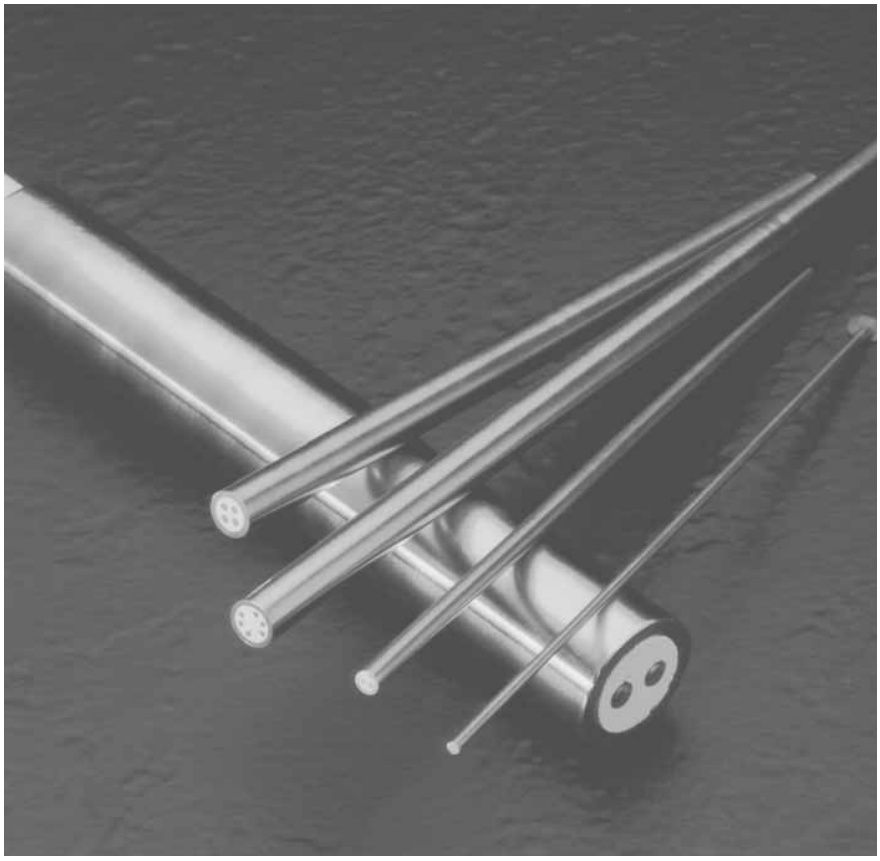
Mineral Insulated Metal-Sheathed Cable

XACTPAK® Cable

Watlow helped pioneer XACTPAK® mineral insulated, metal-sheathed cable. The unique properties of XACTPAK make it ideally suited to solve a wide variety of problem applications.

The outer sheath can be made from any malleable metal in a wide range of diameters, containing single or multiple wires. Easily formed or bent, it can accommodate virtually any configuration. The outer sheath protects thermocouple or thermocouple extension wires from oxidation and hostile environments that would quickly destroy unprotected wire.

The mineral insulations available provide excellent high temperature dielectric strength to ensure signals are carried faithfully to your instrumentation or controls.



Performance Capabilities

- Available in standard and special limits of error accuracy
- Diameters from 0.010 to 0.5 inch (0.25 to 12.7 mm)
- Compliance with recognized agency tolerances and specifications
- Sheath materials available to withstand a wide variety of hostile and corrosive environments
- Calibrated for intended temperature range
- Temperature ranges from 0 to 1480°C (32 to 2700°F)
- Cryogenic cable available upon request

Features and Benefits

Fireproof cable

- Perform where conventional insulated wires burn and degrade

Fast and accurate

- Precisely measures temperature for a fast response

Tight moisture and gas seals

- Resists contamination

High pressure rating

- Allows use in pressure vessels and vacuum applications

Form flexibility

- Adapts to virtually any application

Thermal shock resistance

- Withstands thermal cycling

Compact, durable and corrosion resistant

- Long life performance with minimum constraints on applications

High temperature rating

- Meets demanding application needs

Applications

- Atomic research
- Bearing temperature
- Blast furnaces
- Catalytic reformers
- Diesel engines
- Food and beverage
- Furnaces
- Glass and ceramic
- Heat treating
- Instrument cabling
- Jet engines and test cells
- Kilns
- Laboratory and research
- Medical
- Nuclear reactors
- Power stations and steam generators
- Refineries and oil processing
- Rocket engines
- Semiconductor processing
- Turbines
- Vacuum furnaces

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Technical Data

Quality Control and Testing

To maintain quality and consistency, XACTPAK cable is manufactured under carefully controlled procedures and rigid standards of cleanliness. Quality checks are made at critical points throughout the manufacturing process.

