# MICROWAVE TUNING COMPONENTS

EXXELIA

# MICROWAVE TUNING ELEMENTS

RoHS Compliant

## DESCRIPTION

Economical means of introducing a variable reactance to microwave circuits such as waveguides, filters, cavities and other resonant structures. High resolution tuning, Self-locking constant torque drive mechanism, Excellent tuning stability, Low dynamic noise, One handed adjusting/tuning, no need for locking nut. Available with Gold, Silver plating and passivated finish, Metallic, dielectric, resistive types available. Adjustments in applications from L to Ka band and beyond.

**High Reliability** versions are available on special order

Custom design upon request

**RoHS compliant**

## APPLICATIONS

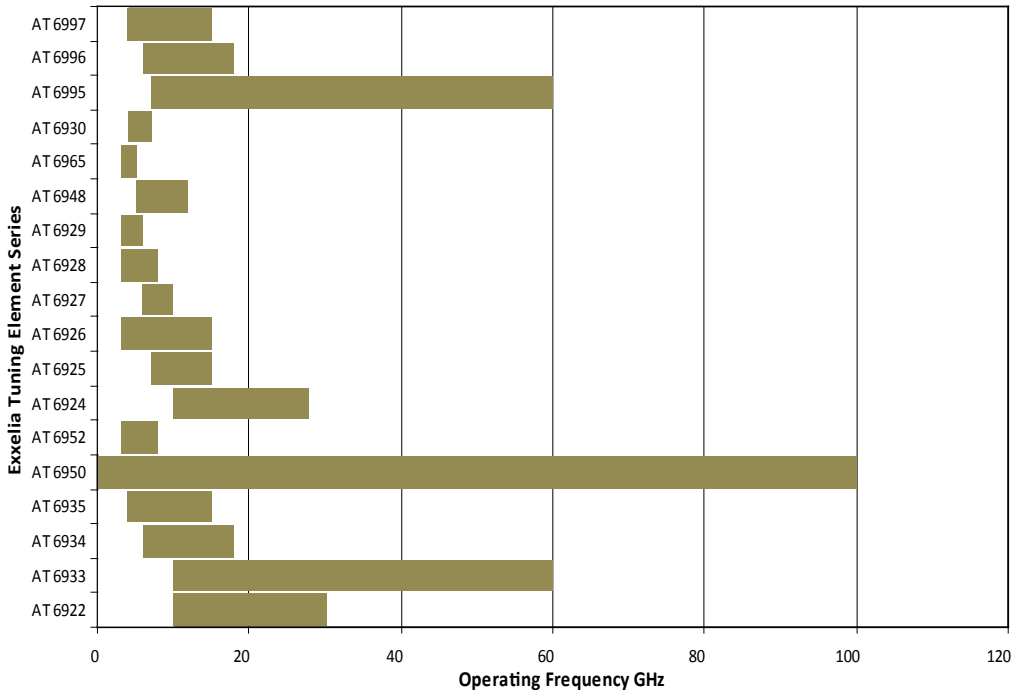
Comb-line and inter-digital filters

Coaxial structures

Waveguide circuitry

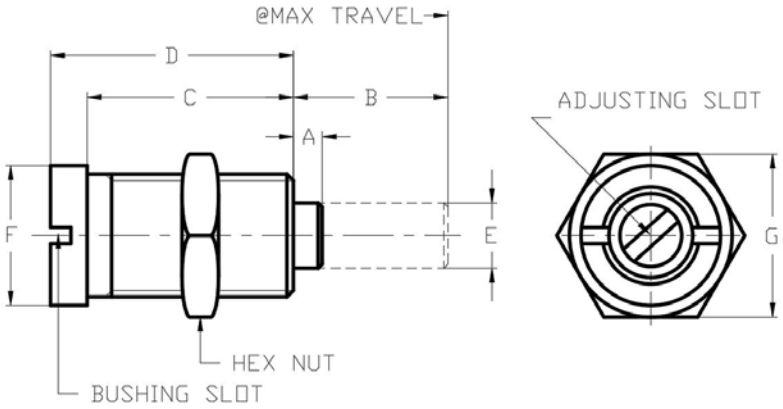
Gunn oscillators

### Impedance transformers Space applications




## I. MICROWAVE TUNING ELEMENTS

Tuning Elements consist of a brass mounting bushing with a rotor of the same material including a tuning rod made of metallic or dielectric or absorbent material and a nut.



