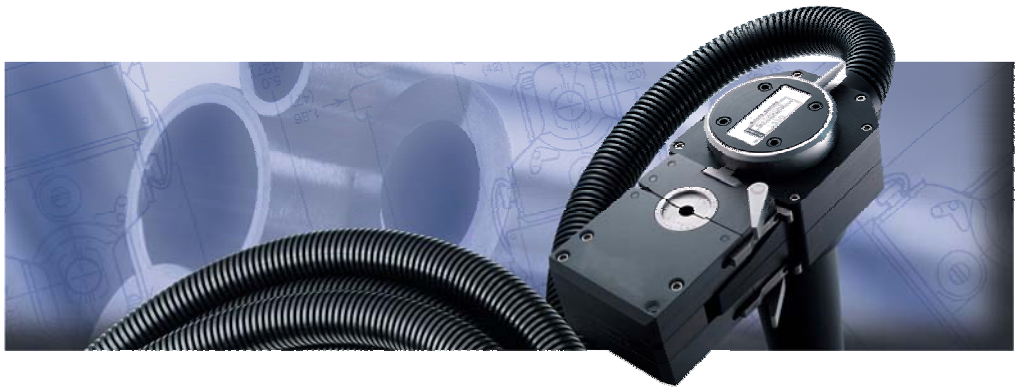
SERIES 5 WELD HEAD



USER'S MANUAL

Swagelok®

The Swagelok Limited Lifetime Warranty

Swagelok hereby warrants to the purchaser of this Product that the non-electrical components of the Product shall be free from defects in material and workmanship for the life of the Product. All electrical components installed in or on the Product are warranted to be free from defects in material and workmanship for twelve months from the date of purchase.

The purchaser's remedies shall be limited to replacement and installation of any parts that fail through a defect in material or workmanship.

MANUFACTURER SPECIFICALLY DISAVOWS ANY OTHER REPRESENTATION, EXPRESS OR IMPLIED, WARRANTY, OR LIABILITY RELATING TO THE CONDITION OF USE OF THE PRODUCT, AND IN NO EVENT SHALL SWAGELOK BE LIABLE TO PURCHASER, OR ANY THIRD PARTY, FOR ANY DIRECT OR INDIRECT CONSEQUENTIAL OR INCIDENTAL DAMAGES.

SERIES 5 WELD HEAD

Weld Head

The Series 5 SWS weld head delivers consistent, precise welds for outside diameters from 1/8 to 5/8 in. (3 to 16 mm).

A DC motor in the weld head drives a rotor, which carries the tungsten electrode around the weld joint. Optical circuitry in the weld head sends precise feedback to the power supply to control the speed of the rotor.

All moving parts in the weld head are mounted in low-friction devices to provide smooth, consistent operation.

A spring-loaded, floating brush continuously contacts approximately one-third of the circumference of the rotor. This configuration ensures consistent, uniform electrical conductance to the rotor and electrode.

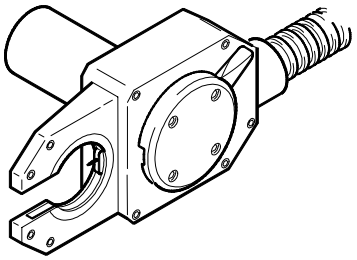


Figure 1 Series 5 Weld Head

Fixture Block

The Series 5 SWS fixture block accurately aligns and holds tubing, fittings, and valve bodies. The modular design allows you to select different side plates and create the configuration needed for the job.

The fixture block is separate from the weld head, allowing work pieces to be easily aligned and fixtured before welding. Using multiple fixture blocks can increase productivity.

Each fixture block is designed to accommodate a range of work piece sizes. A unique and patented Universal Collet Insert (UCI) fits into the fixture block to match the diameter of the work piece. The collet design firmly holds tubing and fittings that vary ± 0.005 in. (0,13 mm) from nominal outside diameter. The collets exchange quickly, making the fixture block very adaptable to changing work requirements.

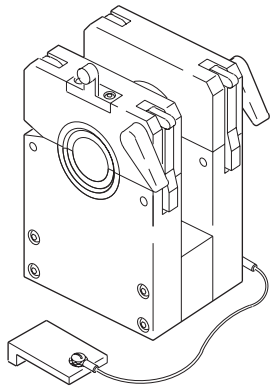


Figure 2 Series 5 Fixture Block

Unpacking the Weld Head Components

The following weld head components are packaged in a foam-lined shipping container:

- weld head
- arc gap gage
- electrode package
- tool package.

Perform the following steps when your Swagelok Series 5 weld head arrives:

1. Inspect the container for damage.
2. Remove the components from the container.
3. Check the items for any damage.
4. Verify that the weld head serial number matches the serial number on the shipping container.
5. Record the model and serial numbers, and the delivery dates on page 7 of the *Regulatory* Module.

Installing the Weld Head

The weld head has four connectors that plug into the power supply. See Figure 3.

The four connectors on the cable are:

- fixture
- electrode (red)
- work (green)
- weld head shielding gas.

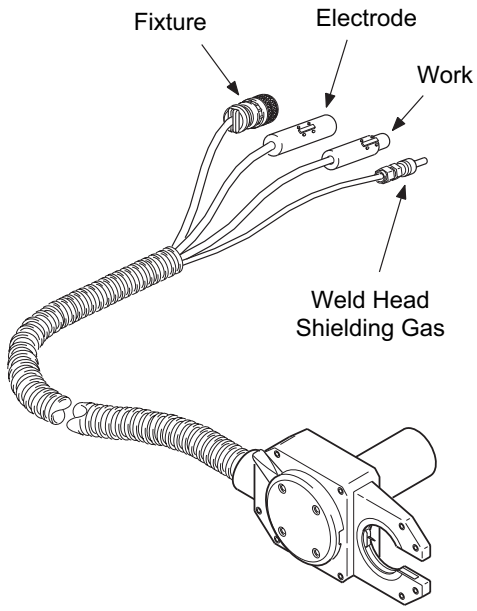


Figure 3 Weld Head

Connect the four connectors to the rear panel of the power supply by performing the following steps (see Figure 4):

1. Locate the weld head.
2. Align the notch on the multi-pin connector with the small tab in the mating socket on the rear panel labeled FIXTURE. Insert the connector in the socket. Turn the connector sleeve clockwise by hand until it is tight. This connection provides the control signals to drive the weld head.
3. Insert and fully seat the red connector into the socket on the rear panel labeled ELECTRODE. Twist the connector 1/4-turn clockwise to lock it into place. This connection is the negative (-) terminal of the weld head.
4. Insert the green connector into the socket on the rear panel labeled WORK. Twist the connector 1/4-turn clockwise to lock it into place. This connection is the positive (+) terminal of the weld head.
5. Insert the weld head shielding gas connector into the Swagelok Quick-Connect stem labeled TO WELD HEAD. Ensure that the connector is firmly attached. This connection provides shielding gas to the weld head through a solenoid valve in the power supply.

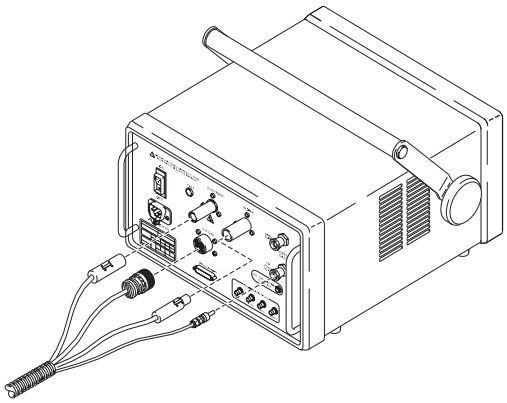


Figure 4 Weld Head Connectors

Caution!

Ensure that the fixture connector is fully seated in the mating socket and the threaded sleeve is tight.

Note:
The weld head shielding gas connector must be a single-end shut-off (SESO) Swagelok Quick-Connect stem (SS-QC4-S-400).

Installing the Electrode in the Weld Head

This Swagelok weld head comes with a selection of electrodes. The following instructions show how to properly install an electrode in the weld head.

Selecting the Proper Electrode

Electrode length and diameter depend on your weld head model and the outside diameter of the work piece being welded. To select the correct electrode, use the Electrode Selection Table.

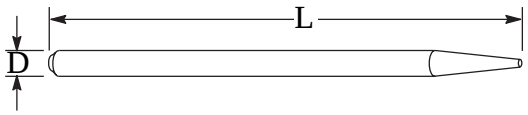


Table 1 Electrode Selection Table

Electrode Part No.	Component OD	Electrode Length (L)	Electrode Diameter (D)
CWS-C.040-.705-P	1/8 in. 3/16 in. 3 mm	0.705 in. (17,90 mm)	0.040 in. (1,02 mm)
CWS-C.040-.605-P	1/4 in. 5/16 in. 6 mm 8 mm	0.605 in. (15,37 mm)	0.040 in. (1,02 mm)
CWS-C.040-.555-P	3/8 in. 1/2 in. 10 mm 12 mm	0.555 in. (14,10 mm)	0.040 in. (1,02 mm)
CWS-C.040-.450-P	5/8 in. 15 mm	0.450 in. (11,43 mm)	0.040 in. (1,02 mm)
CWS-C.040-.405-P	16 mm	0.405 in. (10,29 mm)	0.040 in. (1,02 mm)

Electrode Geometry

This illustration shows the electrode shape Swagelok suggests. Properly ground electrodes provide consistent, repeatable welds. Pre-ground electrodes are available from your Swagelok representative. See your parts list for ordering information.

The electrode part numbers are assigned as follows:

SWS – X.### - #.### - ### - P

- **X** — Material Designator: C = Ceriated, T = Thoriated
- **###** — Electrode Diameter
- **#.###** — Electrode Length
- **###** — Tip Diameter
- **P** — Package Designator

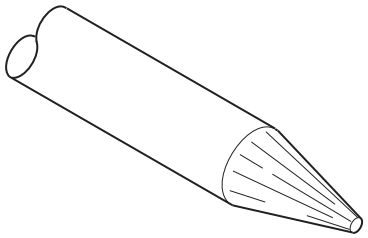
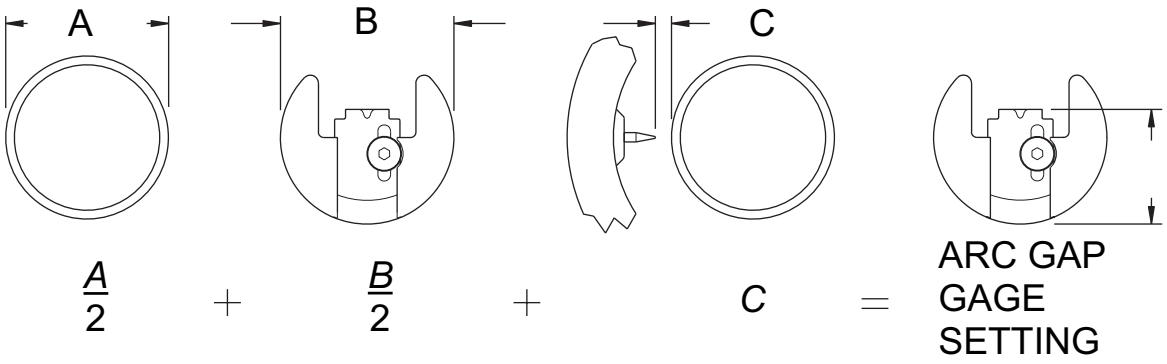


Figure 5 Tungsten Electrode

The ceriated electrode material type is a mixture of 98% tungsten and 2 % cerium and is commonly referred to as "2 % ceriated." This electrode type has demonstrated improved arc starting performance over the 2 % thoriated type, particularly when using purified shielding gas.

Calculating Arc Gap Gage Settings

To determine the arc gap gage setting for a specific arc gap, use the formula below.



Where

A = largest OD on the weld end of the tubing or fitting (welding diameter).

B = Arc gap gage diameter

C = desired arc gap

Figure 6 Arc Gap Gage Setting Formula

Example No. 1: (Series 5 Weld Head)

1/4 to 1/4 in. tube butt weld - largest outside diameter	A= 0.253 in.
Arc gap gage diameter	B= 1.244 in.
Desired arc gap	C= 0.028 in.

$$\frac{0.253 \text{ in.}}{2} + \frac{1.244 \text{ in.}}{2} + 0.028 \text{ in.} = 0.777 \text{ in.}$$

Example No. 2: (Series 5 Weld Head)

6 to 6 mm tube butt weld - largest outside diameter	A = 6,081 mm
Arc gap gage diameter	B = 31,60 mm
Desired arc gap	C = 0,71 mm

$$\frac{6{,}081 \text{ mm}}{2} + \frac{31{,}60 \text{ mm}}{2} + 0{,}71 \text{ mm} = 19{,}551 \text{ mm}$$

Setting the Arc Gap

The proper arc gap setting facilitates control of the weld and improves consistency. The following steps cover how to set the arc gap.

The arc gap is set by using the arc gap gage provided with the weld head. The gage is adjusted for the desired arc gap and then installed in the rotor aperture. With the gage in place, the electrode can be positioned with reasonable accuracy.