All XACTPAK cable is inspected and tested for sheath condition, insulation density, conductor uniformity, electrical continuity, insulation resistance, calibration conformance and physical dimension. Special testing and certification—including helium leak, homogeneity and metallurgical examination, among others—are available on request.

Quality Assurance

Every coil of XACTPAK cable is thoroughly tested for continuity, insulation resistance, physical dimensions and physical appearance.

Each lot, or batch of XACTPAK contains raw materials (sheath, insulation, wires) from one production lot which eliminates the need to calibrate every thermocouple cut from a coil because of poor homogeneity.

Samples from each lot are calibrated in our modern calibration laboratory by highly skilled technicians. Unlike some manufacturers who calibrate at a few low temperature calibration points, Watlow calibrates throughout the range that the cable is designed for.

For a more complete discussion of Watlow's advanced technological capabilities, refer to the laboratory services section, pages 30 to 35.

Care, Handling and Fabrication of XACTPAK Cable

To maximize the performance advantages made possible by XACTPAK cable's overall premium quality, the following instructions covering its storage, handling and further fabrication should be observed.

Storage

To prevent moisture from being absorbed by its hygroscopic mineral insulation, both ends of each length of XACTPAK cable are sealed at the factory. To further guard against moisture penetration, it is advisable to store XACTPAK material in a dry place.

Moisture

If XACTPAK cable is not adequately sealed, its insulation will absorb moisture. This will lower its electrical resistance and may prove to be troublesome in subsequent welding. Minor moisture penetration can be remedied by using a blow torch to heat the sheath. Apply the flame six to seven inches from the open end and slowly work the flame to and over the end. Reseal the end after it has cooled to about 82°C (180°F). Deep moisture penetration is unlikely, but should it occur the material may be baked at approximately 121°C (250°F) for 24 hours to increase its insulation resistance. If baking does not bring the insulation resistance back to acceptable levels, the material should be discarded.

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Technical Data

Care, Handling and Fabrication of XACTPAK Cable

Continued

Cutting

When pieces are cut from a length of XACTPAK cable, the exposed ends should immediately be squared and sealed. Squaring and sealing will guard against possible contamination and remove any loosened insulation or distorted wire caused by cutting. A light pressure sanding with a 180-grit belt is the easiest method for rough squaring of 0.040 inch or larger diameter XACTPAK cable. Using hard pressure against the sanding belt will cause excessive heat build-up which may "smear" the soft metal over the insulation. After sanding, a clean fine toothed file should be used to dress the squared ends. Each exposed end should then be sealed with XACTSEAL to prevent moisture absorption.

Inexperienced personnel may find 0.032 inch or smaller diameter XACTPAK cable difficult to handle and will probably prefer to have all cutting, stripping and fabricating done at our factory.

Insulation Resistance

XACTPAK mineral insulated, metal-sheathed cable should have a minimum room temperature insulation resistance of 100 megohms when tested at 50V⎓(dc) both wires to sheath and wire to wire.

All ceramics used in XACTPAK cable will decrease in resistance as temperature increases.

Shipping and Packaging

XACTPAK cable is stocked in random lengths from 20 feet to the "Maximum Stock Lengths" listed in the tables on the following pages. We reserve the right to supply random lengths of our choice unless specific cut lengths are specified on your order.

On request, XACTPAK cable can be furnished in other coil dimensions or shipped in straight form when necessary. Longer lengths are available on special order.

Stripping

A hand stripping tool will readily remove the sheath from 0.010 through 0.125 inch diameter XACTPAK cable. However, due to the difficulty of working with 0.032 inch or smaller diameter material, it is recommended that small diameter material be ordered factory stripped. Material larger than 0.125 inch diameter can be stripped on a lathe with a suitable tool bit or lathe-mounted stripping tool. It is also possible to strip larger sizes of XACTPAK cable by using a hacksaw to make a ring cut through the sheath at the desired distance from the end. Hammering the severed portion of sheath at several places will break up the insulation allowing the sheath to be slipped off. After stripping, the exposed conductors should be sandblasted or cleaned with emery cloth. The exposed ends should be resealed immediately after completion of the stripping operation.

