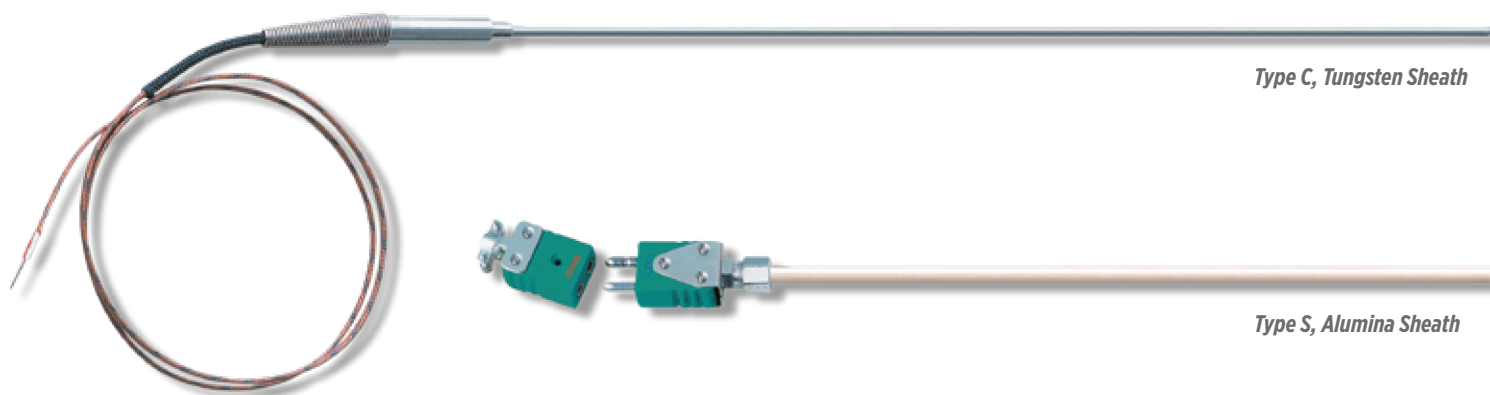


High Temperature Thermocouple Assemblies

Operating Temperatures Up to 4200° F (2315° C)



Type B, Alumina Sheath



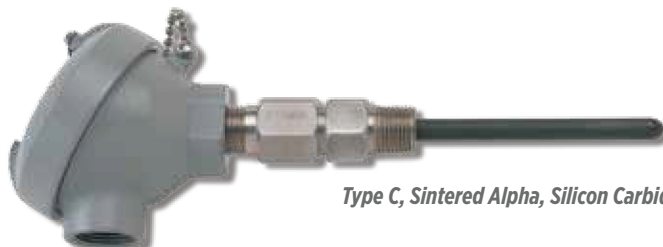
Type C, Tungsten Sheath



Type S, Alumina Sheath



Type R, Quartz Sheath



Type C, Sintered Alpha, Silicon Carbide Sheath



Type S, Alumina Sheath



Type C, with Molybdenum Sheath

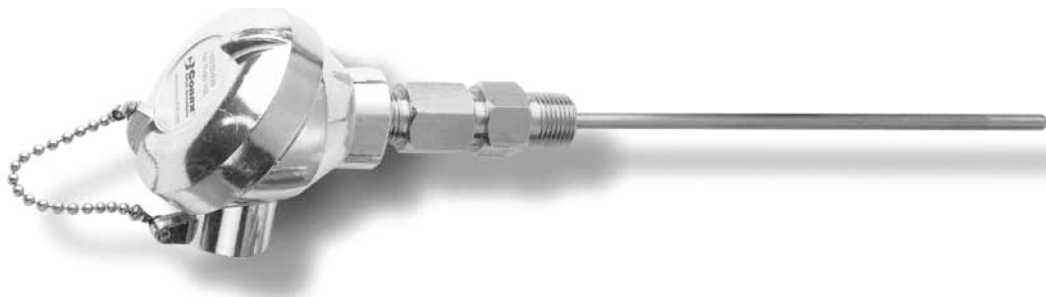
Conax
TECHNOLOGIES

Ideas. Solutions. Success.

Reliable Thermocouples for High Temperature Applications

Conax Technologies' High Temperature Thermocouples are specifically designed for durability and reliability in high temperature applications to 4200° F (2315° C). Such applications generally involve oxidizing, reducing, inert gas or contamination atmospheres that challenge the life of the thermocouple. Conax brings more than 65 years of experience in the design and manufacture of temperature sensing devices to the selection of appropriate materials

and designs to maximize the life and reliability of thermocouples in these environments. This catalog reviews the primary characteristics of materials used in thermocouple elements, sheaths and insulations and outlines our standard configurations. For further assistance in determining the appropriate temperature sensing assembly for your application or for custom needs, contact a Conax sales engineer at +1 800 223 2389.



Thermocouple Types

Choose the thermocouple type from the temperature range table below.

Minimum requirements for all Conax Technologies' thermocouples are standard limits of error and are denoted by a single letter (eg. S).

Special limits of error are also available and are designated by a double calibration letter (eg. SS). For limits of error, see the Tolerance Chart on page 13.

Thermocouple Types			
Catalog Type	Calibration	Upper Service Temperature	Remarks
S	Platinum-10% Rhodium vs. Platinum	2700° F (1480° C)	For use in oxidizing and inert atmospheres. For vacuum atmospheres, use with protection tube.
R	Platinum-13% Rhodium vs. Platinum	2700° F (1480° C)	For use in oxidizing and inert atmospheres. For vacuum atmospheres, use with protection tube.
B	Platinum-30% Rhodium vs. Platinum-6% Rhodium	3100° F (1700° C)	For use in oxidizing and inert atmospheres. For vacuum atmospheres, use with protection tube.
C*	Tungsten-5% Rhenium vs. Tungsten-26% Rhenium	4200° F (2315° C) 3450° F (1900° C)	For use in hydrogen or inert atmospheres For use in vacuum atmospheres

*Formerly Conax Technologies Type W5.

Note: • Upper Temperature Limits per ASTM E230 for 24 AWG wire for types S, R and B.
• For Type C, special limits of error wire is not available (ref. ASTM E988).

Insulation Materials

Material	Chemical Symbol	Upper Service Temperature	Remarks
Alumina	Al ₂ O ₃	3000° F (1650° C)	High-purity aluminum oxide is the standard insulation material supplied for Conax Technologies' high temperature thermocouple assemblies. Alumina offers high thermal conductivity and high electrical resistivity.
Hafnia	HfO ₂	4352° F (2400° C)	Hafnium oxide is usually present in zirconium ores in amounts ranging from .5 to 2 percent. Refined high-purity hafnia offers a higher electrical resistivity at elevated temperatures than yttria or zirconia. Hafnia's resistivity is comparable to that of beryllium oxide, but hafnia does not present the potential health problems associated with beryllium oxide. Hafnia is therefore replacing beryllium oxide in many applications. Hafnia is the commonly recommended insulation for Conax Type C thermocouples.

