

Mounting and Assembly of Sandwich Bodies



Sun offers sandwich and subplate mounted bodies for most of its cartridge functions. These mounting configurations are complete circuit elements that mount under directional control valves. Similar to other Sun mounting configurations, the sandwich and subplate bodies are available in aluminum and ductile iron material.

Mounting of ISO 03 (CETOP 3) Sandwiches

Many of Sun's ISO 03 (CETOP 3) sandwich bodies are designed for multi-functional use to permit maximum circuit flexibility. With the exception of a limited range of sandwich bodies, Sun ISO 03 (CETOP 3) sandwich bodies do not have a counterbore for installing O-ring seals. Instead, Sun uses a special seal plate with a raised "NIB" and a locating "NOTCH". Sun bodies incorporate oversize, symmetrical mounting holes to allow the bodies to be rotated about the "Y" axis and the "X" axis as shown in Figure 1.

Rotation about the "Y" axis enables the "A" and "B" port connections to be interchanged and rotation about the "X" axis enables the "P" and "T" ports to be interchanged.

All Sun seal plates are manufactured to accommodate current industry standards regarding port and mounting bolt locations. Each Sun ISO 03 (CETOP 3) sandwich body is supplied with a "NIB" locating hole which is drilled on each mounting face to position the body in the correct relationship to the ports and mounting holes. To further ensure that all bodies are located properly, all ISO 03 (CETOP 3) sandwich bodies are stamped with an arrow (or arrows) to show the relationship to the notch in the seal plate (see Figure 2). Multi-function bodies are "NOTCH" stamped for all possible mounting positions and all positions should be carefully inspected to be sure the intended function is correctly installed.

ISO 03 (CETOP 3) Sandwich Bodies stamped with numbers to orient body for desired function

The function symbols on the data pages for Sun's ISO 03 (CETOP 3) sandwich bodies (see Figure 3 on page 2) are shown with numbers (1,2,3,4) in the upper right and lower left hand corners. These numbers correspond to numbers stamped on the face of the bodies and designate the functionality of the product. Because many of these bodies can be used for different functions, the bodies are stamped to help the user orient the body for the function desired. The Meter-out A and Meter-in B functions are shown in the symbols with the numbers 3 and 4, which correspond to the numbers stamped on the opposite face of the body.

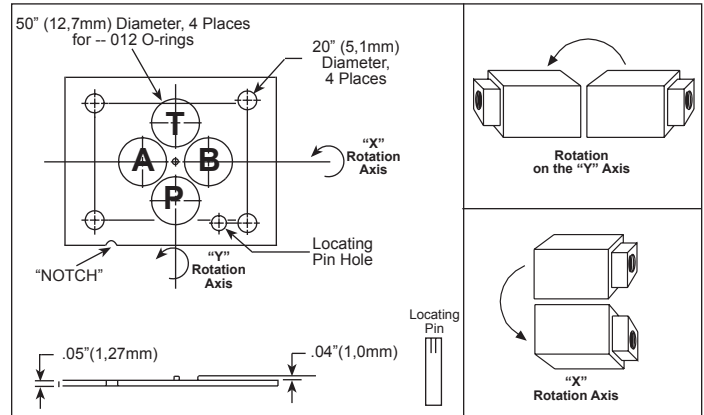


Figure 1. Body Rotation Reference

Assembly of ISO 03 (CETOP 3) Sandwiches

1. Place the seal plate on the subplate mounting surface with the nib facing outward or away from the subplate and the locating pin hole on the seal plate aligned with the pin hole on the subplate mounting surface. At this point, the "NOTCH" in the seal plate should be adjacent to the "P" port of the valve interface. See Figure 1.
2. Position the Sun sandwich body so that the control "NOTCH" arrow for the required function points to the "NOTCH" in the seal plate. See Figure 2.
3. Move the sandwich body as required to engage the "NIB" on the seal plate with the clearance hole in the body.