Forming

Because XACTPAK cable's sheath is dead soft and bright annealed, it can be formed and shaped to most contours without risk of cracking. As a rule of thumb, the sheath can be formed around a mandrel twice the sheath diameter without damage. In other words, 0.125 inch diameter XACTPAK cable can be wound around a 0.250 inch diameter mandrel.

XACTPAK Cable

Technical Data

Care, Handling and Fabrication of XACTPAK Cable

Continued

Welding

Because of the delicate nature of the work and to avoid possible contamination, it is recommended that the fabrication of "hot" or "measuring" junctions be done at our factory.

If they are attempted in the field, a welding rod of the same material as the sheath should be used, and the welding method should be by inert gas. Flux should not be used as it will contaminate the insulation.

Other weldments, such as to a vessel or pipe, should be made in an inert atmosphere to prevent oxidation of the sheath. When working with XACTPAK cable of 0.040 inch outside diameter or less, extreme caution should be used not to burn through the sheath.

How to Select XACTPAK Cable to Suit Your Requirements

Our mineral insulated metal-sheathed cable section has been designed for ease of use so that the right cable is chosen for each application. The following four items must be considered when selecting XACTPAK mineral insulated metal-sheathed cable:

1. Sheath Material

The sheath serves to isolate and protect the wires and insulation from contamination and mechanical damage. There is no sheath material which is appropriate for all conditions so Watlow offers a wide variety to choose from. Temperature, strength, corrosiveness, service life and cost must be considered when selecting a sheath material.

2. Calibration

Watlow stocks all ASTM recognized thermocouple types along with many that have not been recognized, such as the full line of tungsten rhenium thermocouples. We also manufacture cable with other wire alloys such as nickel, copper, nickel clad copper, 304 SS, Alloy 600 and virtually any malleable metal.

3. Insulation Material

The insulation separates the conductors from each other and the outer sheath. When selecting insulation, temperature rating, environment and cost must be taken into account.

4. Physical Characteristics

The diameter of the sheath and the wall thickness will directly affect the following:

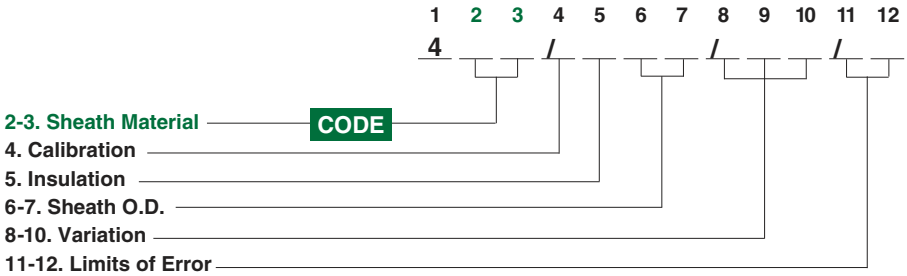
- Time response
- Service life
- Flexibility
- Pressure rating
- Strength

5. Specify Coil Lengths

Random—the factory selects for you (20 foot minimum). Special—specify lengths and tolerance. Cut to length charges and minimum order quantities may apply.

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable



Sheath Material

The following information is designed to be used as a guide and may not be correct in every application. If in doubt, consult with your Watlow sales engineer or the factory.

Alloy 600

01—Maximum temperature: 1175°C (2150°F). Most widely used thermocouple sheath material. Good high temperature strength, corrosion resistance, resistance to chloride ion stress corrosion cracking and oxidation resistance to high temperatures. Do not use in sulfur bearing environments. Good in nitriding environments.

304 SS

02—Maximum temperature: 900°C (1650°F). Most widely used low temperature sheath material. Extensively used in food, beverage, chemical and other industries where corrosion resistance is required. Subject to damaging carbide precipitation in 480 to 870°C (900 to 1600°F) range. Lowest cost *corrosion resistant* sheath material available.

310 SS

03—Maximum temperature: 1150°C (2100°F). Mechanical and corrosion resistance, similar to but better than 304 SS. Very good heat resistance. This alloy contains 25 percent chromium, 20 percent nickel. Not as ductile as 304 SS.

316 SS

04—Maximum temperature: 900°C (1650°F). Best corrosion resistance of the austenitic stainless steel grades. Widely used in the food and chemical industry. Subject to damaging carbide precipitation in 482 to 870°C (900 to 1600°F) range.

347 SS

05—Maximum temperature: 870°C (1600°F). Similar to 304 SS except nickel niobium stabilized. This alloy is designed to overcome susceptibility to carbide precipitation in the 480 to 870°C (900 to 1600°F) range. Used in aerospace and chemical applications.