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# MICROWAVE TUNING ELEMENTS

## I.1 METALLIC TUNING ELEMENTS

Metallic Tuning Elements consist of a brass mounting bushing with an integral tuning rotor of the same material and a nut. Bushing is gold plated, rotor and nut are passivated.

Optional materials and plating are available upon request.

| Designation | Frequency Band | Bushing Thread UNS | A | | B | | C | | D | | ØE | | ØF | | G | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mm | inches | mm | inches | mm | inches | mm | inches | mm | inches | mm | inches | mm | inches |
| **AT 6924-0 SL RoHS** | X to K | .120-80 | 0 | (0.000) | 3.8 | (0.150) | 5.1 | (0.201) | 6.0 | (0.236) | 1.8 | (0.071) | 3.4 | (0.134) | 4.0 | (0.157) |
| **AT 6924-1 SL RoHS** | | | 1.2 | (0.047) | 1.9 | (0.075) | 2.2 | (0.087) | 3.1 | (0.122) | | | | | | |
| **AT 6924-2 SL RoHS** | | | 0 | (0.000) | 1.9 | (0.075) | 5.1 | (0.201) | 6.0 | (0.236) | | | | | | |
| **AT 6924-3 SL RoHS** | | | 0 | (0.000) | 0.8 | (0.031) | 2.2 | (0.087) | 3.1 | (0.122) | | | | | | |
| **AT 6925-0 SL RoHS** | C and X | .190-64 | 0 | (0.000) | 3.8 | (0.150) | 5.4 | (0.213) | 6.4 | (0.252) | 3.2 | (0.161) | 5.3 | (0.209) | 5.5 | (0.217) |
| **AT 6925-1 SL RoHS** | | | 0 | (0.000) | 0.6 | (0.024) | 2.2 | (0.087) | 3.2 | (0.126) | | | | | | |
| **AT 6925-3 SL RoHS** | | | 3.3 | (0.130) | 7.1 | (0.280) | 5.4 | (0.213) | 6.4 | (0.252) | | | | | | |
| **AT 6925-7 SL RoHS** | | | 1.1 | (0.043) | 4.9 | (0.193) | 5.4 | (0.213) | 6.4 | (0.252) | | | | | | |
| **AT 6925-8 SL RoHS** | | | 0.2 | (0.008) | 2.0 | (0.079) | 3.2 | (0.126) | 4.3 | (0.169) | | | | | | |
| **AT 6925-9 SL RoHS** | | | 0 | (0.000) | 2.3 | (0.091) | 6.5 | (0.256) | 7.5 | (0.295) | | | | | | |
| **AT 6926-0 SL RoHS** | C and X | .234-64 | 0 | (0.000) | 2.7 | (0.106) | 4.6 | (0.181) | 5.3 | (0.209) | 4.1 | (0.209) | 6.8 | (0.268) | 7.0 | (0.276) |
| **AT 6926-1 SL RoHS** | | | 0 | (0.000) | 0.7 | (0.028) | 2.4 | (0.094) | 3.2 | (0.126) | | | | | | |
| **AT 6926-4 SL RoHS** | | | 2.3 | (0.091) | 8.8 | (0.346) | 5.5 | (0.217) | 9.1 | (0.358) | | | | | | |
| **AT 6926-5 SL RoHS** | | | 0.6 | (0.024) | 2.7 | (0.106) | 4.0 | (0.157) | 4.8 | (0.189) | | | | | | |
| **AT 6926-6 SL RoHS** | | | 2.6 | (0.102) | 11.5 | (0.453) | 5.4 | (0.213) | 11.5 | (0.453) | | | | | | |
| **AT 6926-7 SL RoHS** | | | 1.9 | (0.075) | 4.6 | (0.181) | 4.6 | (0.181) | 5.3 | (0.209) | | | | | | |
| **AT 6926-9 SL RoHS** | | | 0 | (0.000) | 2.7 | (0.106) | 5.5 | (0.217) | 9.1 | (0.358) | | | | | | |
| **AT 6926-10 SL RoHS** | | | 0 | (0.000) | 4.6 | (0.181) | 5.5 | (0.217) | 9.1 | (0.358) | | | | | | |
| **AT 6927-0 SL RoHS** | C and X | .234-64 | 0 | (0.000) | 6.5 | (0.256) | 5.5 | (0.217) | 9.1 | (0.358) | 4.1 | (0.268) | 6.8 | (0.268) | 7.0 | (0.276) |
| **AT 6928-0 SL RoHS** | C | | 0 | (0.000) | 8.8 | (0.346) | 5.4 | (0.213) | 11.5 | (0.453) | 4.1 | (0.268) | 6.8 | (0.268) | 7.0 | (0.276) |
| **AT 6928-2 SL RoHS** | C | | 6.1 | (0.240) | 8.8 | (0.346) | 4.6 | (0.181) | 5.3 | (0.209) | 4.1 | (0.268) | 6.8 | (0.268) | 7.0 | (0.276) |
| **AT 6929-0 SL RoHS** | C | .190-64 | 0 | (0.000) | 11.4 | (0.449) | 13 | (0.512) | 14 | (0.551) | 3.2 | (0.209) | 5.3 | (0.209) | 5.5 | (0.217) |
| **AT 6948-0 SL RoHS** | C and X | .312-64 | 0 | (0.000) | 5.9 | (0.232) | 8.2 | (0.323) | 9.2 | (0.362) | 5.3 | (0.374) | 9.5 | (0.374) | 10.0 | (0.394) |
| **AT 6965-0 SL RoHS** | L and S | .469-32 | 0 | (0.000) | 12.7 | (0.500) | 17.3 | (0.681) | 18.3 | (0.720) | 8.8 | (0.531) | 13.5 | (0.531) | 14.3 | (0.563) |