Setting the Arc Gap Gage

1. Measure the outside diameters of the work pieces being welded using a caliper or micrometer. See Figure 7(A). The M100 will calculate the arc gap automatically for you during an Auto Entry weld development. This is based on the standard OD.
2. Refer to Table 2 to find the “actual” outside diameter nearest to your measurement.
3. Adjust the arc gap gage to match the setting from Table 3. See Figure 7(B).

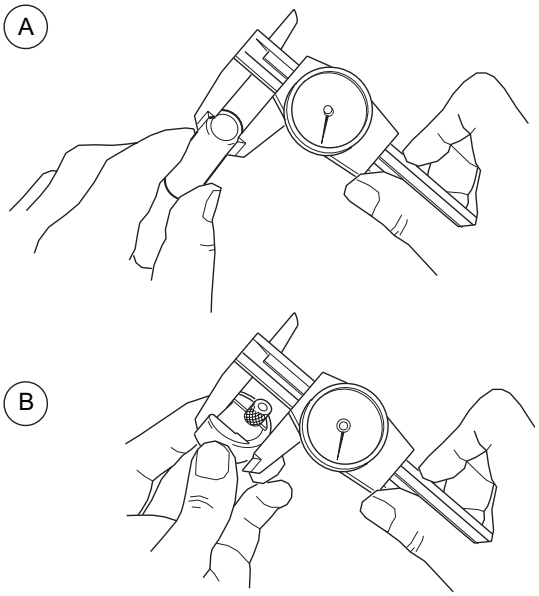


Figure 7 Setting the Arc Gap Gage

Table 2 SWS-5H-C Arc Gap Gage Dia. 1.244 in.

Nominal OD (in.)	Actual OD (in.)	Setting for 0.025 in. Arc Gap (in.)	Setting for 0.030 in. Arc Gap (in.)	Setting for 0.035 in. Arc Gap (in.)	Setting for 0.040 in. Arc Gap (in.)	Setting for 0.045 in. Arc Gap (in.)	Setting for 0.050 in. Arc Gap (in.)	Setting for 0,51 mm Arc Gap (mm)	Setting for 0,64mm Arc Gap (mm)	Setting for 0,89mm Arc Gap (mm)	Setting for 1,02mm Arc Gap (mm)
1/8	0.125	0.710	0.715	0.720	0.725	0.730	0.735	17,91	18,04	18,29	18,42
1/4	0.250	0.772	0.777	0.782	0.787	0.792	0.797	19,48	19,61	19,86	19,99
3/8	0.375	0.835	0.840	0.845	0.850	0.855	0.860	21,08	21,21	21,46	21,59
1/2	0.500	0.897	0.902	0.907	0.912	0.917	0.922	22,66	22,79	23,04	23,17
5/8	0.625	0.960	0.965	0.970	0.975	0.980	0.985	24,25	24,38	24,63	24,76

Table 3 SWS-5H-C Arc Gap Gage Dia. 31,60 mm

Nominal OD (mm)	Actual OD (mm)	Setting for 0,50 mm Arc Gap (mm)	Setting for 0,64mm Arc Gap (mm)	Setting for 0,76mm Arc Gap (mm)	Setting for 1,02mm Arc Gap (mm)	Setting for 1,14 mm Arc Gap (mm)
3	3,00	17,80	17,94	18,06	18,19	18,32
6	6,00	19,30	19,44	19,56	19,69	19,82
8	8,00	20,30	20,44	20,56	20,69	20,82
10	10,00	21,30	21,44	21,56	21,69	21,82
12	12,00	22,30	22,44	22,56	22,69	22,82

Table 4 SWS-5H-C ATW Arc Gap Gage Dia. 1.244 in. (31,60 mm)

ATW Size	Cuff OD	Setting for 0.035 in (0,89 mm) Arc Gap
1/4 in.	0.29 in.	0.801 in.
3/8 in.	0.41 in.	0.863 in.
1/2 in.	0.55 in.	0.931 in.
6 mm	7 mm	20,19 mm
8 mm	9 mm	21,20 mm
10 mm	11 mm	22,20 mm
12 mm	13,2 mm	23,32 mm

Inserting the Electrode into a Rotor

1. Without the fixture block attached, press **WELD** on the operator panel.
2. Use **JOG** to position the rotor as shown in Figure 8.
3. Loosen the two electrode clamping screws. If you are replacing the electrode, remove the electrode.
4. Insert the new electrode, with the sharp tip pointing out. Tighten the electrode clamping screws slightly to hold it in place temporarily.
5. Set the proper arc gap with the arc gap gage.

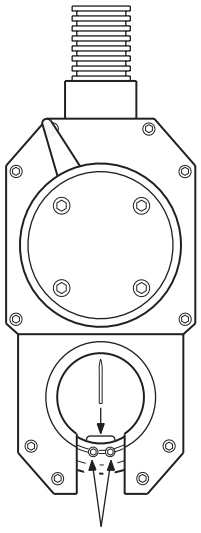


Figure 8 Electrode Installation

WARNING!

DO NOT PRESS START WHILE TOUCHING THE ELECTRODE.

Caution!

Do not jog or move the rotor unless the electrode is clamped in place.

Setting the Arc Gap

1. Use **JOG** to position the rotor as shown in Figure 9. This allows access to the electrode clamping screws.
2. Insert the arc gap gage into the rotor. See Figure 9(A).
3. Tilt the weld head upward. Loosen the electrode screw allowing the electrode to drop onto the gage surface. See Figure 9(B).
4. Tighten the electrode clamping screws just enough to secure the electrode. Remove the arc gap gage.
5. Press **HOME** to return the rotor to the home position.

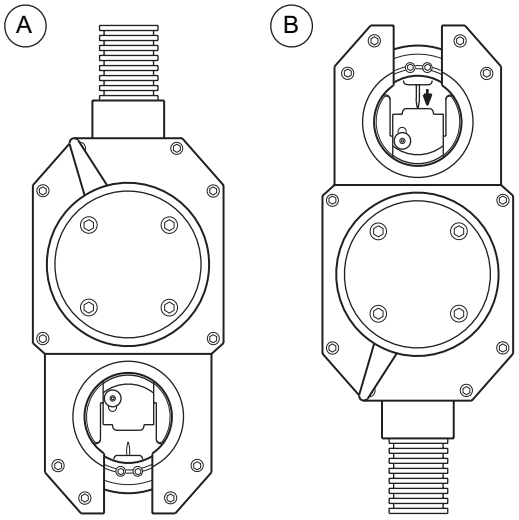


Figure 9 Setting the Arc Gap

Caution!

Do not jog or move the rotor unless the electrode is clamped in place.

Preparing the Work

It is important to prepare the tube pieces properly before welding. Refer to Figure 10.

Tubing must be square and burr-free to ensure repeatable, high-quality autogenous fusion welds. Cut the tubing to length with a hacksaw or tube cutter. Face the tube ends with a lathe or a portable facing tool. Deburr the ends, making sure that both the inside and outside diameters are square and burr-free. Clean the tube ends using an appropriate solvent.

Minimize the chance of a poor quality weld by following these guidelines:

- Tube ends must be square.
- Tube ends must not have a wall thickness variation exceeding ± 15% of nominal.
- Tube ends must be burr-free.
- Tube ends must be free of any rust, grease, oil, paint, or other surface contaminants.

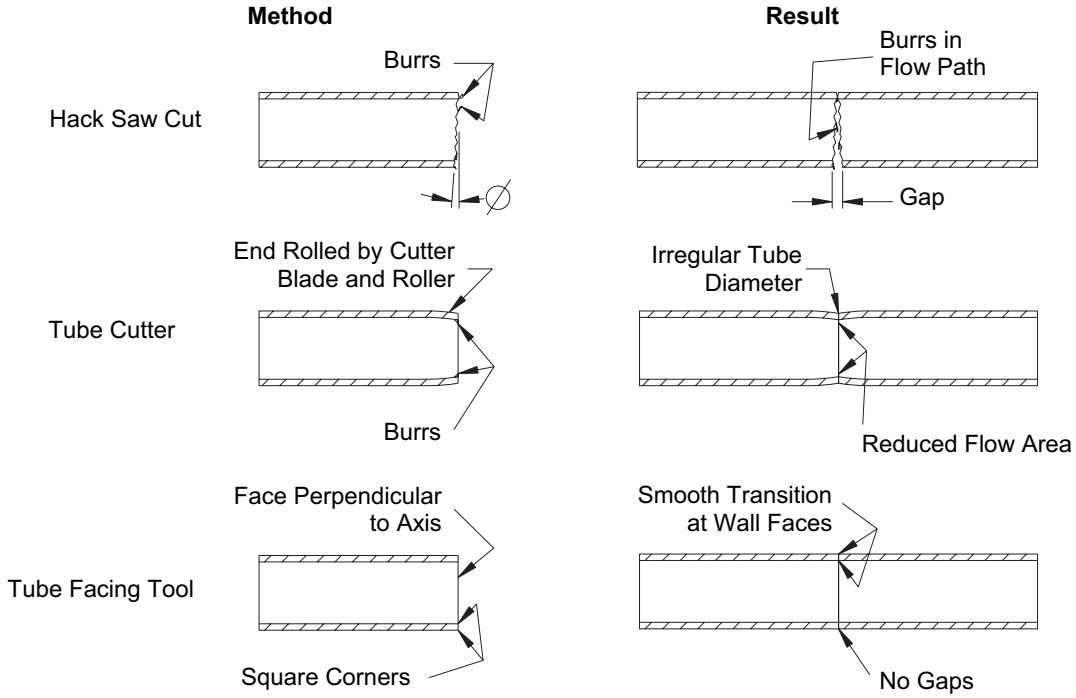


Figure 10 Tube Preparation

Fixturing the Work

Select or configure the appropriate fixture block. Select the collets to match the work outside diameter.

Selecting the Fixture Block and Collets

1. Select the fixture block that accepts the outside diameter of the tube to be welded.

Table 5 Fixture Block

Model	OD Capacity	Minimum Weld Extension Length
CWS-5TFB	1/8 to 5/8 in. (3 to 16 mm)	3/4 in. (19 mm)
CWS-5FSP1	1/4 in.	Used when welding VCR or VCO fittings with captured male or female nuts with extension lengths of less than 3/4 in. (19 mm)
CWS-5FSP2	1/8 to 1/2 in. (6 to 12mm)	Used to hold Micro-Fit fittings with an extension length of 1/4 in. (6 mm)
SWS-5FSP3L	1/8 to 1/2 in. (3 to 12mm)	Used to hold certain valves with an extension length of 1/2 in. (12 mm)
SWS-5FSP3R		
SWS-5FSP4L	1/4 to 3/8 in. (6 to 9 mm)	Used to hold Swagelok valves BN, DI, DS, HD, DA, and DP with an extension length of 1/4 in. (6 mm)
SWS-5FSP4R		

2. Select the proper collets for the diameter of the parts being welded. Refer to Table 6.

Table 6 Collets

Model	OD Capacity	Comments
CWS-5UCI-X①	1/8 in. to 5/8 in. (3 mm to 16 mm)	Tubing Add “mm” suffix for metric sizes.
CWS-5UFCI-.95	n/a	Fixture collets to hold adapter inserts for CWS-5FSP1 side plate
CWS-5UFCI-X①	1/8 in. to 5/8 in. (3 mm to 16 mm)	Tube collet for 5FSP1 and 5FSP2
CWS-5MWCI-04	1/8 in., 1/4 in., 6 mm	For Micro-Fit fittings
CWS-5MWCI-06	3/8 in., 8 mm, 10 mm	For Micro-Fit fittings
CWS-5MWCI-08	1/2 in., 12 mm	For Micro-Fit fittings
SWS-5F3UCI-X①	1/8 in. to 1/2 in. 6 mm, 8 mm, 10 mm	For valves

① Where X identifies the collet size in 1/16ths or metric (mm suffix)

Installing the Collets in a Tube Fixture Block

1. Release both levers and open the tube fixture block. See Figure 11.
2. Install the collet halves in both the top and bottom side plates and tighten the collet screws. Make sure the collet shoulder is flush against the fixture side plate. See Figure 12(B).