446 SS

13—Maximum temperature: 1150°C (2100°F). Ferritic stainless steel which has good resistance to sulfurous atmospheres at high temperatures. Good corrosion resistance to nitric acid, sulfuric acid and most alkalies. 27 percent chromium content gives this alloy the highest heat resistance of any ferritic stainless steel.

321 SS

16—Maximum temperature: 870°C (1600°F). Similar to 304 SS except titanium stabilized for inter-granular corrosion. This alloy is designed to overcome susceptibility to carbon precipitation in the 480 to 870°C (900 to 1600°F) range. Used in aerospace and chemical applications.

Hastelloy® X

18—Maximum temperature: 1205°C (2200°F). Widely used in aerospace applications. Resistant to oxidizing, reducing and neutral atmospheric conditions. Excellent high temperature strength along with superior oxidation resistance. Resistant to stress corrosion cracking in petrochemical applications.

Inconel® 601

19—Maximum temperature: 1175°C (2150°F) continuous, 1260°C (2300°F) intermittent. Similar to Alloy 600 with the addition of aluminum for outstanding oxidation resistance. Designed for high temperature corrosion resistance. This material is good in carburizing environments, and has good creep rupture strength. *Do not use in vacuum furnaces!* Susceptible to intergranular attack by prolonged heating in 540 to 760°C (1000 to 1400°F) temperature range.

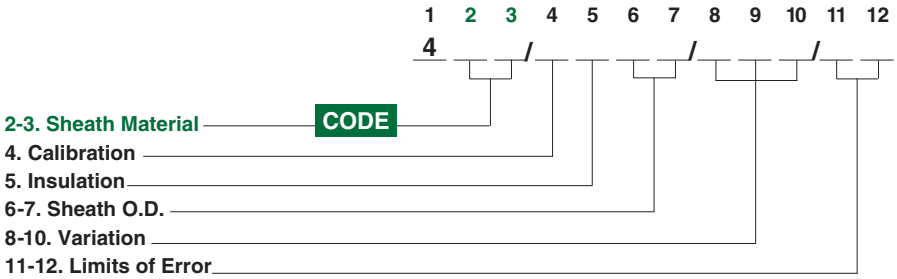
Hastelloy® is a registered trademark of Haynes International.

Inconel® is a registered trademark of the Special Metals Corporation.

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Sheath Material
Continued



Inconel® 625

25—Maximum temperature: 980°C (1800°F). Used in many aerospace applications. Excellent high temperature strength. Excellent resistance to pitting and crevice corrosion. Unaffected by radiation embrittlement.

Haynes® Alloy 230

32—Maximum temperature: 1150°C (2100°F). This alloy offers excellent high temperature strength, oxidation resistance and long term thermal stability. Used in aerospace applications, chemical process industries and high temperature industrial heating applications. This alloy is recommended for use in nitriding environments.

Haynes® Alloy HR-160

38—Maximum temperature 1175°C (2150°F). Developed to provide superior sulfidation-resistance at high temperatures. This alloy shows good resistance to corrosion in some salt bath applications. Applications include sulfur furnaces, waste incinerators, coke burners, recuperators, cement kilns and high temperature furnaces.

Haynes® Alloy 718

42—Maximum temperature 700°C (1300°F). A precipitation hardendable Inconel® alloy developed for corrosion resistance and excellent weldability. Applications include gas turbine, aerospace, oil and gas production and nuclear.

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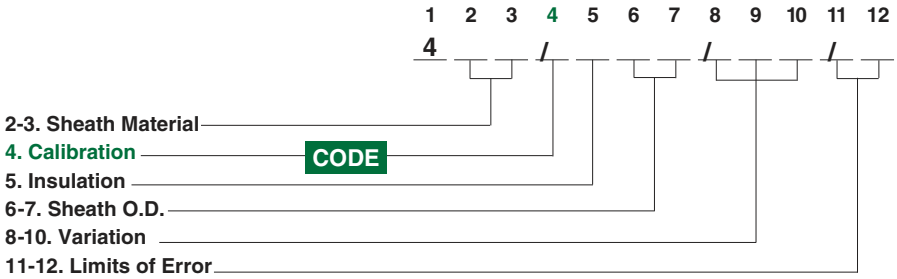
XACTPAK Cable



Calibration

ASTM Type J

1—Type J's positive leg (JP) is iron. Its negative leg (JN) is approximately 45 percent nickel-55 percent copper. When protected by compacted mineral insulation and outer sheath, Type J is usable from 0 to 815°C (32 to 1500°F). Type J is not susceptible to short range ordering in the 0 to 538°C (700 to 1000°F) temperature range, (+2 to +4°F drift) which occurs with ASTM Type E and K. This low cost, stable thermocouple calibration is primarily used with 96 percent pure MgO insulation and stainless steel sheath.

