# General Information

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General Purpose Controls

**L Standard Screw Adjustment**

**K Handknob with Lock Knob**
Handknob and lock knob added to L control. Sun handknob kits for field conversion are available. See cartridge control kits.

**O Handknob with Panel Mount**
Special threaded cartridge hex body with panel nut for mounting cartridge through access hole in control panel. Handknob and lock knob included.

*Panel Hole:*
- Series 1 cartridges: 19.0 mm dia.
- Series 2 cartridges: 25.4 mm dia.

**C Tamper Resistant Factory Set**
Steel cover press-fits onto L control cartridge shoulder. Valves may be ordered in this configuration. **Specify pressure setting on order.** Setting stamped on cartridge hex. Kits for field conversion are available. See cartridge control kits.

Special Purpose Controls (for use in systems where adjustment is seldom changed after installation)

**J Socket Head Set Screw with Cap**
Stem seal O-ring under locknut. Adjustment screw is not retained. No overset protection.

**F Wrench Adjustment**
Stem seal O-ring under locknut. Adjusting screw is not retained. Overset protection-pilot spring cannot go solid.

Counterbalance Valves

All Sun counterbalance cartridges are built with a leakproof adjustment (O-ring seals on the adjusting screw) but are not designed for frequent adjustment in the field. Cartridges that are factory pre-set by Sun to a customer specified pressure setting are available and can be installed directly on a machine without the need for further adjustment.

**L Standard Leakproof Screw Adjustment**
O-ring seal on adjust screw.

**C Tamper Resistant Factory Set**
See C Control description above.
### General Information

#### Cartridge Control Kits

<table>
<thead>
<tr>
<th>Service Kit</th>
<th>Use specifically with Control/Cartridge</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustment</td>
<td>All F controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screw Kit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>991-006</td>
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<tr>
<td>Adjustment</td>
<td>All J controls</td>
<td></td>
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</tr>
<tr>
<td>Screw Kit</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>991-010</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Tamper Resistant Cover

1. Remove original wire stop ring and locknut.
2. Thread on the adapter locknut and install new wire stop ring through slot provided.
3. Adjust valve to desired setting and tighten adapter locknut.
4. Slide lock assembly over adapter, lock and remove key.

#### Key Lock Kit

For all Sun cartridges with L adjustment (except Series 0 and counterbalance cartridges).

#### K Hand Knob Kit

Use this kit to adapt all L controls to K controls (except Series 0 and counterbalance cartridges).

**991-211**
- **K** control for Series 0

**991-222**
- **O** controls

#### Panel Hand Knob Kit

**991-215**
- All Series 1 cartridges
- Series 1 - 22.2 mm (7/8") hex M20 thread

**991-216**
- All Series 2 cartridges
- Series 2 - 28.6 mm (1 1/8") hex 1"-14 thread

#### H Calibrated Hand Knob Kit

Use this kit to adapt all L controls to H controls.

**991-219**
- FDCB, NCEB, NCEC, NFDC, NFDD only

**991-220**
- FDEA, FDFA, NCFA, NCFG, NCGB, NCGC, NFEC, NFED, NFFC, NFDD only

**991-221**
- FDBA, NCBB, NCCC, NFCC, NFDC only

#### Lockwire

**911-012**
- All M, O and R controls (except solenoid operated cartridges).

#### Adjustment Screw Kit

**991-112-003 Viton**
- CKCA L"CKCD L" CKCB L"CPCA L"

**991-112-007 Buna-N**
- CKCC L"

#### Adjustment Screw Kit

**991-212-003 Viton**
- CKEA L"CKED L" CKEB L"CPEA L"

**991-212-007 Buna-N**
- CKEC L"

Note: The H control is only available for the cartridges shown to the left.

Only for cartridges originally supplied with an H handknob. Valves can not be modified in the field.

Only cartridges date stamped “41” or later and originally supplied with plastic knobs. Lock knob snaps onto locknut furnished on cartridge.

Only cartridges date stamped “62” or earlier.