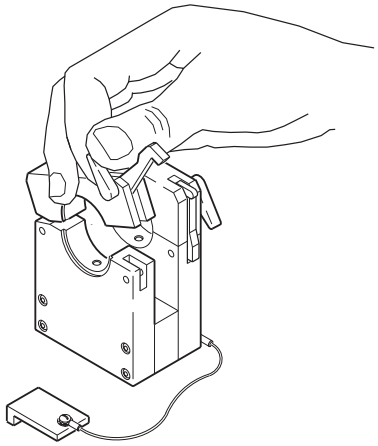


Figure 11 Opening the Fixture Block

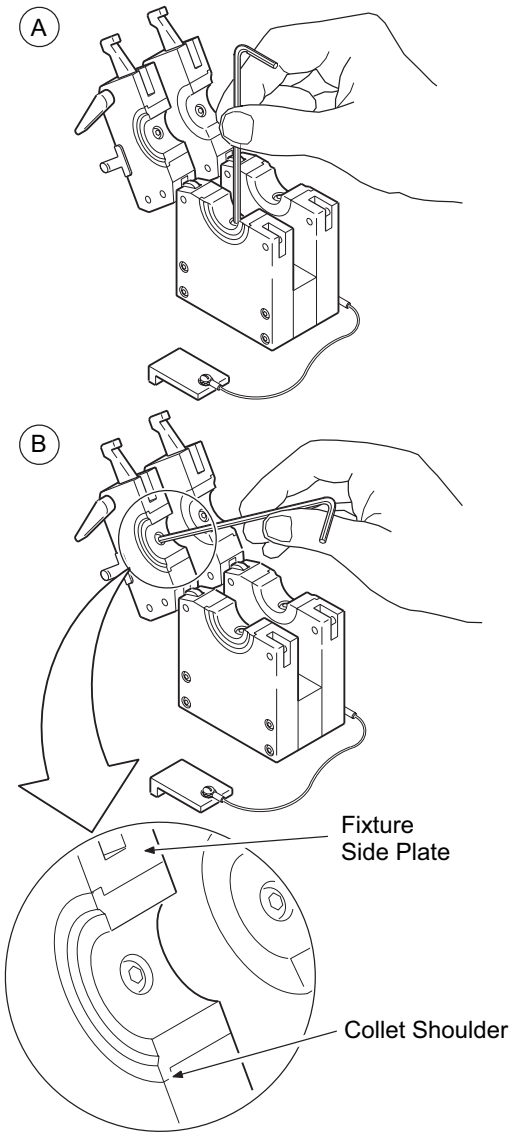


Figure 12 Installing Collets

Aligning the Work Pieces in the Tube Fixture Block

1. Place the centering gage in one side of the tube fixture block. The centering gage must span the width of the collet. See Figure 13.
2. Butt one work piece against the centering gage. See Figure 14(A).
3. Lock down the top side plate. See Figure 14(B).
4. Remove the centering gage.

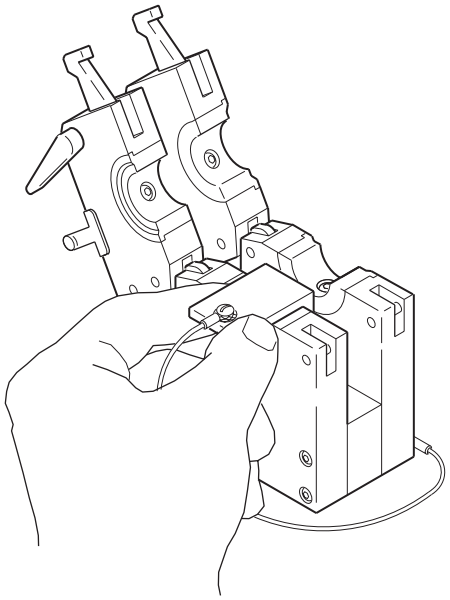


Figure 13 Place the Centering Gage

Note:
When welding a Swagelok ATW fitting to tubing, butt the tubing against the centering gage first.

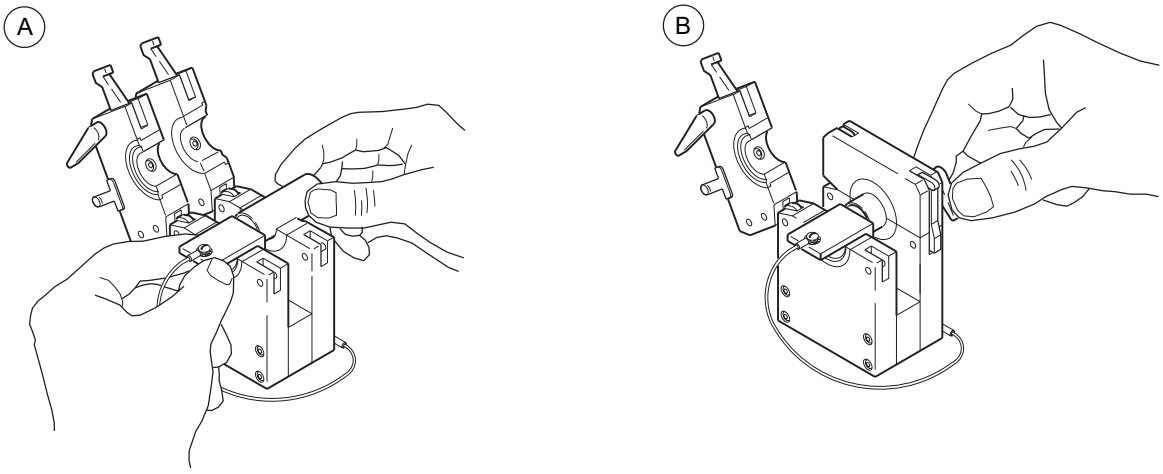


Figure 14 Placing First Work Piece in the Fixture Block

5. Butt the second work piece against the first work piece, and lock down the top side plate. See Figure 15.
6. Inspect 360° around the weld joint for fit and alignment. If alignment is not correct proceed to the next section.

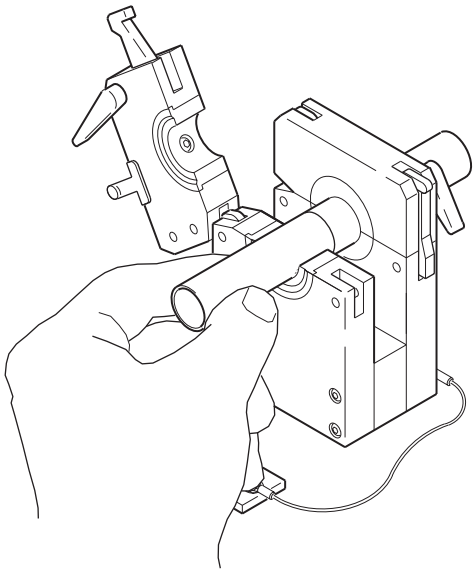


Figure 15 Placing Second Work Piece

Adjusting the Fixture Block

The modular design of the Series 5 Fixture block allows you to assemble the block to meet a variety of welding requirements.

In order to maintain precise alignment of the work pieces in the fixture block, the side plates must be periodically aligned.

This section covers:

- Tube-to-tube
- Micro-Fit fitting-to-tube
- Micro-Fit fitting-to-Micro-Fit fitting

Tube-to-tube Fixture block

To align the fixture block, follow these steps:

1. Turn the fixture block over and locate the directional arrows on the plenum. The arrows point to the appropriate side plate. See Figure 16.
2. Using the provided 3/32 in. hex wrench, unscrew the four cap screws in the appropriate side plate just enough to loosen it from the plenum. See Figure 16 to locate the appropriate side plate.
3. Turn the fixture block upright and release both levers and open both sides of the fixture block.

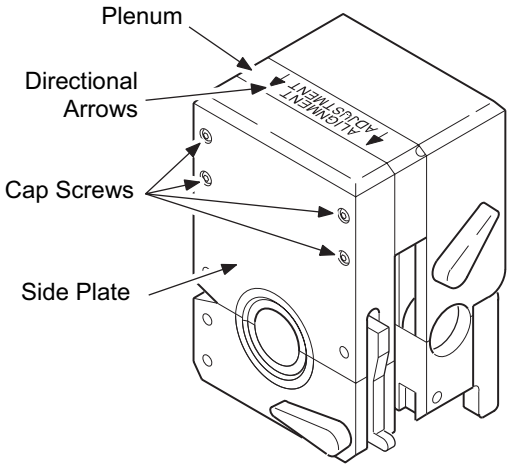


Figure 16 Loosening the Side Plate

4. Place a straight length of tubing (minimum length 1.50 in (38,1 mm) in the collets such that it rests across both side plates.
5. Close and lock the side plate that is not adjustable. See Figure 17.
6. Lock down the top of the loosened side plate.
7. Tighten the four cap screws in the loosened side plate. Take care to tighten the screws evenly to prevent the side plate from slipping.
8. Open the side plates and remove the tubing.

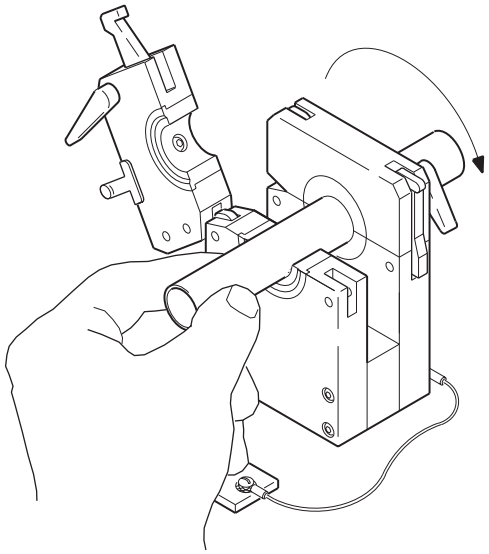


Figure 17 Placing the Tubing

Micro-Fit Fitting-to-Tube Fixture Block

To align the fixture block, follow these steps:

1. Turn the fixture block over and locate the directional arrows on the plenum. The arrows point to the appropriate side plate. See Figure 18.
2. Using the provided 3/32 in. hex wrench, unscrew the four cap screws in the appropriate side plate just enough to loosen it from the plenum. See Figure 18 to locate the appropriate side plate.
3. Turn the fixture block upright and release the lever and open the top of the tube side plate.
4. Choose and install a collet that holds tubing that matches the outside diameter of the Micro-Fit fitting.

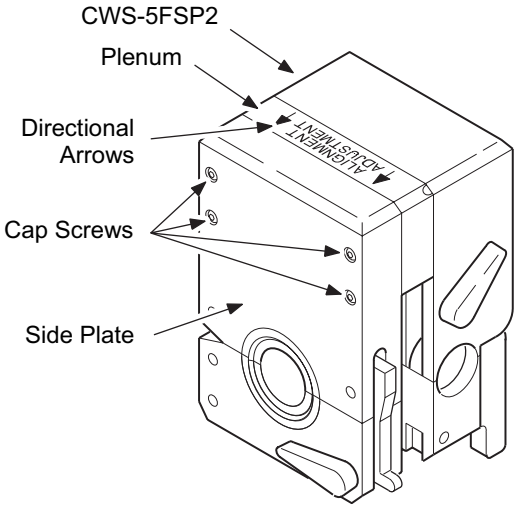


Figure 18 Loosening the Side Plate

5. Unlatch and remove the top of the CWS-5FSP2 Side Plate. See Figure 19.
6. Using the centering gage, place a straight length of tubing (minimum length 0.75 in. (19,1 mm)) in the tube side plate and lock down the top of the plate.

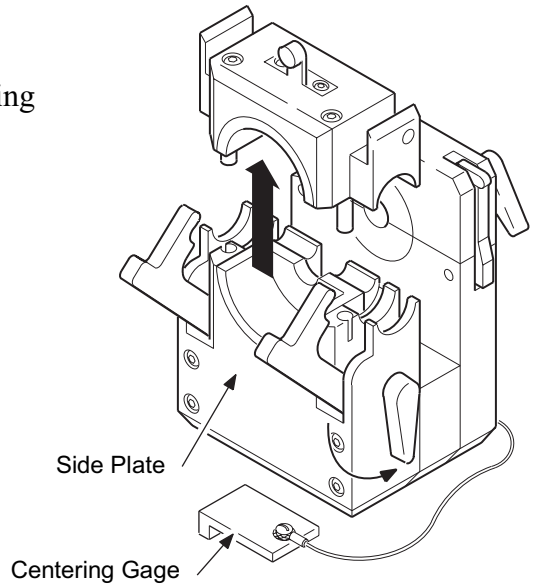


Figure 19 Removing the Top of the Side Plate

7. Place the Micro-Fit fitting in the fitting side plate and close and latch the top.
8. Align the Micro-Fit fitting with the tubing. See Figure 20.

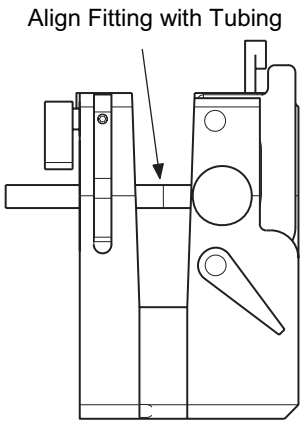


Figure 20 Aligning the Micro-Fit Fitting With the Tubing

9. While maintaining the fitting-to-tubing alignment, tighten the four cap screws in the adjustable side plate. Take care to tighten the screws evenly to prevent the side plate from slipping.

Micro-Fit Fitting to Micro-Fit Fitting Fixture Block

To align the fixture block, follow these steps:

1. Turn the fixture block over and locate the directional arrows on the plenum. The arrows point to the appropriate side plate. See Figure 21.
2. Using the provided 3/32 in. hex wrench, unscrew the four cap screws in the appropriate side plate just enough to loosen it from the plenum. See Figure 21 to locate the appropriate side plate.