Other Insulation Materials

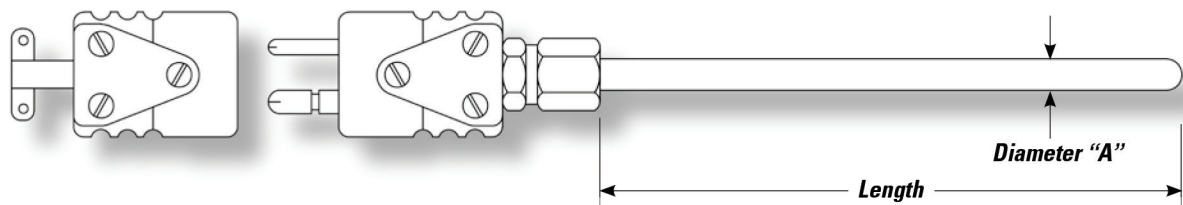
Material	Chemical Symbol	Upper Service Temperature	Remarks
Magnesium Oxide	MgO	2500° F (1370° C)	Used primarily with compacted sheathed thermocouples
Thorium Oxide	ThO ₂	4532° F (2500° C)	Low electrical resistivity, good resistance to reducing environments
Yttrium Oxide	Y ₂ O ₃	3632° F (2000° C)	Low electrical resistivity, stabilizer material for zirconium

Sheath Materials

Material	Chemical Symbol	Upper Service Temperature	Remarks
Molybdenum	Mo	3400° F (1870° C)	Molybdenum offers excellent mechanical properties at elevated temperatures and is exceptional for use in reducing or neutral atmospheres. Molybdenum offers superb thermal shock resistance and has potentially unlimited life at high temperatures in a vacuum. Pure hydrogen, argon and helium atmospheres are completely inert to molybdenum. Performance is poor in oxidizing atmospheres. Above 800° F (427° C), molybdenum will react with oxygen. Above 1100° C molybdenum will react with carbon/graphite, see pg. 11 for more info.
Tungsten	W	4200° F (2315° C)	Tungsten has the best strength at high temperatures of all the common refractory metals. Tungsten provides good abrasion resistance. It can be used in hydrogen at all temperatures, and in dry argon and helium. Tungsten is not recommended for use in oxygen bearing environments, as oxygen is known to cause physical degradation in only a few hours depending on temperature and oxygen content.
Tantalum	Ta	4500° F (2482° C)	Tantalum is best used in reducing or neutral atmospheres and in a vacuum environment. Its performance is poor in oxidizing atmospheres, and it must be protected from gases such as oxygen and nitrogen at temperatures above 570° F (300° C). Tantalum is outranked by tungsten for high temperature strength. Tantalum is excellent for thermal cycling applications and is the most corrosion resistant of the refractory materials. It is almost completely immune to attack by acids except hydrofluoric acid.
Alumina	Al ₂ O ₃	3000° F (1650° C)	High-purity aluminum oxide offers high thermal conductivity, high electrical resistivity and good resistance to thermal shock. It also offers excellent resistance to chemical attack. Aluminum oxide functions well in oxidizing, reducing or high vacuum applications, but is not recommended for high vacuum environments in the presence of graphite at temperatures exceeding 2372° F (1300° C).
Sintered Alpha Silicon Carbide	SASiC	3000° F (1650° C)	No free silicon, higher density than SiC, low porosity, excellent thermal shock resistance, high chemical, corrosion and abrasion resistance. Excellent thermal conductivity.

**Molybdenum, Tungsten and Tantalum sheath assemblies are backfilled with argon and sealed to prevent oxidation.*

Thermocouple Assemblies with PJFC-Plug/Jack Termination



Plug & Jack Assembly

Standard polarized plug and jack termination for use with all calibration types. Plug and jack assemblies are made from molded glass filled thermoset compounds and are designed to operate in temperatures to 300° F (150° C). Polarity identification marks are molded in the bodies for installation assistance.

Progressive Description Example

.187" Tubewell Diameter

Molybdenum Tubewell

24 Gauge Wire

"C" Type

Insulation Material

Ungrounded Junction

PJFC Termination

12.50" Sheath Length

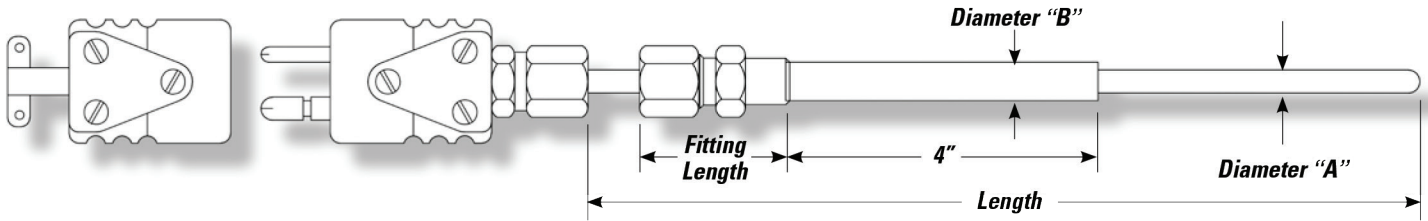
C 24 - MO 18 - AL - U - PJFC - 12.50 "

Calibration Type	Wire Gauge	Tubewell Material	Tubewell Diameter "A"	Insulation Material	Junction	Termination Style	Sheath Length (L) in Inches, two decimal places
S	30	MO-Molybdenum	6 = .062"	AL-(Al ₂ O ₃) Standard	U-Ungrounded	PJ-(Male plug only)	Length required
R	24	TA-Tantalum	12 = .125"	HF-(HfO ₃) Optional		PF-(Female jack only)	
B		W-Tungsten	18 = .187"			PJF-(Male plug and female jack)	
C		AL-Alumina (Al ₂ O ₃)	25 = .250"			PJFC-(Plug, jack & wire clamp)	
			37 = .375"				

Notes

- .062" sheath is only available in MO sheath with 30 AWG wire.
- .125" diameter sheath is only available with 30 gauge wire only for AL and W sheaths.
- Tantalum and Tungsten are not available in .375" diameter.