NOTE: In every installation, the seal plate nib must be oriented toward the directional control valve and away from the subplate or manifold. All locating "NIBS" in the sandwich valve stack must point away from the subplate.

4. After determining the correct alignment of the sandwich body to the seal plate, lift the body and plate together, turn

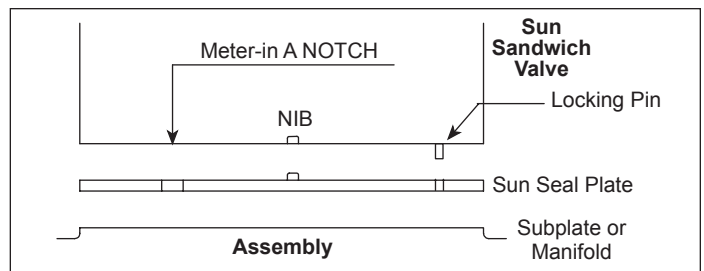


Figure 2. Assembly

the assembly over and locate the correct hole in which to press the locating pin. The locating pin is shipped separately. Press the pin, serrated end first, into the body until it stops. The pin must protrude below the seal plate to positively align with the mounting surface. If a valve stack requires disassembly at anytime, the pin should not be removed. It will simplify the reassembly of the valve stack.

NOTE: Not all manufacturers of subplates offer a pin clearance hole which requires the pin to be omitted.

- After all the body alignments have been determined and all pins installed, assemble the valve stack in the required functional order. Make sure all the O-rings are properly positioned. Install the directional control valve on top of the stack and tighten the stud nuts alternately to the proper torque of 40-45 lb.in. (4.5–5.0 Nm).

Steps to Avoid Seal Plate Leaks

- Make sure the mounting surface is flat and without burrs.
- Do not polish the mounting surface. (*Machining marks help to keep the O-rings from acting as pumps.*)
- Remove any dings on the corners of seal plates that could create gaps.
- Studrods or cap screws must not bottom out in the threaded mounting holes.
- It is very important to keep all of the o-ring sealing surfaces “dry”. The hydrostatic properties of an oil film under the o-rings, and at the seal plate interface, can