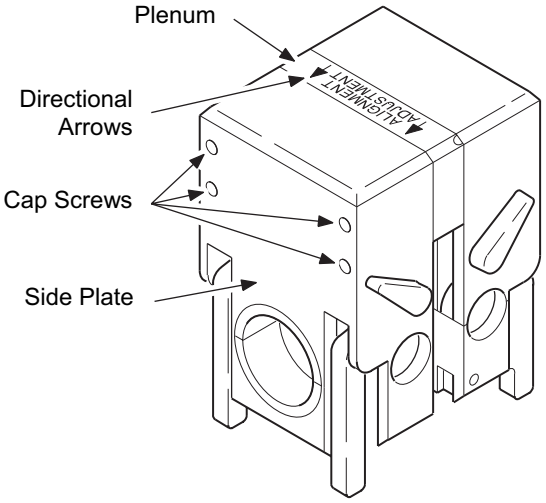


Figure 21 Loosening the Side Plate

3. Turn the fixture block upright and remove the tops of the CWS-5FSP2 Side Plates. See Figure 22.
4. Using the centering gage, place one Micro-Fit fitting in one of the side plates.
5. Reinstall that side plate top.
6. Insert the second Micro-Fit fitting into the other side plate and close its top.

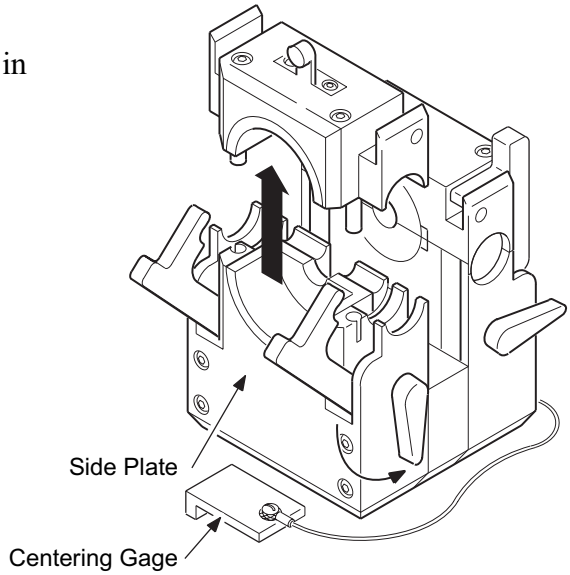


Figure 22 Removing the Top of the Side Plate

7. Align the two Micro-Fit fittings by adjusting the side plate that is loose. See Figure 23.
8. While maintaining the fitting-to-fitting alignment, tighten the four cap screws in the adjustable side plate. Take care to tighten the screws evenly to prevent the side plate from slipping.

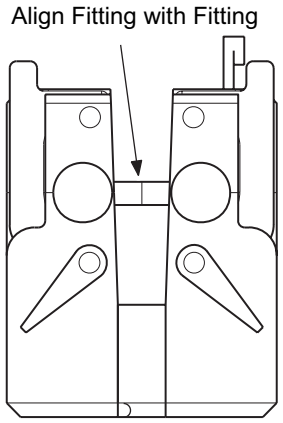


Figure 23 Aligning the Micro-Fit Fittings

Mating the Weld Head to the Fixture Block

1. Rotate the locking lever on the weld head counter-clockwise until it stops. See Figure 24.
2. Insert the weld head into the fixture block. See Figure 25(A).
3. Rotate the locking lever clockwise to secure the weld head. See Figure 25(B).
4. Check status on the front panel to verify the power supply is in the **READY** state.

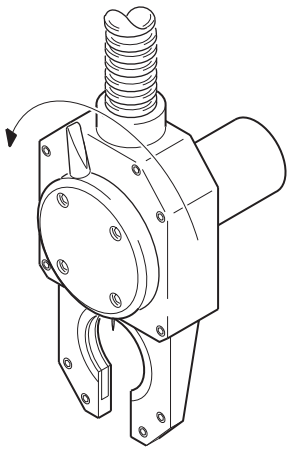


Figure 24 Releasing the Locking Lever

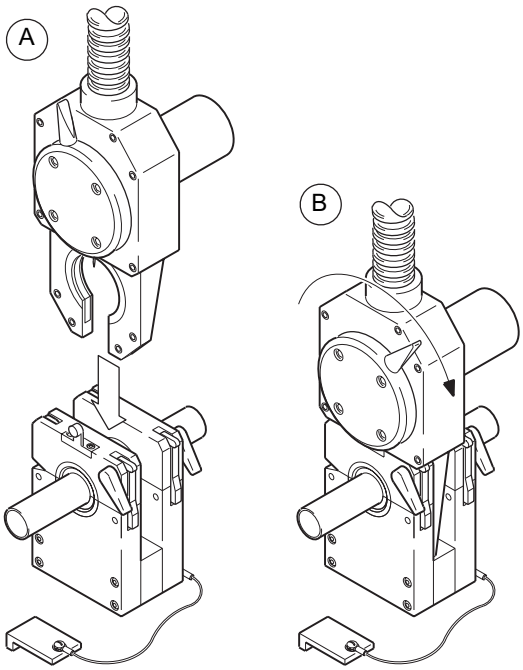


Figure 25 Mating the Weld Head to the Fixture Block

Operating the Weld Head

Operate the weld head using the following parameters:

Shield Gas Flow Rate std ft^3/hr (std L/min)	10 to 20 (4,7 to 9,5)
Prepurge and Postpurge minimum time in seconds	20①
Start Power	U-Low-Low-Normal②③
Maximum Recommended Average Amps	50 Amps at 50% Duty Cycle

① Flow should be continuous for cooling when welding at high current rates.

② Use U-low start power for wall thickness less than 0.010 in. (0,25 mm) and an arc gap of 0.020 in. (0,51 mm) or less.

Use Low start power for wall thickness less than 0.030 in. (0,76 mm) and an arc gap of 0.025 in. (0,64 mm) or less.

Use Norm start power for wall thickness greater than 0.030 in. (0,76 mm) and an arc gap of 0.035 in. (0,89 mm) or less.

③ U-low power setting only available on M100 Power Supply.

Maintenance

To ensure your Swagelok Welding System (SWS) equipment is always in proper working order, you must perform periodic maintenance on the system components.

This section describes the procedures necessary for maintaining the fixture blocks and weld head.

Detailed part drawings and information are included at the end of this manual for your reference.

Perform fixture block maintenance daily and after every 1,000 to 1,200 welds.

Note:
If you experience problems while performing the procedures in this section, refer to Troubleshooting or contact your Swagelok representative.

Note:
Replace any defective parts. Service replacement parts are available through your Swagelok representative.

Fixture Block Daily Maintenance

At the start of each workday:

1. Inspect the fixture block for cleanliness, wear and damage. See Figure 26.
2. Remove dirt, carbon, and vapor deposits from the fixture block with a clean, soft cloth. A solvent such as alcohol or acetone can be used. Remove heavier deposits with a fine-grit abrasive pad.

At the end of each workday, clean and store the fixture block in a dry place.

Fixture Block Periodic Maintenance

Every 1,000 to 1,200 welds:

1. Inspect and clean the collets. See Figure 26(A).
2. Check for scratches and dents.
3. Remove dirt and oxides from all surfaces of the collet with a soft stainless steel wire brush.
4. Remove any oxides from the non-anodized mating surfaces of the side plates with a fine-grit abrasive pad. See Figure 26(B).
5. Remove any dirt and oxides from the inside surfaces of the side plates with a clean, soft cloth. See Figure 26(C). Remove heavier deposits with a fine-grit abrasive pad.
6. Check the lever cam and latch for smooth operation. See Figure 27.
    a. Remove lever cam by removing the set screw from the latch and pulling the lever cam from the fixture block.
    b. Clean the lever cam and lightly lubricate if necessary.
    c. Replace the set screw and verify that it is locked tightly in position.

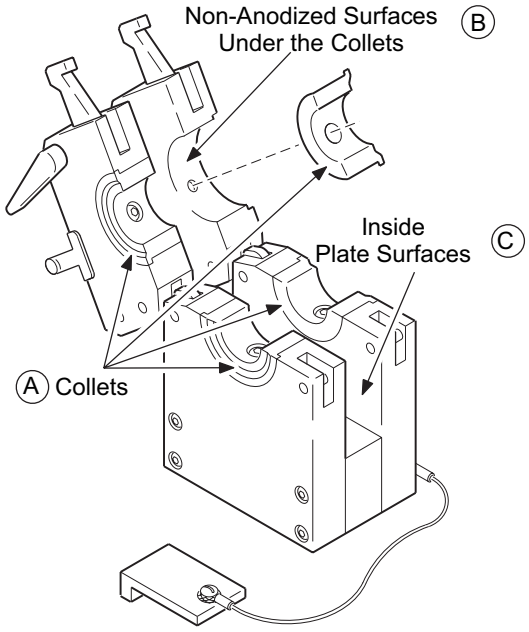


Figure 26 Cleaning the Collets and Collet Mounting Surfaces

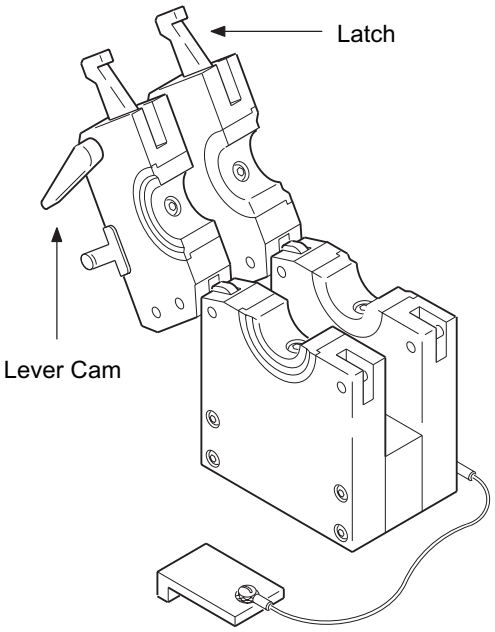


Figure 27 Lever Cam and Latch

Weld Head Daily Maintenance

Perform weld head maintenance daily and every 1,000 to 1,200 welds. Depending on usage and wear, maintenance may be performed before the 1,000-weld mark.

At the start of each work day:

1. Inspect the weld head for cleanliness. Pay close attention to the rotor area. See Figure 28.
2. Press **HOME**. Check the rotor for smooth rotation. If the rotation is erratic or noisy, disassemble the weld head and clean the rotor, gears, and brush. See **Weld Head Disassembly and Cleaning** on page 25.

At the end of each work day:

1. Remove dirt, carbon, and vapor deposits from the weld head with a clean, soft cloth and a solvent such as isopropyl alcohol.
2. Store the weld head in a clean, dry place.

Weld Head Periodic Maintenance

Every 1,000 to 1,200 welds, measure the rotor speed to verify its accuracy.

Creating the Weld Head Timing Check Program

1. Select PROG/CREATE.
2. Select MANUAL ENTRY, then press **ENTER**.
3. Select LEVELS ONLY, then press **ENTER**.
4. Enter **2** levels, then press **ENTER**.
5. Enter the programmer name. Typically it would be your name.
6. Enter the Side 1 tube diameter (5), then press **ENTER.**
7. Select 5H from the Weld Head pick list.

WARNING!

DISCONNECT THE WELD HEAD FROM THE POWER SUPPLY BEFORE PERFORMING THE ADJUSTMENT OR MAINTENANCE.

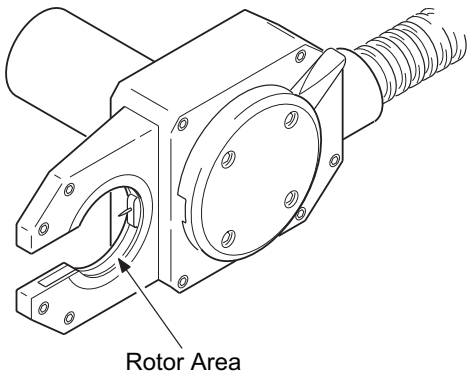


Figure 28 Inspect Exposed Surfaces of the Weld Head

Caution!

Do not use lubricants inside the weld head.

8. Using Table 7, enter the following parameters.

Table 7 Parameters

Parameter	Entry
Start Power	Normal
Start Current	20
Rotor Delay	0
Prepurge	5
Postpurge	5
Downslope	0

9. Using Table 8, enter the following parameters for level 1 and level 2.

Table 8 Level 1 and Level 2 Parameters

Parameter	Level 1 Setting	Level 2 Setting
Impulse	2.0	2.0
Maintenance	2.0	2.0
Weld Time	15	15
Ramp	0	0
Pulse Rate	1	1
Pulse Width	50	50
Speed Hi	8.00	0.00
Speed Lo	8.00	0.00

10. Press the **WELD** mode key.
11. Select SAVE TO MEMORY, then press **ENTER**.
12. Enter the procedure name (Timing Test), then press **ENTER**.

Checking the Weld Head Timing

1. Select WELD/TEST.
2. Press **START**.
3. After verifying the screen displays “WELD HEAD IS CLEAR TO ROTATE”, press **ENTER**.
4. Verify the rotor completes two revolutions then check that no part of the rotor is exposed after it stops. See Figure 29.

If the rotor does not complete the revolutions and stop correctly, contact your Swagelok representative.

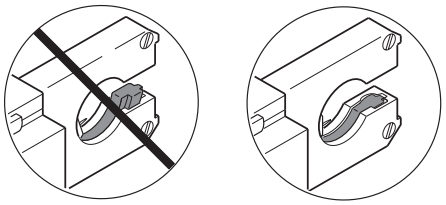


Figure 29 Rotor Position

WARNING!

