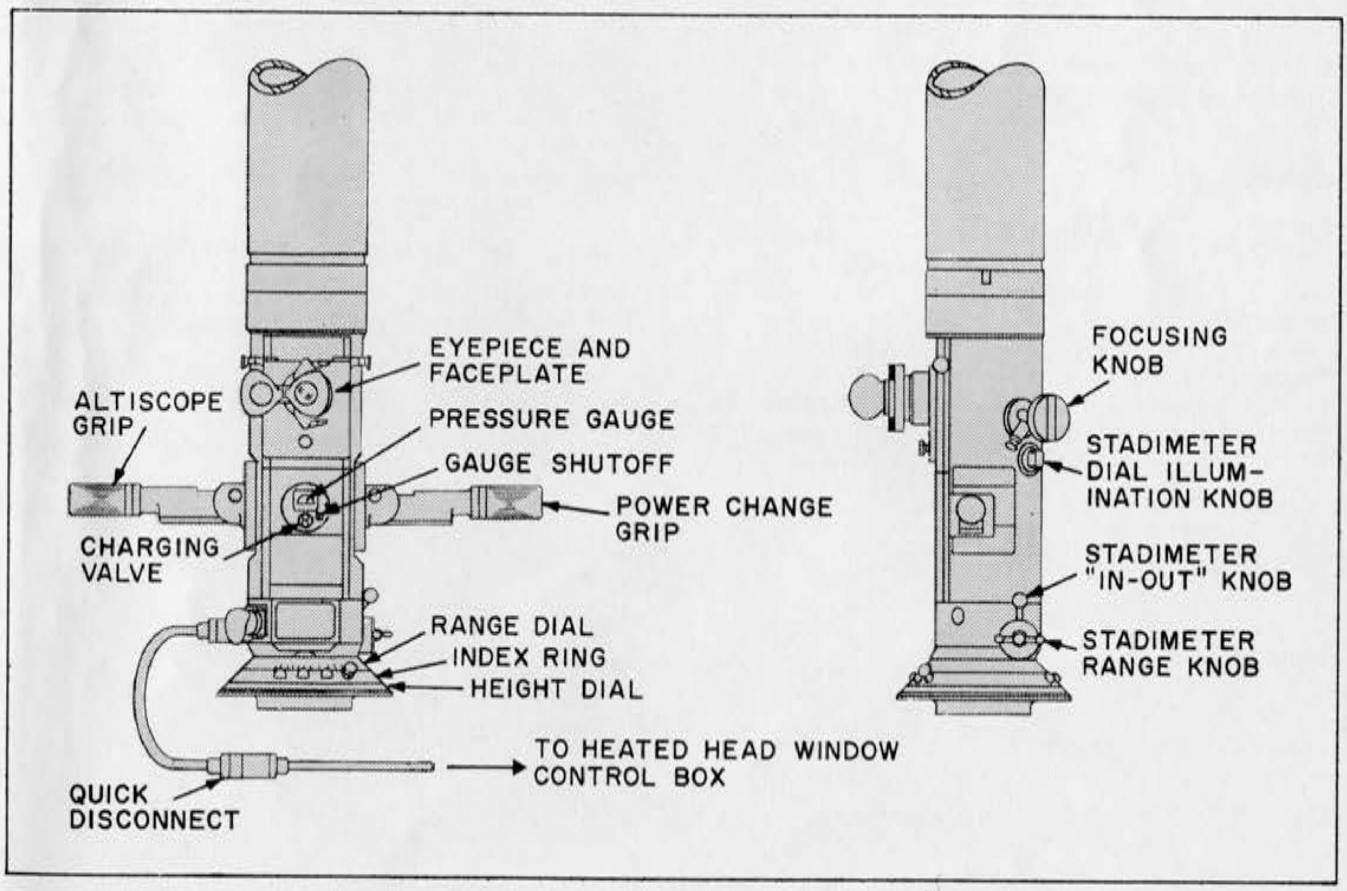


Figure 2-1 Periscope Operating Controls

The graduated ring is free floating between the training handle grip and the main body of the training handle and is driven by the training handle grip through a screw riding in a slot in the graduated ring. The slot is machined at assembly to compensate for backlash in the elevation drive mechanism within the periscope. With the graduated ring functioning properly and with human error involved in reading the scale, the elevation scale may be considered accurate to within ±1-1/2 degrees.

2-3 MAGNIFICATION (See Figure 2-1)

Selection of periscope magnification is controlled by the right training handle grip. For high power observation the top of the grip is turned towards the observer to the limit of travel. For low power observation the top of the grip is turned away from the observer to the limit of travel. The magnification in use is indicated by index marks on the training handle scale.

2-4 STADIMETER (See Figure 2-1)

The stadimeter is a direct reading range finding device which enables the observer to estimate the range of a target whose height is known. Two controls are provided for operation of the stadimeter. The stadimeter "in-out" lever is used to place the stadimeter system in a "ready for use" condition (the stadimeter split lens is rotated into the optical system). The stadimeter range knob is used to vertically displace two identical images, the amount of displacement being controlled by the observer via this knob.

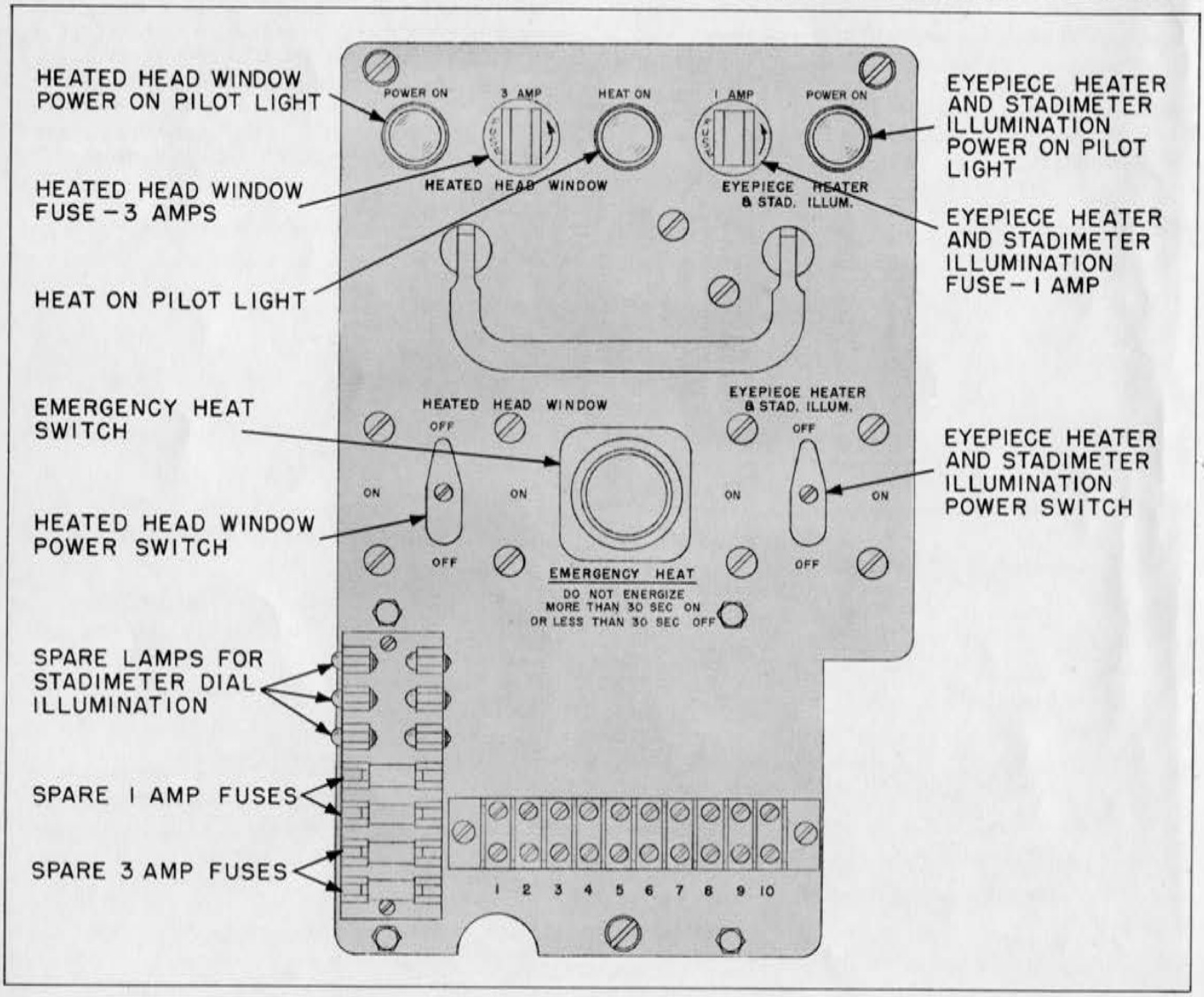


Figure 2-2 Control Panel

The stadimeter measures angles and computes the range on the basis of the estimated target height. Therefore, the range readings will be no more accurate than the estimate of target height.

NOTE

The height dimension selected for observation should be one which is known, or which can be estimated with fair accuracy. The reference points should be definite, easy to see and widely spaced. The mast head and waterline, for instance while affording the greatest vertical distance, might both be invisible at long range.

A typical example of stadimeter operation is as follows:

a. The stadimeter index ring is positioned until the estimated target (waterline to masthead) height, as shown on the stationary height dial, is opposite the index ring pointer.

b. The stadimeter range knob should then be rotated (displacing the images) until the waterline of one image is in line with the masthead of the other image.

c. When this condition exists the estimated target range is indicated opposite the high power or low power pointer on the upper edge of the index ring. Readings should be taken from the high power pointer when the high power pilot light is illuminated or from the low power pointer when the low power pilot light is illuminated.

A stadimeter range may be taken with a periscope exposure of about 30 seconds. It is assumed that the approximate bearing of the target is known and the reference points have been pre-selected and set on the height dial. The periscope may then be turned approximately on target and the focus set for the observer's eye. If the periscope is then exposed, no time will be lost in focusing and little time expended in centering the object and bringing the reference points into coincidence.

2-5 HEATED HEAD WINDOW (See Figure 2-2 and 2-3)

In severe icing conditions, turn on the head window heater at least two minutes before exposing the head. This amount of preheat with the head submerged will prevent ice formation on the glass. Once formed, ice is melted at a slow rate by the heater. The remedy in this case is to submerge the head with the heater on.

The heated head window is energized by a switch on the control box. Operation of the system is automatic once the system is energized. A thermostat in the head cavity controls operation of the relay which opens and closes the heater circuit. An emergency heat switch is provided to override the thermostat, if so desired. It is recommended that the emergency heat be used for no more than 30 seconds at a time and that at least 30 seconds elapse between power applications. Pilot lights are provided to indicate "POWER ON" and "HEAT ON".

2-6 EYEPIECE HEATER & STADIMETER SCALE ILLUMINATION (See Figure 2-2 and 2-3)

The eyepiece heater is controlled by a switch on the heated head window control box assembly. This switch also provides power for the stadimeter scale illumination. A pilot light is provided to indicate when power is "ON". The degree of illumination for the stadimeter dials is controlled by a rheostat located beneath the periscope focusing knob. It is recommended that power be kept on the eyepiece heater whenever there is a possibility of fogging. The stadimeter lamps should be switched off at the rheostat when the periscope is to be unused for an extended period.

2-7 PRESSURE GAUGE (See Figure 2-1)

The pressure gauge shut off is used to isolate the pressure gauge from internal pressure of the periscope. To read pressure within the periscope, back off on the gauge shut off screw until it seats on the snap ring. This is the normal operating position.

CAUTION

When applying pressure in excess of 30 psi to the periscope or when pulling a vacuum on the periscope make certain that the gauge shutoff is completely closed by rotating shut off screw clockwise until it bottoms solidly.

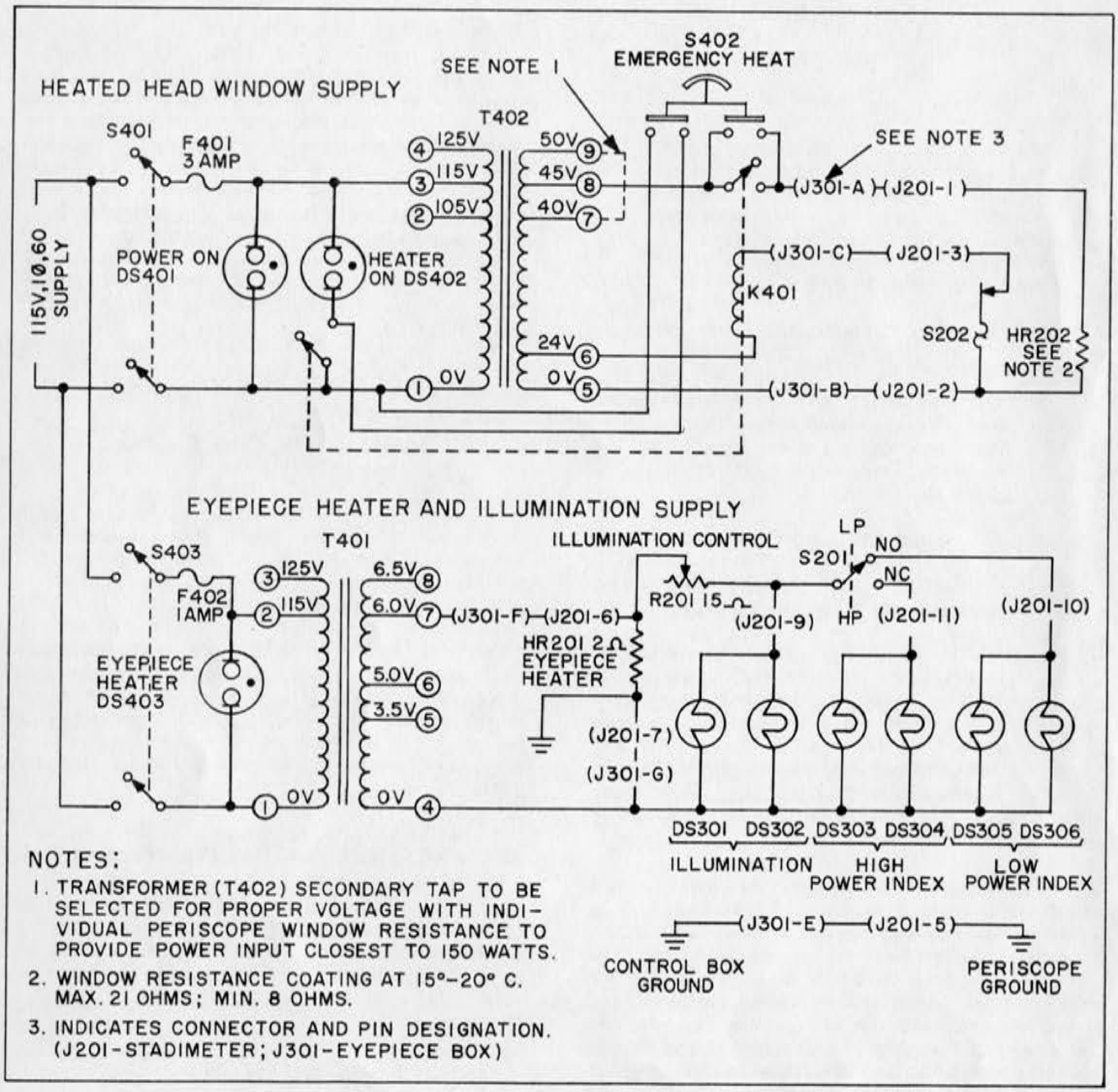


Figure 2-3 Electrical Schematic Diagram

SECTION 3
INSTALLATION

3-1 GENERAL

This section describes the methods of installation, including handling, alignment and mounting instructions for the Type 2E Periscope.

CAUTION

Under no circumstances should clamps containing set screws be used nor should any clamp be placed within 18 inches of the joint between the tube and taper. Also, do not clamp in the area of the stadimeter lens assembly. Refer to Figure 1-1 for location of stadimeter lens assembly.

Submarine Periscope Manual NAVPERS 16155, Chapter 2, covers handling and hoisting of periscopes in general and should be reviewed prior to installation or removal of the periscope.

3-2 HANDLING

For shipment the periscope is secured within the standard shipping box by chocks, with brass clamps provided to prevent lengthwise movement in the box. The clamps should remain with the shipping box for reuse. The shipping box name plate is placed at the end of the box containing the lower, heavier end of the periscope.

The periscope is a sturdy instrument once installed aboard ship, but its length and weight make certain precautions advisable when handling and shipping. When shipped by truck, if any part of the box overhangs the truck bed, it should be the end containing the upper lighter end of the periscope. Slings for hoisting the shipping box should be attached at more than one point preferably the quarter points.

The correct method of packing a periscope in its shipping box is a relatively simple but important operation, since severe damage to the equipment may result if it is improperly packed. The same care should be used to pack damaged instruments being returned for repair, to insure that no further damage is incurred during transit.