Thermocouple Assemblies with PJFC-Plug/Jack Termination and Support Tube



Plug & Jack Assembly

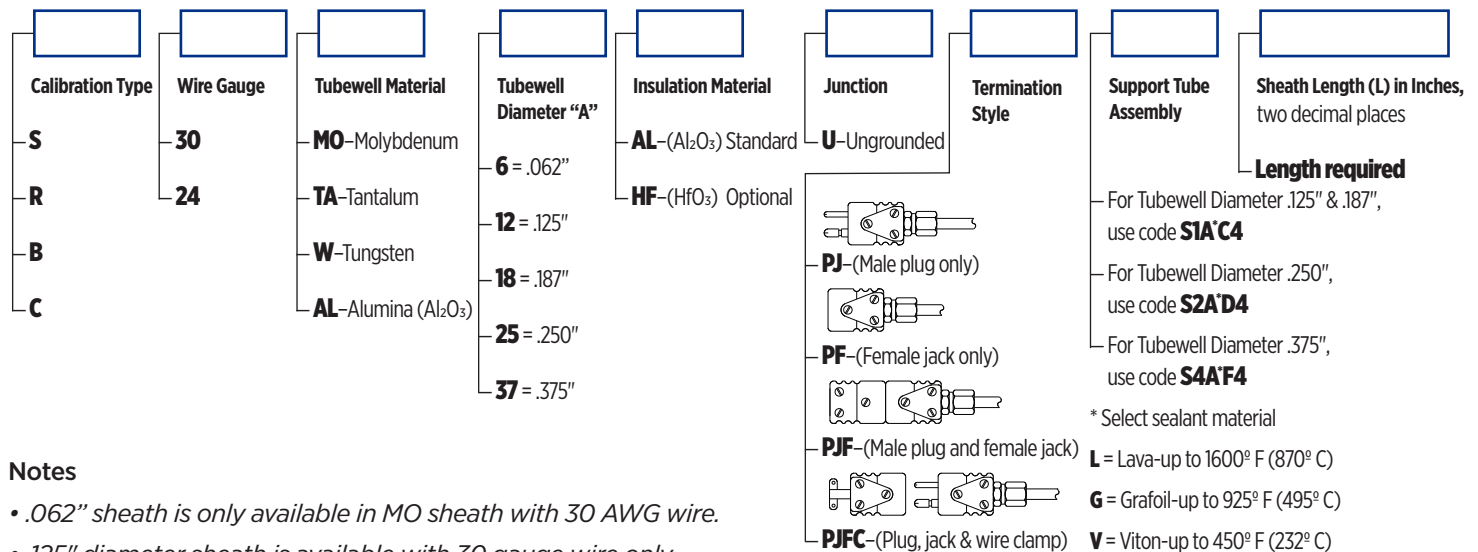
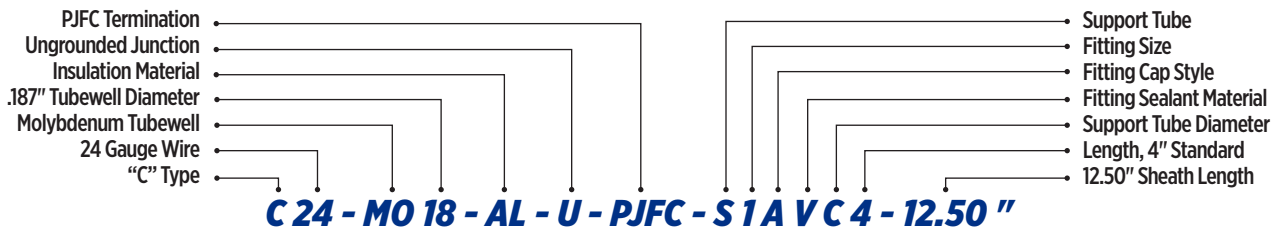
An adjustable support tube offers flexibility for immersion adjustment while protecting the sheath from potential damage during installation. The rigid, thick wall offers additional support when penetrating the vessel/furnace wall.

Standard polarized plug and jack termination for use with all calibration types. Plug and jack assemblies are made from molded glass filled thermoset compounds and are designed to operate in temperatures to 300° F (150° C). Polarity identification marks are molded in the bodies for installation assistance.

Support Tube Data

Thermocouple Diameter "A"	Support Tube Diameter "B"	Code	Fitting Length
.125"	.312"	C	1.12"
.187"	.312"	C	1.12"
.250"	.375"	D	1.50"
.375"	.500"	F	2.00"

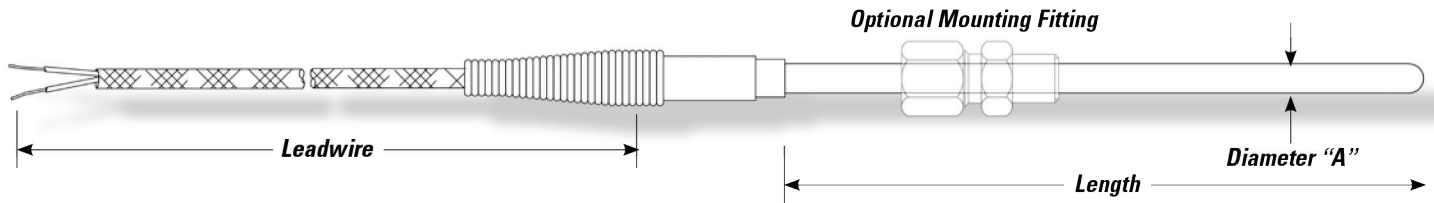
Progressive Description Example



Notes

- .062" sheath is only available in MO sheath with 30 AWG wire.
- .125" diameter sheath is available with 30 gauge wire only.
- Tantalum and Tungsten are not available in .375" diameter.
- Lava sealant not recommended for high vacuum.
- Support tube materials: 316SS body and tube, 303SS cap and follower.
- Support tube assembly torque values, see page 12; S1=MPG Series, S2=PG2 Series, S4=PG4 Series.

Thermocouple Assemblies with T3/T4 Leadwire Termination



T3/T4 Assembly

This exclusive Conax Technologies design provides a practically unbreakable connection between the leadwire and probe lead. The T3 epoxy-filled transition is supplied with PTFE-insulated extension wire as standard; silicone-impregnated fiberglass insulation is also available. Standard extension end leads are 24" long (longer leads available on request). When the progressive description specifies 24 gauge probe wire, 20 gauge extension wire is standard. When the progressive description specifies 30 gauge probe wire, 24 gauge extension wire is standard. T4 termination provides a stainless steel overbraid for maximum flexibility and abrasion resistance. Available in all sheath materials and wire types. Both termination types function to 300° F (150° C) continuous temperature.

Progressive Description Example

.187" Tubewell Diameter
Alumina Tubewell
24 Gauge Wire
"R" Type

Insulation Material
Ungrounded Junction
T3 Termination
18.00" Sheath Length

R 24 - AL 18 - AL - U - T3 - 18.00 "

Calibration Type	Wire Gauge	Tubewell Material	Tubewell Diameter "A"	Insulation Material	Junction	Termination Style	Sheath Length (L) in Inches, two decimal places
S	30	MO-Molybdenum	6 = .062"	AL-(Al ₂ O ₃) Standard	U-Ungrounded	T3-PTFE	Length required
R	24	TA-Tantalum	12 = .125"	HF-(HfO ₃) Optional		T4-PTFE/SS	
B		W-Tungsten	18 = .187"			T3F-Fiberglass	
C		AL-Alumina (Al ₂ O ₃)	25 = .250"			T4F-Fiberglass/SS	
			37 = .375"				

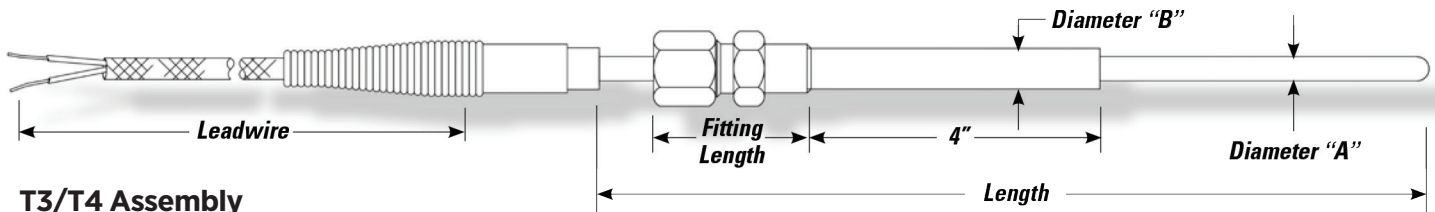
Notes

- .062" sheath is only available in MO sheath with 30 AWG wire.
- .125" diameter sheath is available with 30 gauge wire only.
- Tantalum and Tungsten are not available in .375" diameter.
- Extension grade leadwire.