THE ROTOR WILL ROTATE ONE REVOLUTION TO HOME POSITION 15 SECONDS AFTER COMPLETING THE TWO REVOLUTIONS.

Weld Head Disassembly and Cleaning

This section describes how to disassemble the weld head and rotor.

Weld Head

To disassemble the weld head, follow these steps:

1. Blow any loose material from the weld head assembly with clean, low-pressure air.
2. Remove the four screws, locking ring, and locking ring plate. See Figure 30.

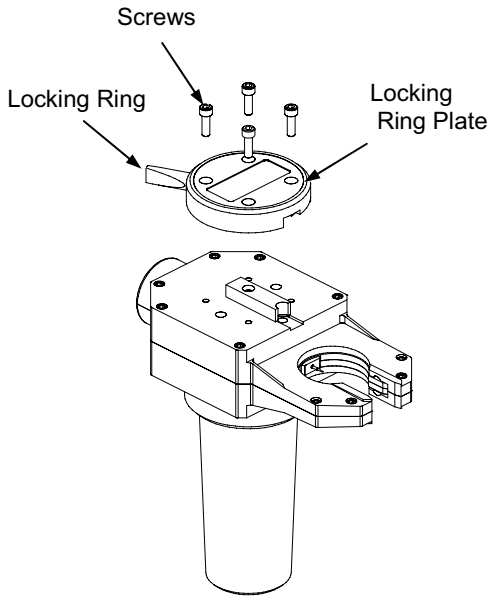


Figure 30 Removing the Locking Ring and Locking Ring Plate

3. Remove the work extension screw with lock washer, and the work extension. Inspect the work extension for pitting, wear, or damage. See Figure 31.
4. Replace work extension if necessary. Refer to the **Parts Drawings** at the end of this manual for part ordering information.

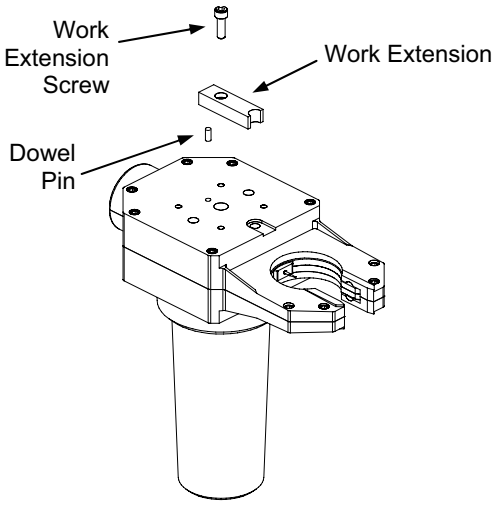


Figure 31 Removing the Work Extension

5. Remove the weld head housing screws from the housing. Using a slight rocking motion, carefully separate the locking ring half of the weld head housing from the motor half. See Figure 32.
6. Carefully separate the weld head housing halves so that internal components are not damaged. See Figure 32.
7. Remove the rotor from the motor half of the weld head housing. See Figure 33.
8. Carefully lift the power block subassembly out of the motor half of the weld head housing. See Figure 34.

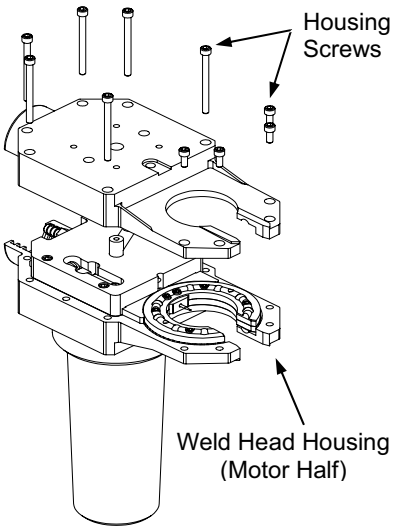


Figure 32 Removing the Locking Ring Half of the Weld Head Housing

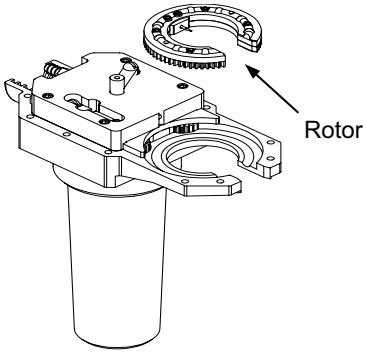


Figure 33 Removing the Rotor

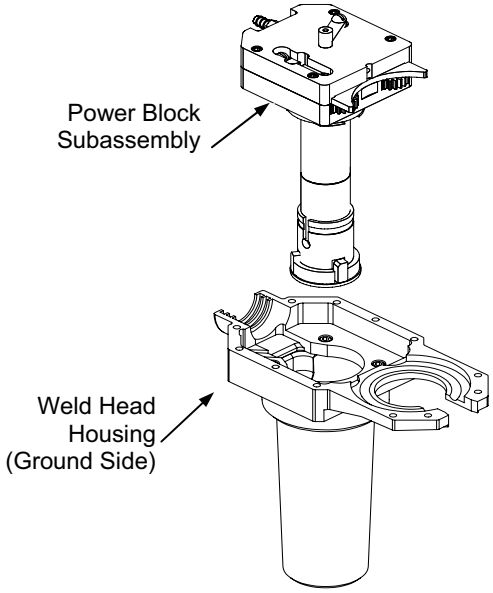


Figure 34 Removing the Power Block Subassembly

9. Examine the brush. See Figure 35.

   Inspect and clean the brush using the following steps:

   a. Check the brush for excessive wear.

   b. Ensure the brush has a groove. Replace the brush if the groove is not present by referring to the appropriate motor and power block assembly drawing in **Parts Drawings** at the end of this manual.

   c. Remove any oxidation from the brush with a fine-grit abrasive pad.

10. Blow any loose material from the power block assembly with clean, low-pressure air.

11. Ensure that the two power strap screws are tight. See Figure 36.

12. Ensure that the work plate screw is tight and free from excessive oxidation. See Figure 37. Clean the work plate with a fine-grit abrasive pad if necessary.

13. Inspect the gears for wear and replace if damaged by referring to the appropriate motor and power block assembly drawing in **Parts Drawings** at the end of this manual.

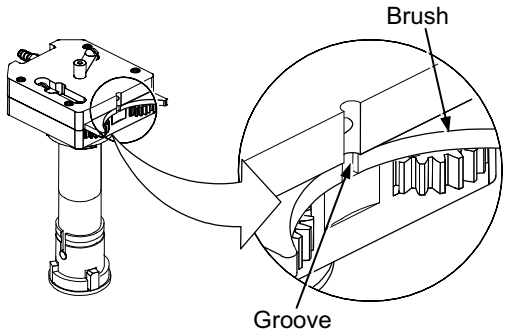


Figure 35 Inspecting the Brush

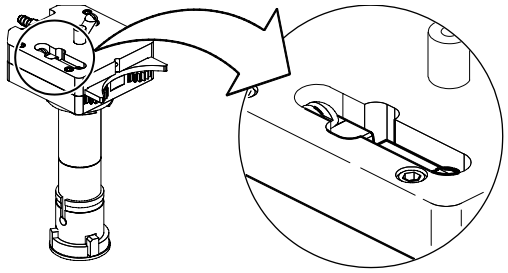


Figure 36 Inspecting the Power Strap Screws

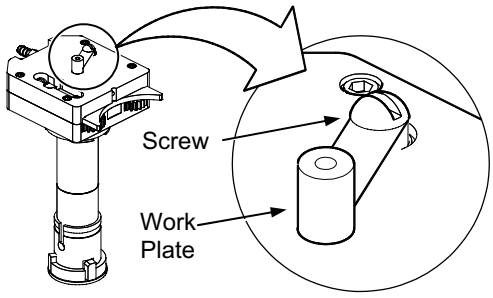


Figure 37 Inspecting the Work Plate and Screws

Rotor

To disassemble the rotor, follow these steps:

1. Remove the rotor screws and the electrode clamping plate screws from the rotor. Remove the electrode from the ceramic insert. See Figure 38.
2. Place the rotor on a clean, dry surface with the rotor opening facing up. Separate the gear ring from the brush ring enough to clear the two rotor pins. See Figure 39.
3. Completely separate the gear ring from the brush ring as shown in Figure 40. Lay the rings flat on the work surface.
4. Remove the ball bearings from the gear and brush rings.
5. Inspect the ball bearings for wear and damage. Replace if necessary.
6. If the ball bearings are dirty, clean them with isopropyl alcohol or cleaning solution. Dry the balls thoroughly.

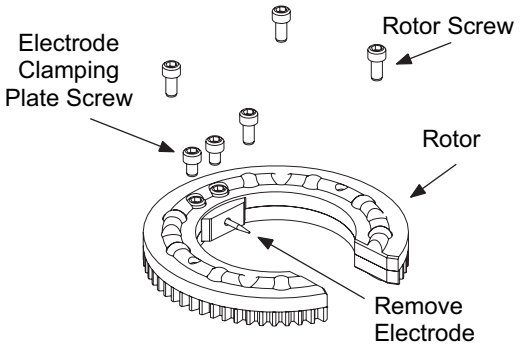


Figure 38 Removing the Rotor and Electrode Clamping Plate Screws

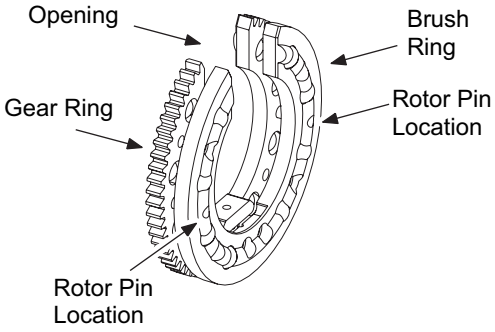


Figure 39 Placing the Rotor on the Work Surface

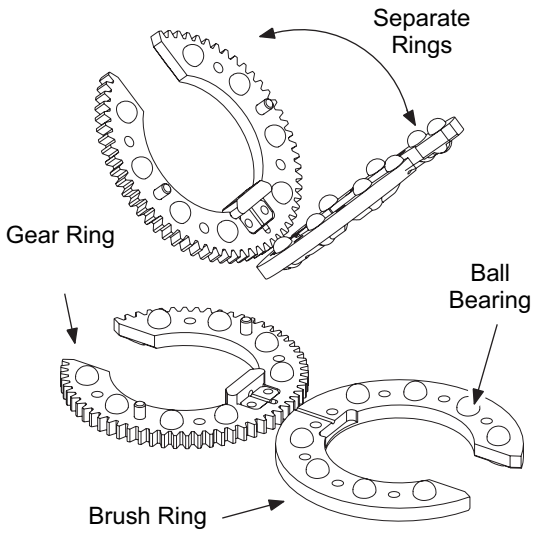


Figure 40 Separating the Gear Ring from the Brush Ring

7. Remove the ceramic insert. See Figure 41.
8. Inspect the ceramic insert. If it has carbon or other deposits, clean it with a fine-grit abrasive pad or soft nylon brush.
9. Remove the electrode clamping plate. Clean it with a fine-grit abrasive pad. See Figure 42.
10. Inspect the brush and gear rings for dirt or other deposits. Clean the rings with a fine-grit abrasive pad or soft stainless steel wire brush.
11. Dry all parts with clean, low-pressure air before reassembly.

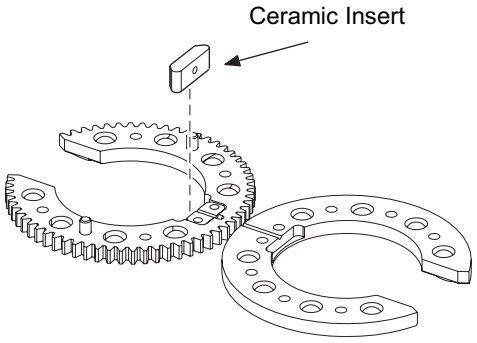


Figure 41 Removing the Ceramic Insert

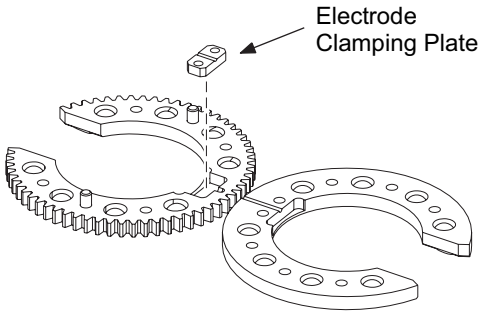


Figure 42 Removing the Electrode Clamping Plate

Weld Head Assembly

Assembly of the weld head and rotor is the reverse of the disassembly procedures.

To assemble the weld head, follow these steps:

1. Complete the steps in reverse order in **Rotor** on page 28.
2. Complete the steps in reverse order in **Weld Head Disassembly** on page 25.

Caution!

Do not pinch any internal wiring during reassembly.

Parts Drawings

This section includes exploded assembly drawings and associated parts lists. These drawings are provided as a guide to identifying part names. For specific part ordering information, contact your Swagelok representative.