Before being packed, the periscope should be wiped clean. All optical surfaces in the head assembly and eyepiece box should be covered with lens tissue taped in place. The head assembly should then be covered with kraft paper, or equal, taped in place. To support the periscope during a hoisting operation a pair of rope slings or equivalent may be rigged around the outer tube about eight feet from each end. Chain hoist or a block and tackle arrangement secured to each sling may be used to raise the periscope. Keep the periscope in a horizontal attitude during the hoisting operation to prevent slippage in the rope slings.

3-3 REMOVAL OF MISCELLANEOUS COMPONENTS

Before the periscope can be lowered through the hull all components that project beyond the 7-1/2 inch diameter of the outer tube must be removed. The components to be removed and procedures for removal are given below:

NOTE

Do not disturb the position of the stuffing box shafts and mating receptacles once these components have been removed. Correct alignment, when the components are reinstalled, will be simplified if the mechanical linkages are not disturbed.

(a) Training Handles

Rotate the altiscope grip to "O" degree elevation and the power change grip to low power. Remove by taking out the hex head bolts securing the training handles to the eyepiece box.

(b) Focusing Knob Assembly

With the plunger out, rotate focusing knob clockwise to stop at +1.5 diopters before removing focusing knob assembly. Remove by taking out the screws securing the focusing knob assembly to the eyepiece box.

(c) Stadimeter Illumination Knob

Rotate knob to off position and remove by taking out the screw securing the knob to the rheostat shaft. Take care not to lose the key which positions the knob on the shaft.

(d) Eyepiece and Faceplate Assembly

Pull out the two plunger knobs at the top to release the assembly. Rotate slightly downward and pull plate off the spring loaded detents.

3-3A STADIMETER DIAL AND DRIVE ASSEMBLY

The stadimeter dial and drive assembly is separated from the periscope for shipping pur-

poses. It is essential that the coupling halves on the periscope and stadimeter be oriented properly prior to installation of the stadimeter. The couplings are set at the factory in the proper orientation. The following is a description of how coupling orientation is established and how the stadimeter is removed from the periscope.

The stadimeter range input crank should be rotated to the extreme clockwise position and the "In-Out" lever rotated clockwise to the extreme "IN" position. When this has been accomplished the four socket head screws, held captive by retaining rings, can be loosened and the stadimeter assembly will be free except for the electrical connector. Lower the stadimeter assembly just enough to gain access to the electrical connector. Disconnect the electrical connector.

3-3B

After the components outlined in paragraph 3-3 have been removed, the periscope may be lowered through the hull dome stuffing box in a manner similar to that described in Submarine Periscope Manual, NavPers 16165, Chapter 2.

3-4 HOISTING YOKE

Install the hoisting yoke in a manner similar to that described in Submarine Periscope Manual, NavPers 16165, Chapter 2.

3-5 INSTALLATION OF MISCELLANEOUS COMPONENTS

Once the periscope is supported by the hoisting yoke the components that were previously removed may be reinstalled. The procedures listed below should be followed to insure proper operation.

(a) Training Handles

Prior to installation make certain the altiscope grip is set for "O" degree elevation and the power change grip is set for low power. It may be necessary to back off on the grips, to align the square key to the square shaft on the eyepiece box.

(b) Focusing Knob

Make certain that the focusing knob is set at 1.5 diopters. To accomplish this pull out the plunger and rotate the focusing knob CW until the 1.5 diopter stop is contacted. When installing the assembly it may be necessary to back off on the knob to align the square key to the square shaft on the eyepiece box.

(c) Stadimeter Dials and Drive Assembly

NOTE

Prior to installing the stadimeter, install the eyepiece and faceplate assembly and look through the periscope to make certain that the stadimeter lens is in the optical path and that split lenses are coincident. If this is not the case, rotate the couplings on the bottom of the eyepiece box until the above is accomplished. With the optics in this condition, the coupling halves should be parallel to one another and to the centerline of the two dowel pin holes. Exercise care not to damage the couplings during this operation.

Remove the two access hole plugs on the stadimeter assembly using wrench P-1423-5. This will permit visual access to the coupling halves during installation. The top face of the stadimeter assembly contains two dowel pins for orientation purposes. Position the stadimeter assembly so these dowel pins line up with the mating holes on the lower face of the eyepiece box.

NOTE

Make sure that the "Range" input crank is rotated to the extreme clockwise position and that the stadimeter "In-Out" lever is rotated clockwise to the extreme "IN" position.

Install the electrical connector. Slowly raise the stadimeter assembly to engage the coupling halves. Observe the couplings through the access holes to insure proper mesh. If the couplings are not engaging properly back off on range input crank and stadimeter "in-out" lever just enough to align coupling halves.

After the couplings have been satisfactorily engaged the stadimeter assembly may be secured to the eyepiece box with the four captive screws. Replace the access hole plugs.

A check on proper installation of the stadimeter assembly can be made by noting that: 1. With the "In-Out" lever in the extreme clockwise position the split lens shall be in the optical light path. 2. With the stadimeter range input crank in the extreme clockwise position and the index ring set for a 15 ft. high target the H.P. mark of the index ring shall read infinity range with the split lens in coincidence.

3-6 Heated Head Window Control Box

The heated head window control box (see Figure 4-8) is a bulkhead mounted unit. Be sure to allow sufficient clearance for the hinged cover to be fully opened and that the unit is within range of the power cable assemblies supplied. Once the control box is installed provide 115V, 1Ø, 60∿ input to the unit and connect the two cable assemblies from the control box to the periscope. A quick disconnect fitting is used to join these two cable assemblies and is designed to release if the periscope is lowered without manually disconnecting the cable. It is recommended that the cable assembly be manually disconnected each time the periscope is lowered. The quick disconnect fitting is not intended for routine use in unplugging the periscope.

SECTION 4

MAINTENANCE

4-1 GENERAL

Maintenance shall consist of periodic visual and operational inspections together with the necessary adjustments to assure the optimum performance of the periscope. The thoroughness with which these inspections are made is of great importance since early detection and correction of minor troubles will increase the useful life of the equipment.

4-2 FOGGING

Two types of fogging may be encountered when using the periscope. External fogging of the head or eyepiece window is temporary in nature and will disappear as the glass surfaces become warmer. External head window fogging can be removed by energizing the window heater. External fogging of the eyepiece window can be cleared with lens tissue or a soft lintless cloth. However, the heater in the eyepiece will soon defog the window if the eyepiece heater circuit is energized as soon as the periscope is raised. Internal fogging of the optics indicates that the hermetic seal of the periscope has been broken, allowing gas leakage and subsequent breathing action of the periscope during temperature changes. This action causes water vapor to enter the tube, a condition which may result in fogging of the internal optical surfaces. Since this condition is not correctable at sea, it is important that all possible preventive measures be taken to maintain the hermetic seal of the periscope. Proper adjustment of stuffing box gland nuts is essential. Unusually free motion of any control or loss of internal gas pressure calls for an immediate check of all stuffing boxes and tightening of packing glands, as necessary. Normal gauge pressure for various gas temperatures, based on 7.5 psig at 70°F, are given below:

Temperature (°F)	Gauge Pressure (PSI)
140	10.4
120	9.6
100	8.8
80	7.9
60	7.1
40	6.2
20	5.4
0	4.6

4-3 STUFFING BOX ADJUSTMENTS

The hermetic seal around each operating shaft entering the eyepiece box is maintained by stuffing box packings which are compressed and forced into a snug fit with the shaft and the walls of the stuffing box by means of the packing gland nut. These nuts are provided with holes to accept a pin wrench and with a set screw for locking the nut in place after adjustment. When adjusting gland nuts, they should be tightened until a moderate stiffness of operation of the shaft indicates that the packing washers have been forced into a snug fit. A soapy water solution may be used to test leakage of the stuffing boxes.

The stuffing boxes of the periscope are as follows:

(a) Training handle stuffing boxes. These are located beneath each training handle bracket and are reached by removing the training handle assembly.

(b) Focusing hand wheel stuffing box. This is reached by removing the focusing knob assembly.

(c) Two stadimeter shaft stuffing boxes. These are reached by removing the stadimeter assembly. See Section III for instructions on removal and installation of the stadimeter assembly.

(d) Rheostat illumination knob stuffing box. Remove knob and identification plate to gain access to this stuffing box.

4-4 CLEANING

All external optical surfaces should be cleaned as often as necessary, using lens paper or a soft, clean lint free cloth. The paper or cloth may be moistened with alcohol to remove grease. Unnecessary cleaning should be avoided.

NOTE

Before cleaning optical surfaces, the surface should be examined for any foreign matter which might tend to scratch the surface of the glass if removed with a lens tissue or cloth.

These particles should be removed with light strokes of a camel hair brush before further cleaning is attempted.

The outer tube should be wiped down frequently with an absorbent cloth to remove any sea water which may have seeped through the seal.

4-5 LUBRICATION

The stadimeter dial and drive assembly must be pumped with a dehydrated water repellant grease, such as bearing grease MIL-G-16908, until the grease oozes out the sides. The lubrication fitting is located in a recess or the underside of the stadimeter dial and drive assembly. Excess grease should be wiped off periodically. This will also provide a protective coating on the outer surfaces of the drive unit.

4-6 INSPECTION

The following are inspection requirements that should be performed on a daily basis.

(a) The periscope should be capable of being hoisted and trained through 360° without tendency to bind.

(b) All controls should operate with moderate stiffness, indicating proper tightening of packing in stuffing boxes.

(c) All external optical surfaces should be inspected for cleanliness.

(d) Wipe excess grease from the stadimeter dial and drive assembly.

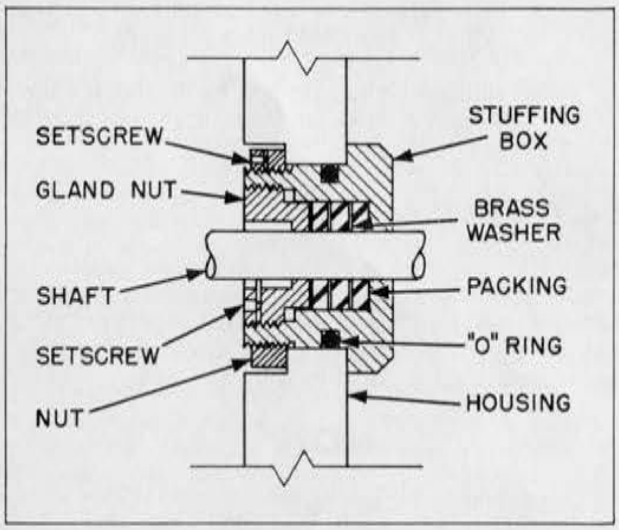


Figure 4-1
Typical Stuffing Box Arrangement

NOTE

If there is no evidence of grease on the sides of the assembly additional grease will be required. See paragraph 4-5 for lubrication instructions.

When components and/or assemblies have been partially or completely disassembled perform the following inspection procedures.

NOTE

It is recommended that disassembly be performed only to the extent necessary to make repairs and/or replace faulty parts. Always provide proper support when driving out taper pins so as not to distort or bend other parts and/or components. It is a good practice to scribe "match" marks on all linkages, gears, etc. prior to disassembly so that they may be reinstalled in the same position.

(a) Examine all threaded parts for crossed, filled and/or stripped threads.

(b) Examine all gears for worn or damaged teeth. Replace any gears that do not function smoothly.

(c) Examine all gear trains for grinding or excessive backlash. Make adjustments as necessary for smooth operation. If proper operation can not be attained by adjustments replace the faulty parts.

4-7 CARE OF FLOODED PERISCOPES

A casualty which results in flooding of the periscope tube and eyepiece box with sea water calls for prompt action to reduce damage due to corrosion.

If practicable, sea water should be drained from the instrument, which should then be thoroughly flushed with fresh water, dried, filled with Tectyl, Grade III or No. 511, and sealed.

A second but less desirable alternative is to drain the sea water from the periscope, flush it thoroughly with fresh water and refill it with fresh water, after which it should be sealed.

If neither of the above expedients is practicable, it is probable that less damage will result if the tube is allowed to remain flooded with sea water rather than being drained and dried, since the latter course may result in concentrated deposits of salts on metal parts.

The above measures should be considered as temporary expedients only. A flooded periscope should be removed and turned into an appropriate repair facility as soon as possible.

4-8 OPTICAL REFERENCE

It is recommended that an optical reference point be established on the hull of the submarine. This will enable the maintenance technician to bring the periscope to the same bearing and elevation each time, providing the periscope height is the same each time. It is preferable that the reference point be established at -10 degree elevation and 0 degree azimuth, however, this may vary due to the configuration of each submarine. The reference point should be recorded in a log so that the periscope may be trained to the same reference point each time. Whenever installation of the periscope is altered the optical reference point must be re-established or verified.

4-9 LEFT TRAINING HANDLE (See Figure 4-2)

4-10 Disassembly

Before attempting disassembly of the training handle the tension on spring (36) must be relieved. Remove cover (31) and backoff on the four special screws (32). This will relieve spring tension. Once special screws (32) are removed spring block (35) is free. Disassembly sequence from this point on is optional. The following sequence is presented as a guide, however, it is recommended that the unit be disassembled only to the extent necessary to replace faulty parts and/or accomplish necessary repairs.

(a) Unscrew nut (1) and remove washer (2) and training handle grip (4). Ball plunger (3) and the graduated altiscope ring (5) are attached to the training handle grip. Remove screw (6) to release the graduated altiscope ring (5). Ball plunger (3) can be unscrewed from the training handle grip.

(b) Once the training handle grip has been removed the woodruff key (9) is free and washer (7) can be removed. The intermediate stop ring (42) is also free to slide off.

(c) To release detent bushing (8) unscrew set screw (43) and fillister head screw (44).

(d) To release stop ring (39) remove three flat head screws (41).

(e) Bracket (23) is attached to the training handle hinge (37) by two pivot pins (14). Remove caps (12) by unscrewing flat head screws (11). Remove retaining rings (13) to release pivot pins (14). Use special tool #B-566.333 to remove pivot pins (14). This will release bracket (23). Bevel gear (22) can be removed by pulling straight out.

NOTE

Do not remove bushings (24) from bracket (23) unless there is excessive wear or damage to the bushings.

(f) Remove screw (21) to release bevel gear (20) from shaft (10). Spring (19) will be free.

NOTE

Bevel gear (20) is under spring tension. Use care in removing the bevel gear.

(g) To disassemble the remaining parts of the leaf spring assembly pull dowel pins (33) free of hinge (37) and push spring forward in hinge (37) until rollers (27) protrude beyond the hinge. Remove retaining ring (25) and pull out shaft (29). Washers (26), bearings (28) and rollers (27) are now free.

(h) Drive out slotted taper pin (17). This will release collar (18), thrust washer (16) and bearing (15). Shaft (10) and thrust washer (38) may now be withdrawn from hinge (37).

4-11 Reassembly

Reassembly is essentially the reverse of disassembly. Once bracket (23) is attached to hinge (37) spring assembly (36) may be secured, however, hinge (37) must be folded to the up position on bracket (23) for full access to the ends of spring (36) and rollers (27). Insert dowel pins (33) and take up special screws (32) to secure the spring assembly. Adjust the position of ball plunger (3) so that the detent engages firmly and the handle may be rotated with moderate effort.

The graduated altiscope ring (5) is free floating with respect to the training handle grip (4) and is driven by the training handle grip through a screw (6) riding in a slot in the graduated altiscope ring. If replacement of the altiscope ring is required the mounting hole must be machined at final assembly to compensate for backlash in the elevation drive mechanism. When securing the altiscope ring take up on screw (6) moderately until the unthreaded section engages the threads of the tapped hole. This should leave sufficient clearance for the altiscope ring to float free.