Only cartridges date stamped “62” or earlier.
**General Information**

**CAVITY PLUGS**

It is sometimes desirable to remove a Sun cartridge valve and still maintain the integrity of the hydraulic system. This may be necessitated by the need to flush a system after repairs or a piping change, or to change an operating function in the circuit. For these requirements, Sun offers two styles of cavity plugs - all ports blocked and main ports open to flow.

### Plugs for Two Port Cavities:

<table>
<thead>
<tr>
<th>Series</th>
<th>Cavity</th>
<th>All Ports Open</th>
<th>All Ports Blocked</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>T-8A</td>
<td>XAOA-XX*</td>
<td>XACA-XX*</td>
</tr>
<tr>
<td>0</td>
<td>T-162A</td>
<td>XZOA-XX*</td>
<td>XZCA-XX*</td>
</tr>
<tr>
<td>1</td>
<td>T-10A</td>
<td>XFOA-XX*</td>
<td>XFCA-XX*</td>
</tr>
<tr>
<td>1</td>
<td>T-13A</td>
<td>XFOA-XX*</td>
<td>XGCA-XX*</td>
</tr>
<tr>
<td>2</td>
<td>T-3A</td>
<td>XCOA-XX*</td>
<td>XCCA-XX*</td>
</tr>
<tr>
<td>2</td>
<td>T-5A</td>
<td>XCOA-XX*</td>
<td>XDCA-XX*</td>
</tr>
<tr>
<td>3</td>
<td>T-16A</td>
<td>XIOA-XX*</td>
<td>XICA-XX*</td>
</tr>
<tr>
<td>4</td>
<td>T-18A</td>
<td>XKOA-XX*</td>
<td>XKCA-XX*</td>
</tr>
</tbody>
</table>

*Insert in the seventh position model code digit N to order Buna-N seals or V to order Viton seals.

### Plugs for Three Port Cavities

<table>
<thead>
<tr>
<th>Series</th>
<th>Cavity</th>
<th>Ports 1 to 2 Open</th>
<th>All Ports Blocked</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>T-9A</td>
<td>XAOB-XX*</td>
<td>XACB-XX*</td>
</tr>
<tr>
<td>0</td>
<td>T-163A</td>
<td>XZOB-XX*</td>
<td>XZCB-XX*</td>
</tr>
<tr>
<td>1</td>
<td>T-11A</td>
<td>XEOA-XX*</td>
<td>XECA-XX*</td>
</tr>
<tr>
<td>2</td>
<td>T-2A</td>
<td>XBOA-XX*</td>
<td>XBCA-XX*</td>
</tr>
<tr>
<td>3</td>
<td>T-17A</td>
<td>XHOA-XX*</td>
<td>XHCA-XX*</td>
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<tr>
<td>4</td>
<td>T-19A</td>
<td>XJOA-XX*</td>
<td>XJCA-XX*</td>
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</table>

### Plugs for Four Port Cavities (Internal Locating Shoulder)

<table>
<thead>
<tr>
<th>Series</th>
<th>Cavity</th>
<th>Ports 1 to 2 Open</th>
<th>All Ports Blocked</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>T-21A</td>
<td>XMOA-XX*</td>
<td>XMCA-XX*</td>
</tr>
<tr>
<td>2</td>
<td>T-22A</td>
<td>XMOA-XX*</td>
<td>XNCA-XX*</td>
</tr>
<tr>
<td>3</td>
<td>T-23A</td>
<td>XPOMA-XX*</td>
<td>XPMA-XX*</td>
</tr>
<tr>
<td>4</td>
<td>T-24A</td>
<td>XQOA-XX*</td>
<td>XQCA-XX*</td>
</tr>
</tbody>
</table>
General Information

CAVITY PLUGS

Plugs for Four Port Cavities (External Locating Shoulder)