ASTM Type K

2—Type K's positive leg (KP) is approximately 90 percent nickel-10 percent chromium. Its negative leg (KN) is approximately 95 percent nickel-two percent aluminum-two percent manganese-one percent silicon. When protected by compacted mineral insulation and outer sheath, Type K is usable from -35 to 1260°C (-32 to 2300°F). If the application is between 600 to 1100°F, we recommend Type J or N because of short range ordering that can cause drift of +2 to +4°F in a few hours time. Type K is relatively stable to radiation transmission in nuclear environments. For applications below 0°C (32°F), special alloy selections are usually required.

ASTM Type T

3—Type T's positive leg (TP) is pure copper. Its negative leg (TN) is approximately 45 percent nickel-55 percent copper. When protected by compacted mineral insulation and outer sheath, Type T is usable from 0 to 350°C (32 to 660°F) and very stable in cryogenic and low temperature applications. For applications below 0°C (32°F) special alloy selections may be required.

ASTM Type E

4—Type E's positive leg (EP) is approximately 90 percent nickel-10 percent chromium. Its negative leg (EN) is approximately 45 percent nickel-55 percent copper. When protected by compacted mineral insulation and outer sheath, Type E is usable from 0 to 900°C (32 to 1650°F) and has the highest EMF output per degree of all ASTM types. If the application temperature is between 600 to 1100°F, we recommend Type J or N because of short range ordering which can cause drift of +1 to +3°F in a few hours time. For applications below 0°C (32°F), special alloy selections may be required.

ASTM Type N

8—Type N's positive leg (nicrosil) is approximately 14 percent chromium-1.4 percent silicon-84.6 nickel. Its negative leg (nisil) is approximately 4.4 percent silicon-95.6 percent nickel. When protected by compacted mineral insulation and outer sheath, it's usable from 0 to 1260°C (32 to 2300°F). Type N overcomes several problems inherent in Type K. Short range ordering, (+2 to +4°F drift), in the 315 to 590°C (600 to 1100°F) range is greatly reduced, and drift rate at high temperatures is considerably less. Type N is also more stable than Type K in nuclear environments.

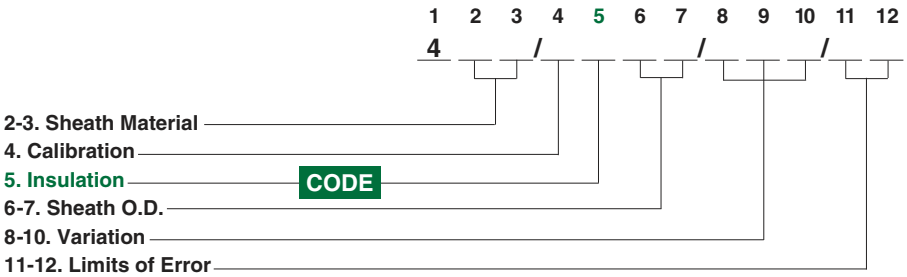
Miscellaneous

9—Consult factory.

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Insulation



High Purity Magnesium Oxide (MgO) 99.4 Percent Minimum Purity

1—Low impurity levels make this insulation very useful for all thermocouple calibrations up to 1370°C (2500°F). Above 2500°F we recommend using hafnia oxide insulation because of MgO's low resistivity. This material meets the requirements established in ASTM E-235.

Alumina Oxide (Al2O3) 99.6% Minimum Purity

2—Although this material is comparable to MgO in its electrical properties and cost, it does not compact well and tends to "powder out." This undesirable characteristic has made this insulation unpopular in industry so cable with this type of insulation is available only as a "special."

Magnesium Oxide (MgO) 96% Minimum Purity

5—This low cost insulation is similar to high purity MgO (1) except it should be used in applications below 1095°C (2000°F) because of the impurity levels. This insulation *should not* be used with platinum or in nuclear applications.

Hafnia Oxide (HfO2)

7—Hafnia is now being used as a substitute for beryllia oxide because of beryllia's toxicity problem. The temperature limit of hafnia is 2500°C (4530°F), which is higher than BeO.