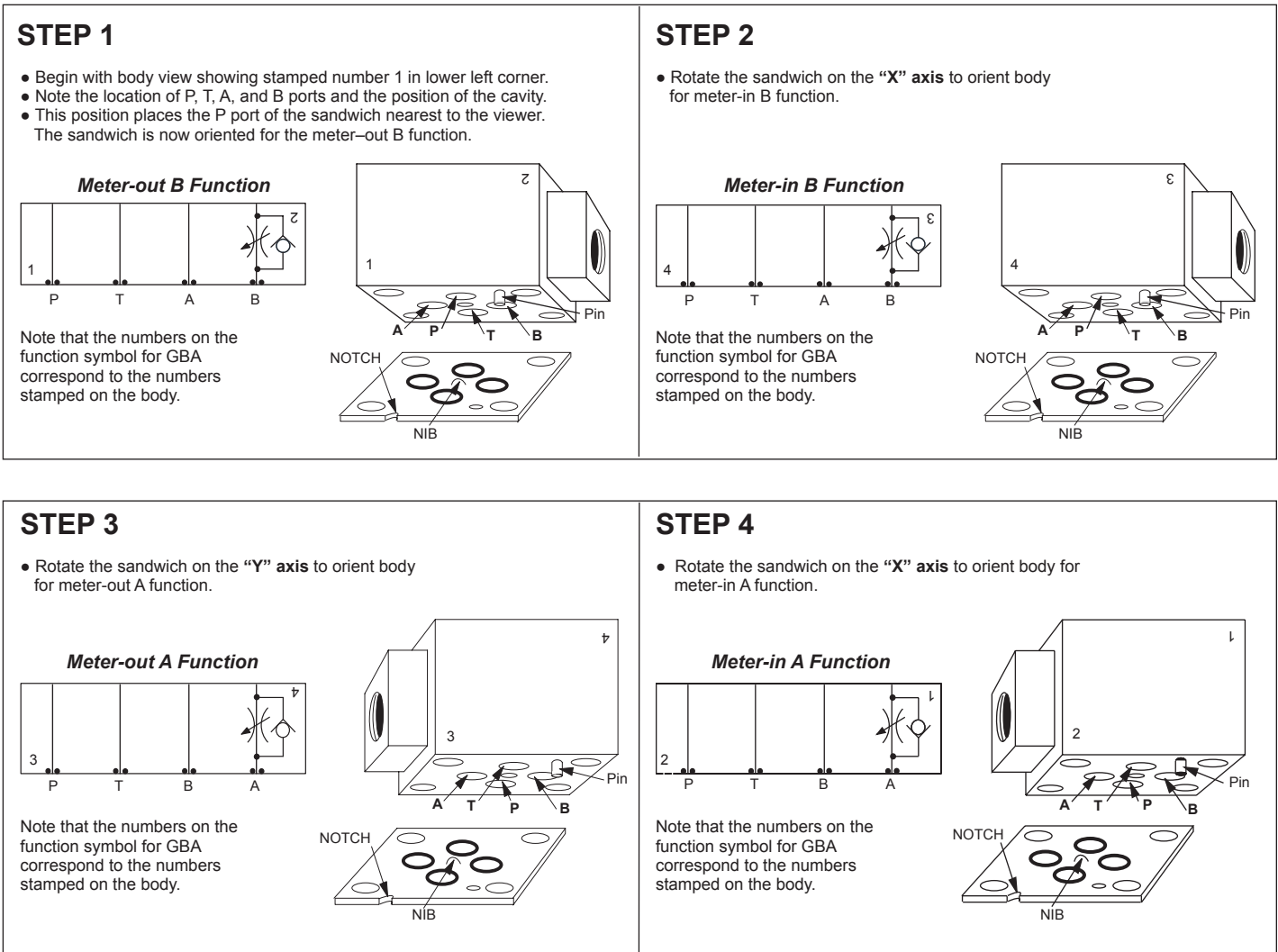


Figure 3: Steps 1 through 4: Orientation Example for ISO 03 (CETOP 3) Sandwich Body GBA

create a fluid path leading from the pressurized port to the outside edge of the stack. *(Under this condition, as noted in step 1, an O-ring can actually act as a “pump”.)*

Warning: If you start with a wet seal interface in your stack, there’s a good chance it will always stay wet!

Orientation Example for ISO 03 (CETOP 3) bodies

Steps 1 through 4 in *Figure 3* on page 2 describe in detail the steps for the orientation of a GBA sandwich body.

Mounting ISO 05 (CETOP 5) Sandwich Bodies

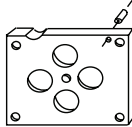
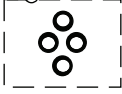
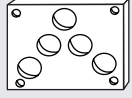
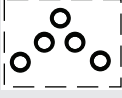
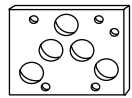
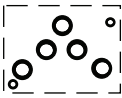
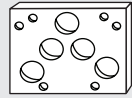
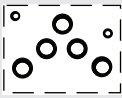
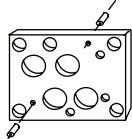
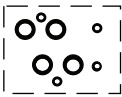
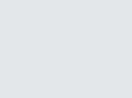
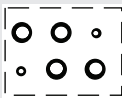
Sun ISO 05 (CETOP 5) sandwich bodies are available for many mounting configurations. The standard ISO 05 (CETOP 5)/NFPA D05 is offered with two methods of sealing the fluid interface. The sealing method depends

on the ability of the body to be rotated about its “Y” axis. Sandwich bodies that can be rotated will use a Sun seal plate supplied with the body. Non-rotating bodies will have counterbores machined into the body sealing surface for O-ring placement. The ISO 05 (CETOP 5) sandwich body can only be rotated about the “Y” axis referred to in the ISO 03 (CETOP 3) sandwich section. (There is no “NIB” on the ISO 05 (CETOP 5) subplate.) “X” axis rotation is not possible due to the lack of symmetry of the fluid ports.