For longer lead length specify, example: 36" leadwire requested - T3 (36")

Optional mounting fitting provides pressure or vacuum sealing.
Progressive description example: **R24-AL18-AL-U-T3-PG2AV-18.00"**

Thermocouple Assemblies with T3/T4 Leadwire Termination and Support Tube



T3/T4 Assembly

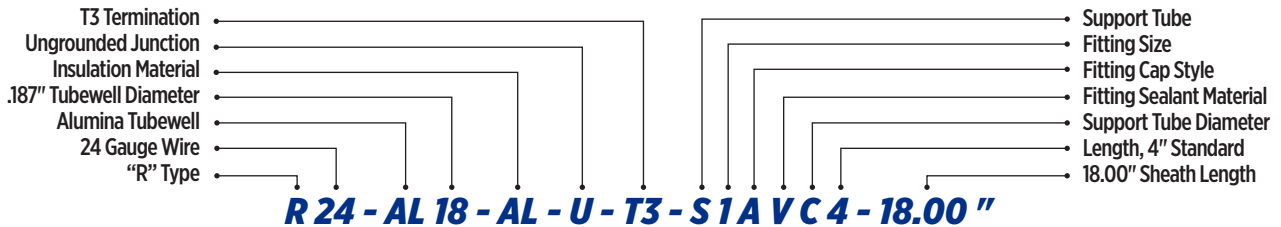
An adjustable support tube offers flexibility for immersion adjustment while protecting the sheath from potential damage during installation. The rigid, thick wall offers additional support when penetrating the vessel/furnace wall.

This exclusive Conax Technologies design provides a practically unbreakable connection between the leadwire and probe lead. The T3 epoxy-filled transition is supplied with PTFE-insulated extension wire as standard; silicone-impregnated fiberglass insulation is also available. Standard extension end leads are 24" long (longer leads available on request). When the progressive description specifies 24 gauge probe wire, 20 gauge extension wire is standard. When the progressive description specifies 30 gauge probe wire, 24 gauge extension wire is standard. T4 termination provides a stainless steel overbraid for maximum flexibility and abrasion resistance. Available in all sheath materials and wire types. Both termination types function to 300° F (150° C) continuous temperature.

Support Tube Data

Thermocouple Diameter "A"	Support Tube Diameter "B"	Code	Fitting Length
.125"	.312"	C	1.12"
.187"	.312"	C	1.12"
.250"	.375"	D	1.50"
.375"	.500"	F	2.00"

Progressive Description Example



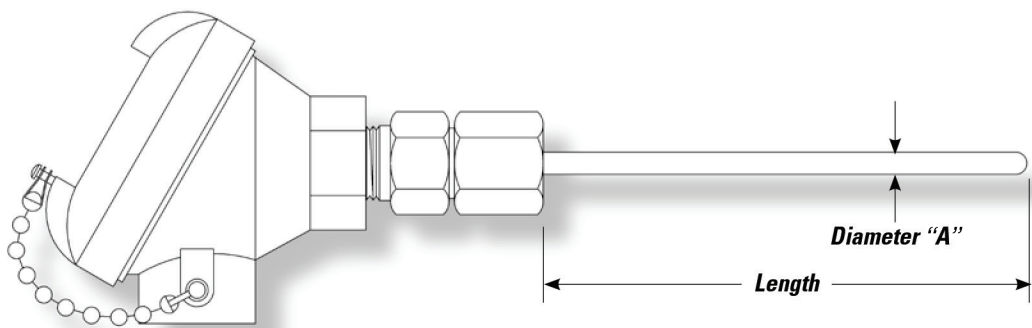
Calibration Type	Wire Gauge	Tubewell Material	Tubewell Diameter "A"	Insulation Material	Junction	Termination Style	Support Tube Assembly	Sheath Length (L) in Inches, two decimal places
S	30	MO-Molybdenum	6 = .062"	AL-(Al ₂ O ₃) Standard	U-Ungrounded	T3 PTFE	For Tubewell Diameter .125" & .187", use code S1A'C4	Length required
R	24	TA-Tantalum	12 = .125"	HF-(HfO ₃) Optional		T4 PTFE/SS	For Tubewell Diameter .250", use code S2A'D4	
B		W-Tungsten	18 = .187"			T3F Fiberglass	For Tubewell Diameter .375", use code S4A'F4	
C		AL-Alumina (Al ₂ O ₃)	25 = .250"			T4F Fiberglass/SS	* Select sealant material	
			37 = .375"				L = Lava-up to 1600° F (870° C)	
							G = Grafoil-up to 925° F (495° C)	
							V = Viton-up to 450° F (232° C)	

Notes

- .062" sheath is only available in MO sheath with 30 AWG wire.
- .125" diameter sheath is available with 30 gauge wire only.
- Tantalum and Tungsten are not available in .375" diameter.
- Lava sealant not recommended for high vacuum.
- Extension grade leadwire.
- Support tube materials: 316SS body and tube, 303SS cap and follower.
- Support tube assembly torque values, see page 12; S1=MPG Series, S2=PG2 Series, S4=PG4 Series.

For longer lead length specify, example: 36" leadwire requested - T3 (36")

Thermocouple Assemblies with Terminal Heads



Terminal Head Assembly

Conax Technologies provides high temperature assemblies with T5, T8 and T11 termination heads in aluminum, stainless steel or cast iron to meet application needs. T5 termination heads meet NEMA 4 requirements providing protection against windblown dust and rain, splashing water, hose-directed water and external ice formation. (See page 11 for details on termination heads.) The sheath is affixed to the terminal head using a Conax Technologies packing gland Type PG4 with lava sealant. Terminal heads with terminal blocks and gasket seal are rated to 275° F (135° C).

Progressive Description Example

Insulation Material

.375" Tubewell Diameter

Alumina Tubewell

24 Gauge Wire

"S" Type

Ungrounded Junction

T5 Cast Iron Termination

Seal Fitting

12.00" Sheath Length

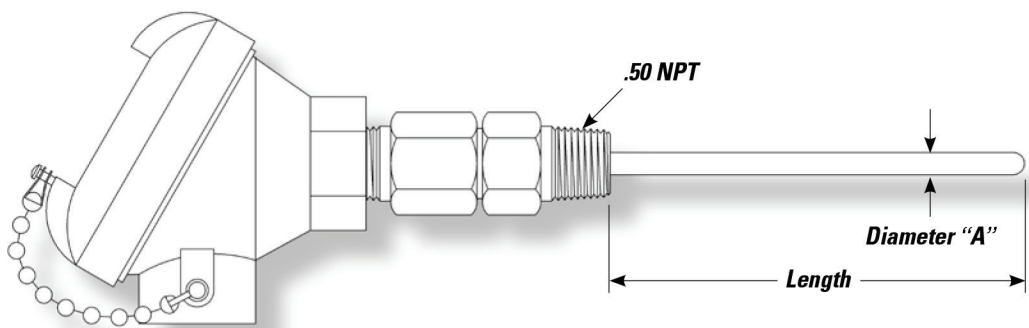
S 24 - AL 37 - AL - U - T5CI (PG4AL) - 12.00 "

Calibration Type	Wire Gauge	Tubewell Material	Tubewell Diameter "A"	Insulation Material	Junction	Termination Style	Seal Fitting	Sheath Length (L) in Inches, two decimal places
S	30	MO-Molybdenum	6 = .062"	AL-(Al ₂ O ₃) Standard	U-Ungrounded	T5AL-Aluminum NEMA 4	PG4AL-(L=lava)	Length required
R	24	TA-Tantalum	12 = .125"	HF-(HfO ₃) Optional		T5SS-Stainless Steel NEMA 4x (with corrosion resistance)		
B		W-Tungsten	18 = .187"			T5CI-Cast Iron NEMA 4		
C		AL-Alumina (Al ₂ O ₃)	25 = .250"			T11-Aluminum weathertight		
			37 = .375"					

Notes

- .062" sheath is only available in MO sheath with 30 AWG wire.
- .125" diameter sheath is available with 30 gauge wire only.
- Tantalum and Tungsten are not available in .375" diameter.