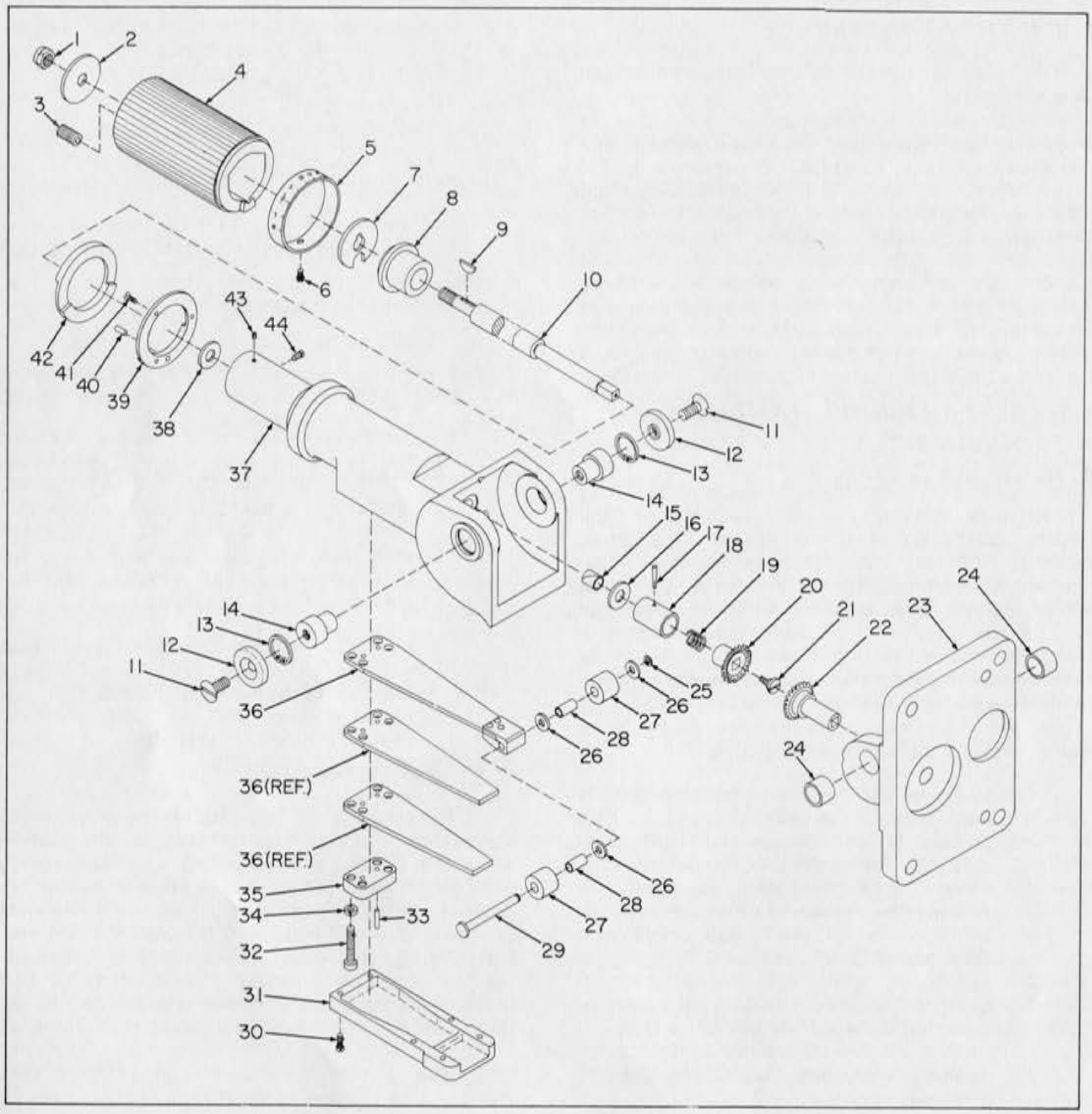


Figure 4-2 Left Training Handle Assembly

(See Section V for Legend and Parts Information)

When the training handle has been completely assembled make certain that the two flats of bevel gear shaft (22) are parallel to the vertical centerline of the periscope with the grip detented at zero degrees elevation.

Refer to the following paragraphs for instructions on replacement of the detent bushing (8) and grip (4).

4-12 Detent Bushing Replacement

Position the new detent bushing (8) so that the "V" groove is 180 degrees from the key way of shaft (10) with the periscope oriented at 0° elevation. Secure the detent bushing with set screw (43). Fillister head screw (44) will be installed later when the detent bushing has been properly oriented. Completely assemble the remaining parts of the training handle.

Turn the grip slightly in either direction until you are certain that the spring loaded plunger has engaged the "V" groove of the detent bushing. Note the setting of the graduated altiscope ring (5). If the altiscope ring reads zero the detent bushing is correctly oriented. If this is not the case remove the grip and re-position the detent bushing, using the trial and error method, until the correct orientation is obtained. Once the detent bushing is positioned properly drill and #2-56NC-3B tap a hole in the bushing concentric with the counterbored hole in hinge (37). Screw in fillister head screw (44) to secure the bushing and re-install the remaining parts.

4-13 Grip Replacement

If grip (4) is replaced it will be necessary to machine each side of the stop, on the grip, to permit the necessary rotation of the shaft. The stop on the grip is slightly oversized to permit this adjustment. This adjustment is made with the training handle installed on the periscope.

Slide the new grip (4) on the training handle assembly and make certain that the ball plunger (3) engages the "V" groove of bushing (8). This is the position for zero degree elevation.

Position the altiscope ring (5) so that the zero mark coincides with the index mark on hinge (37). Drill and tap #4-48NF-3B hole in the grip concentric with the hole in the graduated altiscope ring.

NOTE

Make the necessary adjustments to compensate for backlash in the elevation drive mechanism as outlined in paragraph 4-11.

Secure the altiscope ring with fillister head screw (6). Rotate the grip to each extreme and check that the stop engages at -10 degrees and +74 degrees. Machine the stop on grip (4) as required to align the index mark on hinge (37) with the -10 degree and +74 degree mark on the altiscope ring.

4-14 Grip & Detent Bushing Replacement

If both the grip and detent bushing require replacement it is necessary to make use of the optical reference point established in paragraph 4-8.

The first step would be to orient the graduated altiscope ring with respect to the optical reference point and machine the new grip to locate both stops. Once this has been accomplished the new detent and bushing may be oriented to zero degree elevation and secured. The procedures for these adjustments are similar to those described in the preceding paragraphs.

4-15 Bracket Bushing Replacement

The ID of replacement bushings (24) are undersized and must be line reamed at assembly to 0.5000 -0.0000/+0.0006 inch diameter to accommodate pivot pin (14). Press fit the bushings (24) in the bracket (23) and line ream to dimensions indicated above.

4-16 RIGHT TRAINING HANDLE (See Figure 4-3)

4-17 Disassembly

Disassembly of the right training handle is similar to that of the left training handle. There are a few detail part differences. Spring tension must be relieved before disassembly is attempted. Remove cover (34) and back off on the four special screws (32). This will relieve spring tension. Once the special screws (32) are removed block (29) is free. Disassembly sequence from this point on is optional. The following sequence is presented as a guide. It is recommended that the training handle be disassembled only to the extent necessary to make repairs and/or replace faulty parts.

(a) Unscrew nut (22) and remove washer (23) and training handle grip (24). The graduated power change ring (26) is attached to the training handle grip by screw (25).

(b) Once the training handle grip has been removed Woodruff key (19) is free and washer (20) can slide off.

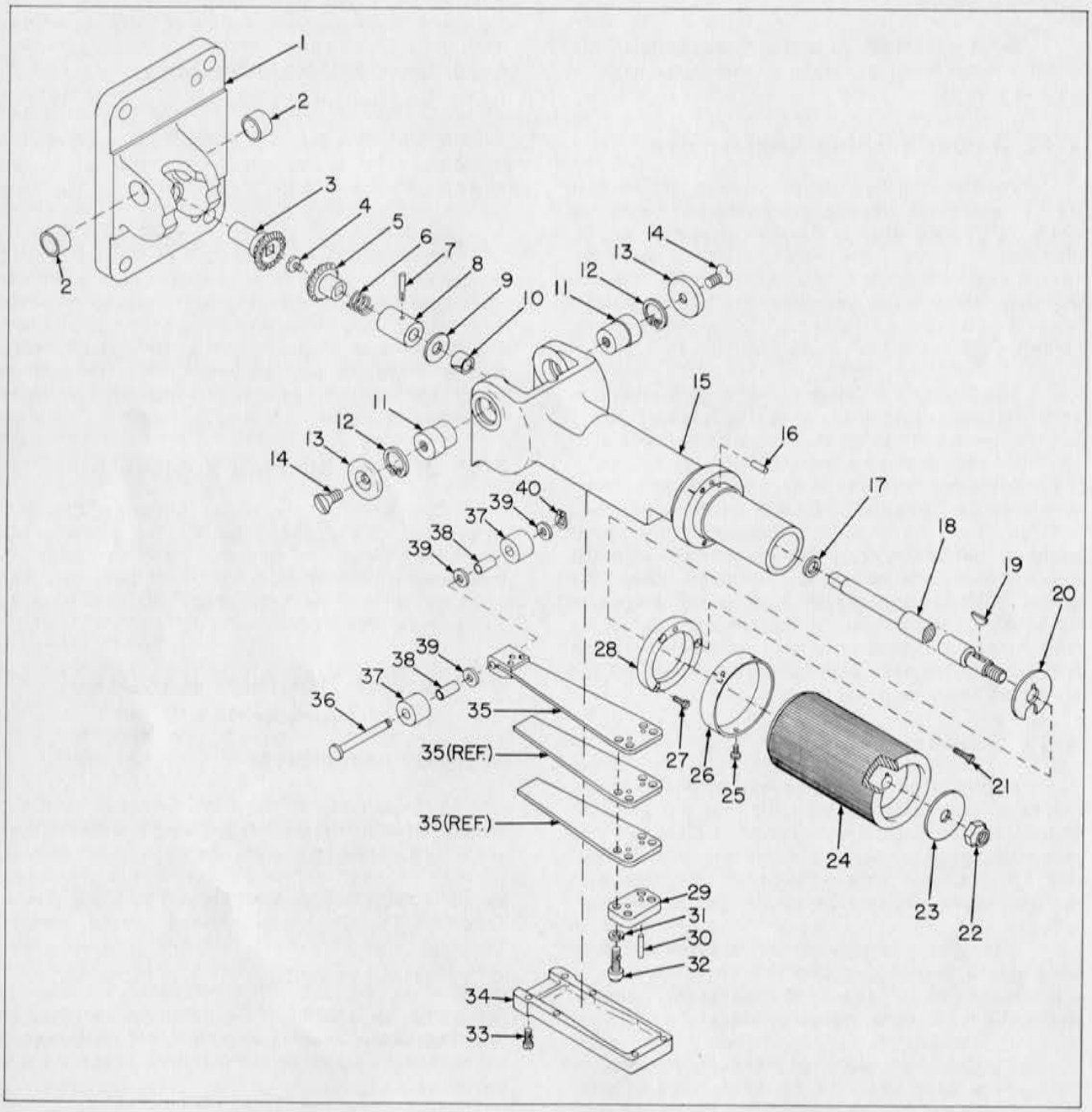


Figure 4-3 Right Training Handle Assembly

(See Section V for Legend and Parts Information)

(c) Stop ring (28) is secured to hinge (15) by three flat head screws. One screw (27) is only 3/8 in. long (two screws (21) are 1/2 in. long) and is used on the thinner section of stop ring (28).

(d) Bracket (1) is attached to the training handle hinge (15) by two pivot pins (11). Remove caps (13) by unscrewing flat head screws (14). Remove retaining rings (12) to release pivot pins (11). Use special tool #B-566.333 to remove pivot pins (11). This will release bracket (1). Bevel gear (3) can be removed by pulling straight out.

(e) Remove screw (4) to release bevel gear (5) from shaft (18). Spring (6) will be free.

NOTE

Bevel gear (5) is under spring tension. Use care in removing the bevel gear.

(f) To disassemble the remaining parts of the leaf spring assembly pull dowel pins (30) free of hinge (15) and push spring forward in hinge (15) until rollers (37) protrude beyond hinge (15). Remove retaining ring (40) and pull out shaft (36). Washers (39), bearings (38) and rollers (37) are now free.

(g) Drive out slotted taper pin (7). This will release collar (8), thrust washer (9) and bearing (10). Shaft (18) and thrust washer (17) may now be withdrawn from hinge (15).

4-18 Reassembly

Reassembly is essentially the reverse of disassembly. Once bracket (1) is attached to hinge (15) spring assembly (35) may be secured, however, hinge (15) must be folded to the up position on bracket (1) for full access to the ends of spring (26) and the rollers (37). Insert dowel pins (30) and take up on screws (32) to secure the spring assembly. When the training handle is completely assembled make certain that with the training handle grip in the "LP" position two flats of bevel gear (3) are parallel to the vertical centerline of the periscope.

4-19 Grip Replacement

Preassembly machining is required if grip (24) is replaced. The stop on the grip slightly oversized to permit this machining and adjustment. With the training handle installed on the periscope and the power change mechanism in a central position (neither high nor low power) slide on the new training handle grip. Turn to the low power position and sight through the periscope making sure the optics are in the low power position. If this is not the case it will be necessary to machine the grip stop slightly to permit the power change mechanism to come to rest in the low power position. Repeat this machining operation, as necessary until the power change mechanism satisfactorily seats in the low power position.

Once the Low Power stop has been satisfactorily adjusted the power change ring may be installed. With the periscope in the low power position orient the power change ring so that the "LP" mark coincides with the index mark on hinge (15). Drill and #4-48NF-3B tap a hole on the new grip concentric with the hole in the power change ring. Use screw (25) to secure the power change ring. When this has been accomplished machine the other stop so that the "HP" mark coincides with the index mark on hinge (15). Check that the periscope is in the high power position when these marks coincide.

CAUTION

Be very careful that the stops are not over machined. When the stop is oriented properly the actual power position should be driven home by the mechanism inside the periscope after the training handle stop has been engaged. It is possible to listen for the internal detents to pop into place after the training handle stop has made contact.

4-20 Bracket Bushing Replacement (See Paragraph 4-15)

4-21 FOCUSING KNOB ASSEMBLY (See Figure 4-4)

4-22 Disassembly

The sequence of disassembly is optional. The following instructions are presented as a guide, however, it is recommended that the unit be disassembled only to the extent necessary to replace faulty parts and/or accomplish the necessary repairs.

(a) Place knob extension arm in the extended position to gain access to nut (13) and retaining ring (14). It may be desirable to remove the extension arm, for this operation, if so drive out pin (20) to release arm (17) spacer (18) and spring (19). Use special wrench A-547.697 to

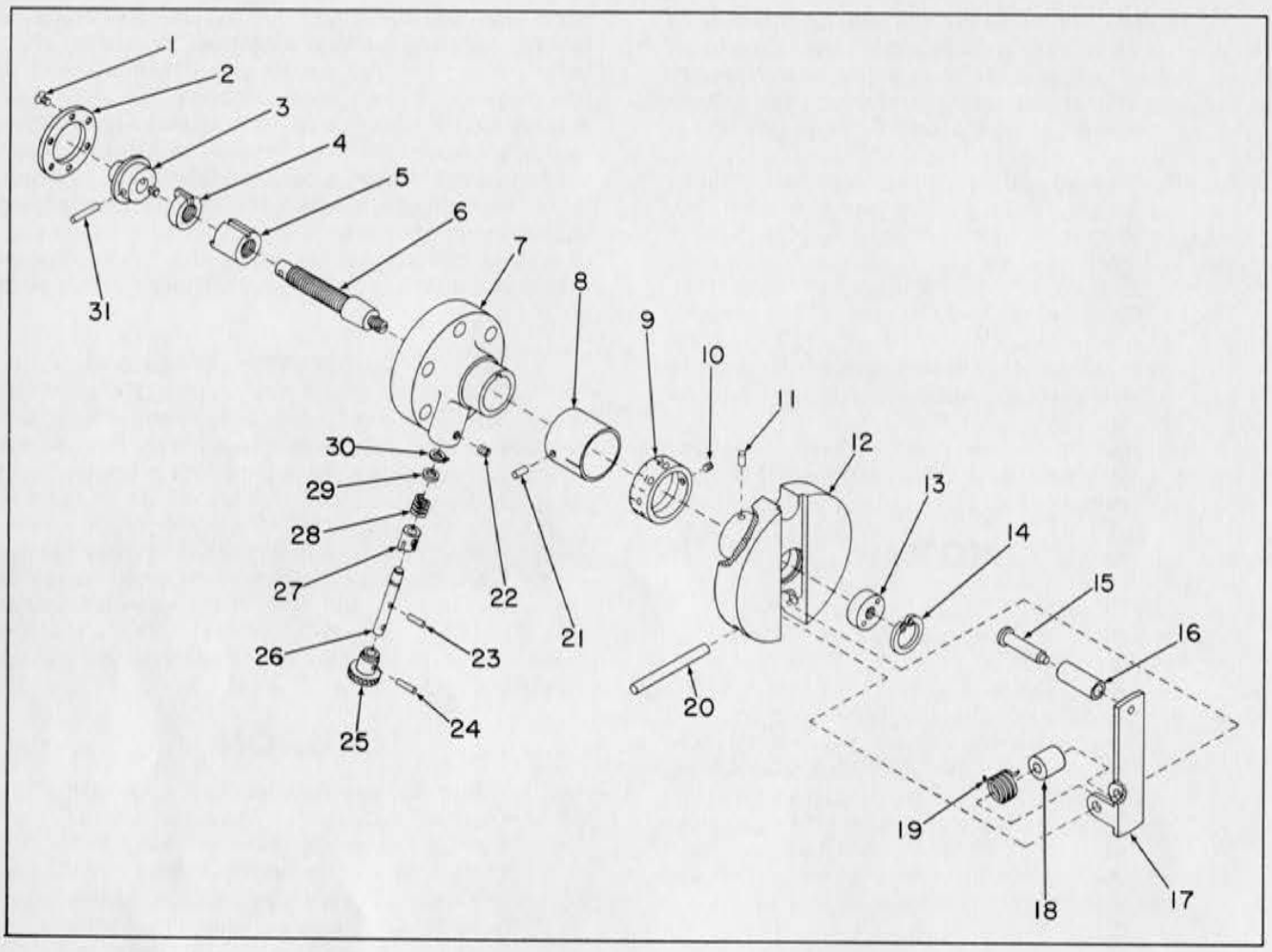


Figure 4-4 Focusing Knob Assembly

(See Section V for Legend and Parts Information)

back off on nut (13) until it pushes against retaining ring (14). This action will break knob (12) free from the taper of shaft (6). The diopter scale (9) can now be removed by loosening set screw (10).