CUSTOM DESIGN upon request

## I.2 DIELECTRIC TUNING ELEMENTS

Dielectric Tuning Elements are used whenever the lowest loss tuning for high frequency applications is required. When dielectric rod is introduced into a cavity, the self resonant frequency is lowered due to the cavity “appearing” larger.

The basic dielectrics used in **EXXELIA** Microwave Tuning Elements are sapphire, quartz and alumina.

# MICROWAVE TUNING ELEMENTS

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Electrical properties of each dielectric material are:

| Dielectric Material | Approximate Dielectric Constant @ 10 GHz | Approximate Dissipation Factor @ 10 GHz |
|---|---|---|
| Sapphire | 9.9 | 0.0001 |
| Quartz | 3.8 | 0.0001 |
| Alumina | 9.7 | 0.0002 |

| Designation | Rod Material | Frequency Band | Bushing Thread UNS | A | | B | | C | | D | | ØE | | ØF | | G | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | mm | inches | mm | inches | mm | inches | mm | inches | mm | inches | mm | inches | mm | inches |
| **AT 6933-0 SL RoHS** | Sapphire | X and K | .120-80 | 0.6 | (0.024) | 4.3 | (0.169) | 5.1 | (0.201) | 6.0 | (0.236) | 1.6 | (0.063) | 3.4 | (0.134) | 4.0 | (0.157) |
| **AT 6933-1 SL RoHS** | Sapphire | | | 0 | (0.000) | 3.3 | (0.130) | 5.1 | (0.201) | 6.0 | (0.236) | 0.9 | (0.035) | | | | |
| **AT 6933-2 SL RoHS** | Quartz | K | | 0.6 | (0.024) | 4.3 | (0.169) | 5.1 | (0.201) | 6.0 | (0.236) | 1.6 | (0.063) | | | | |
| **AT 6934-0 SL RoHS** | Sapphire | C. X and K | .234-64 | 0.3 | (0.012) | 3.0 | (0.118) | 4.6 | (0.181) | 5.3 | (0.209) | 3.9 | (0.154) | 6.8 | (0.268) | 7.0 | (0.276) |
| **AT 6935-0 SL RoHS** | Sapphire | X and K | | 0.3 | (0.012) | 6.8 | (0.268) | 5.5 | (0.217) | 9.1 | (0.358) | 3.9 | (0.154) | | | | |