Thermocouple Assemblies with Terminal Head and Direct Mount



Terminal Head Assembly

Conax Technologies provides high temperature assemblies with T5, T8 and T11 termination heads in aluminum, stainless steel or cast iron to meet application needs. T5 termination heads meet NEMA 4 requirements providing protection against windblown dust and rain, splashing water, hose-directed water and external ice formation. (See page 11 for details on termination heads.) The sheath is affixed to the terminal head using a Conax Technologies packing gland Type PG4 with sealant. Terminal heads with terminal blocks and gasket seal are rated to 275° F (135° C).

The direct mount style features a B Cap with .50 NPT mounting.

Progressive Description Example

Insulation Material

.375" Tubewell Diameter

Alumina Tubewell

24 Gauge Wire

"S" Type

Ungrounded Junction

T5 Cast Iron Termination

Seal Fitting

12.00" Sheath Length

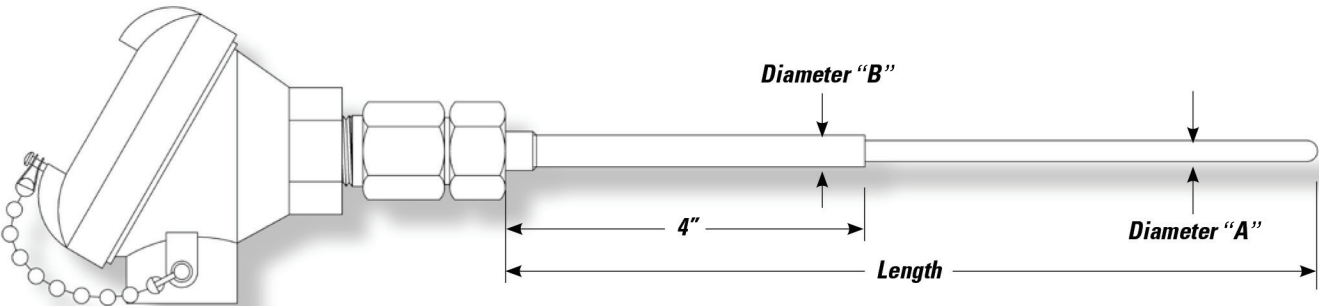
S 24 - AL 37 - AL - U - T5CI (PG4AL) - 12.00 "

Calibration Type	Wire Gauge	Tubewell Material	Tubewell Diameter "A"	Insulation Material	Junction	Termination Style	Direct Mount Seal Fitting	Sheath Length (L) in Inches, two decimal places
S	30	MO -Molybdenum	6 = .062"	AL -(Al ₂ O ₃) Standard	U -Ungrounded		PG4BL -(L=lava)	Length required Sealant Material Properties L = Lava-up to 1600° F (870° C) G = Grafoil-up to 925° F (495° C) V = Viton-up to 450° F (232° C)
R	24	TA -Tantalum	12 = .125"	HF -(HfO ₃) Optional			PG4BG -(G=Grafoil)	
B		W -Tungsten	18 = .187"		T5AL -Aluminum NEMA 4		PG4BV -(V=Viton)	
C		AL -Alumina (Al ₂ O ₃)	25 = .250" 37 = .375"		T5SS -Stainless Steel NEMA 4x (with corrosion resistance) T11 -Aluminum weathertight			

Notes

- .062" sheath is only available in MO sheath with 30 AWG wire.
- .125" diameter sheath is available with 30 gauge wire only.
- Tantalum and Tungsten are not available in .375" diameter.
- Lava sealant not recommended for high vacuum.

Thermocouple Assemblies with Terminal Head and Support Tube



Terminal Head Assembly

Conax Technologies provides high temperature assemblies with T5, T8 and T11 termination heads in aluminum, stainless steel or cast iron to meet application needs. T5 termination heads meet NEMA 4 requirements providing protection against windblown dust and rain, splashing water, hose-directed water and external ice formation.

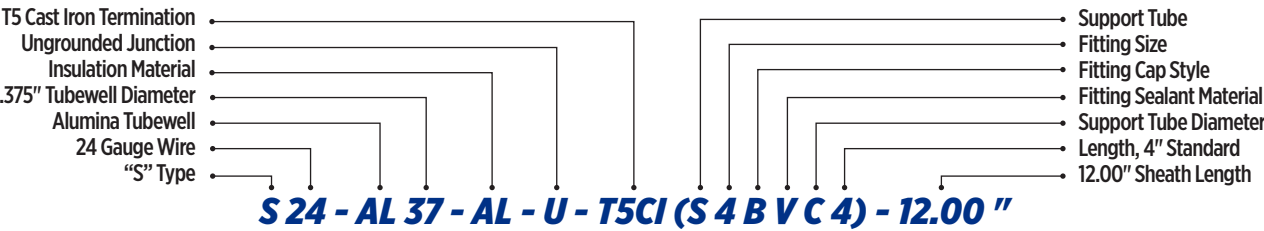
The sheath is affixed to the terminal head using a Conax Technologies packing gland Type PG4 with lava sealant. Terminal heads with terminal blocks and gasket seal are rated to 275° F (135° C).

The support tube supports the sheath from cantilever deflection and offers protection during penetration of the vessel/furnace wall. The rigid, thick wall provides additional sheath protection from potential damage during mounting/compression fitting installation.

Support Tube Data

Thermocouple Diameter "A"	Support Tube Diameter "B"	Code
.125"	.312"	C
.187"	.312"	C
.250"	.375"	D
.375"	.500"	F

Progressive Description Example



Calibration Type

S

R

B

C

Wire Gauge

30

24

Tubewell Material

MO-Molybdenum

TA-Tantalum

W-Tungsten

AL-Alumina (Al₂O₃)

Tubewell Diameter "A"

6 = .062"

12 = .125"

18 = .187"

25 = .250"

37 = .375"

Insulation Material

AL-(Al₂O₃) Standard

HF-(HfO₃) Optional

Junction

U-Ungrounded

T5AL-Aluminum NEMA 4

T5SS-Stainless Steel NEMA 4x (with corrosion resistance)

T5CI-Cast Iron NEMA 4

T11-Aluminum weathertight

Termination Style

T5AL-Aluminum NEMA 4

T5SS-Stainless Steel NEMA 4x (with corrosion resistance)

T5CI-Cast Iron NEMA 4

T11-Aluminum weathertight

Support Tube Assembly

For Tubewell Diameter .125" & .187", use code **S4B'C4**

For Tubewell Diameter .250", use code **S4B'D4**

For Tubewell Diameter .375", use code **S4B'F4**

Sealant Material Properties

L = Lava-up to 1600° F (870° C)

G = Grafoil-up to 925° F (495° C)

V = Viton-up to 450° F (232° C)

Sheath Length (L) in Inches, two decimal places

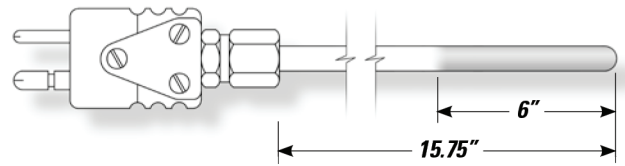
Length required

Notes

- .062" sheath is only available in MO sheath with 30 AWG wire.
- .125" diameter sheath is available with 30 gauge wire only.
- Tantalum and Tungsten are not available in .375" diameter.
- Lava sealant not recommended for high vacuum.