The parts identified in this section include:

- SWS-5H-C Weld Head
- SWS-5H-C Rotor Assembly
- SWS-5H-C Motor and Power Block Assembly
- CWS-5TFB Tube Fixture Block
- CWS-5FSP1 Special Purpose Fixture Block
- CWS-5FSP2 Special Purpose Fixture Block
- SWS-5FSP3L Side Plate
- SWS-5FSP3R Side Plate
- SWS-5FSP4L Side Plate
- SWS-5FSP4R Side Plate

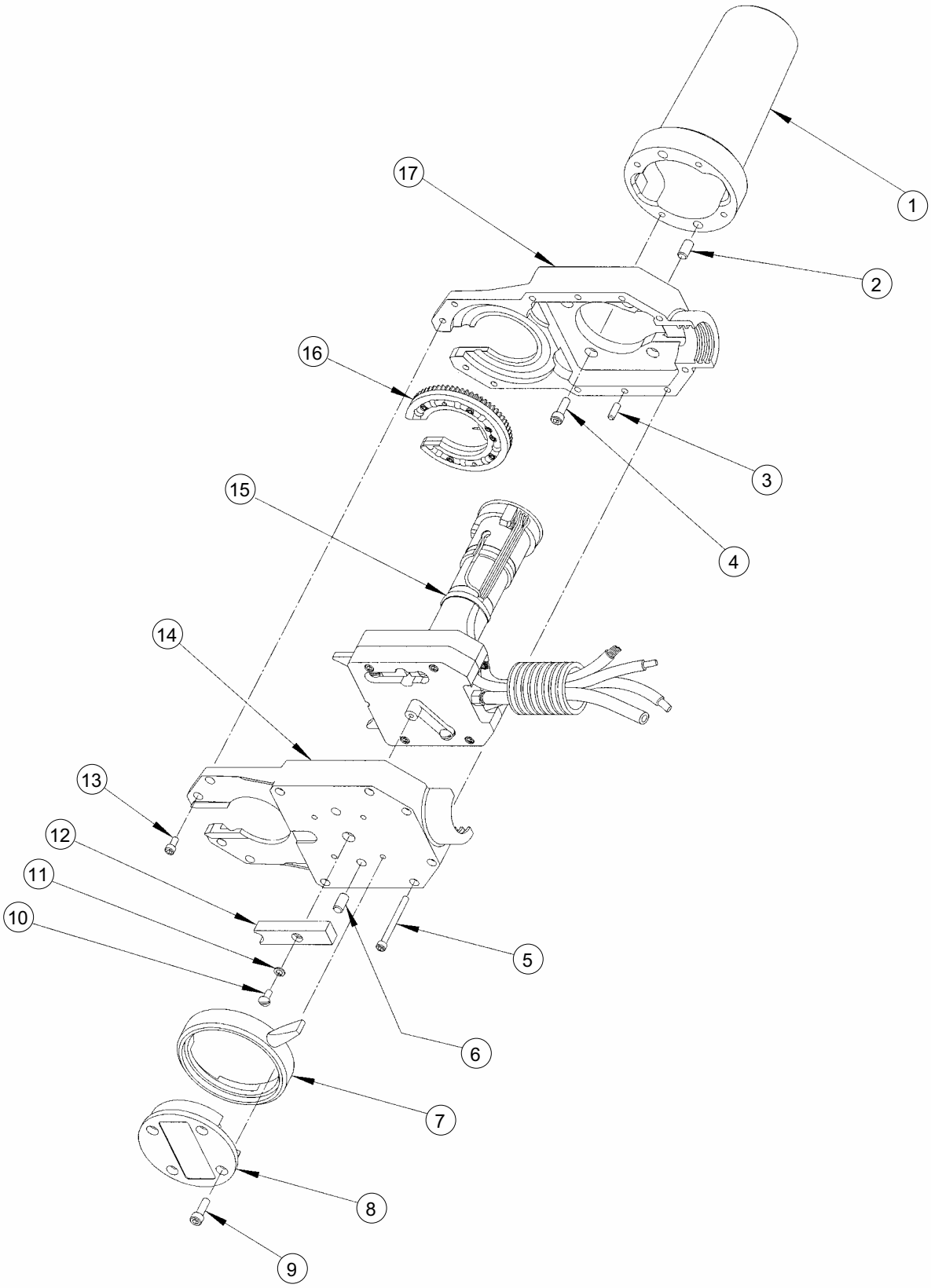


Figure 43 SWS-5H-C Weld Head

Table 9 SWS-5H-C Weld Head Parts List

Reference No.	Description	Part No.	Minimum Order Quantity
1	Motor Cover	11121	1
2	SS Dowel Pin, 0.187 X 0.375 in.	13138	10
3	SS Dowel Pin, 0.125 X 0.375 in.	13135	10
4	SS Socket Head Cap Screw, 6-32 X 0.312 in.	13254	10
5	SS Socket Head Cap Screw, 4-40 X 1.250 in.	13162	10
6	Plastic Dowel Pin, 0.190 X 0.375 in., modified	13143	10
7	Locking Ring	21065	1
8	Locking Ring Plate	11104-A	1
9	Plastic Socket Head Cap Screw, 6-32 X 0.437 in.	13105	10
10	Brass Pan Head Screw 4-40 X 0.250 in.	13101	10
11	Brass #4 Split Lock Washer	13208	10
12	Work (+) Extension Bar	21093	1
13	SS Socket Head Cap Screw, 4-40 X 0.260 in., modified	13182	10
14	Housing (Work Side)①	21133	1
15	Motor Assembly	N/A	N/A
16	Rotor Assembly	11051	1
17	Housing (Motor Side)②	21211	1

For part ordering information, contact your Swagelok representative.

① Use part number 11160 for the CWS-5H-B

② Use part number 10006-1 for the CWS-5H-B

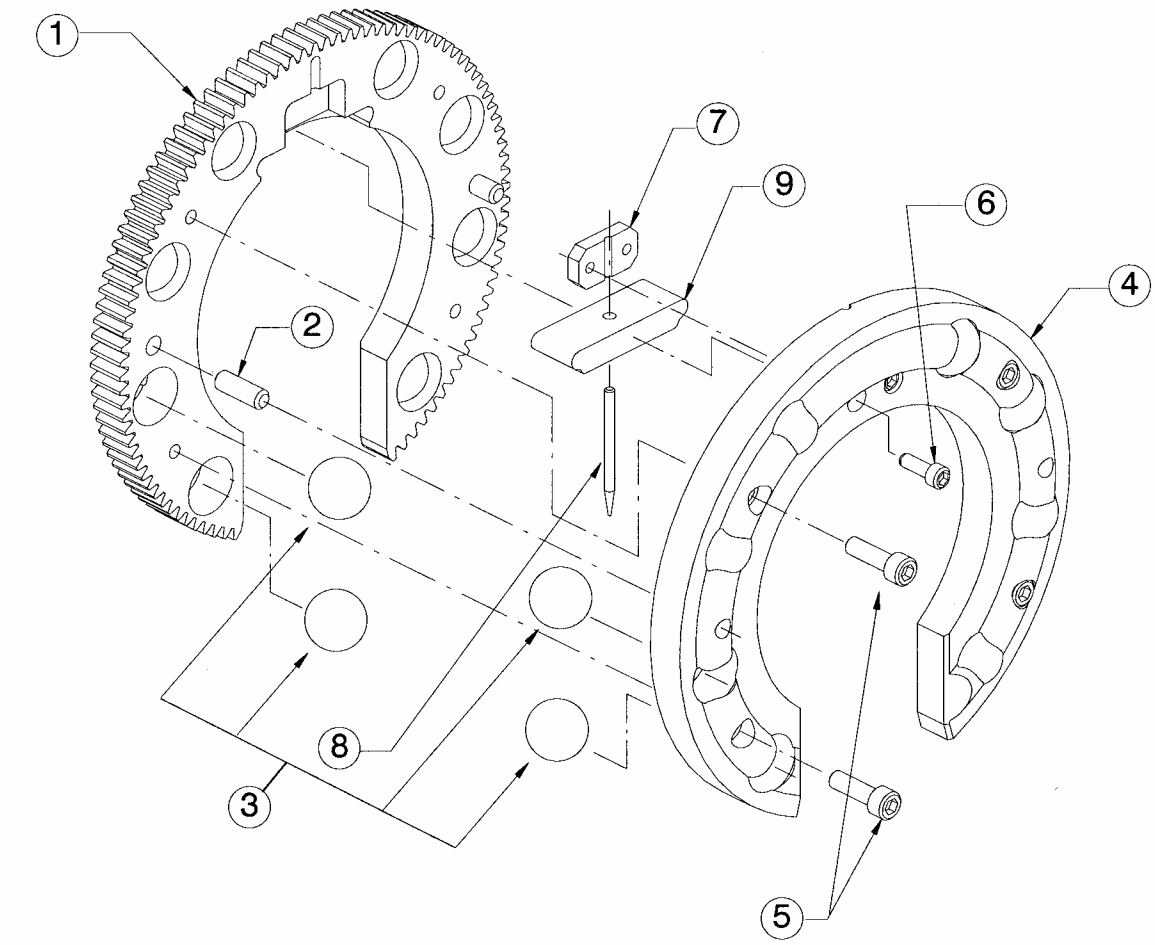


Figure 44 SWS-5H-C Rotor Assembly

Table 10 SWS-5H-C Rotor Assembly Parts List

Reference No.	Description	Part No.	Minimum Order Quantity
1	Rotor Gear Ring	10008-1	1
2	Dowel Pins	N/A	N/A
3	Plastic Ball Bearing, 0.187 in.	11153	10
4	Rotor Brush Ring	11131-B	1
5	SS Socket Head Cap Screw, 2-56 X 0.187 in.	13111	10
6	SS Socket Head Cap Screw, 2-56 X 0.125 in.	13110	10
7	Electrode Clamping Plate	11108	1
8	See Electrode Chart	N/A	N/A
9	Ceramic Insert	11132	1

For part ordering information, contact your Swagelok representative.