NOTE

If knob (12) does not break loose from taper on shaft (6) use a wooden or lead mallet and break knob (12) loose by light pounding.

(b) Remove retainer (2) by unscrewing the six flat head screws (1). The shaft (6) focusing stop (3), focusing nut (4) and camera stop (5) can now be withdrawn as an assembly.

(c) Knob (25), sleeve (27), plunger (26), spring (28), washer (29), retaining ring (30), dowel pin (23) and dowel pin (24) are removed as an assembly by taking out set screw (22).

(d) Sleeve (8) is pinned to the focusing knob housing (7) with dowel pin (21).

4-23 Reassembly

Reassembly is essentially the reverse of disassembly. Plunger assembly (items 23 through 30) and shaft assembly (items 3, 4, 5 and 6), must be preassembled before final assembly. Set screw (22) must be staked in place at final assembly. If focusing nut (4) or focusing stop (3) have been replaced the tabs must be machined for 0.040 minimum engagement.

If knob (12) is taken off and/or replaced or if the diopter scale is taken off and/or replaced the diopter scale must be oriented for proper readings. To orient the diopter scale pull out the plunger and crank the knob CW several turns until a stop is contacted. Set the diopter scale to read 1.5 diopters and tighten the set screw.

4-24 Camera Focus Stop Adjustment (See Figure 4-4)

When the plunger is pulled out, the focusing knob can be cranked counterclockwise several turns to an adjustable stop which locates the erector lens in position for sharp focus at the camera eyepiece reticle. This position will vary from one periscope to the next. A counterclockwise rotation of knob (12) turns focusing shaft (6) forcing focusing nut (4) towards camera stop (5).

The camera stop adjustment consists of relocating the axial position of camera stop (5) on focusing shaft (6). To make this adjustment loosen nut (13) with special wrench (A547.679) and break knob (12) loose from the taper of focusing shaft (6) by backing off on nut (13) until the nut pushes against retaining ring (14). This action will break knob (12) free from the taper of focusing shaft (6).

NOTE

If the above procedure does not break the knob loose use a rubber or leather mallet and tap knob (12) lightly until it is free.

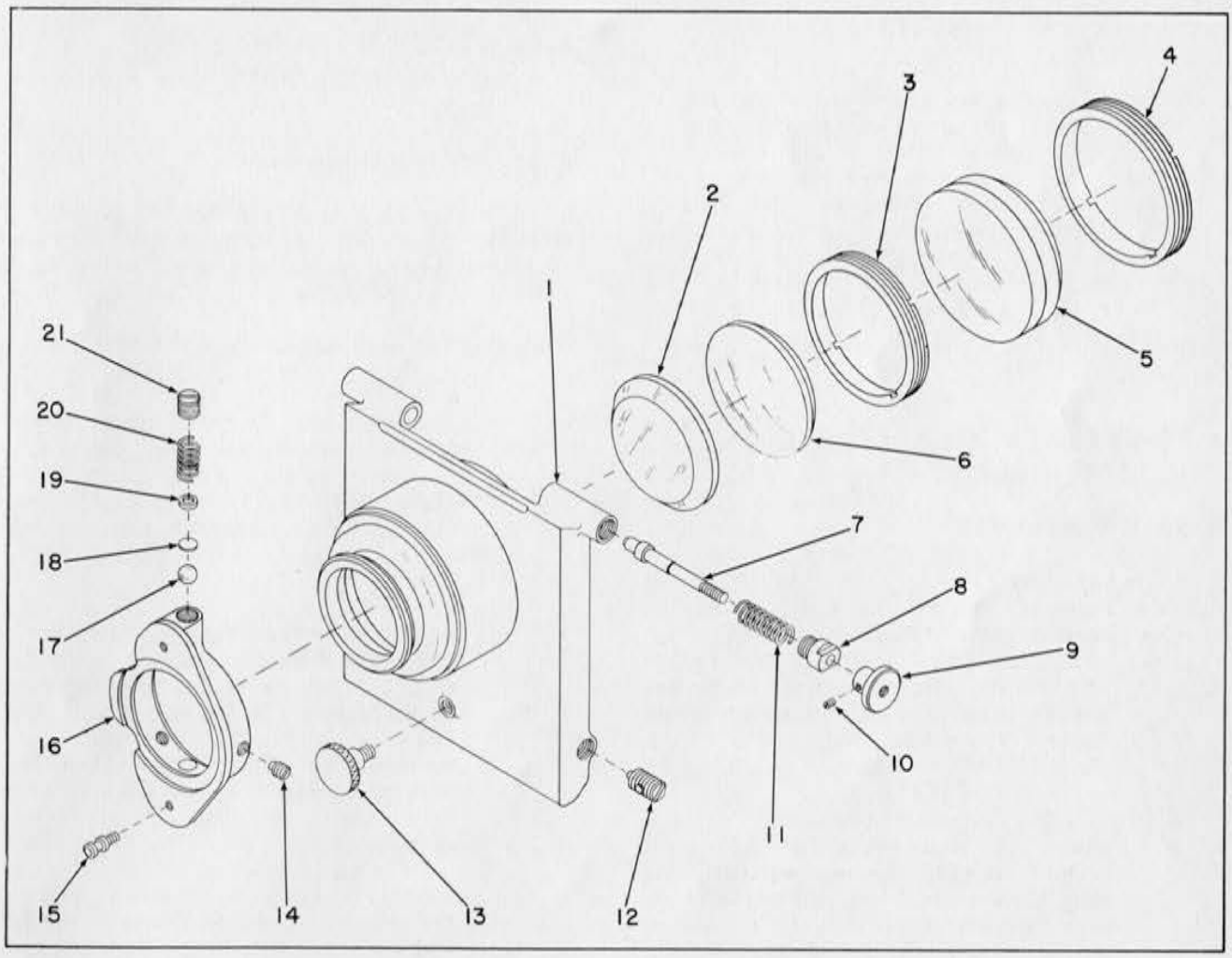


Figure 4-5 Eyepiece and Faceplate Assembly

(See Section V for Legend and Parts Information)

Holding knob (12) which is keyed to camera stop (5), turn focusing shaft (6) and nut (13) with special wrench (A-547.679) until the instrument is focused for the camera being used.

After the correct focus is attained re-engage the taper on shaft (6) with a light blow to knob (12) and engage the stop several times by applying a light CCW force to knob (12) making adequate compensation for backlash.

If desirable focus does not repeat make adjustments as outlined above until the proper focus is attained by engaging the camera stop with a CCW rotation of knob (12). When the camera stop repeats properly tighten nut (13) with special tool, A-547.679.

NOTE

The diopter scale must be oriented each time the camera stop position is changed. To do so proceed as follows: Pull out the plunger and crank knob (12) clockwise several turns until the 1.5 diopter stop in the focusing knob assembly is contacted. Loosen set screw (10) and reset diopter scale (9) to read 1.5 diopters. Tighten set screw (10).

4-25 EYEPIECE & FACEPLATE ASSEMBLY (See Figure 4-5)

4-26 Disassembly

Disassembly should be performed only to the extent shown in figure 4-5 and only if replacement or repair of parts is required.

(a) To remove eyepiece adapter (16) unscrew three screws (14) and take out screws (21), springs (20), washers (19), discs (18) and balls (17).

(b) Plunger assembly (items 7 thru 11) are held in place by bushing (8). Remove it as an assembly by unscrewing bushing (8). Loosen set screw (10) and unscrew knob (9) from plunger rod (7) to release the remaining parts. Relieve spring tension gradually when doing this.

(c) Unscrew lock rings (3 and 4) to remove the field lens (5) and eye lenses (2 and 6).

4-27 Reassembly

Reassembly is essentially the reverse of disassembly. Apply Loctite "H" compound to all threaded parts, except ball plunger (12). Preassemble items 7 through 11 prior to final assembly.

Place eyeguard adapter (16) on the faceplate assembly (1) and tighten three set screws (14), then back off on each set screw 1/8 turn. Install items 17 thru 21 so that a moderate effort is required to rotate the eyeguard adapter and the ball detent engages firmly.

If the eye lenses (2 and 6) were disassembled insert 0.037 inch tin foil between the two lenses, on the outer perimeter prior to assembly. The tin foil should be approximately 1/8 x 1/4 inch and spaced 90° apart.

4-28 STADIMETER DIAL AND DRIVE ASSEMBLY (See Figure 4-7)

4-29 Disassembly

Disassembly should be limited to replacement and/or repair of faulty parts. Complete disassembly procedures are given below in the event this is necessary.

(a) The unit may be broken down into two major assemblies prior to detail disassembly of parts. Before this can be done, however, the lower wiring harness (C-566.329) must be disconnected from terminal block (36). Remove five screws (39). This will release housing (41) including all attached components, from dial mount (14) and attached components.

(b) Loosen set screw (104) and loosen lock ring (103) with special tool #A566.339. Once this has been accomplished items 86 through 95, 99 through 102, 105 and 108 through 110 can be removed as an assembly by pulling out on crank (108). Remove nut (110) to release hand crank (108). Do not loose key (95). Knob (109) is peened over in crank (108) and as such is an inseparable assembly. Once the crank (108) is removed, bearings (99 and 102) and spacers (100 and 101) can be pulled off. Drive out taper pin (86) to release bevel gear (87). Remove retaining ring (88) to release bearing (89). Drive out taper pins (90) to release stops (91 and 93). Nut (92) is then free to be threaded off of shaft (94).

(c) Remove guide (82) and cover (81) to gain access to screws (80). Remove screws (80) to release lever (79). Pull straight out when removing lever (79). Remove cover (106) by taking out screws (107). Bearing mount (97) can now be withdrawn along with bearings (96 and 98).

(d) Remove screws (58) and slip off dowel retainers (59). This will release items 55 through 64 as an assembly. Drive out taper pin (56) to release coupling (55). Drive out taper pin (63) and withdraw pinion (64) from bearing mount (61). Bearings (57) and bevel gear (62) are free.

(e) Remove screws (72) and slip off dowel retainers (73). Remove items (65 through 71) as an assembly. Drive out taper pins (66) to release gears (65 and 71). Spacers (67), bearings (68) and shaft (70) can now be withdrawn from bracket (61).

(f) Remove screws (45) and slip off dowel retainers (46 and 48). Note that dowel retainer (46) is slightly smaller than the other dowel retainers. Remove items 42 through 53 as an assembly. Drive out taper pins (43 and 50) to release coupling (42) and helical gear (49). Withdraw shaft (44) and retaining ring (43). Flange bearings (47) can be pushed out from the inside of bracket (51).

(g) Disconnect all wires to terminal block (36). Remove screws (33) including washers (34 and 35) to release terminal block (36). Terminal block mount (37) is held in place by two screws (38).

(h) Internal gear (20) can be removed by taking out screws (19). Remove range dial (31) by taking out screw (30) and dowel screws (32). Remove screws (22) and lift out bearing and gear mount (23). Remove bearing retainer (25) by taking out screws (24). Bearings (26 and 29), spacers (27 and 28) and bearing retainer (4) are free and can be lifted out.

(i) Lift indicator ring (3) from mount (14) in order to gain access to the pilot light wiring. Disconnect the wires and remove the indicator ring. Take out screws (1) to release knobs (2). Pilot light sockets (5) are held in place by a nut and washer. Height dial (8) can be removed by taking out screws (9) and dowel screws (10).

(j) Electrical connectors (54) are part of a potted cable assembly. The cables are held in place by clamps (12). Do not break down this assembly.

4-30 Reassembly

Reassembly is essentially the reverse of disassembly. Items 65 through 71, 55 through 64, and 42 through 53 should be preassembled before assembly to housing (41). Except for bearings (96, 98, 99 and 102) all bearings must be preloaded for no axial shake. In no case shall the amount of preload exceed 4 lb or 0.0002 in. whichever is easier to measure.

(a) Spacers (67) have been machined at assembly for a proper mesh between gears (65 and 49) and gear (71) and bearing mount (97). If any of the gear train components require replacement new spacers and machining will be required for a proper mesh of the gears.

(b) Spacer (101) has been machined for 0.0001-0.0003 in. preload in bearings (99 and 102). If replacement bearings and/or spacers are required the new spacer must be machined at assembly for 0.0001-0.0003 in. preload in the bearings.

(c) Cover (105) has been machined at assembly for 0.0001-0.0003 in. preload in bearings (96 and 98). If replacement of bearings, cover or bearing mount becomes necessary cover (105) must be machined at assembly for 0.0001-0.0003 in. preload in the bearings.

(d) Make certain the guide on stop nut (92) does not bind in the groove in bearing mount (61). The nut should travel back and forth smoothly when rotating the hand crank (108).

(e) Spacers (27 and 28) have been machined at assembly to reduce axial play in bearings (26 and 29). If replacement bearings and/or spacers are required a machining operation will be required to insure smooth operation of the bearings. Take-up gradually on screws (22) until the bearings are operating smoothly.

(f) Before installing indicator ring (3) the wiring harness from terminal block (36) to the pilot lights must be connected. Refer to Figure 4-6 for wiring data. After the unit has been satisfactorily assembled apply grease in accordance with the instructions given in paragraph 4-5.

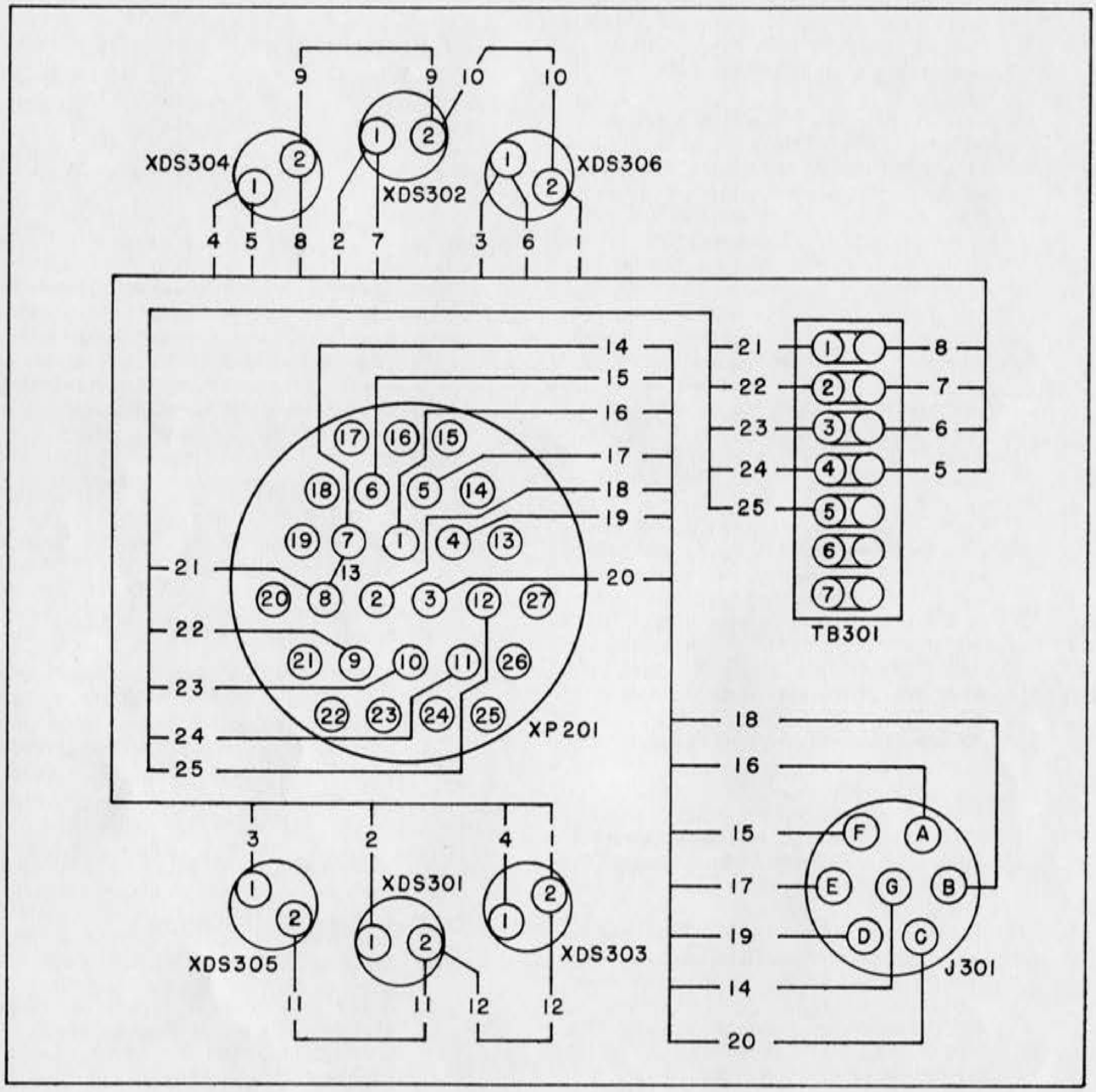


Figure 4-6 Stadimeter Dial and Drive Assembly Wiring Diagram

Table 4-1
WIRING DATA FOR STADIMETER DIAL AND DRIVE ASSY. (See Figure 4-6)