Tungsten-Coated Molybdenum for Graphite-Lined Furnaces

At temperatures above 2010° F (1100° C), graphite dust from graphite liners/shields or heating elements can attack and carburize molybdenum sheaths. This causes the sheath to crystallize and become porous, losing its protective properties. The thermal elements in turn crystallize and open. Coating the heat-affected length of the molybdenum sheath with a thick layer of tungsten reduces this carburization action and extends probe life. The tungsten coating also provides increased abrasion resistance.



Progressive Description Example:
S24-M018(W6")-AL-U-PJ-15.75"

Termination Styles

T5

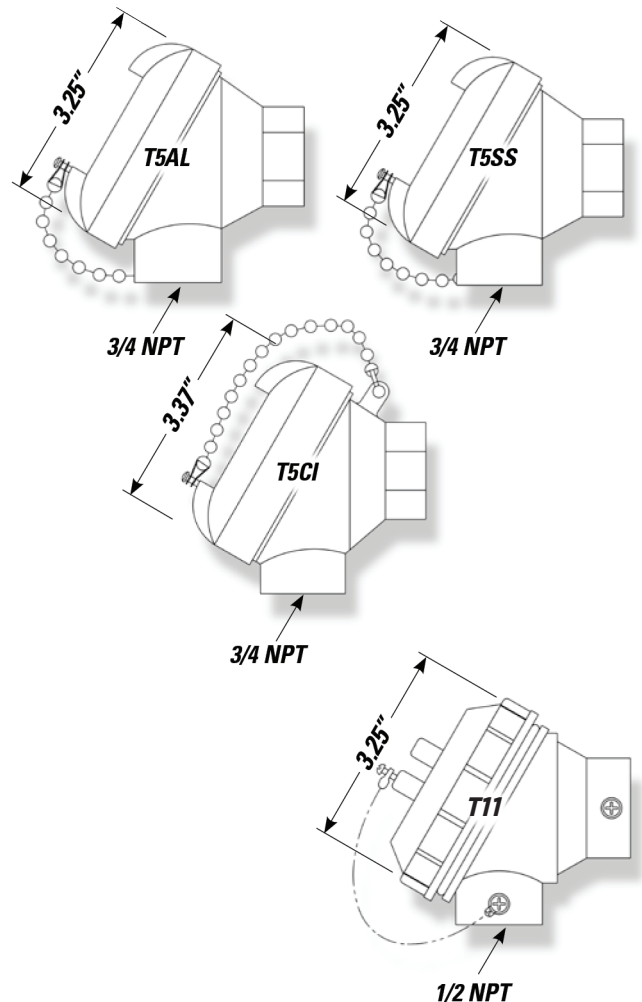
The T5 terminal head is a highly versatile, gasket-sealed head that meets NEMA 4 standards with termination styles T5AL (aluminum) and T5CI (cast iron). Termination style T5SS (stainless steel) meets NEMA 4X standards and provides a degree of corrosion resistance. T5 heads feature 6 terminal posts. Covers are tethered to the body with a ball-chain. Temperature rating with gasket is 300° F (150° C).

T11

The T11 termination provides a screw cover with chain leash and a 6-post terminal block. The T11 is available in cast aluminum with a high gloss silver-painted finish designed to resist weak acids, organic solvents, alkalies, sunlight and dust. Temperature is rated at 275° F (135° C).

Note

- See Catalog 5005 for full selection of termination heads.



Adjustable Immersion Mounting Fittings

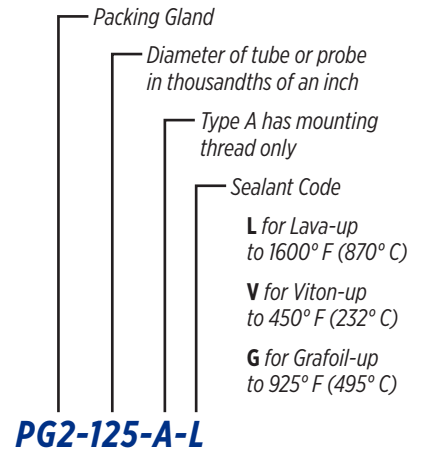
Single Thermocouple Assembly

Conax Technologies' Packing Glands provide pressure or vacuum sealing of thermocouples. The reusable stainless steel fitting with replaceable sealant can be used in gas or liquid environments. Listed sealing gland torque values are determined for supplied thermocouple and support tube assemblies operating at 300 psig maximum pressure and 68° F (20° C) temperature.



Support Tube Data					Torque (in lbs except as noted)		
Catalog Number	Tube or Probe Diameter	Thread NPT	Length "A"	Hex Size	Viton®	Lava	Grafoil®
MPG-125-*	.125"	1/8"	1-3/16"	1/2"	35-40	70-75	55-60
MPG-187-*	.187"	1/8"	1-3/16"	1/2"	35-40	70-75	55-60
PG2-125-*	.125"	1/4"	2"	3/4"	95-100	250-260	210-220
PG2-187-*	.187"	1/4"	2"	3/4"	75-80	205-215	180-190
PG2-250-*	.250"	1/4"	2"	3/4"	55-60	160-170	150-160
PG4-250-*	.250"	1/2"	2-1/2"	1"	45-50 ft-lbs	80-85 ft-lbs	45-50 ft-lbs
PG4-312-*	.312"	1/2"	2-1/2"	1"	45-50 ft-lbs	80-85 ft-lbs	45-50 ft-lbs
PG4-375-*	.375"	1/2"	2-1/2"	1"	45-50 ft-lbs	80-85 ft-lbs	45-50 ft-lbs
PG5-500-*	.500"	3/4"	2-7/8"	1-1/2"	55-60 ft-lbs	200-220 ft-lbs	90-100 ft-lbs

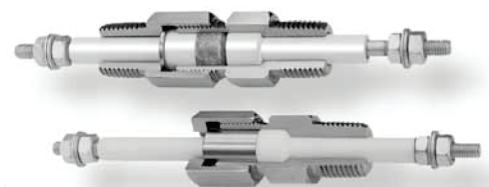
*Catalog Numbering System



All pressure and vacuum ratings are determined at 68° F (20° C). Viton is a registered trademark of Dow Elastomers L.L.C. Grafoil is a registered trademark of UCAR Carbon Company.



Insulated power lead sealing glands provide versatility for sealing against gas or liquid in applications such as vacuum and gas back-filled furnaces. PL Glands are designed to seal pressures ranging from vacuum to 10,000 psi (690 bar) in temperatures ranging from -300° F to 450° F (-185° C to +232° C). Seals 1-12 wires, 18 to 8 gauge, 5 to 55 amps, 600-volt rated.



PTFE (EGT) Glands

Electrode Seals for Pressure/Vacuum Service

Electrode Glands with ceramic insulators or one-piece PTFE insulator sealant are available for use in vacuum furnaces, environmental chambers and other applications requiring the thermal and/or electrical isolation of electrodes, tubes or temperature sensors. The EG Series with ceramic insulators are rated for 2000 VDC voltage. EGT Series with PTFE insulator are rated for 8000 VDC voltage.