**Custom dimensions are available upon request**

## I.3 RESISTIVE TUNING ELEMENTS

Resistive Tuning Elements provide a consistent and accurate means of attenuating microwave energy. Rod made of magnetically loaded epoxy exhibits broadband lossy properties.

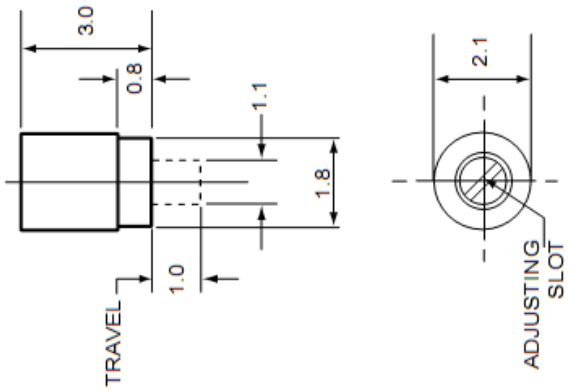
| Designation | Frequency Band | Bushing Thread UNS | A | | B | | C | | D | | ØE | | ØF | | G | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mm | inches | mm | inches | mm | inches | mm | inches | mm | inches | mm | inches | mm | inches |
| **AT 6950-0 SL RoHS** | Broad Band | .120-80 | 0.6 | (0.024) | 4.3 | (0.169) | 5.1 | (0.201) | 6.0 | (0.236) | 1.6 | (0.063) | 3.4 | (0.134) | 4.0 | (0.157) |
| **AT 6950-1 SL RoHS** | | | 0 | (0.000) | 3.3 | (0.130) | 5.1 | (0.201) | 6.0 | (0.236) | 2.0 | (0.079) | 3.4 | (0.134) | 4.0 | (0.157) |
| **AT 6952-0 SL RoHS** | | .234-64 | 0 | (0.000) | 6.4 | (0.252) | 5.5 | (0.217) | 9.1 | (0.358) | 3.9 | (0.154) | 6.8 | (0.268) | 7.0 | (0.276) |

**Custom dimensions are available upon request**

## I.4 mm WAVE TUNING ELEMENTS

The millimeter Wave Tuning Elements are higher frequency versions of both Tuning Elements described in this data sheet.

Part number: **AT 6922 RoHS**, Bushing and rotor are made of brass gold plated. Usage in the frequency bands X to K. Bushing can be mounted with solder, epoxy or press-fit.



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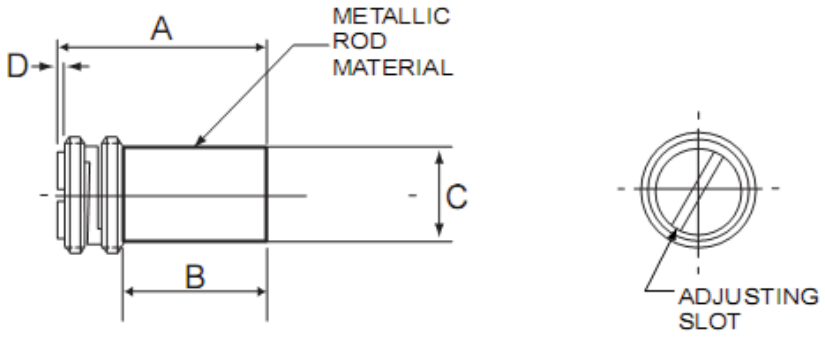
# MICROWAVE TUNING ELEMENTS

## II. TUNING ROTORS

Extended range metallic and dielectric rotors are used where direct insertion of the tuning element is desired.