Mounting ISO 05 (CETOP 5) x, y Sandwich Bodies

Sun ISO 05 (CETOP 5) x, y sandwich bodies are furnished with pilot and drain connections. Due to the differences in the U.S. and European seal plates, none are supplied with these bodies. They must be ordered separately to correctly match the other valve bodies in the stack. *See Table for Retainers on page 3.*

RETAINERS AND SEALS FOR SANDWICH VALVES

| Valve Pattern Interface | Seal Retainer Only | | Seals | Seal Kit Only | | Seal and Seal Retainer Kit |
|--|---|-----------------|---|----------------|-------------|----------------------------|
| | Seal Retainer | Retainer Number | | Kit Container | Kit Number | Kit Number |
| ISO 03 (CETOP 3) NFPA D03 Was NFPA D01: ISO 03 (CETOP 3) |  | 991-013 |  | Viton | | Viton |
| | | | | 4) 500-101-012 | 990-105-003 | 990-106-003 |
| | | | | Buna-N | | Buna-N |
| | | | | 4) 500-001-012 | 990-105-007 | 990-106-007 |
| ISO 05 (CETOP 5) NFPA D05 Was NFPA D02: ISO 05 (CETOP 5) |  | 991-005 |  | Viton | | Viton |
| | | | | 5) 500-101-014 | 990-110-003 | 990-111-003 |
| | | | | Buna-N | | Buna-N |
| | | | | 5) 500-001-014 | 990-110-007 | 990-111-007 |
| ISO 05 x, y "02H" U.S. |  | 991-008 |  | Viton | | Viton |
| | | | | 5) 500-101-014 | 999-120-003 | 9990-120-010 |
| | | | | Buna-N | | Buna-N |
| | | | | 5) 500-001-014 | 990-120-007 | 990-120-009 |
| ISO 05 x, y (CETOP 5) RPS5H |  | 991-009 |  | Viton | | Viton |
| | | | | 5) 500-101-014 | 990-120-004 | 990-120-011 |
| | | | | Buna-N | | Buna-N |
| | | | | 5) 500-001-014 | 990-120-008 | 990-120-012 |
| ISO 07 (CETOP 7) NFPA D07 Was NFPA D04: ISO 07 (CETOP 7) |  | 990-140-001 |  | Viton | | Viton |
| | | | | 2) 500-101-111 | 990-140-002 | 990-140-003 |
| | | | | Buna-N | | Buna-N |
| | | | | 2) 500-001-111 | 990-140-007 | 990-140-008 |
| ISO 08 (CETOP 8) NFPA D08 Was NFPA D06: ISO 08 (CETOP 8) |  | ----- |  | Viton | | ----- |
| | | | | 2) 500-101-114 | 990-130-003 | ----- |
| | | | | Buna-N | | ----- |
| | | | | 2) 500-101-114 | 990-130-007 | ----- |
| | | | | 4) 500-101-121 | | ----- |
| | | | | 4) 500-110-121 | | ----- |

STUDNUTS AND STUDKITS FOR SANDWICH BODIES

Studkits for ISO 03 (CETOP 3) and ISO 05 (CETOP 5) Sandwich Bodies

To simplify the installation of ISO 03 (CETOP 3) and ISO 05 (CETOP 5) sandwiches, Sun offers uncut (can be cut to length in the field) or precut studkits in both inch and metric standard threaded rod. Once the rods are installed in a subplate or manifold, they act as a guide in assembling the sandwich body stack. After the directional control valve is assembled on top of a stack, Sun studnuts are used to retain the assembled stack.

The inch and metric studrods are both made of high tensile, fully threaded ASTM-A-193 Grade B material with the following mechanical properties:

- 125,000 psi (862 MP_a) minimum tensile strength.
- 105,000 psi (724 MP_a) minimum yield point.
- 26 –32 Rc hardness.