Other Sheath Materials

Material	Chemical Symbol	Maximum Operating Temperature	Remarks
Silicon Carbide	SiC	3000° F (1650° C)	Excellent thermal conductivity, corrosion resistance and abrasion resistance, good thermal shock resistance.
Fused Quartz	SiO ₂	3050° F (1677° C)	Excellent thermal shock resistance, unreactive to most acids and metals, performs well in oxidizing, inert or neutral atmospheres.
Mullite	3Al ₂ O ₃ • 2SiO ₂	2750° F (1510° C)	Low thermal expansion, good thermal shock resistance, excellent mechanical strength.
Platinum or Platinum-Rhodium	Pt or Pt/Rh	3092° F (1700° C)	Excellent in oxidizing and inert atmospheres. Use with silica is not recommended. Reacts with fluorine and other halogens above 500° C. Very sensitive to sulfur corrosion.

Accuracy of Thermocouples

°C				°F		
ANSI/ASTM	Temperature Range	Standard	Special	Temperature Range	Standard	Special
R or S	0° to 600°	±1.5°	±0.6°	32° to 1112°	±2.7°	±1.08°
	600° to 1480°	±0.25% T	±0.1% T	1112° to 2700°	±0.25% (T-32)	±0.1% (T-32)
B	870° to 1700°	±0.5% T	±0.25% T	1600° to 3100°	±0.5% (T-32)	±0.25% (T-32)
C*	0° to 426°	±4.4°	-	32° to 800°	±8°	-
	426° to 2315°	±1% T	-	800° to 4200°	±1% (T-32)	-

*Formerly Conax Technologies Type W5.

Thermocouple Characteristics

Thermocouple Characteristics			Color Coding	
ANSI/ASTM	Symbol Single	Generic Names	Individual Conductor	Overall Jacket Extension Grade Wire
S	SP	Platinum 10% Rhodium	Black	Green
	SN	Platinum	Red	
R	RP	Platinum 13% Rhodium	Black	Green
	RN	Platinum	Red	
B	BP	Platinum 30% Rhodium	Gray	Gray
	BN	Platinum 6% Rhodium	Red	
C	CP	Tungsten 5% Rhenium	Green	Red
	CN	Tungsten 26% Rhenium	Red	

Conax Solutions for the Semiconductor Industry

Conax meets the demanding needs of the semiconductor industry with a wide range of temperature sensors and sealing devices specifically designed for the unique requirements of this industry. Conax offers standard products that can be easily adapted to meet the most challenging processes and applications of this industry. In addition, Conax design engineers are continuously at work to develop new sensor and compression seal fitting configurations to support the needs of this rapidly changing field.

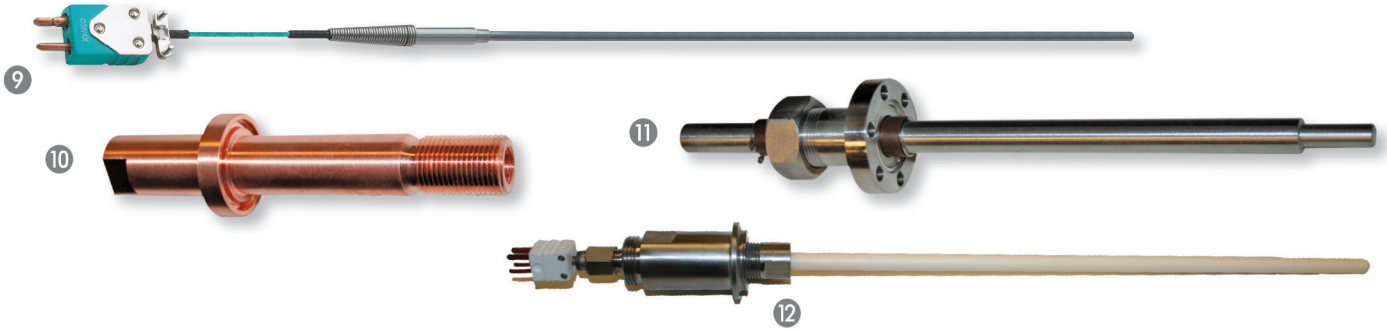
Drawing on our more than 65-year history of innovation, our engineers are capable of meeting the customized needs of our customers' product design challenges. From material processing to finished-product testing, our sensor/compression seal fitting designs provide value-based performance and reliability even in the most challenging environments.

Wafer Processing



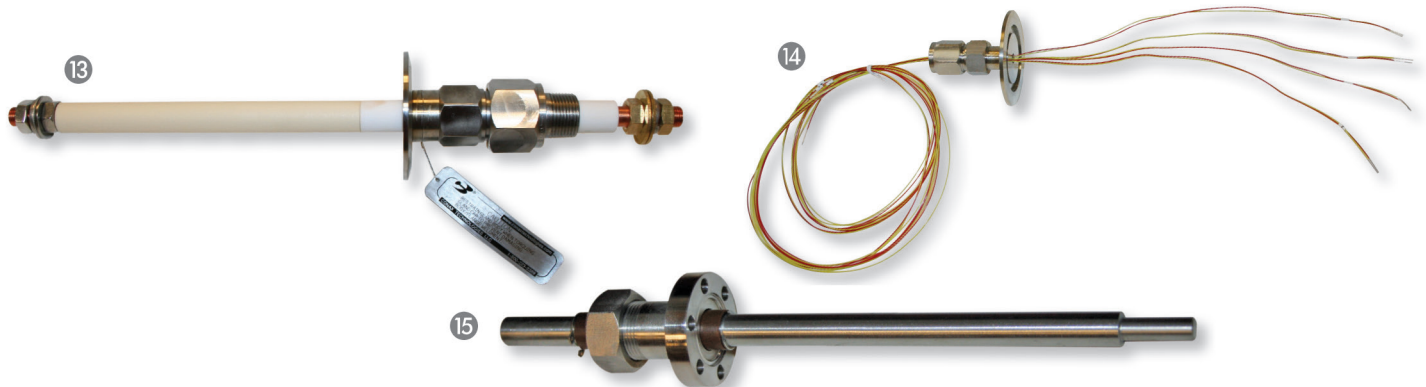
- 1** Profile thermocouples are available for both vertical and horizontal furnaces. 3-zone and 5-zone thermocouples may be manufactured with varying wire diameters and calibration types. For more applications of this product, see page 6.
- 2** Spike thermocouples and torch thermocouples may be supplied with flying leads, connectors or other custom configurations. For more applications of this product, see page 6.
- 3** Conax manufactures an extensive line of thermocouples for the ASM Epsilon Epitaxial Reactor. See further details starting on page 4.
- 4** Triple-Point calibration thermocouple for the Applied Materials/Moore Technologies Epitaxial Barrel Reactor.
- 5** Single-Point version of the calibration thermocouple for the Applied Materials/Moore Technologies Epitaxial Barrel Reactor.
- 6** Typical alumina sheathed dual junction, dual seal thermocouple used in general furnacing and ingot furnacing applications.
- 7** Small diameter thermocouples with spring loading used in applications such as ion implantation.
- 8** Fiber optic vacuum feedthrough used in applications such as passing laser signals into and out of UHV photolithography tools for precise stage movement measurements.