Taps designed specifically to insure proper fit are available

## II.1 METALLIC TUNING ROTORS




**Models made of brass**

| Designation | Thread | A | | B | | Ø C | | D | | Slot W x L |
|---|---|---|---|---|---|---|---|---|---|---|
| | | mm | inches | mm | inches | mm | inches | mm | inches | |
| **AT 6501-3 RoHS** | M 1.5 x 0.25 | 4.4 | (0.173) | 2.3 | (0.091) | 1.1 | (0.043) | 0.4 | (0.016) | 0.25 x 1.1 |
| **AT 6501-0 RoHS** | M 2.5 x 0.25 | 5.4 | (0.213) | 3.3 | (0.130) | 2.1 | (0.083) | | | 0.4 x 1.9 |
| **AT 6501-1 RoHS** | | 4.4 | (0.173) | 2.3 | (0.091) | | | | | |
| **AT 6501-2 RoHS** | | 7.7 | (0.303) | 5.6 | (0.220) | | | | | |
| **AT 6995-0 RoHS** | .094-80 UNS | 3.1 | (0.122) | 0.8 | (0.031) | 1.8 | (0.071) | 0.5 | (0.020) | 0.4 x 1.5 |
| **AT 6995-1 RoHS** | | 4.2 | (0.165) | 1.9 | (0.075) | | | | | |
| **AT 6995-2 RoHS** | | 6.1 | (0.240) | 3.8 | (0.150) | | | | | |
| **AT 6996-1 RoHS** | .156-64 UNS | 6.4 | (0.252) | 3.8 | (0.150) | 3.2 | (0.126) | 0.25 | (0.010) | 0.5 x 3.0 |
| **AT 6996-2 RoHS** | | 9.7 | (0.382) | 7.1 | (0.280) | | | | | |
| **AT 6996-3 RoHS** | | 14.0 | (0.551) | 11.4 | (0.449) | | | | | |
| **AT 6996-4 RoHS** | | 3.2 | (0.126) | 0.6 | (0.024) | | | | | |
| **AT 6996-5 RoHS** | | 7.5 | (0.295) | 4.9 | (0.193) | | | | | |
| **AT 6996-6 RoHS** | | 4.6 | (0.181) | 2.0 | (0.079) | | | | | |
| **AT 6996-8 RoHS** | | 4.9 | (0.193) | 2.3 | (0.091) | | | | | |
| **AT 6997-0 RoHS** | .190-64 UNS | 14.1 | (0.555) | 11.5 | (0.453) | 4.1 | (0.161) | 0.25 | (0.010) | 0.5 x 3.7 |
| **AT 6997-1 RoHS** | | 5.3 | (0.209) | 2.7 | (0.106) | | | | | |
| **AT 6997-2 RoHS** | | 9.1 | (0.358) | 6.5 | (0.256) | | | | | |
| **AT 6997-3 RoHS** | | 11.4 | (0.449) | 8.8 | (0.346) | | | | | |
| **AT 6997-4 RoHS** | | 3.3 | (0.130) | 0.7 | (0.028) | | | | | |
| **AT 6997-5 RoHS** | | 7.2 | (0.283) | 4.6 | (0.181) | | | | | |