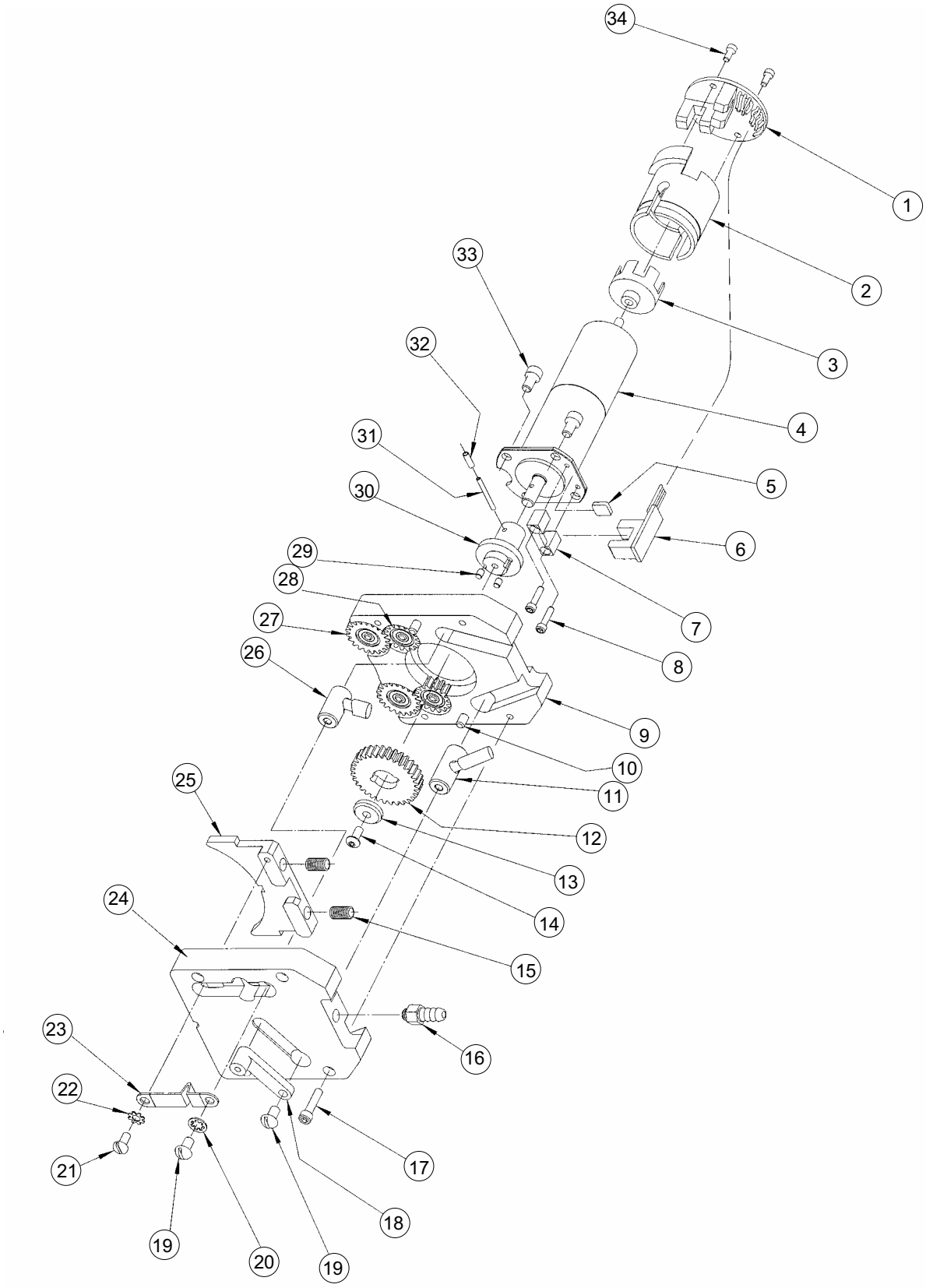


Figure 45 SWS-5H-C Motor and Power Block Assembly

Table 11 SWS-5H-C Motor and Power Block Assembly Parts List

Reference No.	Description	Part No.	Minimum Order Quantity
1	Encoder Circuit Board	10708	1
2	Sleeve Sensor Mount	N/A	N/A
3	Encoder Wheel	N/A	N/A
4	Motor	N/A	N/A
5	Home Sensor Mount Shim	11126	1
6	Home Sensor	10709	1
7	Home Sensor Mount	11125	1
8	SS Socket Head Cap Screw, 2-56 X 0.375 in.	13145	10
9	Power Block (Motor Side)①	21126	1
10	SS Dowel Pin, 0.125 X 0.375 in.	13135	10
11	Work (+) Post	N/A	N/A
12	Drive Gear	11122	1
13	Retaining Washer	11128	1
14	SS Button Head Cap Screw, 4-40 X 0.250 in.	13167	10
15	Brush Springs	11157	10
16	Purge Bayonet	B-BN4-K62	1
17	SS Socket Head Cap Screw, 4-40 X 0.500 in.	13163	10
18	Work Plate	11053-A	1
19	Brass Round Head Screw, 6-32 X 0.250 in.	13124	10
20	SS #6 Internal Tooth Lock Washer	13251	10
21	Brass Pan head Screw, 4-40 X 0.250 in.	13101	10
22	SS #4 External Star Washer	13171	10
23	Power Strap	11117	1
24	Power Block (Work Side)②	21207	1
25	Brush	11111	1
26	Power Post	N/A	N/A
27	Gear Assembly	10009-4	1
28	Gear Assembly	10009-3	1
29	SS Dowel Pin, 0.093 X 0.125 in.	13133	10
30	Drive Coupler	N/A	N/A
31	Drive Coupler Pin	N/A	N/A
32	Drive Coupler Pin Sleeve	N/A	N/A
33	SS Socket Head Cap Screw, 6-32 X 0.250 in.	13174	10
34	SS Socket Head Cap Screw, 2-56 X 0.187 in.	13111	10

For part ordering information, contact your Swagelok representative

① Use Part Number 11103-B for the CWS-5H-B.

② Use Part Number 11102-B for the CWS-5H-B.

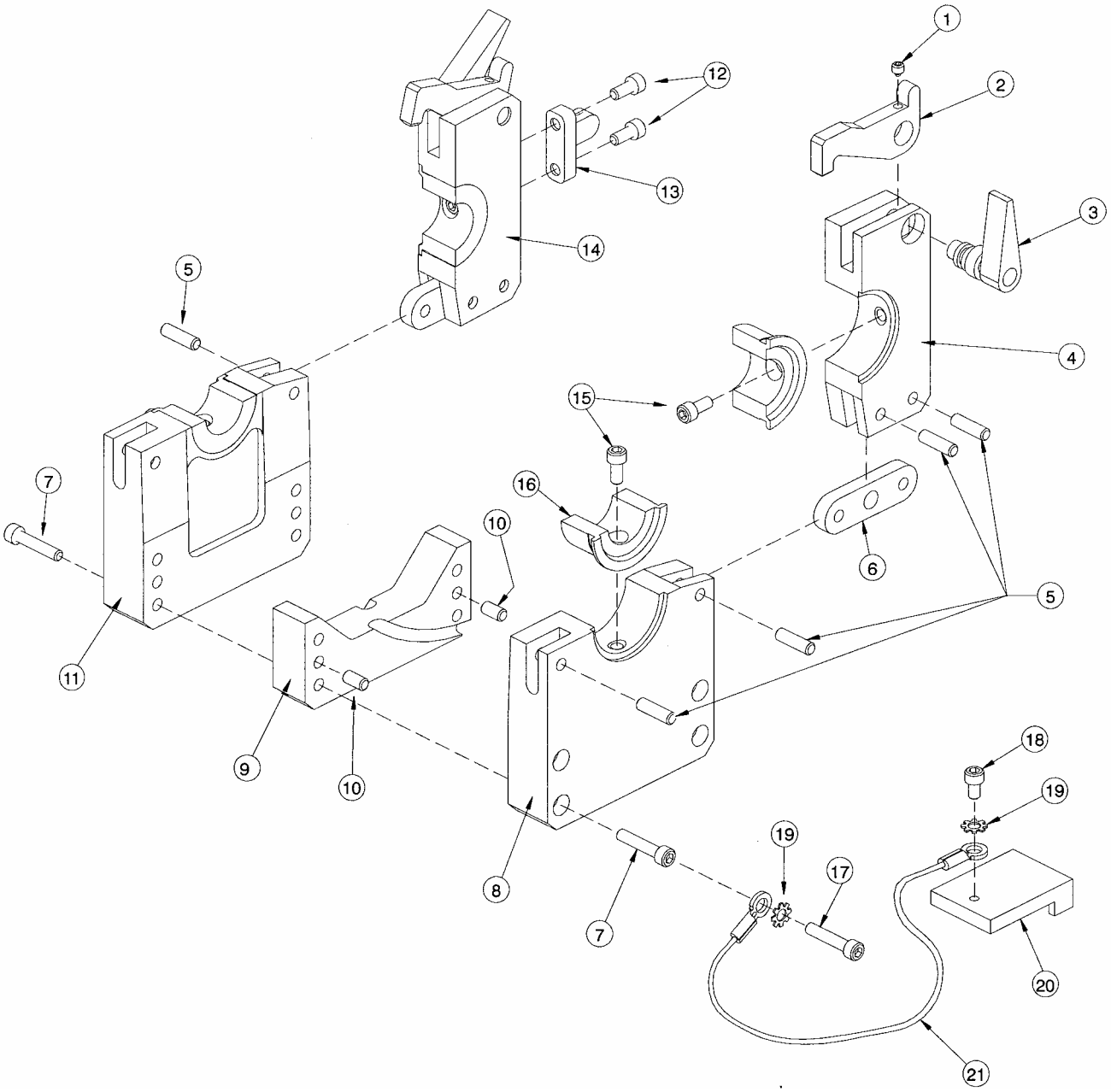


Figure 46 CWS-5TFB Tube Fixture Block

Table 12 CWS-5TFB Tube Fixture Block Parts List

Reference No.	Description	Part No.	Minimum Order Quantity
1	SS Set Screw, 4-40 X 0.125 in.	12132	10
2	Latch	12131	1
3	Lever Cam Assembly	12130-2	1
4	Top Side Plate (right)	CWS-5TSPR	1
5	Dowel Pin	N/A	N/A
6	Hinge	N/A	N/A
7	SS Socket Head Cap Screw, 4-40 X 0.563 in.	13115	10
8	Bottom Side Plate (right)	CWS-5TSPR	1
9	Plenum Assembly	CWS-5PLEN	1
10	Dowel Pin	N/A	N/A
11	Bottom Side Plate (left)	CWS-5TSPL	1
12	SS Socket Head Cap Screw, 4-40 X 0.250 in.	13112	10
13	Locking Tab	12134	1
14	Top Side Plate (left)	CWS-5TSPL	1
15	SS Socket Head Cap Screw, 4-40 X 0.250 in.	13112	10
16	See Collet Tables	N/A	N/A
17	SS Socket Head Cap Screw, 4-40 X 1.250 in.	13162	10
18	SS Socket Head Cap Screw, 4-40 X 0.187 in.	13207	10
19	SS #4 External Star Washer	13171	10
20	Centering Gauge	CWS-5CG	1
21	6 in. lanyard	410-003	1

For part ordering information, contact your Swagelok representative.

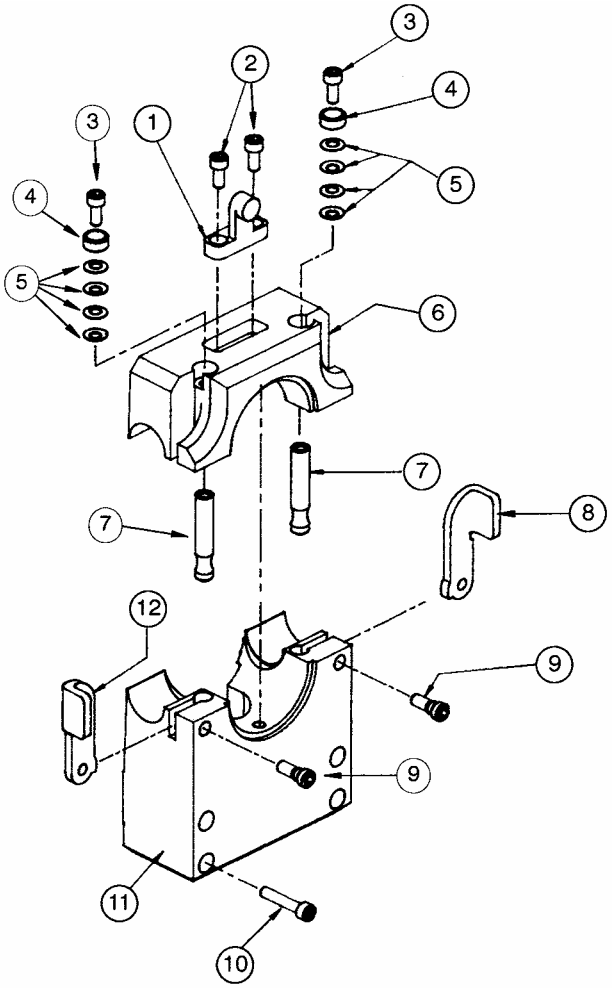


Figure 47 CWS-5FSP1 Special Purpose Fixture Block

Table 13 CWS-5FSP1 Special Purpose Fixture Block Parts List

Reference No.	Description	Part No.	Minimum Order Quantity
1	Locking Tab	12134	1
2	SS Socket Head Cap Screw, 4-40 X 0.250 in.	13112	10
3	SS Socket Head Cap Screw, 4-40 X 0.250 in.	13112	10
4	Plastic Spacer	13245	10
5	Bellville Spring Washer	13244	10
6	Top Side Plate	21200	1
7	Cam Pin	12160-A	1
8	Right Latch Cam	12159	1
9	SS Set Screw, 10-32 X 0.420 in., modified	13224	1
10	SS Socket Head Cap Screw, 4-40 X 0.563 in.	13115	10
11	Bottom Side Plate	21201	1
12	Left Latch Cam	12158	1

For part ordering information, contact your Swagelok representative.