<table>
<thead>
<tr>
<th>Series</th>
<th>Cavity</th>
<th>All Ports Open</th>
<th>All Ports Blocked</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>T-31A</td>
<td>XFOA-XX*</td>
<td>XRCA-XX*</td>
</tr>
<tr>
<td>2</td>
<td>T-32A</td>
<td>XGOA-XX*</td>
<td>XSCA-XX*</td>
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<tr>
<td>3</td>
<td>T-33A</td>
<td>XIOA-XX*</td>
<td>XTCA-XX*</td>
</tr>
<tr>
<td>4</td>
<td>T-34A</td>
<td>XKOA-XX*</td>
<td>XVCA-XX*</td>
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</table>

Plugs for Six Port Cavities

<table>
<thead>
<tr>
<th>Series</th>
<th>Cavity</th>
<th>Ports 1, 2, 3 and 4 Open</th>
<th>Ports 5 and 6 Blocked</th>
<th>All Ports Blocked</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>T-61A</td>
<td>XMOA-XX*</td>
<td>XRCC-XX*</td>
<td>XRCX-XX*</td>
</tr>
<tr>
<td>2</td>
<td>T-62A</td>
<td>XNOA-XX*</td>
<td>XSCC-XX*</td>
<td>XSCX-XX*</td>
</tr>
<tr>
<td>3</td>
<td>T-63A</td>
<td>XPOA-XX*</td>
<td>XTCC-XX*</td>
<td>XTCC-XX*</td>
</tr>
<tr>
<td>4</td>
<td>T-64A</td>
<td>XQOA-XX*</td>
<td>XVCC-XX*</td>
<td>XVCC-XX*</td>
</tr>
</tbody>
</table>

Cavity Adaptor (Adapts Waterman 12-2 Cavity to the Sun T-8A Cavity)

<table>
<thead>
<tr>
<th>Cavity</th>
<th>All Ports Open</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-2</td>
<td>XAAA-8X*</td>
</tr>
</tbody>
</table>

*Insert in the seventh position model code digit N to order Buna-N seals or V to order Viton seals.
### General Information

#### SOLENOID ELECTRICAL CONNECTOR OPTIONS

**Pilot Flow Solenoid Valves: DAAA, DBAA**

ISO / DIN 43650  
SAE J858-A  
Twin Lead

<table>
<thead>
<tr>
<th>Description</th>
<th>Coil only part number</th>
<th>Coil only part number</th>
<th>Coil only part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>115 V AC 50/60 Hz</td>
<td>760-211</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>230 V AC 50/60 Hz</td>
<td>760-223</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>6 V DC</td>
<td>760-206</td>
<td>760-506</td>
<td>N/A</td>
</tr>
<tr>
<td>12 V DC</td>
<td>760-212</td>
<td>760-512</td>
<td>760-712</td>
</tr>
<tr>
<td>24 V DC</td>
<td>760-224</td>
<td>760-524</td>
<td>760-724</td>
</tr>
<tr>
<td>36 V DC</td>
<td>760-236</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>48 V DC</td>
<td>760-248</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Full Flow Solenoid Valves: DLDA, DTDA, DMDA, DNDA**

ISO / DIN 43650  
AMP® Junior Timer  
Twin Lead

<table>
<thead>
<tr>
<th>Description</th>
<th>Coil only part number</th>
<th>Coil only part number</th>
<th>Coil only part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>115 V AC 50/60 Hz</td>
<td>770-211</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>230 V AC 50/60 Hz</td>
<td>770-223</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>12 V DC</td>
<td>770-212</td>
<td>770-612</td>
<td>770-712</td>
</tr>
<tr>
<td>24 V DC</td>
<td>770-224</td>
<td>770-624</td>
<td>770-724</td>
</tr>
<tr>
<td>48 V DC</td>
<td>770-248</td>
<td>770-648</td>
<td>770-748</td>
</tr>
</tbody>
</table>

AMP® is a registered trademark.
No allowance has been made for viscosity effects, or regain of pressure downstream.