CUSTOM DESIGN upon request

# MICROWAVE TUNING ELEMENTS

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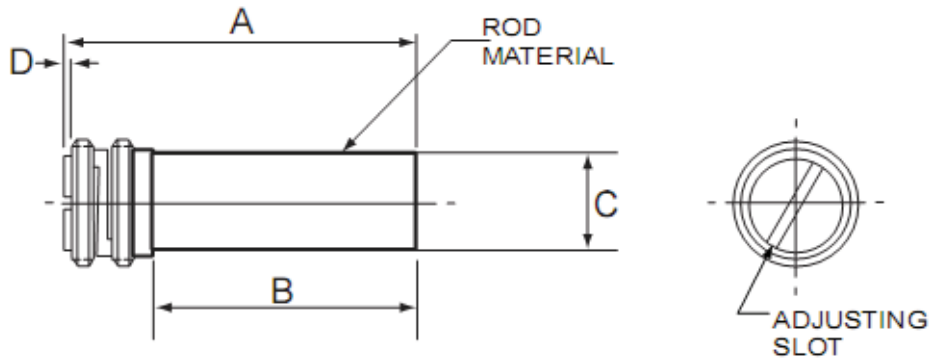
## II.2 DIELECTRIC TUNING ROTORS




Models with dielectric rod

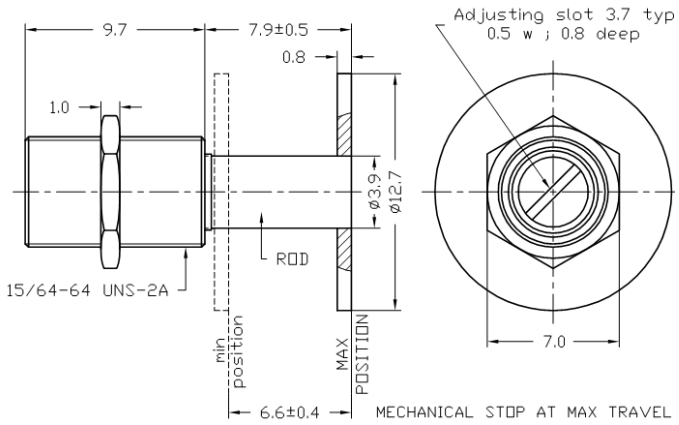
| Designation | Rod material | Thread | A | | B | | Ø C | | D | | Slot W x L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mm | inches | mm | inches | mm | inches | mm | inches | |
| **AT 6930-4 RoHS** | Sapphire | .094-80 UNS | 5.8 | (0.228) | 2.5 | (0.098) | 0.9 | (0.035) | 0.5 | (0.020) | 0.4 x 1.5 |
| **AT 6930-8 RoHS** | | | 6.6 | (0.260) | 3.5 | (0.138) | 1.6 | (0.063) | 0.5 | (0.020) | |

CUSTOM DESIGN upon request

## III. DRO TUNERS

DRO tuners are precision components designed exclusively for tuning dielectric resonator devices such as filters and oscillators.

Rod is made of Invar silver plated and disk made of brass silver plated. Different disk diameters are available.




| Designation | Nominal Frequency | Disk diameter | |
|---|---|---|---|
| | | mm | inches |
| **AT 4010-1 RoHS** | 2 GHz | 24.6 | (0.969) |
| **AT 4011-1 RoHS** | 3 GHz | 19.0 | (0.748) |
| **AT 4012-1 RoHS** | 4 GHz[2] | 12.7 | (0.500) |
| **AT 4012-2 RoHS** | | 15.9 | (0.626) |