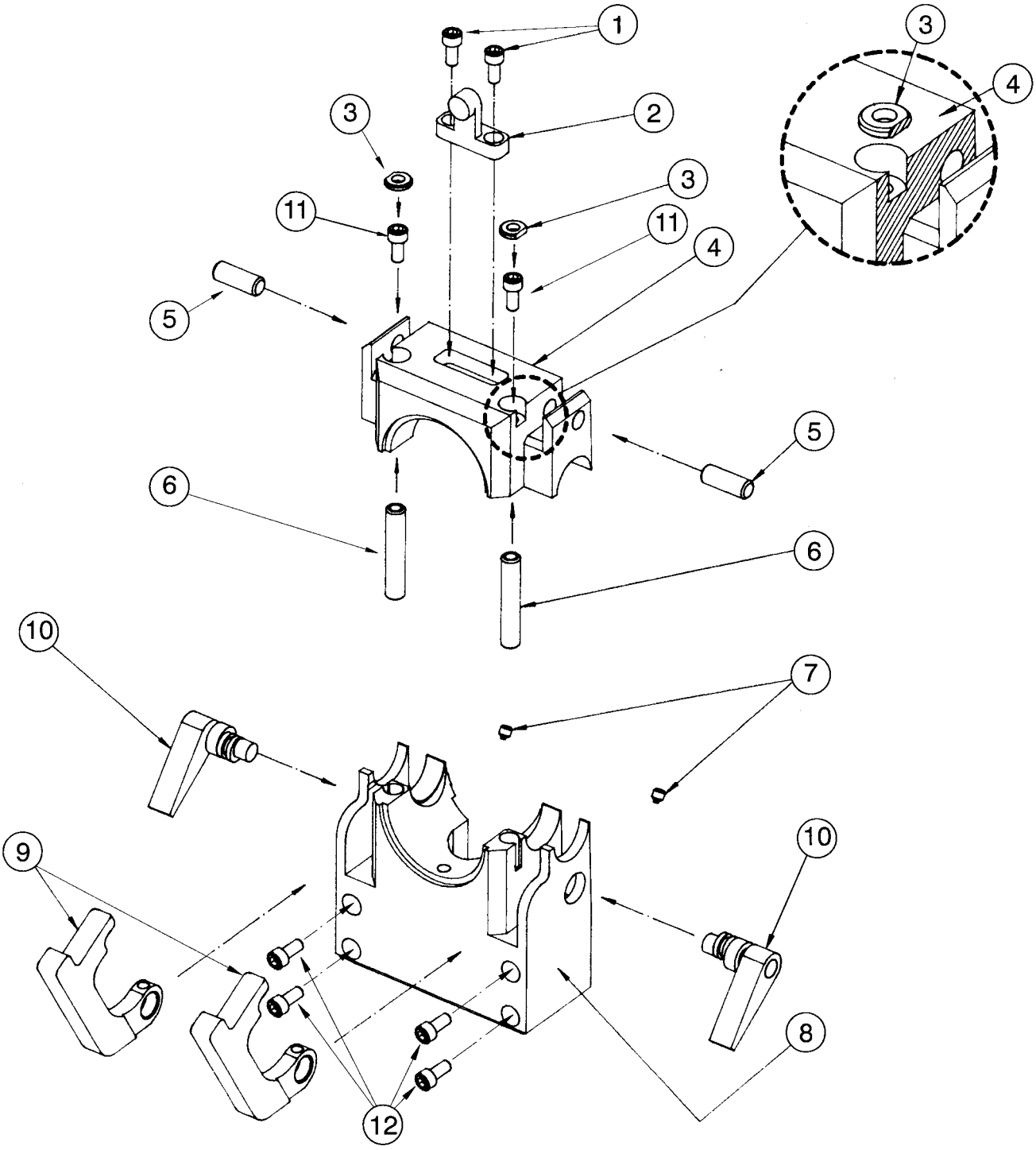


Figure 48 CWS-5FSP2 Special Purpose Fixture Block

Table 14 CWS-5FSP2 Special Purpose Fixture Block Parts List

Reference No.	Description	Part No.	Minimum Order Quantity
1	SS Socket Head Cap Screw, 4-40 x 0.250 in.	13112	10
2	Locking Tab	12134	1
3	Plastic Screw Retainer	12169	10
4	Top Side Plate	21202	1
5	Dowel Pin	N/A	N/A
6	Locator Pin	12168	1
7	SS Set Screw, 4-40 X 0.125 in.	12132	10
8	Bottom Side Plate	21203	1
9	Latch	12167	1
10	Lever Cam Assembly	12130-2	1
11	SS Socket Head Cap Screw, 4.40-X 0.250 in.	13112	10
12	SS Socket Head Cap Screw, 4-40 X 0.563 in.	13115	10

For part ordering information, contact your Swagelok representative.

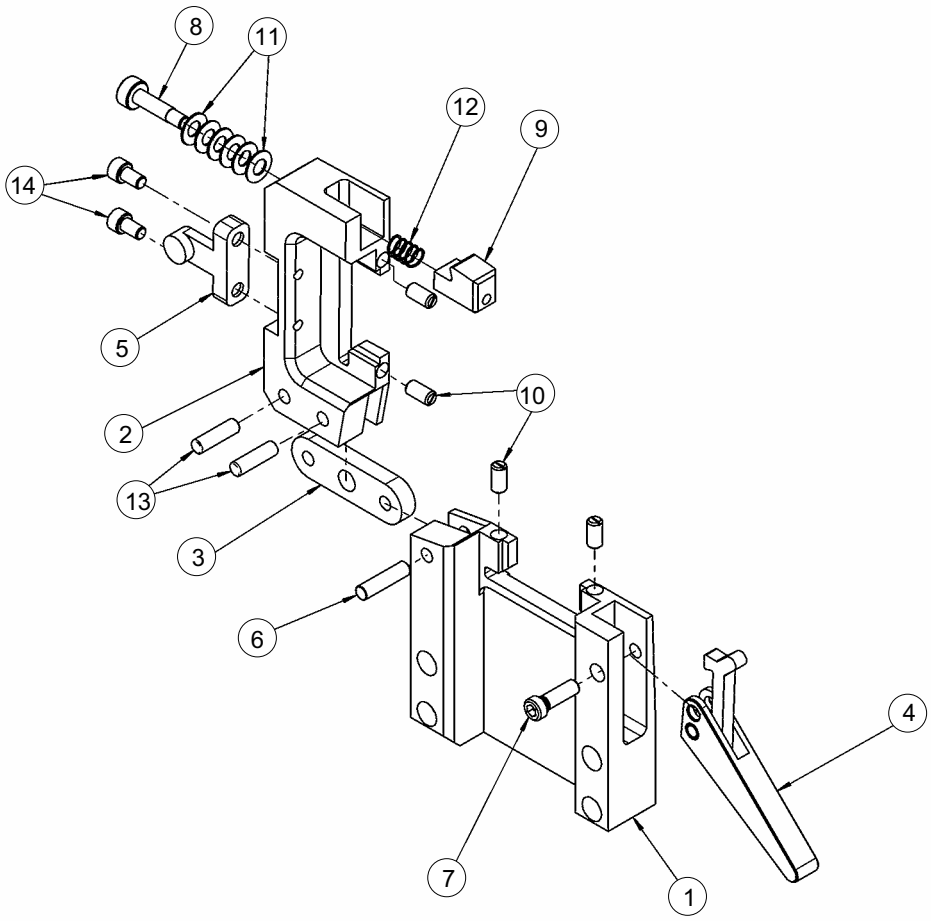


Figure 49 SWS-5FSP3L Side Plate

Table 15 SWS-5FSP3L Side Plate

Reference No.	Description	Part No.	Minimum Order Quantity
1	Bottom Side Plate	N/A	N/A
2	Top Side Plate	N/A	N/A
3	Hinge	N/A	N/A
4	Lever	21030	1
5	Locking Tab	12134	1
6	Dowel Pin	N/A	N/A
7	SS Set Screw, 4-40 X 0.495 in., modified	13226	10
8	SS Socket Head Shoulder Screw, 4-40 X 0.125 X 0.375 in.	13248	10
9	Catch	12122	1
10	Ball Plunger 5-40 X 0.250 in.	13246	10
11	Bellville Spring Washer	13247	10
12	Spring	13370	10
13	Dowel Pin	N/A	N/A
14	SS Socket Head Cap Screw, 4-40 X 0.187 in.	13207	10

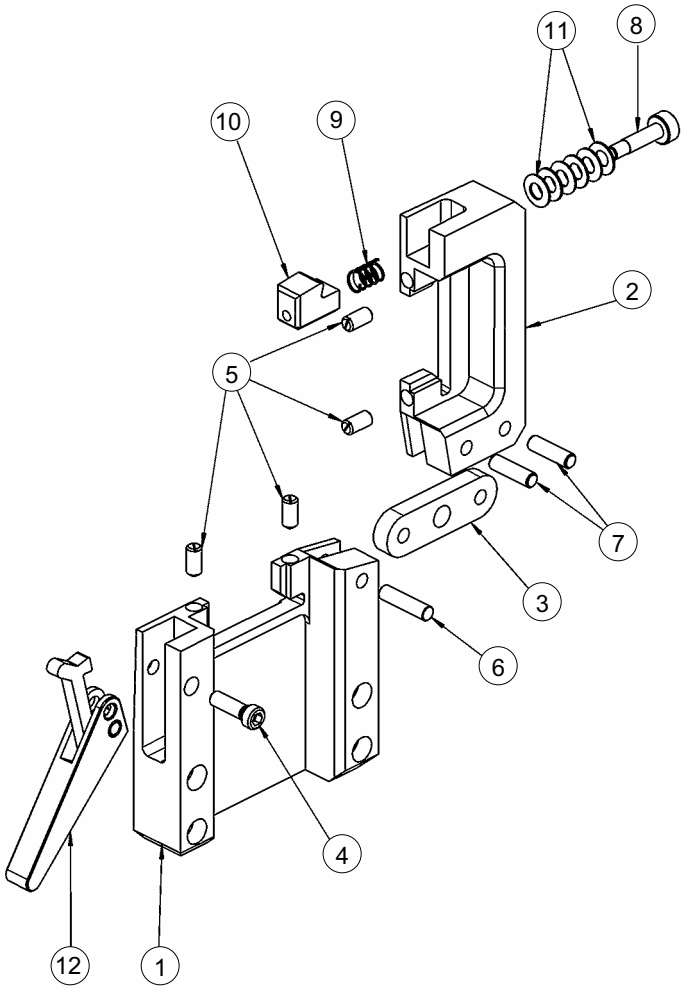


Figure 50 SWS-5FSP3R Side Plate

Table 16 SWS-5FSP3R Side Plate

Reference No.	Description	Part No.	Minimum Order Quantity
1	Bottom Side Plate	N/A	N/A
2	Top Side Plate	N/A	N/A
3	Hinge	N/A	N/A
4	SS Set Screw 10-32 X 0.495 in., modified	13226	10
5	Ball Plunger, 5-40 X 0.250 in.	13246	10
6	Dowel Pin	N/A	N/A
7	Dowel Pin	N/A	N/A
8	SS Socket Head Shoulder Screw, 4-40 X 0.125 X 0.375 in.	13248	10
9	Spring	13370	10
10	Catch	12122	1
11	Bellville Spring Washer	13247	10
12	Lever	21030	1

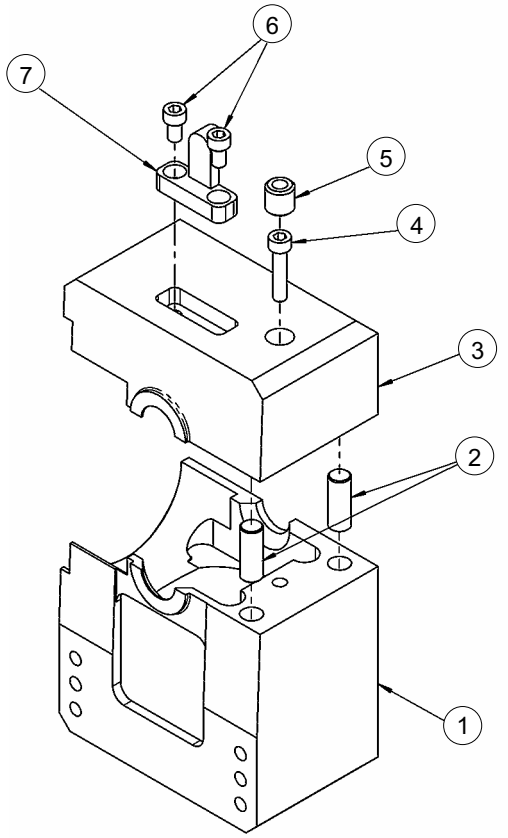


Figure 51 SWS-5FSP4L-XX Side Plate

Table 17 SWS-5FSP4L-XX Side Plate

Reference No.	Description	Part No.	Minimum Order Quantity
1	5FSP4L-XX Bottom	1/4 in. (04): 21213 3/8 in. (06): 21217 6 mm (06 mm): 21221	1
2	Dowel Pin	N/A	N/A
3	5FSP4L-XX Top	1/4 in. (04): 21212 3/8 in. (06): 21216 6 mm (06 mm): 21220	1
4	SS Socket Head Cap Screw, 4-40 X 0.500 in.	13163	10
5	Screw Retainer	12114	10
6	SS Socket Head Cap Screw, 4-40 X 0.187 in.	13207	10
7	Locking Tab	12134	1

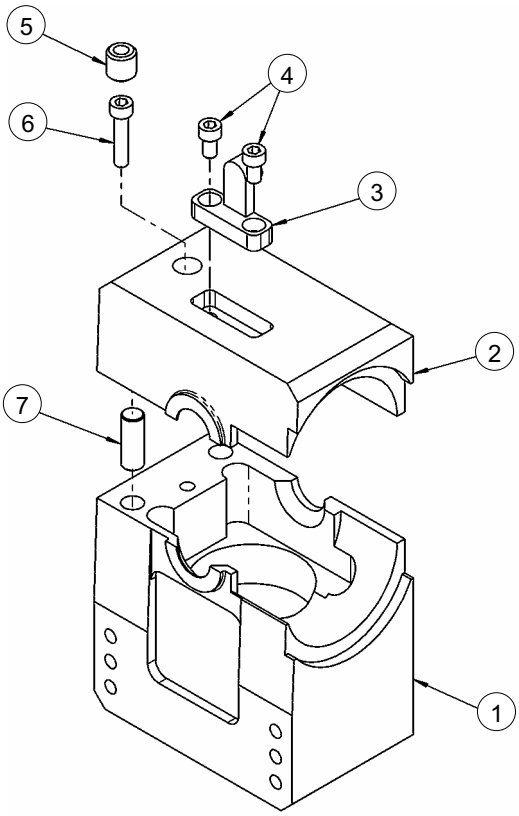


Figure 52 SWS-5FSP4R-XX Side Plate

Table 18 SWS-5FSP4R-XX Side Plate

Reference No.	Description	Part No.	Minimum Order Quantity
1	5FSP4R-XX Bottom	1/4 in. (04): 21215 3/8 in. (06): 21219 6 mm (06 mm): 21223	1
2	5FSP4R-XX Top	1/4 in. (04): 21214 3/8 in. (06): 21218 6 mm (06 mm): 21222	1
3	Locking Tab	12134	1
4	SS Socket Head Cap Screw, 4-40 X 0.187 in.	13207	10
5	Screw Retainer	12114	10
6	SS Socket Head Cap Screw, 4-40 X 0.500 in.	13163	10
7	Dowel Pin	N/A	N/A

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