These charts are based on the formula:

\[ Q = \frac{A}{2 \alpha P} \]

Where:
- \( Q \) = Flow m³/sec.
- \( \alpha \) = orifice coefficient
- \( A \) = orifice dia. cm²
- \( P \) = pressure drop N/m²
- \( \rho \) = density Ns²/m⁴

This equation becomes:

\[ Q (l/min) = 0.4212 \times d^2 \text{ (mm)} \sqrt{\text{pressure drop (bar)}} \]

when \( c = 0.6 \)

\( \rho = 0.9 \text{ g/cm}^3 \)
General Information: Cartridge Cavities and Cavity Tools

NOTES: Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

T-8A  2 Port Sun Cavity

Minimum Clearance Distances:

* See respective Pilot Stage Cartridge Outline Drawing for Deep Socket and Hex Point clearance centreline dimensions

High Speed Steel  |  Titanium Coated
--- | ---
Form Drill TD-8A  |  994-008-001  |  994-008-101
Form Reamer TR-8A  |  995-008-001  |  995-008-101
Metric Tap M16x1.5-6H  |  998-991  |  998-991-101

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

7/8” Hex Deep Socket:
Sun P/N: 998-100-006, Snap-On P/N: SIML280

T-9A  3 Port Sun Cavity

Minimum Clearance Distances:

* See respective Pilot Stage Cartridge Outline Drawing for Deep Socket and Hex Point clearance centreline dimensions

High Speed Steel  |  Titanium Coated
--- | ---
Form Drill TD-9A  |  994-009-001  |  994-009-101
Form Reamer TR-9A  |  995-009-001  |  995-009-101
Metric Tap M16x1.5-6H  |  998-991  |  998-991-101

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

7/8” Hex Deep Socket:
Sun P/N: 998-100-006, Snap-On P/N: SIML280
**General Information: Cartridge Cavities and Cavity Tools**

**NOTES:** Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

## SERIES 0

### T-162A  2 Port Sun Cavity

<table>
<thead>
<tr>
<th>Description</th>
<th>Model Code</th>
<th>Model Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form Drill</td>
<td>994-162-001</td>
<td>994-162-101</td>
</tr>
<tr>
<td>Form Reamer T-162A</td>
<td>995-162-001</td>
<td>995-162-101</td>
</tr>
<tr>
<td>Metric Tap M16x1.5-6H</td>
<td>998-991</td>
<td>998-991-101</td>
</tr>
</tbody>
</table>

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

**3/4” Hex Deep Socket:**
- Sun P/N: 998-100-005, Snap-On P/N: S241

### T-163A  3 Port Sun Cavity

<table>
<thead>
<tr>
<th>Description</th>
<th>Model Code</th>
<th>Model Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form Drill</td>
<td>994-163-001</td>
<td>994-163-101</td>
</tr>
<tr>
<td>Form Reamer T-163A</td>
<td>995-163-001</td>
<td>995-163-101</td>
</tr>
<tr>
<td>Metric Tap M16x1.5-6H</td>
<td>998-991</td>
<td>998-991-101</td>
</tr>
</tbody>
</table>

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

**3/4” Hex Deep Socket:**
- Sun P/N: 998-100-005, Snap-On P/N: S241

---

**Minimum Clearance Distances:**

#### T-162A 2 Port Sun Cavity
- Minimum Depth of 10.3 for Working Parts Clearance
- 22.2 Hex Point to Socket Diameter
- 11.5 Manifold Edge
- 24.6 Deep Socket

#### T-163A 3 Port Sun Cavity
- Minimum Depth of 10.3 for Working Parts Clearance
- 22.2 Hex Point to Socket Diameter
- 11.5 Manifold Edge
- 24.6 Deep Socket

---

**Cavity Diameters to be concentric to threads within 0.05.**

© SUN Hydraulics Corporation
General Information: Cartridge Cavities and Cavity Tools