Wire No.	From	To	Type
1	XDS303-2	XDS306-2	MWC22(7)J9
2	XDS301-1	XDS302-1	MWC22(7)J9
3	XDS305-1	XDS306-1	MWC22(7)J9
4	XDS303-1	XDS304-1	MWC22(7)J9
5	TB301-4	XDS304-1	MWC22(7)J9
6	TB301-3	XDS306-1	MWC22(7)J9
7	TB301-2	XDS302-1	MWC22(7)J9
8	TB301-1	XDS304-2	MWC22(7)J9
9	XDS304-2	XDS302-2	MWC22(7)J9
10	XDS302-2	XDS306-2	MWC22(7)J9
11	XDS305-2	XDS301-2	MWC22(7)J9
12	XDS301-2	XDS303-2	MWC22(7)J9
13	XP201-7	XP201-8	MWC22(7)J9
14	J301-G	XP201-7	MWC22(7)J9
15	J301-F	XP201-6	MWC22(7)J9
16	J301-A	XP201-1	MWC18(16)J9
17	J301-E	XP201-5	MWC22(7)J9
18	J301-B	XP201-2	MWC18(16)J9
19	J301-D	XP201-4	MWC18(16)J9
20	J301-C	XP201-3	MWC18(16)J9
21	TB301-1	XP201-8	MWC18(16)J9
22	TB301-2	XP201-9	MWC18(16)J9
23	TB301-3	XP201-10	MWC18(16)J9
24	TB301-4	XP201-11	MWC18(16)J9
25	TB301-5	XP201-12	MWC18(16)J9

4-31 In-Out Mechanism Adjustments

If any of the parts establishing timing of the in-out mechanism require replacement, orientation of the coupling will be required.

(a) Push the "in-out" lever down from its near vertical limit position until it bottoms at its lower limit position, then back off approximately 1°.

(b) Rotate the range mechanism so that nut (92) is held firmly against stop (93).

(c) With the lever and range mechanism in the positions outlined above orient the coupling (42) so that the rectangular groove is parallel to a line established by locating pins (12A) and the rectangular groove in coupling (55) within 0.003 TIR or ±10 minutes of arc.

NOTE

The applicable bearings must be preloaded as outlined in paragraph 4-30.

4-32 Range Input Mechanism Adjustments

If any of the parts establishing the timing for the range input mechanism require replacement, orientation of the coupling and adjustments to the split lens stop will be required. These adjustments are outlined in paragraphs 4-33 and 4-34.

4-33 Coupling Orientation

(a) Position stop (91) on the shaft arbitrarily, leaving ample clearance for future adjustment, if required. Secure stop (91) with a set screw only.

(b) With the range mechanism (items 86 through 110) installed in the housing rotate the "Range" input crank CCW until traveling nut (92) engages stop (91).

CAUTION

Since stops (91) and (93) will be secured by only a set screw during initial stages of adjustment, care should be taken not to drive traveling nut (92) into the stops with any appreciable force since this will result in damage to shaft (94).

(c) Rotate the "Range" input crank CW six (6) full turns plus 135° +0° -10° and set stop (93) securing it with a set screw. This is only a tentative setting. Final adjustments to set the stop are described in paragraph 4-34.

(d) Push the in-out lever down from its near vertical position, then back off approximately 1°.

(e) With traveling nut (92) held firmly against stop (93) orient coupling (55) so that the rectangular groove is parallel to a line established by locating pins (12A) and the rectangular groove in coupling (42) within 0.003 TIR or ±10 minutes of arc.

4-34 Final Split Lens Stop Adjustment

This adjustment is accomplished just before installing the stadimeter dials and drive assembly to the eyepiece box. The "in-out" coupling at the bottom of the eyepiece box should be in the extreme clockwise position (split lens in the light path and detented in position) and the "in-out" lever on the stadimeter dials and drive assembly should be down from its near vertical position until it bottoms at its lower position.

(a) Rotate the "range" coupling at the bottom of the eyepiece box counterclockwise until the split lens is in coincidence. The rectangular projection of the coupling should be parallel with a line established by the two dowel pin holes in the bottom of the eyepiece box.

(b) With traveling nut (92) held against stop (93) attempt to install the stadimeter dials and drive assembly on the eyepiece box observing the coupling mesh through the access hole. The couplings should mesh easily. If this is not the case remove the assembly and re-position stop (93) by trial and error until the above conditions are satisfied.

NOTE

It may be necessary to back off on the "in-out" lever slightly to engage the other set of coupling halves.

When this is accomplished rotate stop (93) clockwise about 1° allowing a slight overtravel. Secure and pin the stop in this position.

(c) Rotate the hand crank six full turns plus 135° -5° +0° from stop (93) and adjust and pin stop (91) for engagement with traveling nut (92).

4-35 Range and Height Dial Orientation

The following procedures are required only when replacement of dials are necessary. With the stadimeter dials and drive assembly installed on the periscope rotate "range" crank clockwise to a stop and place the "in-out" lever to rest in the horizontal position. This is infinity range for a 15 foot target in high power. Proceed as follows to orient the range and height dials.

(a) Set the height dial (8) so that the center of either scale is facing the front or viewing end of the periscope. Secure with screws (9) and pin in place with dowel screws (10).

(b) Set the indicator ring (3) for a 15 foot target and then set the range dial (31) for infinity on the H.P. mark. Screw and pin range dial (31) in place.

4-36 Eyepiece Box Coupling Adjustments (See Figure 4-7)

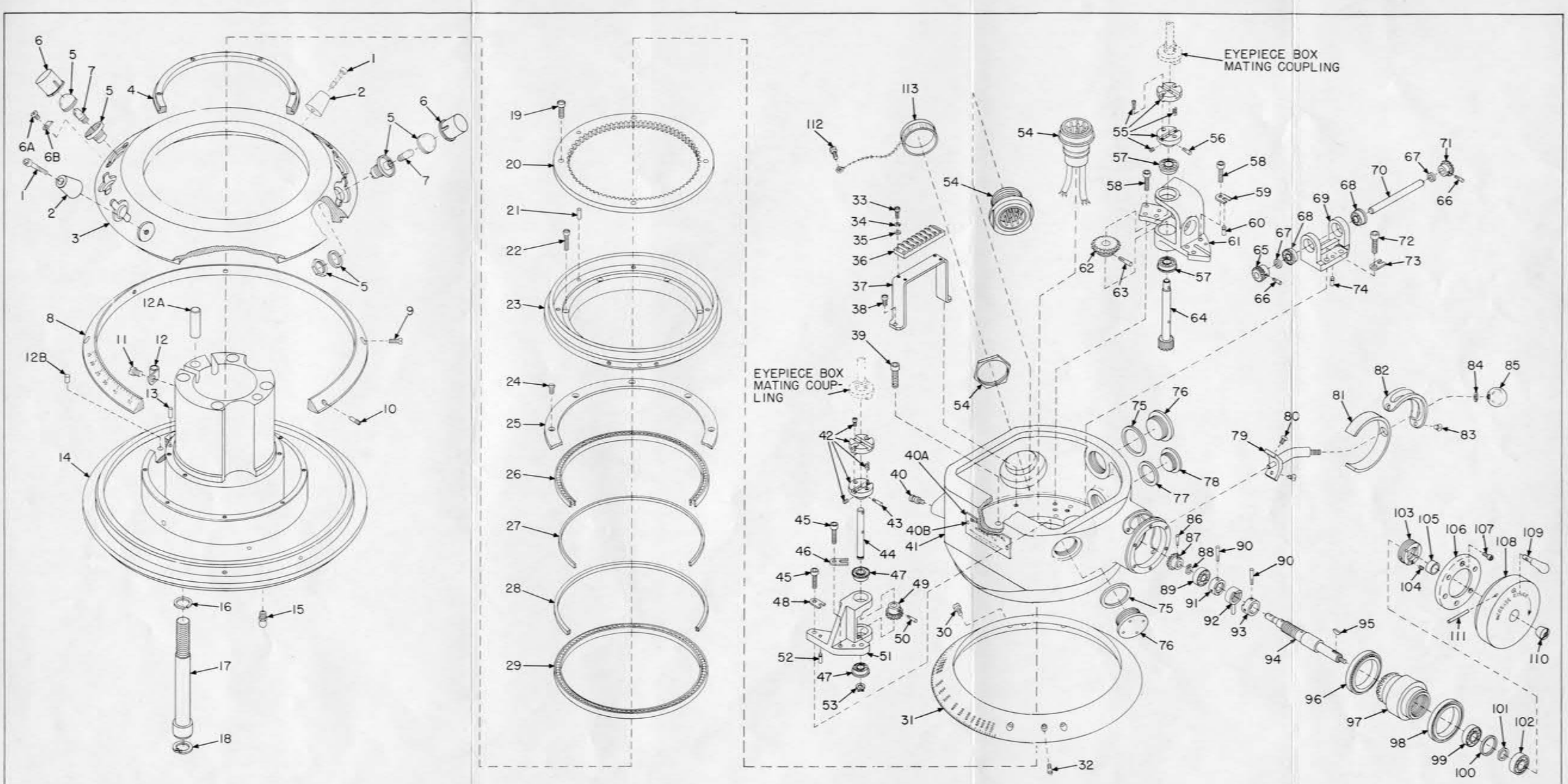
If the couplings at the lower end of the eyepiece box are replaced the following alignment procedures must be accomplished.

(a) Rotate the in-out shaft, at the lower end of the eyepiece box, CW until the split lens is in the light path and detented in position.

(b) Rotate the range shaft, at the lower end of the eyepiece box, CCW to an internal stop until the split lens is coincidence.

(c) Assemble the couplings to the ends of each shaft and set the height of the couplings for 0.020 to 0.030 inch clearance with the mating couplings on stadimeter dials and drive assembly by gauging at assembly.

(d) Orient and pin the couplings so they are parallel to one another and parallel with a line established by the two dowel pin holes on the bottom of the eyepiece box within 0.003 TIR or ±10 minutes of arc.



(See Section V for Legend and Parts Information)

Figure 4-7 Stadimeter Dial and Drive Assembly

4-37 HEATED HEAD WINDOW CONTROL BOX (See Figure 4-8)

4-38 Disassembly

Disassembly of the heated head window control box is relatively simple. The cover is hinged and held in place by two latches at the top of the box. Once the cover is open the panel, with all components attached, may be removed by loosening the three captive screws (36) and pulling out on the handle. If the panel assembly is to be completely detached from the cabinet it will be necessary to remove only the outside cable terminals from terminal board (34). All that is necessary to remove any components is to remove the hardware attaching same provided that electrical leads are detached from the component.

4-39 Reassembly

Reassembly is the reverse of disassembly. Refer to Figure 4-9 for wiring data.

4-40 BLINDER ATTACHMENT (See Figure 4-10)

4-41 Disassembly

(a) Remove clamp (2) to release eyeguard (1) by removing screw (3) and nut (4).

(b) Remove plate (6) by taking out two flat head screws (5). Slide leaf spring (7) off stud (10). Stud (10) and blinder retainer (8) are free once the leaf spring is removed.

(c) Remove pin screws (14) and (15) to release levers (11) and (13).

NOTE

Levers (11) and (13) are under spring tension. Use care when removing these parts.

4-42 Reassembly

Reassembly is the reverse of disassembly.

(a) After retainer (8) and stud (10) are assembled to base plate (9) slide leaf spring (7) onto stud (10) and then install plate (6).

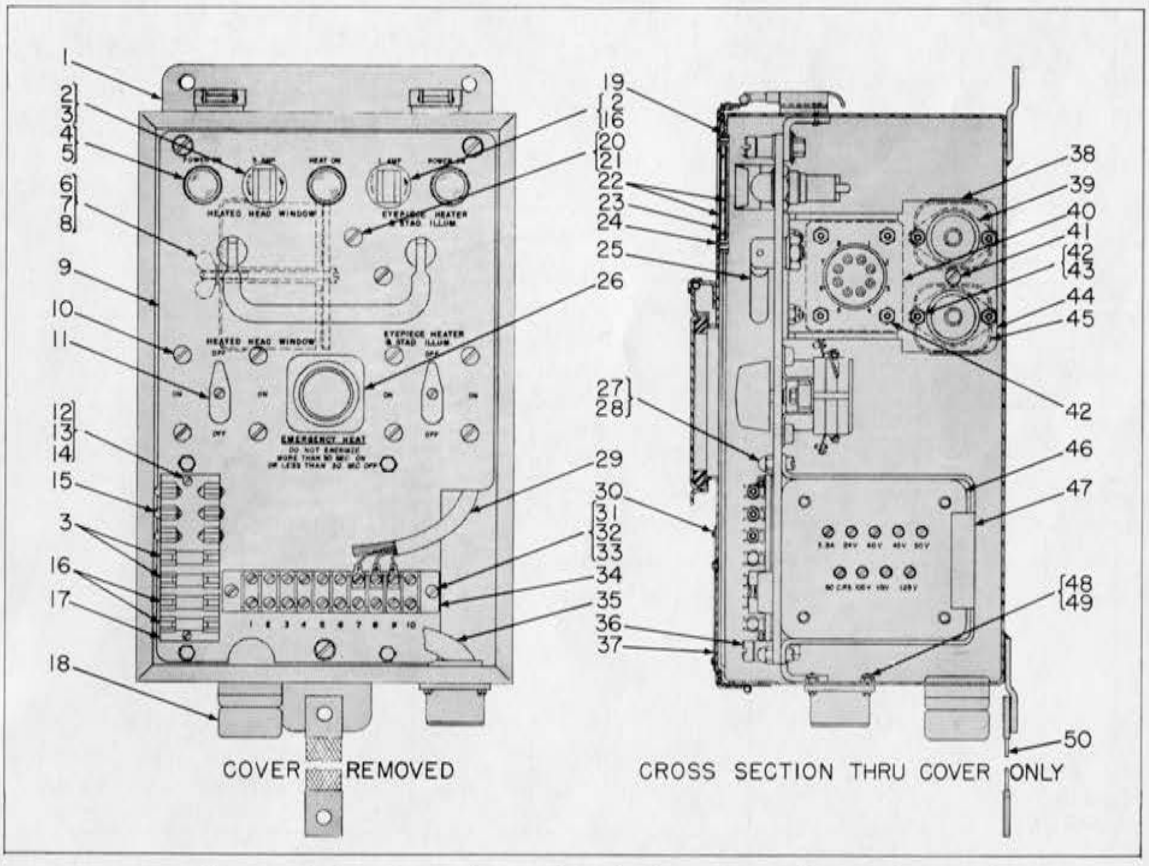


Figure 4-8 Heated Head Window Control Box Assembly

(See Section V for Legend and Parts Information)