The studnuts are special hex socket nuts with the following features:

- An outside diameter equivalent to a standard socket head cap screw.
- Full thread engagement as shown below.
- Mechanical stop between the internal hex and the thread to prevent the hex wrench from being pushed out of its socket. See Figure 4.

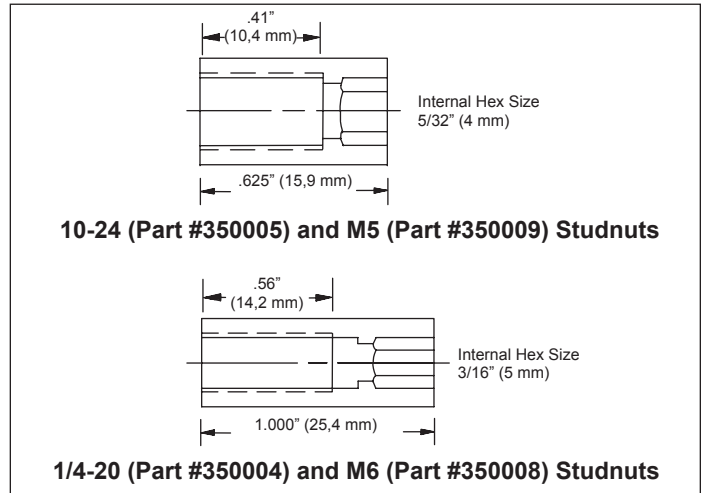


Figure 4. Studnuts

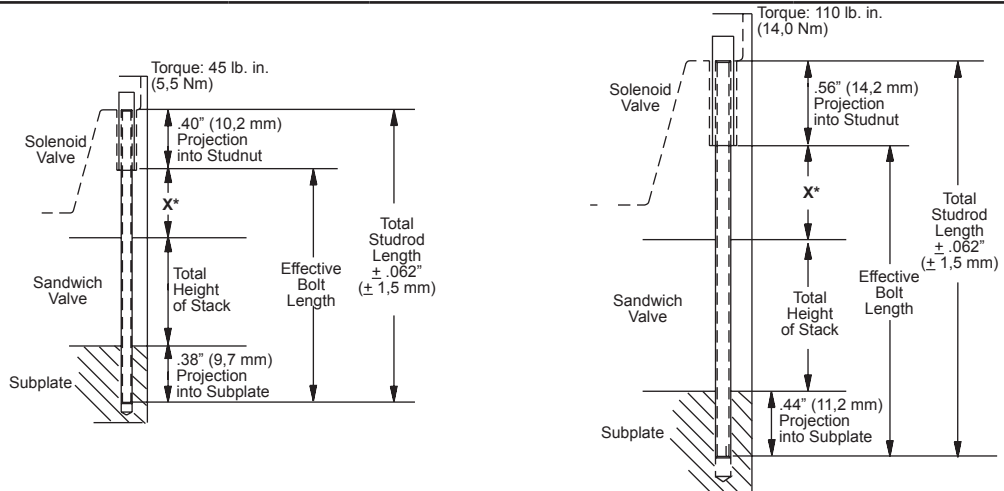
ISO 03 (CETOP 3) STUDKITS: RECOMMENDED TORQUE: 40-45 lb. in. (4,5-5,0 Nm)