**NOTES:** Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

**SERIES 1**

**T-10A 2 Port Sun Cavity**

<table>
<thead>
<tr>
<th>Description</th>
<th>Model Code</th>
<th>Model Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form Drill</td>
<td>994-010-001</td>
<td>994-010-101</td>
</tr>
<tr>
<td>Form Reamer</td>
<td>995-010-001</td>
<td>995-010-101</td>
</tr>
<tr>
<td>Metric Tap</td>
<td>998-998</td>
<td>998-998-101</td>
</tr>
</tbody>
</table>

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

7/8” Hex Deep Socket:
Sun P/N: 998-100-001, Snap-On P/N: S281

**T-13A 2 Port Sun Cavity**

<table>
<thead>
<tr>
<th>Description</th>
<th>Model Code</th>
<th>Model Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form Drill</td>
<td>994-013-001</td>
<td>994-013-101</td>
</tr>
<tr>
<td>Form Reamer</td>
<td>995-013-001</td>
<td>995-013-101</td>
</tr>
<tr>
<td>Metric Tap</td>
<td>998-998</td>
<td>998-998-101</td>
</tr>
</tbody>
</table>

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

7/8” Hex Deep Socket:
Sun P/N: 998-100-001, Snap-On P/N: S281

Cavity Diameters to be concentric to threads within 0.05.
**General Information: Cartridge Cavities and Cavity Tools**

**NOTES:** Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

**SERIES 1**

---

**T-11A 3 Port Sun Cavity**

Cavity Diameters to be concentric to threads within 0.05.

**Minimum Clearance Distances:**

- **15.1 Manifold Edge**
- **28.6 Deep Socket**

---

**T-21A 4 Port Sun Cavity**

Cavity Diameters to be concentric to threads within 0.05.

**Minimum Clearance Distances:**

- **15.9 Manifold Edge**
- **28.6 Deep Socket**

---

**General Information: Cartridge Cavities and Cavity Tools**

**NOTES:** Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

**SERIES 1**

---

**T-11A 3 Port Sun Cavity**

Cavity Diameters to be concentric to threads within 0.05.

**Minimum Clearance Distances:**

- **15.1 Manifold Edge**
- **28.6 Deep Socket**

---

**T-21A 4 Port Sun Cavity**

Cavity Diameters to be concentric to threads within 0.05.

**Minimum Clearance Distances:**

- **15.9 Manifold Edge**
- **28.6 Deep Socket**

---
NOTES: Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

**T-31A 4 Port Sun Cavity**

Cavity Diameters to be concentric to threads within 0.05.

**T-61A 6 Port Sun Cavity**

Cavity Diameters to be concentric to threads within 0.05.

**Minimum Clearance Distances:**

**High Speed Steel**

<table>
<thead>
<tr>
<th>Description</th>
<th>Model Code</th>
<th>Model Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form Drill</td>
<td>994-031-001</td>
<td>994-031-101</td>
</tr>
<tr>
<td>Form Reamer</td>
<td>995-031-001</td>
<td>995-031-101</td>
</tr>
<tr>
<td>Metric Tap</td>
<td>998-998</td>
<td>998-998-101</td>
</tr>
</tbody>
</table>

Note: Drill and Reamer have a 3 Morse taper. Tap has straight shank.

**7/8" Hex Deep Socket:**

Sun P/N: 998-100-001, Snap-On P/N: S281
NOTES: Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

**Series 2**

### T-3A  2 Port Sun Cavity

**Minimum Clearance Distances:**

![Diagram](image1)

#### Dimensions:

- **Socket Wrench Clearance:** 38.1
- **Minimum Hex Extension:** 18.3
- **Maximum L.S. Depth without Socket Clearance:** 11.1
- **Locating Shoulder:** 0.000
- **Minimum Full Thread:** 4.0
- **Uns 1"-14:** 27.38
- **Port:** 24.8
- **Manifold Edge:** 18.3
- **Socket Diameter:** 36.5
- **Hex Point:** 34.9

**Socket Wrench Clearance (not included on Form Drill):**

- 38.1
- 34.9

**High Speed Steel**

- **Form Drill:** 994-003-001
- **Reamer:** 995-003-001
- **UNS Tap:** 998-999

**Titanium Coated**

- **Form Drill:** 994-003-101
- **Reamer:** 995-003-101
- **UNS Tap:** 998-999-101