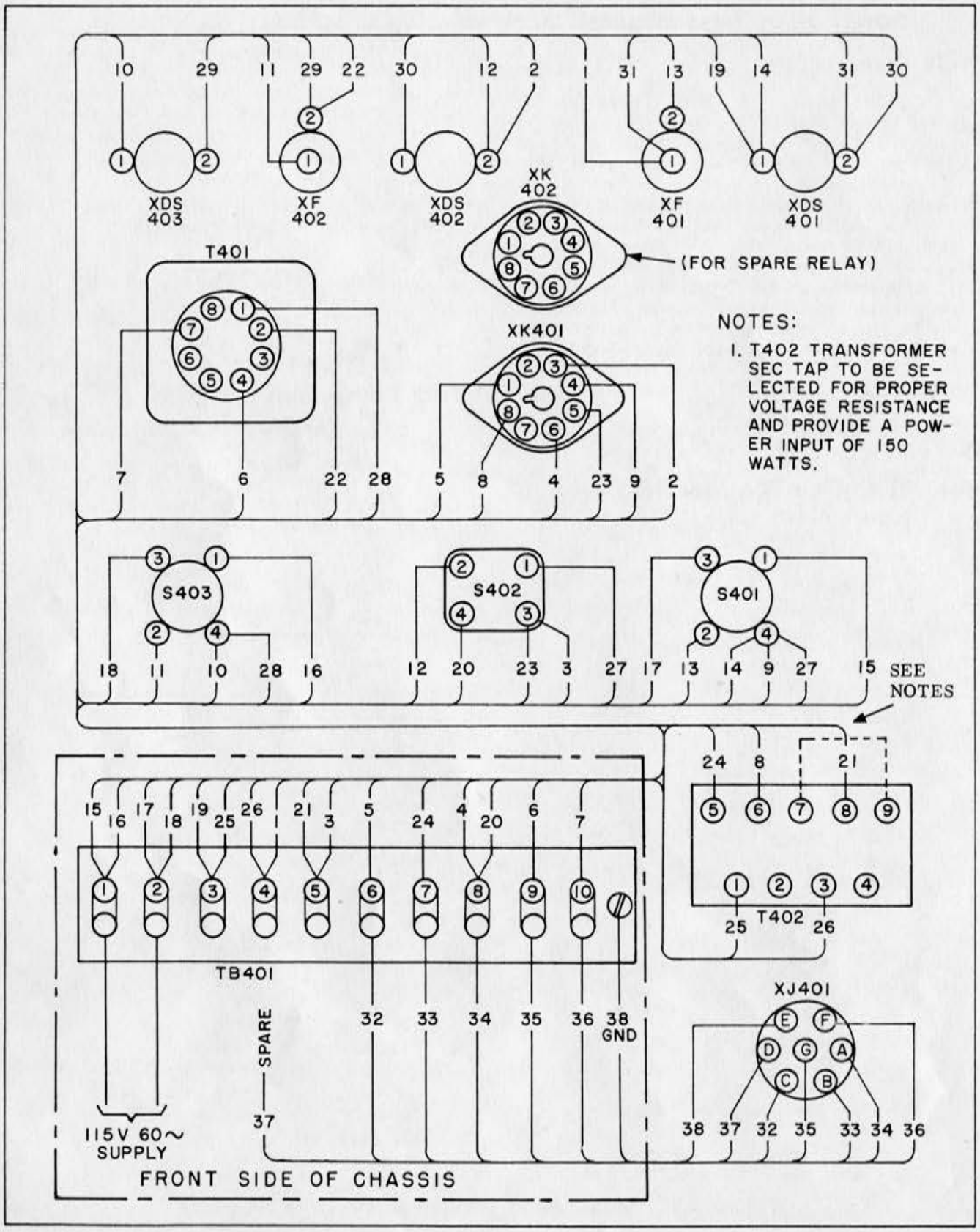


Figure 4-9 Heated Head Window Control Box Assembly Wiring Diagram

Table 4-2
WIRING DATA FOR HEATED HEAD WINDOW CONTROL BOX ASSY.
(See Figure 4-9)

Wire No.	From	To	Type
1	TB401-4	XF401-1	MWC18(16)J9
2	XK401-3	XDS402-2	MWC22(7)J9
3	S402-3	TB401-5	MWC18(16)J9
4	XK401-6	TB401-8	MWC18(16)J9
5	XK401-1	TB401-6	MWC22(7)J9
6	T401-4	TB401-9	MWC22(7)J9
7	T401-7	TB401-10	MWC18(16)J9
8	XK401-8	T402-6	MWC22(7)J9
9	S401-4	XK401-4	MWC18(16)J9
10	XDS403-1	S403-4	MWC22(7)J9
11	S403-2	XF402-1	MWC18(16)J9
12	S402-2	XDS402-2	MWC22(7)J9
13	S401-2	XF401-2	MWC18(16)J9
14	XDS401-1	S401-4	MWC18(16)J9
15	TB401-1	S401-1	MWC18(16)J9
16	S403-1	TB401-1	MWC18(16)J9
17	S401-3	TB401-2	MWC18(16)J9
18	S403-3	TB401-2	MWC18(16)J9
19	XDS401-1	TB401-3	MWC18(16)J9
20	S402-4	TB401-8	MWC18(16)J9
21	T402-8	TB401-5	MWC18(16)J9
22	XF402-2	T401-2	MWC18(16)J9
23	S402-3	XK401-5	MWC18(16)J9
24	TB401-7	T402-5	MWC18(16)J9
25	T402-1	TB401-3	MWC18(16)J9
26	T402-3	TB401-4	MWC18(16)J9
27	S401-4	S402-1	MWC22(7)J9
28	S403-4	T401-2	MWC18(16)J9
29	XDS403-2	XF402-2	MWC22(7)J9
30	XDS402-1	XDS401-2	MWC22(7)J9
31	XDS401-2	XF401-1	MWC22(7)J9
32	XJ401-C	TB401-6	MWC22(7)J9
33	XJ401-B	TB401-7	MWC18(16)J9
34	XJ401-A	TB401-8	MWC18(16)J9
35	XJ401-G	TB401-9	MWC18(16)J9
36	XJ401-F	TB401-10	MWC18(16)J9
37	XJ401-D	SPARE	MWC22(7)J9
38	XJ401-E	GND	MWC18(16)J9

(b) Insert clock spring (12) in the saw cuts of levers (11 and 13) and place the levers and springs in position on base plate (9). Install pin screws (15) to retain the levers. Compress the levers, with the thumb and index finger until the large holes in the levers are concentric with the pin screw holes in the base plate. Install the pin screws (14) and release the levers.

4-43 VARIABLE DENSITY FILTER ATTACHMENT (See Figure 4-11)

4-44 Disassembly

(a) With a small screw driver turn the two friction screws (3) in the outer face of the eyeguard mount (2), clockwise. Then remove the eyeguard mount.

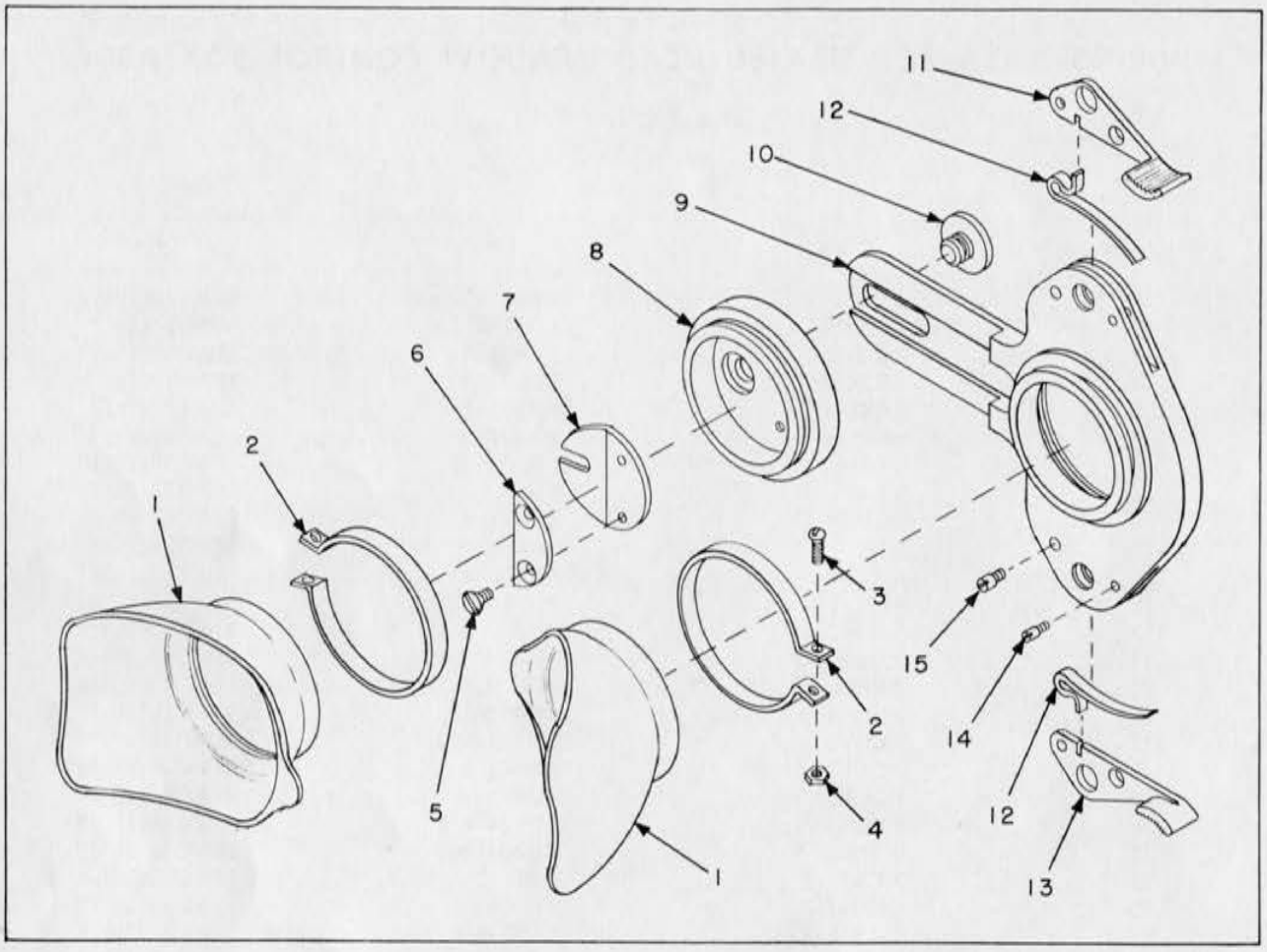


Figure 4-10 Blinder Attachment

(b) Remove the pin screws (14) and (19) to release levers (16) and (18) and springs (15).

NOTE

Levers (16) and (18) are under spring tension. Use care when removing these parts.

(c) Remove base plate (17) by using an adjustable wrench in the two shallow opposite holes in the face of socket (8). Turn the wrench and socket clockwise. When base plate (17) is free knurled sleeve (13) can be lifted off releasing spring (10).

(d) Remove friction spring (10) and screw (9 and 12).

(e) Remove face ring (4), clamp rings (7 and 12), and cradle (5). Remove filters (6 and 11).

4-45 Reassembly

Reassembly is essentially the reverse of disassembly.

(a) Insert springs (15) in the saw cuts of levers (16 and 18) and place the levers and springs in position on base plate (17). Install pin screws (14) to retain the levers. Compress the levers, with the thumb and index finger until the large holes in the levers are concentric with the pin screw holes in the base plate. Install pin screws (19) and release the levers.

(b) Clean the two polarizing filters (6) and (11) and place them in each clamp ring and with their axis marks facing the eyepiece.

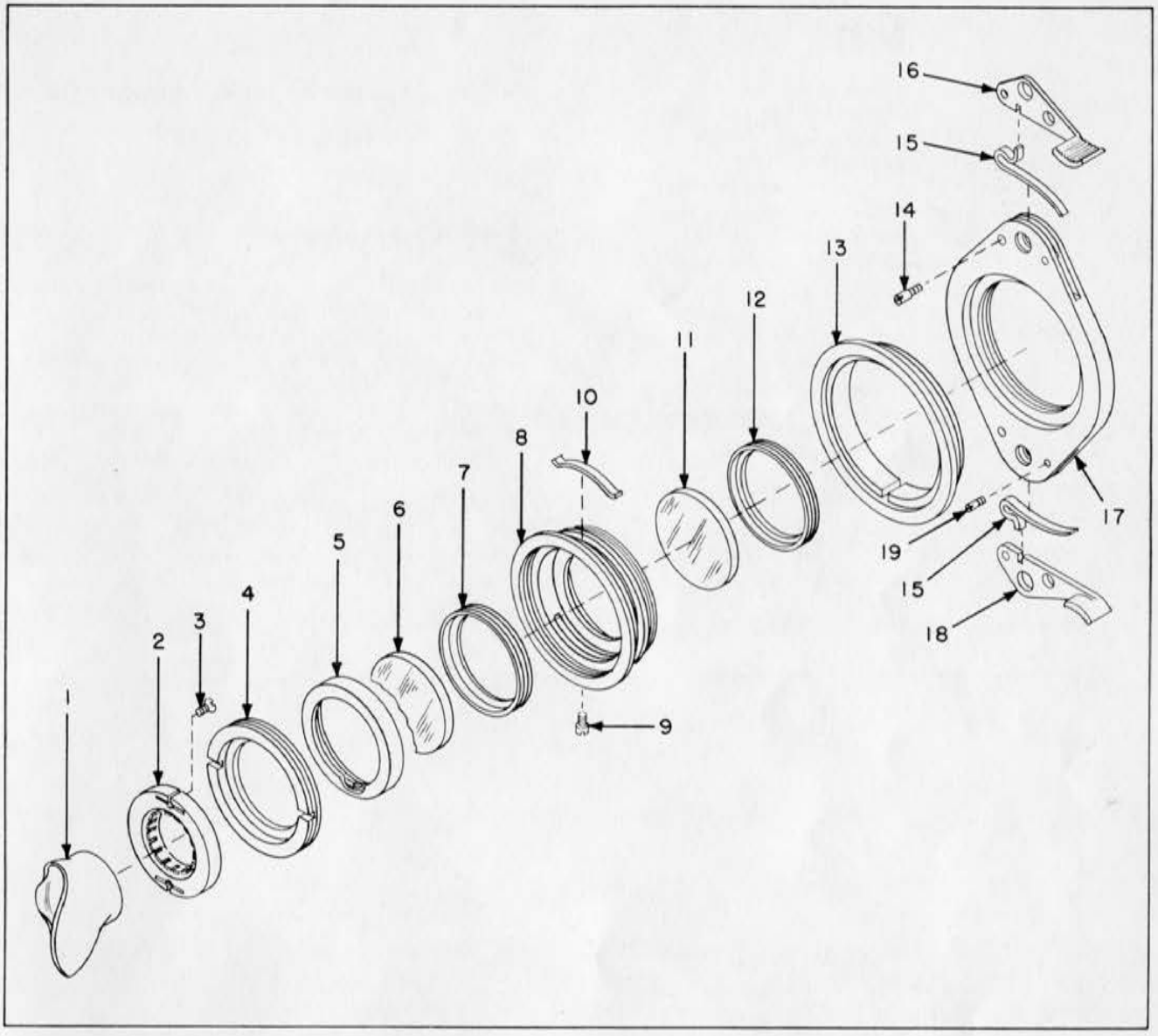


Figure 4-11 Variable Density Filter Attachment

(c) Turn clamp ring (12) and filter (11) in the socket housing and tighten snugly against the counterbored seat.

(d) Turn clamp ring (7) and filter (6) in cradle (5) and tighten snugly against the counterbored seat. Place the assembled cradle and filter in socket housing (8).

(e) Insert driving screw (9) through the 90° radial slot in socket housing (8) and screw it into the tapped hole in cradle (5). Place the spring (10) in the 45° radial recess slot in socket housing (8).

(f) Insert socket housing (8) in sleeve (13). This is done by engaging screw (9) in the key way of sleeve (13), and pressing spring (10) inward while pressing socket housing (8) downward.

(g) Screw the assembled socket housing (8) into base plate (17).

NOTE

1- Check that the axis marks of filter (11) are parallel to the vertical centerline of base plate (17). 2- With the knurled sleeve (13) turned to its complete CCW position the axis marks of filter (6) should be parallel with the vertical centerline of base plate (17). This is the position of maximum light transmission.

(h) Turn face ring (4) into socket housing (17) and tighten snugly.

(i) Place the eyeguard (1) and mount (2) in face ring (4) and secure with two screws (3).

NOTE

Eyeguard (1) is crimped in place. Should replacement be necessary the prongs of eyeguard mount (2) must be straightened. Once this is accomplished the new eyeguard may be installed and crimped in place.

4-46 Eyepiece Electrical Supply Circuit. (See figure 4-12.)

4-47 Disassembly

Disassembly of the eyepiece electrical supply circuit is shown clearly in Figure 4-12. The electrical connector shown in the wiring diagram forms a part of the periscope hermetic seal and should not be disturbed. The wire leads may be unsoldered or resoldered, from the connector pins if replacement is necessary.

4-48 Reassembly.

Reassembly is the reverse of disassembly. Make certain that contact (6) rides freely in insulator cap (2). Any binding that is not overcome by the spring load will result in a poor contact or none at all.