High Brightness LED & MEMS Production



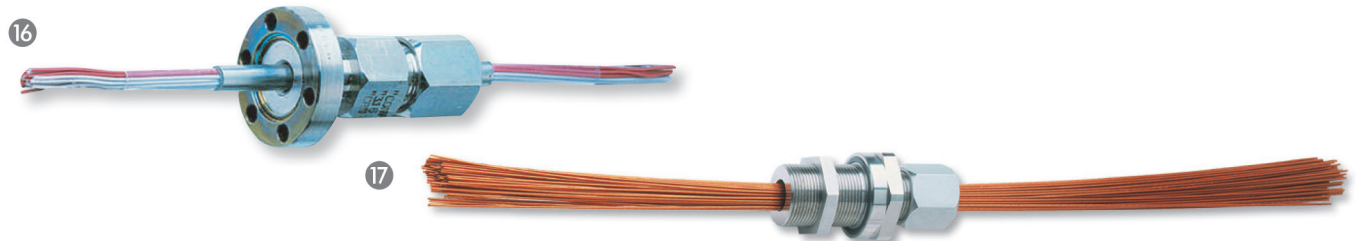
- 9** Susceptor temperature control thermocouple with molybdenum sheath used in MOCVD reactors used to produce High Brightness LEDs.
- 10** Water cooled copper electrode typically used to supply power to heating elements in MOCVD reactors.
- 11** Compression seal fitting with rebuildable molybdenum electrode typically supplies power to heating elements in MOCVD reactors. This design eliminates fragile ceramic-to-metal seal style electrode feedthroughs.
- 12** Typical alumina sheathed dual junction, dual seal thermocouple used in polycrystalline PV and ingot furnacing applications.

Photovoltaic



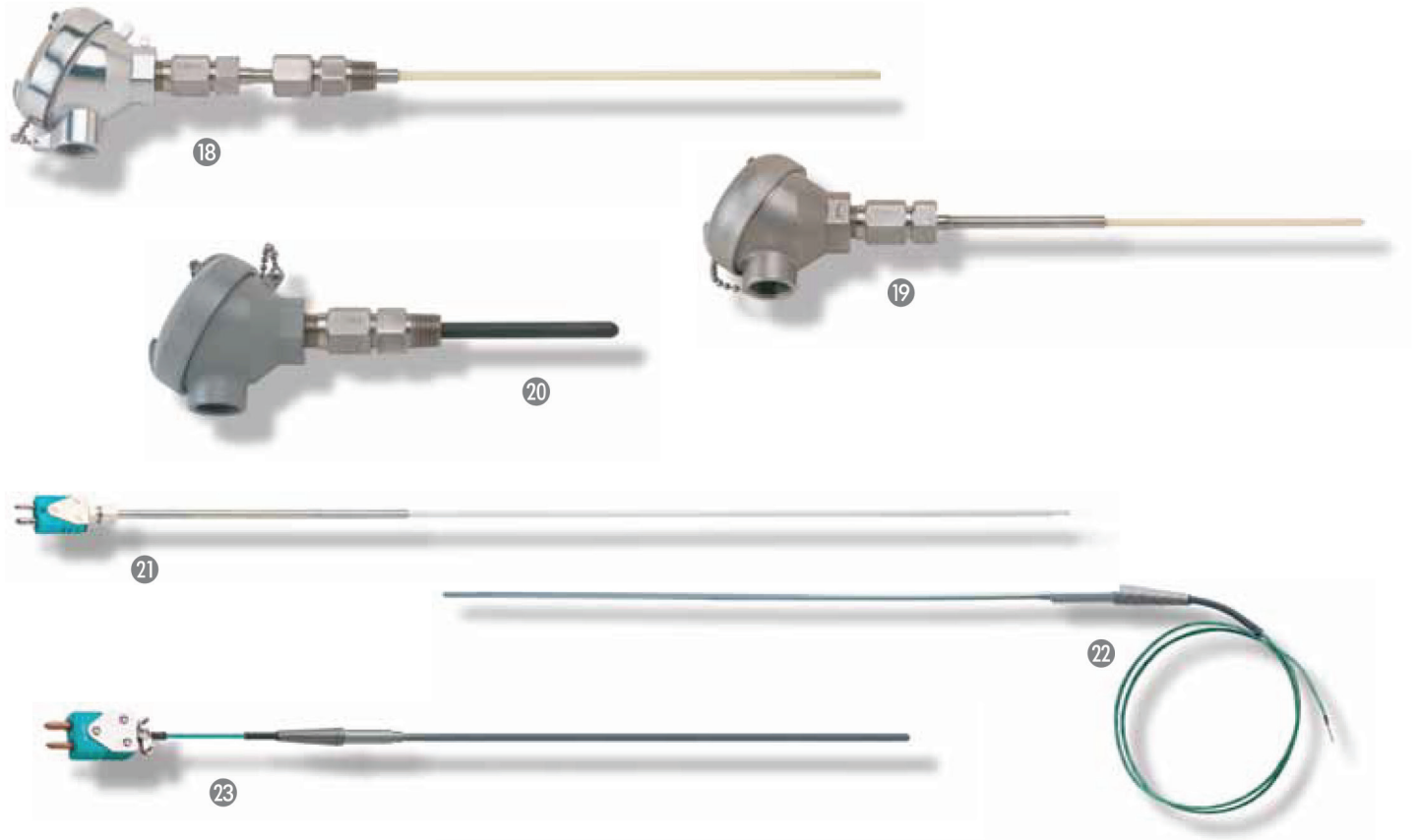
- 13** Typical electrode feedthrough with vacuum flange for supplying power to furnace heating elements in thin-film PV panel production.
- 14** Thermocouple wire feedthrough used to pass thermocouple signals through a vacuum pressure boundary.
- 15** Compression seal fitting with rebuildable molybdenum electrode typically supplies power to heating elements in MOCVD reactors. This design eliminates fragile ceramic-to-metal seal style electrode feedthroughs.

Package & Test



- 16** High density feedthrough with vacuum flange mount used to introduce copper signal and thermocouple wires into HAST (Highly Accelerated Stress Test) chamber.
- 17** Custom designed MHM fitting with O-ring seal for introducing large-diameter wires into HAST chamber.

Industry Applied High Temperature Applications



18 S 24-AL 25-AL-U-T 5AL(S 4BLD 4)PG 4AG-16.00"

19 S 24-AL 18-AL-U-T 5SS(S 4BVC 4)-10.00"
Platinum thermocouple assemblies with support tubes for limit and control. Used in a vacuum-environment, heat-treat furnace with inert-gas purge.

20 C 24-SASIC 37-AL-U-T 5CI(PG 4BL)-6.00"
Tungsten-rhenium Type C assemblies with sintered alpha silicon carbide sheath tubewell for use in semiconductor sintering applications.

21 S 24-AL 18-AL-B-PJ-48.00" SP

Thermocouple for monitoring surface temperature during the manufacturing process of flat panel glass. A unique 44 AWG wire hot junction (0.002" diameter) maximizes time response while minimizing surface contact.

22 R 24-MO 12-AL-U-T 3(36")-18.00"

Single-point platinum thermocouple with molybdenum sheath to manually profile fast-response epitaxial reactors.

23 R 24-MO 18-AL-U-T 3(6")-PJC-16.00"

Molybdenum-sheathed platinum thermocouple, terminated with quick disconnect male plug and flexible leadwire.

2300 Walden Avenue, Buffalo, New York 14225
+1 800 223 2389(P) | +1 716 684 7433(F)
Conax@ConaxTechnologies.com  Made in U.S.A.
Bulletin 6008, Rev E' ©2021 Conax Technologies 07/21


Ideas. Solutions. Success.