**Note:** Drill and Reamer have a #3 Morse taper. Tap has straight shank.

**1 1/8" Hex Deep Socket:**

- **Sun P/N:** 998-100-002
- **Snap-On P/N:** S361

---

### T-5A  2 Port Sun Cavity

**Minimum Clearance Distances:**

![Diagram](image2)

#### Dimensions:

- **Socket Wrench Clearance:** 38.1
- **Minimum Hex Extension:** 17.5
- **Maximum L.S. Depth without Socket Clearance:** 21.4
- **Locating Shoulder:** 0.000
- **Minimum Full Thread:** 4.0
- **Uns 1"-14:** 27.38
- **Port:** 24.8
- **Manifold Edge:** 18.3
- **Socket Diameter:** 36.5
- **Hex Point:** 34.9

**Socket Wrench Clearance (not included on Form Drill):**

- 38.1
- 34.9

**High Speed Steel**

- **Form Drill:** 994-005-001
- **Reamer:** 995-005-001
- **UNS Tap:** 998-999

**Titanium Coated**

- **Form Drill:** 994-005-101
- **Reamer:** 995-005-101
- **UNS Tap:** 998-999-101

**Note:** Drill and Reamer have a #3 Morse taper. Tap has straight shank.

**1 1/8" Hex Deep Socket:**

- **Sun P/N:** 998-100-002
- **Snap-On P/N:** S361

---

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NOTES: Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

**SERIES 2**

### T-2A 3 Port Sun Cavity

Cavity Diameters to be concentric to threads within 0.05.

![Diagram of T-2A 3 Port Sun Cavity](image)

#### Minimum Clearance Distances:

- **High Speed Steel**: 19.1 Manifold Edge
- **Titanium Coated**: 36.5 Deep Socket

<table>
<thead>
<tr>
<th>Description</th>
<th>Model Code</th>
<th>Model Code</th>
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<tbody>
<tr>
<td>Form Drill</td>
<td>994-002-001</td>
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<tr>
<td>Form Reamer</td>
<td>995-002-001</td>
<td>995-002-101</td>
</tr>
<tr>
<td>UNS Tap</td>
<td>998-999</td>
<td>998-999-101</td>
</tr>
</tbody>
</table>

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

### T-22A 4 Port Sun Cavity

Cavity Diameters to be concentric to threads within 0.05.

![Diagram of T-22A 4 Port Sun Cavity](image)

#### Minimum Clearance Distances:

- **High Speed Steel**: 19.5 Manifold Edge
- **Titanium Coated**: 36.5 Deep Socket

<table>
<thead>
<tr>
<th>Description</th>
<th>Model Code</th>
<th>Model Code</th>
</tr>
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<tbody>
<tr>
<td>Form Drill</td>
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<tr>
<td>Form Reamer</td>
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<tr>
<td>UNS Tap</td>
<td>998-999</td>
<td>998-999-101</td>
</tr>
</tbody>
</table>

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

**1 1/8" Hex Deep Socket:**

- Sun P/N: 998-100-002, Snap-On P/N: S361
NOTES: Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

**SERIES 2**

### T-32A 4 Port Sun Cavity

- **Socket Wrench Clearance**
  - Sun P/N: 998-100-002
  - Snap-On P/N: S361

**Minimum Clearance Distances:**

<table>
<thead>
<tr>
<th>Description</th>
<th>High Speed Steel</th>
<th>Titanium Coated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form Drill</td>
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<td>Form Reamer</td>
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<td>995-032-101</td>
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<tr>
<td>UNS Tap</td>
<td>998-999</td>
<td>998-999-101</td>
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</tbody>
</table>

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

1 1/8" Hex Deep Socket:

- Sun P/N: 998-100-002, Snap-On P/N: S361

### T-62A 6 Port Sun Cavity

- **Socket Wrench Clearance**
  - Sun P/N: 998-100-002
  - Snap-On P/N: S361

**Minimum Clearance Distances:**

<table>
<thead>
<tr>
<th>Description</th>
<th>High Speed Steel</th>
<th>Titanium Coated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form Drill</td>
<td>994-062-001</td>
<td>994-062-101</td>
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<tr>
<td>Form Reamer</td>
<td>995-062-001</td>
<td>995-062-101</td>
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<tr>
<td>UNS Tap</td>
<td>998-999</td>
<td>998-999-101</td>
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</tbody>
</table>

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

1 1/8" Hex Deep Socket:

- Sun P/N: 998-100-002, Snap-On P/N: S361

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NOTES: Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

**SERIES 3**

### T-16A 2 Port Sun Cavity

![Diagram of T-16A 2 Port Sun Cavity](image)

Cavity Diameters to be concentric to threads within 0,05.

### T-17A 3 Port Sun Cavity

![Diagram of T-17A 3 Port Sun Cavity](image)

Cavity Diameters to be concentric to threads within 0,05.

**Minimum Clearance Distances:**

#### High Speed Steel

<table>
<thead>
<tr>
<th>Description</th>
<th>Model Code</th>
<th>Titanium Coated</th>
<th>Model Code</th>
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<tbody>
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<tr>
<td>Metric Tap</td>
<td>998-996</td>
<td>998-996-101</td>
<td></td>
</tr>
</tbody>
</table>

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

1 1/4" Hex Deep Socket:

Sun P/N: 998-100-003, Snap-On P/N: S401

**Minimum Clearance Distances:**

#### High Speed Steel

<table>
<thead>
<tr>
<th>Description</th>
<th>Model Code</th>
<th>Titanium Coated</th>
<th>Model Code</th>
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<tr>
<td>Form Drill</td>
<td>994-017-001</td>
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<tr>
<td>Form Reamer</td>
<td>995-017-001</td>
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<td></td>
</tr>
<tr>
<td>Metric Tap</td>
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<td>998-996-101</td>
<td></td>
</tr>
</tbody>
</table>

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

1 1/4" Hex Deep Socket:

Sun P/N: 998-100-003, Snap-On P/N: S401

© SUN Hydraulics Corporation
NOTES: Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

**SERIES 3**

### T-23A 4 Port Sun Cavity

- **62.7 Minimum Hex Extension**
- **44.45 Socket Wrench Clearance** (included on Form Drill)
- **42.5 ref**
- **41.3 Minimum Surface from L.S.**
- **7.14 Port ø Centreline**
- **28.6 Port ø Centreline**
- **12.7 Maximum**
- **36.5 Minimum Full Thread**
- **31.75 ø**
- **26.4 ø Maximum**
- **45° Typical (4) Places**

Cavity Diameters to be concentric to threads within 0.05.

### T-33A 4 Port Sun Cavity

- **17.5 Minimum Hex Extension**
- **44.45 Socket Wrench Clearance** (not included on Form Drill)
- **42.5 ref**
- **11.1 Maximum L.S. Depth without Socket Clearance**
- **0.000 Locating Shoulder**
- **27.0 ø Maximum**
- **30.2 Port ø Centreline**
- **18.3 ø Maximum**
- **36.5 ø Maximum**
- **31.75 ø**
- **31.80 ø**

Cavity Diameters to be concentric to threads within 0.05.

### Minimum Clearance Distances:

#### High Speed Steel

<table>
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<tr>
<th>Description</th>
<th>Model Code</th>
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<tbody>
<tr>
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<td>994-023-101</td>
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<td>Form Reamer TR-23A</td>
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<tr>
<td>Metric Tap M36x2-6H</td>
<td>998-996</td>
<td>998-996-101</td>
</tr>
</tbody>
</table>

#### Note:
- Drill and Reamer have a #3 Morse taper. Tap has straight shank.

**1 1/4" Hex Deep Socket:**

Sun P/N: **998-100-003**, Snap-On P/N: S401
**General Information: Cartridge Cavities and Cavity Tools**