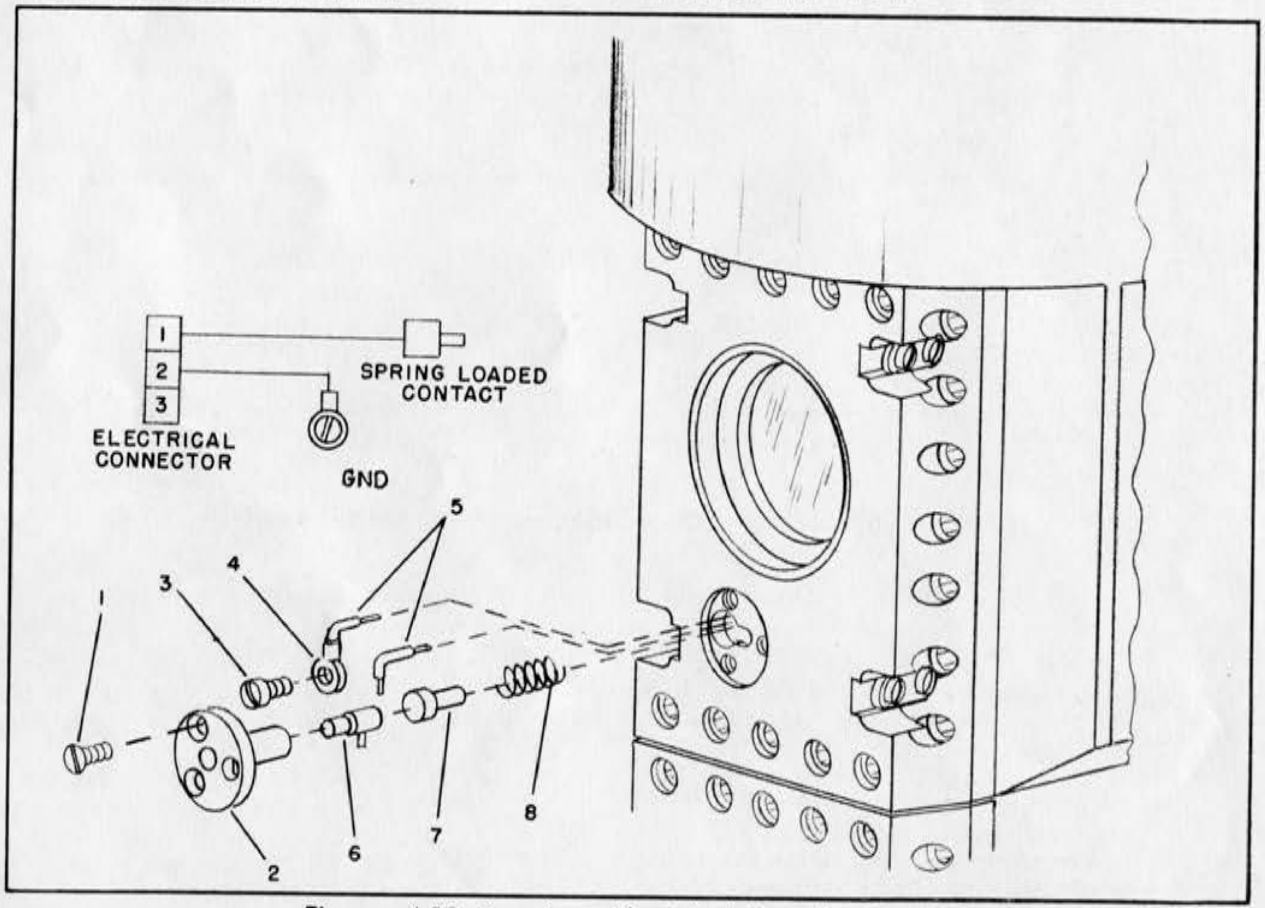


Figure 4-12 Eyepiece Electrical Supply Circuit.
(See Section V for Legend and Parts Information)

Table 4-3
TROUBLE SHOOTING CHART

Trouble	Probable Causes	Remedy
External Head Window Fogging	Heater (HR202) not energized	Use EMERGENCY HEAT switch (S402) to energize the heater. 1. If the heater becomes energized the trouble probably lies with relay (K401). Insert the spare relay in the circuit. If this does not correct the trouble thermostat (S202) or heater (HR202) may be faulty. Repairs to thermostat (S202) or heater (HR202) can not be made without breaking the hermetic seal and should not be performed on-board ship. 2. If the heater does not become energized check the following: a. Fuse (F401) b. Supply voltage (115V, 1Ø, 60 $\sim$) c. Transformer (T-402). Voltage across leads 1 and 2 energize relay (K401) and should be 24VAC. Voltage across leads 1 and either 3, 4 or 5 should be 45± 5 VAC.
External eyepiece window fogging	Heater (HR201) not energized	Check stadimeter scale illumination. 1. If stadimeter scale is illuminated (with the rheostat turned on) the trouble lies in the eyepiece heater circuit. Remove the eyepiece and faceplate assembly and check resistance of heater (HR201). Reading should be approximately 2 ohms. If the heater (HR201) checks out - look for broken wires and/or loose terminals in the circuit. 2. If the stadimeter scale is not illuminated the trouble probably lies in fuse (F-402) or transformer (T401). The voltage across pins F and G of XJ401 (on control box) should be 6VAC.
H.P. or L.P. index lamps not working	Faulty pilot lights	Replace pilot lights
	Open circuit	Check wiring for continuity. Refer to figure 2-3, 4-6 and 4-9.
	Switch (S201, figure 2-3) inoperative	Not within the scope of this manual. Repairs must be performed by maintenance repair facility.
Internal fogging	Loss of gas pressure. (See paragraph 2-7 and 4-2)	Stuffing box seals leaking. (See paragraph 4-3)

TABLE 4-3 TROUBLE SHOOTING CHART (Cont)

Trouble	Probable Causes	Remedy
Periscope out of focus	Focusing knob plunger dis-engaged.	With plunger dis-engaged crank focusing knob CW several turns until a stop is contacted. Diopter scale should read 1.5 diopters. Engage plunger. Refer to paragraphs 4-21 through 4-24.
	Mechanical linkages within periscope are faulty.	Not within scope of this manual. Repairs must be performed by maintenance repair facility.
Altiscope not operating properly	Faulty left training handle assembly.	Remove left training handle assy. and inspect for faulty parts. See paragraphs 4-9 through 4-15.
	Mechanical linkages within periscope are faulty.	Not within scope of this manual. Repairs must be performed by maintenance repair facility.
Can not change power	Faulty right training handle assembly	Remove right training hand assy. and inspect for faulty parts. See paragraphs 4-16 through 4-20.
	Mechanical linkages within periscope are faulty.	Not within scope of this manual. Repairs must be performed by maintenance repair facility.
Stadimeter split lens inoperative	Stadimeter range knob mechanical linkages are faulty.	Remove stadimeter dial and drive assembly and inspect for faulty parts and gear mesh. Trouble probably lies with items 86 thru 95, 99 thru 110 and/or 55 thru 64, figure 4-7. Refer to paragraphs 3-3e and 4-28 thru 4-36.
	Mechanical linkages within periscope are faulty.	Not within scope of the manual. Repairs must be performed by maintenance repair facility.
Stadimeter in-out mechanism inoperative	Stadimeter in-out mechanical linkages are faulty.	Remove stadimeter dial and drive assembly and inspect for faulty parts and/or gear mesh. Trouble probably lies with items 79 thru 85, 96 thru 98, 42 thru 53 and/or 65 thru 74, figure 4-7. Refer to paragraphs 3-3e and 4-28 thru 4-36.
	Mechanical linkages within periscope are faulty.	Not within scope of the manual. Repairs must be performed by maintenance repair facility.

SECTION 5

PARTS LIST

5-1 GENERAL

The following Parts Tabulations have been prepared for use with the exploded view illustrations shown in Section IV. If replacement parts are required (not carried under on-board spares) locate the part and its figure and index number on the illustration and refer to this section for description and part number information. A parts tabulation to cover miscellaneous parts serviceable onboard the submarine is included at the end of the parts lists. These parts are not shown on any illustrations. They can be easily located by the description given. Immediately following the parts tabulation is a list of special tools used for maintenance purposes.

FIGURE 4-2. LEFT TRAINING HANDLE ASSEMBLY, (D-566.85) (FSN PR2040-896-6652)

Index No.	Nomenclature	Qty. Reqd.	Part No.	On-Bd Spare	Federal Stock Numbe:	Index No.	Nomenclature	Qty. Reqd.	Part No.	On-Bd Spare	Federal Stock Number
1	Nut	1	P-2499-584	1	PS5310-896-6731	23	Bracket	1	D-547.377		
2	Washer	1	A-547.413	1	P3120-806-4316	24	Bushing	2	A-566.67		
3	Ball Plunger	1	A-547.412	1	PS2040-896-6506	25	Ring, Retaining	1	P-2499-528	1	PS5340-896-6729
4	Grip	1	B-547.781		PS2040-896-9521	26	Washer, Thrust	3	A-547.551	1	P3120-752-7893
5	Ring, Altiscope	1	B-566.74	1	PS2040-896-6551	27	Roller	2	A-547.409		PS3120-892-1892
6	Screw	1	P-1523-7	1	PS2040-896-6757	28	Bearing	2	A-547.407		PS3120-892-1898
7	Washer	1	A-547.783		PS2040-896-6801	29	Shaft	1	A-547.408		PS2040-896-6456
8	Detent Bushing	1	A-547.370		PS2040-892-1896	30	Screw	6	A-302.6C4-6	3	PS2040-896-6691
9	Key, Woodruff	1	A-547.661	1	P5315-808-0046	31	Cover	1	C547.372		
10	Shaft, Control	1	B-547.402		PS2040-896-6587	32	Screw, Special	4	A-547.663	2	P5305-808-0750
11	Screw	2	AN505C416-10			33	Pin, Dowel	2	MS16555-620	2	P5315-806-7040
12	Cap	2	A566.68		PS2040-896-6651	34	Washer, Lock	4	A-302.3-4	2	P5310-725-6828
13	Ring, Retaining	2	P-2499-530			35	Block	1	A-547.404		P2040-896-6728
14	Pin, Pivot	2	A-566.66		P2040-896-6454	36	Spring, Leaf	1	C-547.405	1	P2040-778-0677
15	Bearing	1	A-547.399		PS2040-896-6588	37	Hinge	1	D-566.70		
16	Washer, Thrust	1	A-547.553	1	P5330-806-4312	38	Washer, Thrust	1	A-547.552	1	P5330-806-4311
17	Pin, Taper	1	A-302.1-6	1	P5315-806-3981	39	Ring, Stop	1	B-566.71		PS2040-896-6501
18	Collar Shaft	1	A-547.398		PS2040-896-6730	40	Pin, Dowel	1	MS16555-625		
19	Spring	1	A-547.397	1	P2040-777-4173	41	Screw	3	AN505C2-5		
20	Gear, Bevel	1	P-1157-6		P3020-468-8149	42	Ring, Stop	1	B-566.72		PS2040-896-6500
21	Screw	1	A-547.555		PS2040-896-6427	43	Screw, Set	1	P-2497-235		
22	Gear, Bevel	1	P-1157-5		P3020-468-8184	44	Screw	1	A-302.6C2-3		

FIGURE 4-3. RIGHT TRAINING HANDLE ASSEMBLY, (D-566.84) (FSN PR2040-896-6653)

Index No.	Nomenclature	Qty. Reqd.	Part No.	On-Bd Spare	Federal Stock Number
1	Bracket	1	D-566.69		
2	Bushing	2	A-566.67		
3	Gear, Bevel	1	P-1157-5		P3020-468-8184
4	Screw	1	A-547.555		PS2040-896-6427
5	Gear	1	P-1157-6		P3020-468-8149
6	Spring	1	A-547.397	1	P2040-777-4173
7	Pin, Taper	1	A-302.1-6	1	P5315-806-3981
8	Collar, Shaft	1	A-547.398		PS2040-896-6730
9	Washer, Thrust	1	A-547.553	1	P5330-806-4312
10	Bearing	1	A-547.399		PS2040-896-6588
11	Pin, Pivot	2	A-566.66		PS2040-896-6454
12	Ring, Retaining	2	P-2499-530		
13	Cap	2	A-566.68		PS2040-896-6651
14	Screw	2	AN505C416-10		
15	Hinge	1	D-566.70		
16	Pin, Dowel	1	MS16555-625		
17	Washer, Thrust	1	A-547.552	1	P5330-806-4311
18	Shaft	1	B-547.402		PS2040-896-6587
19	Key, Woodruff	1	A-547.661	1	P5315-808-0046
20	Washer	1	A-547.783		PS2040-896-6801
21	Screw	2	AN505C2-8		
22	Nut	1	P-2499-584	1	PS5310-896-6731
23	Washer	1	A547.413	1	P3120-806-4316
24	Grip	1	B-566.119		PS2040-896-6654
25	Screw	1	P-1523-7	1	PS2040-896-6757
26	Ring, Power Change	1	A-566.75		PS2040-896-6655
27	Screw	1	AN505C2-6		
28	Ring, Stop	1	B-566.73		PS2040-896-6550
29	Block	1	A-547.404		PS2040-896-6728
30	Pin, Dowel	2	MS16555-620	2	PS5315-806-7040
31	Washer, Lock	4	A-302.3-4	2	P5310-725-6828
32	Screw, Special	4	A-547.663	2	P5305-808-0750
33	Screw	6	A-302.6C4-6	3	PS2040-896-6691
34	Cover	1	C-547.372		
35	Spring, Leaf	1	C-547.405	1	P2040-778-0677
36	Shaft, Cam Follower	1	A-547.408		PS2040-896-6456
37	Roller	2	A-547.409		PS3120-892-1892
38	Bearing	2	A-547.407		PS3120-892-1898
39	Washer, Thrust	3	A-547.551	1	P3120-752-7893
40	Ring, Retaining	1	P-2499-528	1	PS5340-896-6729

FIGURE 4-4. FOCUSING KNOB ASSEMBLY, (C-547.600) (FSN P2040-777-8229)

Index No.	Nomenclature	Qty. Reqd.	Part No.	On-Bd Spare	Federal Stock Number
1	Screw	6	AN505C-4-3	6	G5305-543-5064
2	Retainer	1	A-547.584		PS2040-897-4148
3	Stop, Focusing	1	A-547.587		PS2040-896-6510
4	Nut, Focusing	1	A-547.585		PS2040-896-6422
5	Stop, Camera	1	A-547.586		PS2040-896-6511
6	Shaft, Focusing	1	A-547.604		PS2040-740-1002
7	Housing	1	B-547.588		
8	Sleeve	1	A-547.589		
9	Scale, Diopter	1	A-547.591		PS2040-896-6758
10	Screw, Set	1	P-2497-235	1	P5305-806-7032
11	Pin, Dowel	1	P-2499-130		
12	Knob, Focusing	1	B-547.590		PS2040-896-9527
13	Nut	1	A-547.597	1	P5310-806-7030
14	Ring, Retaining	1	P-2499-529	1	PS5340-896-6733
15	Pin	1	A-547.594		PS5315-823-8689
16	Handle	1	A-547.593		PS2040-897-4153
17	Arm	1	A-547.592		PS2040-896-6509
18	Spacer	1	A-547.595		PS5340-892-1902
19	Spring	1	A-547.596	1	PS5340-724-3575
20	Pin	1	A-547.619		PS5315-823-8685
21	Pin, Dowel	1	P-2499-130		
22	Screw, Set	1	P-2497-332	1	P5305-806-7033
23	Pin, Dowel	1	MS16555-602		
24	Pin, Dowel	1	MS16555-604		
25	Knob, Release	1	A-547.599		PS2040-896-9526
26	Plunger	1	A-547.598, Rev. A		PS2040-896-6665
27	Sleeve	1	A-547.601		PS2040-896-6732
28	Spring	1	A-547.602	1	P2040-778-6387
29	Washer	1	G-43-W-4303	1	G5310-187-4122
30	Ring, Retaining	1	P-2499-426	1	P5340-200-5454
31	Pin, Dowel	1	MS16555-622		

FIGURE 4-5. EYEPIECE AND FACEPLATE ASSEMBLY, (D-547.741)** (FSN PR2040-777-8231)

Index No.	Nomenclature	Qty. Reqd.	Part No.	On-Bd Spare	Federal Stock Number
1	Faceplate Assy	1	*		
2	Eye Lens, Flint	1	B-547.202		PR2040-896-9467
3	Ring, Lock	1	A-547.725		PS2040-896-9465
4	Ring, Lock	1	A-547.727		PS2040-896-6647
5	Eyepiece Field Lens	1	B-547.200		P2040-731-1646
6	Eye Lens, Crown	1	B-547.201		PR2040-896-9466
7	Rod, Plunger	2	A-547.723		PS2040-896-6645
8	Bushing	2	A-547.724		PS2040-896-6644
9	Knob	2	P-1438-4		PS5355-538-2551
10	Screw, Set	2	P-1506-57	2	PM5305-272-6198
11	Spring	2	P-1438-5		PM5340-468-8051
12	Plunger, Ball	2	A-547.742		PS2040-896-6649
13	Knob	1	A-547.721		NSI
14	Screw	3	P-2497-630	3	PF5305-274-0397
15	Pin, Anchor	2	P-1513-5		PM5315-468-8053
16	Adapter, Eyeguard	1	C-547.732		PS2040-896-9468
17	Ball	2	A-547.743	2	P3110-777-8294
18	Disc	2	A-547.744		PS2040-823-5106
19	Washer, Thrust	2	A-547.745	2	P2040-777-8237
20	Spring	2	A-547.746	2	P5340-777-8239
21	Screw	2	P-2497-803		
*	Consists of the following items encapsulated in resin to form a permanent assembly.				
	Heater Wire	1	A-547.556		PS2040-896-9469
	Faceplate	1	D-547.714		
	Contact Mount	1	A-547.715		NSI
	Contact	1	A-547.716		PS2040-896-9471
	Contact Lug	1	A-547.717		KZ9535-232-6887
	Sleeve	1	A-547.718		PS2040-896-6643
	Ring, Lock	1	A-547.726		PS2040-896-6646
	Mount, Eyepiece	1	D-547.731		PR2040-896-9524
	Screw	1	P-2497-88		
	Lug, Terminal	1	P-2499-336		PS2040-896-9525
	Rivet	1	P-2499-398		
**	Supplied as On-Board Spare.				