CUSTOM DESIGN upon request

RoHS Compliant

# MICROWAVE TUNING ELEMENTS

## IV. MECHANICAL AND GENERAL SPECIFICATIONS

| SERIES | Bushing Thread | Tap Designation | Recommended Tap Drill | | Rotational Rotor Torque | | Max Mounting Torque | | Max Nut Mounting Torque | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | mm | inches | cm.N | inches.N | cm.N | inches.N | cm.N | inches.N |
| **AT 6924 RoHS** | .120- 80 UNS | AT 7060 | 2.75 | (0.108) | 2 to 20 | (0.079) to (0.787) | 7.0 | (0.276) | 10.0 | (0.394) |
| **AT 6925 RoHS** | .190-64 UNS | AT 7061 | 4.45 | (0.175) | 3 to 28 | (0.118) to (1.102) | 21.0 | (0.827) | 30.0 | (1.181) |
| **AT 6926 RoHS** | .234-64 UNS | AT 7062 | 5.50 | (0.217) | 7 to 35 | (0.276) to (1.378) | 35.0 | (1.378) | 50.0 | (1.969) |
| **AT 6927 RoHS** | .234-64 UNS | AT 7062 | 5.50 | (0.217) | 7 to 35 | (0.276) to (1.378) | 35.0 | (1.378) | 50.0 | (1.969) |
| **AT 6928 RoHS** | .234-64 UNS | AT 7062 | 5.50 | (0.217) | 7 to 35 | (0.276) to (1.378) | 35.0 | (1.378) | 50.0 | (1.969) |
| **AT 6929 RoHS** | .190-64 UNS | AT 7061 | 4.45 | (0.175) | 3 to 28 | (0.118) to (1.102) | 21.0 | (0.827) | 30.0 | (1.181) |
| **AT 6933 RoHS** | .120- 80 UNS | AT 7060 | 2.75 | (0.108) | 2 to 20 | (0.079) to (0.787) | 7.0 | (0.276) | 10.0 | (0.394) |
| **AT 6934 RoHS** | .234-64 UNS | AT 7062 | 5.50 | (0.217) | 7 to 35 | (0.276) to (1.378) | 35.0 | (1.378) | 50.0 | (1.969) |
| **AT 6935 ROKS** | .234-64 UNS | AT 7062 | 5.50 | (0.217) | 7 to 35 | (0.276) to (1.378) | 35.0 | (1.378) | 50.0 | (1.969) |
| **AT 6948 RoHS** | .312-64 UNS | AT 7065 | 7.55 | (0.297) | 7 to 50 | (0.276) to (1.969) | 84.0 | (3.307) | 70.0 | (2.756) |
| **AT 6950 RoHS** | .120- 80 UNS | AT 7060 | 2.75 | (0.108) | 2 to 20 | (0.079) to (0.787) | 7.0 | (0.276) | 10.0 | (0.394) |
| **AT 6952 RoHS** | .234-64 UNS | AT 7062 | 5.50 | (0.217) | 7 to 35 | (0.276) to (1.378) | 35.0 | (1.378) | 50.0 | (1.969) |
| **AT 6965 RoHS** | .469-32 UNS | AT 7066 | 11.1 | (0.437) | 7 to 56 | (0.276) to (2.205) | 168.0 | (6.614) | 140.0 | (5.512) |

Recommended rotor tuning tool: AT 8777

| SERIES | Rotor Thread | Tap Designation | Recommended Tap Drill | | Recommended Tuning Tool Designation |
|---|---|---|---|---|---|
| | | | mm | inches | |
| **AT 6501-3 RoHS** | M1.5 x 0.25 | **AT 7071** | 1.25 | (0.049) | **AT 8762** |
| **AT 6501-0, -1, -2 RoHS** | M2.5 x 0.25 | **AT 7070** | 2.25 | (0.089) | **AT 8777** |
| **AT 6995 RoHS** | .094-80 UNS | **AT 7064** | 2.05 | (0.081) | |
| **AT 6996 RoHS** | .156-64 UNS | **AT 7059** | 3.55 | (0.140) | |
| **AT 6997 RoHS** | .190-64 UNS | **AT 7061** | 4.45 | (0.175) | |

Precautions to use rotor tunings:

- Typical drilling diameter is the tap core diameter + 0,1 mm
- Flange of machined threads has to be perfect, very smooth, without metallic burrs
- Use recommended tuning tool
- Before screwing the rotor, find the first thread by turning the anti-clockwise

## V. PACKAGING

Parts are delivered in bulk.

## VI. HOW TO ORDER

**Tuning elements**

Examples

| Designation | RoHS |
|---|---|
| AT 6924-3 SL | RoHS |
| AT 6922 | RoHS |

**Tuning rotors**

Examples

| Designation | RoHS |
|---|---|
| AT 6995-2 | RoHS |
| AT 6501-3 | RoHS |

**DRO tuners**

Example

| Designation | RoHS |
|---|---|
| AT 4011-1 | RoHS |