**NOTES:** Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

**SERIES 3**

---

**T-63A 6 Port Sun Cavity**

**Minimum Clearance Distances:**

- **Socket Wrench Clearance**
- **Form Drill**
- **Form Reamer**
- **Metric Tap**

### T-Bolt Mounting Dimensions:

- **28.6 Manifold Edge**
- **49.2 Deep Socket**
- **49.2 Hex Point C to C**
- **Socket Diameter**

### Minimum Depth of Parts Clearance:

- **Cartridge Nose Support**
- **Minimum Depth of 22.2 for Working Parts Clearance**

### Drill and Reamer Specifications:

- **Note:** Drill and Reamer have a #3 Morse taper. Tap has straight shank.

### 1 1/4" Hex Deep Socket:

- **Sun P/N:** 998-100-003
- **Snap-On P/N:** S401

---

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**General Information: Cartridge Cavities and Cavity Tools**

*NOTES:* Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

**SERIES 4**

### T-18A  2 Port Sun Cavity

Cavity Diameters to be concentric to threads within 0.05.

### T-19A  3 Port Sun Cavity

Cavity Diameters to be concentric to threads within 0.05.

### Minimum Clearance Distances:

<table>
<thead>
<tr>
<th>Description</th>
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<th>Titanium Coated Model Code</th>
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</thead>
<tbody>
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<td>Form Drill</td>
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<td>Form Reamer</td>
<td>995-018-001</td>
<td>995-018-101</td>
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<tr>
<td>Metric Tap</td>
<td>998-992</td>
<td>998-992-101</td>
</tr>
</tbody>
</table>

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

1 5/8” Hex Deep Socket:
Sun P/N: 998-100-004, Snap-On P/N: LS522

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**General Information: Cartridge Cavities and Cavity Tools**

NOTES: Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

### SERIES 4

#### T-24A 4 Port Sun Cavity

<table>
<thead>
<tr>
<th>Model Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>994-024-001</td>
<td>Form Drill TD-24A</td>
<td>994-024-101</td>
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<tr>
<td>995-024-001</td>
<td>Form Reamer TR-24A</td>
<td>995-024-101</td>
<td></td>
</tr>
<tr>
<td>998-992-001</td>
<td>Metric Tap M48x2-6H</td>
<td>998-992-101</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.*

**1 5/8” Hex Deep Socket:**
Sun P/N: 998-100-004, Snap-On P/N: LS522

#### T-34A 4 Port Sun Cavity

<table>
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<th>Model Code</th>
<th>Description</th>
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</thead>
<tbody>
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<tr>
<td>995-034-001</td>
<td>Form Reamer TR-34A</td>
<td>995-034-101</td>
<td></td>
</tr>
<tr>
<td>998-992-001</td>
<td>Metric Tap M48x2-6H</td>
<td>998-992-101</td>
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</tr>
</tbody>
</table>

*Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.*

**1 5/8” Hex Deep Socket:**
Sun P/N: 998-100-004, Snap-On P/N: LS522
NOTES: Thin wall deep hex sockets, preferred for installing Sun cartridges, are available from Sun or Snap-On Tools Corporation. Complete cavity machining dimensions are provided with form tools or supplied upon request. Dimensions shown below are simplified for manifold design purposes.

**T-64A 6 Port Sun Cavity**

Cavity Diameters to be concentric to threads within 0.05.

**Minimum Clearance Distances:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Model Code</th>
<th>Model Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form Drill</td>
<td>994-064-001</td>
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<tr>
<td>Form Reamer</td>
<td>995-064-001</td>
<td>995-064-101</td>
</tr>
<tr>
<td>Metric Tap</td>
<td>998-992</td>
<td>998-992-101</td>
</tr>
</tbody>
</table>

Note: Drill and Reamer have a #3 Morse taper. Tap has straight shank.

**1 5/8” Hex Deep Socket:**

Sun P/N: 999-100-004, Snap-On P/N: LS522

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