FIGURE 4-7. STADIMETER DIAL AND DRIVE ASSEMBLY, (F-566.368) (FSN PR2040-863-8030)

Index No.	Nomenclature	Qty. Reqd.	Part No.	On-Bd Spare	Federal Stock Number
1	Screw	2	A-302.9C8-14		
2	Knob	2	A-566.362		P2040-863-8037
3	Ring, Indicator	1	C-566.284		PR2040-896-6474
4	Retainer, Bearing	1	C-566.295		PS2040-896-6565
5	Light, Indicator	6	A-566.100	2	PS2040-896-6802
6	Cover	6	A-566.364		NSI
6A	Screw	12	AN500C4-10		
6B	Clip	12	A-566.361		P2040-863-8036
7	Lamp, Incandescent	6	MS25237-328		G6240-155-7857
8	Dial, Height	1	D-566.110		PR2040-896-6769
9	Screw	4	A-302.6C6-4		
10	Screw, Dowel	2	A-566.320		PS2040-896-6433
11	Screw	2	A-302.6C6-6		
12	Clamp, Wire	2	P-50012-201		PS2040-896-6423
12A	Pin, Dowel	2	MS16555-668		
12B	Pin, Dowel	1	A-566-370		
13	Pin, Dowel	1	MS16555-625		
14	Mount, Stadimeter Dial	1	F-566.115		PR2040-896-6530
15	Fitting, Lubrication	1	A-566.325	1	9C4730-172-0040
16	Washer	4	P-2498-202	4	PS2040-896-6670
17	Screw	4	P-2497-851	4	PS2040-896-6671
18	Ring, Retaining	4	P-2499-448		
19	Screw	4	A-302.6C8-7		
20	Gear, Internal	1	B-566.281		PS2040-896-6767
21	Pin, Dowel	1	MS16555-625		
22	Screw	6	A-302.6C4-12		
23	Mount, Bearing & Gear	1	C-566.285		PR2040-896-6566
24	Screw	8	A-302.7C4-5		
25	Retainer, Bearing	1	B-566.296		PR2040-896-6531
26	Bearing, Ball	1	A-566.292		PS3110-897-2942
27	Spacer Inner Race	1	A-566.294		PS2040-897-4142
28	Spacer, Outer Race	1	A-566.293		PS2040-896-6698
29	Bearing, Ball	1	A-566.292		PS3110-897-2942
30	Screw	4	A-302.6C6-4		
31	Dial, Range	1	D-566.107		PR2040-896-6568
32	Screw, Dowel	2	A-566.320		PS2040-896-6433
33	Screw	4	AN500C4-6		
34	Washer Lock	4	MS35337-78		
35	Washer	4	G-43-W-4302		
36	Block, Terminal	1	A-566.319		NSI
37	Mount, Term. Block	1	A-566.98		NSI
38	Screw	2	A-302.6C8-6		
39	Screw	5	A-302.9C8-10		
40	Pin, Anchor	2	P-1513-5		PM5315-468-8053

FIGURE 4-7. (Cont'd.) STADIMETER DIAL AND DRIVE ASSEMBLY, (F-566.368) (FSN PR2040-863-8030)

Index No.	Nomenclature	Qty. Reqd.	Part No.	On-Bd Spare	Federal Stock Number
40A	Plate, Caution	1	A-566.343		
40B	Screw, Drive	2	P-1873-3		
41	Housing, Stad. Drive	1	D-566.114		
*42	Coupling, Oldham	1	A-566.323		PS2040-896-6763
43	Pin, Taper	1	A-302.1-5		
44	Shaft	1	A-566.324		PS2040-892-2621
45	Screw	4	A-302.9C8-8		
46	Retainer, Dowel Pin	1	P-2499-55		PS2040-896-6738
47	Bearing, Flanged	2	A-554.165		PS3110-897-2950
48	Retainer, Dowel Pin	1	P-2499-54		PS2040-896-6737
49	Gear, Helical	1	C-302.10-26		PS2040-896-6685
50	Pin, Taper	1	A-302.1-5		
51	Bracket, Bearing	1	C-566.163		PS2040-896-6567
52	Pin, Slip Dowel	2	P-2499-6		
53	Ring, Retaining	1	P-2499-411		
54	Harness Assy. Upper	1	C-566.328	1	PS2040-896-6700
*55	Coupling, Oldham	1	A-566.323		PS2040-896-6763
56	Pin, Taper	1	A-302.1-5		
57	Bearing, Flanged	2	A-566.321		Ƶ3110-679-6792
58	Screw	6	A-302.9C8-8		
59	Retainer, Dowel Pin	2	P-2499-54		PS2040-896-6737
60	Pin, Dowel	2	P-2499-6		
61	Mount, Bearing	1	B-566.103		PS2040-896-6569
62	Gear, Bevel	1	B-566.303		PS2040-892-2522
63	Pin, Taper	1	A-302.1-6		
64	Pinion	1	A-566.106		PS2040-896-6570
65	Gear, Helical	1	C-302.10-26		PS2040-896-6685
66	Pin, Taper	2	A-302.1-5		
67	Spacer	2	A-566.306		PS3120-892-1904
68	Bearing, Flanged	2	A-544.165		PS3110-897-2950
69	Bracket, Bearing	1	B-566.111		PS2040-896-6534
70	Shaft	1	D450-16-9		
71	Gear, Bevel	1	B-566.304		PS2040-892-2536
72	Screw	4	A-302.9C8-8		
73	Retainer, Dowel Pin	2	P-2499-54		PS2040-896-6737
74	Pin, Dowel	2	P-2499-6		
75	Gasket, Plug	2	A-566.311	2	PS2040-896-6765
76	Plug	2	A-566.308		PS2040-896-6533
77	Gasket, Plug	1	A-566.310		PS2040-896-6766
78	Plug	1	A-566.309		PS2040-896-6532
79	Lever	1	B-566.353		P2040-863-8032
80	Screw	2	A-302.7C6-4		
81	Band, Cover	1	A-566.283	1	PS2040-896-6518
82	Guide, Lever	1	B-566.267		PS2040-896-6519
83	Screw	2	P-2497-375		
84	Washer	1	MS35337-81		G5310-209-1235
85	Ball, Lever	1	A-566.240		PS2040-896-6521
86	Pin, Taper	1	A-302.1-5		
87	Gear, Bevel	1	B-566.304		PS2040-892-2536
88	Ring, Retaining	1	P-2499-411		
89	Bearing, Ball	1	A-566.252		PS3110-897-2945
90	Pin, Taper	2	A-302.1-6		
91	Stop	1	A-566.253		NSI
92	Nut, Stop	1	A-566.254		NSI
93	Stop	1	A-566.255		NSI
94	Shaft	1	B-566.242		PS2040-896-6762
95	Key	1	P-2499-301		PS5315-230-6245
96	Bearing	1	A-566.326		G3110-142-4333
97	Mount, Bearing	1	B-566.282		PS2440-896-6697
98	Bearing	1	A-566.322		R3110-293-9225
99	Bearing	1	A-566.256		PS3110-897-2944
100	Spacer	1	A-566.266		PS2040-897-4155
101	Spacer	1	A-566.265		PS5310-823-8671
102	Bearing	1	A-566.263		PS3110-897-2948
103	Lockring, Split	1	A-566.271		PS2040-896-6522
104	Screw, Set	1	A-302.5F4-3		
105	Spacer	1	A-566.352		P2040-896-6701
106	Cover	1	B-566.354		P2040-863-8033
107	Screw	6	A-302.6C4-3		
108	Knob	1	B-566.355		P2040-863-8035
109	Handle	1	A-566.241		PS2040-896-6761
110	Nut	1	A-566.356		P2040-863-8034
111	Pin	1	MS16555-615		
112	Screw	1	A-302.6C6-5		
113	Cover Assy	1	**No number		
	Harness, Lower	1	C-566.329	1	PS2040-896-6701

* Consist of 1/2 of Oldham coupling A-566.323. The other 1/2 is located on bottom of Eye-piece Box.

** Consists of B-566.363, A-566.360, A-566.365 and A-566.359. Rivited into a semi-permanent assembly.

FIGURE 4-8. HEATED HEAD WINDOW CONTROL BOX ASSEMBLY, (F-566.9) (FSN PR2040-896-6582)

Index No.	Nomenclature	Qty. Reqd.	Part No.	On-Bd Spare	Federal Stock Number
1	Control Box	1	F-566.162		
2	Fuse Post	2	A-575.23		NSI
3	Fuse, 3 Amp	3	MS90079-2-1		
4	Light, Pilot	3	P-3049-8		P6210-299-4040
5	Lamp, Glow (Neon)	3	G17-L-6806-130		G6240-223-9100
6	Nut, Wing	1	AN350-1032		
7	Washer	1	MS35337-81		
8	Washer	1	G43-W-4305		
9	Plate, Mounting	1	D-566.169		NSI
10	Screw	8	AN505C10-8	4	G5305-271-6308
11	Switch, Rotary	2	P-3495-4	2	P5930-611-6484
12	Screw	2	AN500C4-6		
13	Washer	2	MS35337-78		
14	Washer	4	G43-W-4302		
15	Lamp, Incandescent	6	AN3140-328		G6240-155-7857
16	Fuse, 1 Amp	3	MS90079-1-1		
17	Clip Mounting Assy	1	B-566.178		NSI
*18	Nylon Stuffing Tube	1	9000-S6202-F74385-2D		NSI
19	Bezel, Window	1	B-566.175		PS2040-896-6695
20	Screw	3	AN505C10-10		
21	Locknut	3	P-2499-585		
22	Gasket, Window	2	A-566-174		PS2040-892-2509
23	Window	1	A-566.173		G9330-292-9810
24	Screw	6	AN505C6-4		
25	Handle, Folding	1	B-554.401		PS2040-896-6690
26	Switch, Push Button	1	P-2738-6	1	P5930-258-1970
27	Nut, Cap	4	P-2499-586		
28	Screw	4	AN500C8-8		
29	Upper Wiring Harness Assembly	1	B-566.212		PS2040-896-6440
30	Screw	4	P-1873-3		G5305-531-9520
31	Screw	2	P-2497-420		
32	Washer	2	MS35337-80		
33	Washer	2	G43-W-4304		
34	Terminal Board	1	A-5940-500-5379		N5940-500-5379
35	Lower Wiring Harness Assembly	1	B-566.213		PS2040-896-9477
36	Screw, Captive	3	A-566.176	3	PS2040-894-7035
37	Nameplate	1	A-566.208		NSI
38	Clamp, Relay	1	A-566.172		PS2040-896-6442
39	Socket, Octal	2	P-3686-5		N5935-227-8756
40	Transformer, Power	1	B-554.337		P5950-530-3820
41	Screw	1	P-2496-554		
42	Lock Nut	8	P-2499-557		
43	Screw	4	AN500C4-6		
44	Bracket, Upper	1	B-566.177		
45	Relay	2	A-566.181		PS5945-894-7042
46	Transformer, Pwr	1	P-3692-3		P5950-581-8462
47	Bracket, Transformer	2	B-566.171		NSI
48	Screw	4	AN500C4-6		
49	Locknut	4	P-2499-578		
50	Strap, Ground	1	P-3684-7		
*	Danielson Mfg. Co.				

FIGURE 4-10. BLINDER ATTACHMENT, (P-2505-1) (FSN PF2040-369-2016)

Index No.	Nomenclature	Qty. Reqd.	Part No.	On-Bd Spare	Federal Stock Number
1	Eye Guard	2	B-576-30	2	PS2040-896-6688
2	Clamp, Eyeguard	2	944621 (Bu-ord)	2	Z5340-382-1710
3	Screw	2	Part of index no. 2		
4	Nut	2	Part of index no. 2		
5	Screw	2	P-1506-59	2	
6	Plate Clamp	1	P-2505-2		PS2040-703-7306
7	Spring, Leaf	1	P-2505-5	1	PM5340-369-2376
8	Retainer, Blinder	1	P-2505-4		
9	Plate, Base	1	P-2505-6		
10	Stud	1	P-2505-3		PM5315-664-9704
11	Lever, Left	1	P-1414-4		PM3040-468-8232
12	Spring, Clock	2	P-1414-5	2	PF5340-468-8056
13	Lever, Right	1	P-1414-3		PM3040-468-8231
14	Pin, Screw	2	P-1416-5	2	PF5305-468-8057
15	Pin, Screw	2	P-1416-6	2	PF5305-468-8058

FIGURE 4-11. VARIABLE DENSITY FILTER ATTACHMENT, (P-1415-1) (FSN PM2040-468-8164)

Index No.	Nomenclature	Qty. Reqd.	Part No.	On-Bd Spare	Federal Stock Number
1	Eye Guard	1	P-1417-1		PS2040-468-8068
2	Mount, Eyeguard	1	P-1416-7		
3	Screw	2	P-1416-8		PM5305-206-5331
4	Ring, Face	1	P-1416-2		NSI
5	Cradle	1	P-1415-3		PS2040-896-6429
6	Filter, Polaroid	1	P-1415-6		
7	Ring, Clamp	1	P-1415-2		PM5340-290-1514
8	Housing, Socket	1	P-1416-3		P2040-792-6493
9	Screw	1	P-1415-4		PS2040-896-6430
10	Spring, Friction	1	P-1416-4		PS5340-294-7428
11	Filter, Polaroid	1	P-1415-6		PM2040-586-3729
12	Ring, Clamp	1	P-1415-2		
13	Sleeve, Actuating	1	P-1415-5		
14	Screw, Pin	2	P-1416-6		PF5305-468-8058
15	Spring, Clock	2	P-1414-5		PF5340-468-8056
16	Lever, Left	1	P-1414-4		PM3040-468-8232
17	Plate, Base	1	P-1416-1		
18	Lever, Right	1	P-1414-3		PM3040-468-8231
19	Screw, Pin	2	P-1416-5		PF5305-468-8057

FIGURE 4-12. EYEPIECE ELECTRICAL SUPPLY CIRCUIT.

Index No.	Nomenclature	Qty. Reqd.	Part No.	On-Bd Spare	Federal Stock Number	Index No.	Nomenclature	Qty. Reqd.	Part No.	On-Bd Spare	Federal Stock Number
1	Screw	3	AN505C6-6			6	Contact	1	A-547.720		
2	Cap, Insulator	1	A-547-719			7	Guide	1	A-547.722		
3	Screw	1	A500C4-3			8	Spring	1	A-547.728		
4	Terminal	1	P-2499-337								
5	Wire	As Reqd.	EE#22/ MIL-W-16878								

MISCELLANEOUS PARTS TABULATION

Part No.	Description	Qty.	On-Board Spare	Federal Stock Number
Attaching parts for training handles				
P-2498-442	Screw	8	4	G5305-655-6266
P-2470-6	Washer	8	4	P5310-271-8514
P-2499-199	Pin, Dowel	4	2	
A-547.414	Stop	4	4	P2040-777-8213
Attaching parts for focusing knob assembly				
A302.4C10-12	Screw	6	3	G5305-227-1019
MS35337-81	Washer	6		G5310-209-1235
MS16555-630	Pin, Dowel	2	2	
Stadimeter knob, illumination dial, and attaching parts				
A566.112	Plate, Dial	1		
AN500C4-3	Screw	4		
A566.129	Knob	1		
MS35337-78	Washer	1		
AN500C4-7	Screw	1		

LIST OF SPECIAL TOOLS

Part No.	Description	Unit of issue	Qty.	Federal Stock Number
A-547.679	Wrench, Spanner	each	1	P5120-756-0983
B-566.333	Puller, Pivot Pin	each	1	PS2040-896-6755
P-1423-3	Wrench, Pin	each	1	P5120-338-9782
P-1423-5	Wrench, Gland	each	1	P5120-468-8117
A-566.339	Bearing Retainer Tool, Stadimeter	each	1	PS2040-896-6702
C-566.344	Cap, Shipping	each	1	