| INCH STANDARDS | | METRIC STANDARDS | |
|--|------------|---|------------|
| Kit Contents | Kit Number | Kit Contents | Kit Number |
| 4) 10-24 Studnuts | 992-011 | 4) M5 Studnuts | 992-111 |
| 4) approximately 7" (178 mm) long 10-24 Studrods | | 4) approximately 7" (178 mm) long M5 Studrods | |
| 4) 10-24 Studnuts | 992-012 | 4) M5 Studnuts | 992-112 |
| 4) approximately 12" (305 mm) long 10-24 Studrods | | 4) approximately 12" long (305 mm) long M5 Studrods | |
| 50) 10-24 Studnuts | 992-013 | 50) M5 Studrods | 992-113 |
| 10) approximately 36" (914 mm) long 10-24 Studrods | | 10) approximately 36" (914 mm) long M5 Studrods | |
| 50) 10-24 Studrods | 992-550 | 50) M5 Studnuts | 992-750 |
| 4) 10-24 Studnuts | 922-650 | 4) M5 Studnuts | 992-850 |
| 4) 10-24 Studnuts | | 4) M5 Studrods | |
| 4) 10-24 Studrods cut to customer specified length $\pm .062"$ ($\pm 1,5$ mm) | | cut to customer specified length: $\pm .062"$ ($\pm 1,5$ mm) | |

ISO 05 (CETOP 5) STUDKITS: RECOMMENDED TORQUE: 105-110 lb. in. (12,0-12,5 Nm)

| INCH STANDARDS | | METRIC STANDARDS | |
|--|------------|--|------------|
| Kit Contents | Kit Number | Kit Contents | Kit Number |
| 4) 1/4-20 Studnuts 4) approximately 7" (178 mm) long 1/4-20 Studrods | 992-001 | 4) M6 Studnuts 4) approximately 7" (178 mm) long M6 Studrods | 992-101 |
| 4) 1/4-20 Studnuts 4) approximately 12" (305 mm) long 1/4-20 Studrods | 992-002 | 4) M6 Studnuts 4) approximately 12" long (305 mm) long M6 Studrods | 992-102 |
| 50) 1/4-20 Studnuts 10) approximately 36" (914 mm) long 1/4-20 Studrods | 992-003 | 50) M6 Studrods 10) approximately 36" (914 mm) long M6 Studrods | 992-103 |
| 50) 1/4-20 Studrods | 992-500 | 50) M6 Studnuts | 992-700 |
| 4) 1/4-20 Studnuts 4) 1/4-20 Studnuts 4) 1/4-20 Studrods cut to customer specified length: $\pm .062"$ ($\pm 1,5$ mm) | 922-600 | 4) M6 Studnuts 4) M6 Studrods cut to customer specified length: $\pm .062"$ ($\pm 1,5$ mm) | 992-800 |

STUDROD LENGTH DETERMINATION CHART



| ISO 03 (CETOP 3) | | | | ISO 05 (CETOP 5) ISO 05 x,y (CETOP 5 x,y) | | | |
|--------------------|----------------|-------------|---------|---|-------|-------------|---------|
| | Model | "X" inches* | "X" mm* | | Model | "X" inches* | "X" mm* |
| Continental | EB03M | .625 | 15,9 | VS12M | | 1.31 | 33,3 |
| Continental | VS5M | .625 | 15,9 | ED05M | | 1.31 | 33,3 |
| Double A (Vickers) | Q*-3 | 1.56 | 36,9 | Q*-5 | | 1.05 | 26,7 |
| Parker-Hannifin | D1VW | 1.50 | 38,1 | D3W | | 1.91 | 48,5 |
| Racine Bosch | .25NG6 | .87 | 22,1 | 1/4" | | 1.38 | 35,1 |
| Rexroth | 4WRA6 | 1.26 | 32,0 | 4WE10, 4WEH10 | | 1.18 | 30,0 |
| Dynex/Rivett | 6500 Series 03 | .44 | 11,2 | 6500-02 | | .38 | 9,7 |
| Vickers/40 | DG4V | 1.56 | 39,2 | DG4S4 | | 1.05 | 26,7 |
| Vicker/60 | DG4V | .83 | 21,1 | DG4V5 | | 1.18 | 30,0 |
| Nachi 1 | SSG01 | 1.44 | 36,6 | SSG03, E10, E20 | | 2.38 | 60,5 |

* The X dimension was accurate as of the publication date of this information. Verify in the applicable manufacturers literature.