Mineral Insulated Metal-Sheathed Cable

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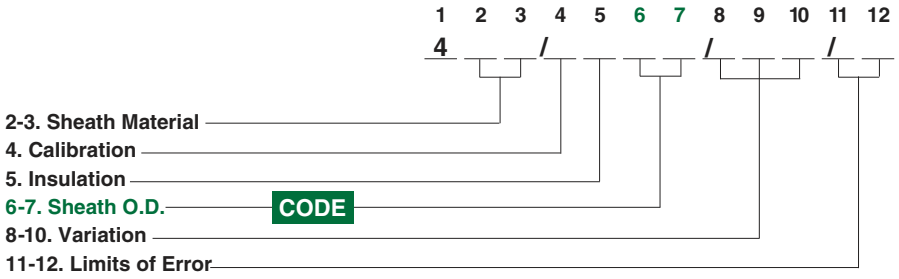
Sheath O.D.



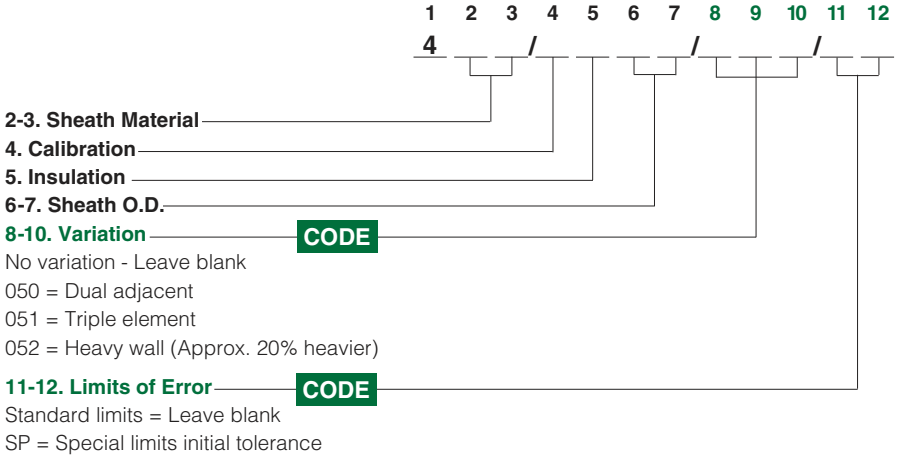
Code No.	Sheath Diameter		Approximate Standard	Weight Coil	Average Response Time* Still Water (seconds)	
	Nominal	Tolerance			lbs/100 ft.	G-JCT
01	0.020 inch	+0.001 –0.0005	9 inch	0.08	<0.02	0.03
02	0.032 inch	+0.001 –0.0005	9 inch	0.20	0.02	0.07
03	0.040 inch	+0.001 –0.0005	9 inch	0.32	0.04	0.13
04	0.063 inch	±0.001	24 inch	0.74	0.220	0.40
05	0.090 inch	±0.001	24 inch	1.50	0.33	0.68
06	0.114 inch	+0.002 –0.001	24 inch	2.45	0.38	0.85
07	0.125 inch	+0.002 –0.001	24 inch	3.00	0.50	1.10
08	0.188 inch	+0.002 –0.001	24 inch	6.65	1.00	2.30
11	0.250 inch	+0.003 –0.001	24 inch	11.65	2.20	4.10
12	0.313 inch	+0.003 –0.001	24 inch	19.60	5.00	7.00
13	0.375 inch	+0.003 –0.001	straight or 40 inch coils	28.10	8.00	11.00
14	0.430 inch	+0.003 –0.001	straight or 40 inch coils	35.0	11.00	15.00
15	0.500 inch	+0.003 –0.001	straight or 40 inch coils	47.0	15.00	20.00
16	0.010 inch	+0.001 –0.0005	9 inch	0.019	<0.02	<0.02
17	0.011 inch	+0.001 –0.0005	9 inch	0.022	<0.02	<0.02
18	0.0126 inch	+0.001 –0.0005	9 inch	0.029	<0.02	<0.02
19	0.025 inch	+0.001 –0.0005	9 inch	0.13	<0.02	0.05
51	0.5 mm	±0.02	23 cm	0.08	<0.02	0.03
52	1.0 mm	±0.02	23 cm	0.32	0.04	0.13
53	1.5 mm	±0.02	61 cm	0.65	<0.15	0.35
54	2.0 mm	±0.03	61 cm	1.13	0.25	0.55
55	3.0 mm	±0.03	61 cm	2.60	0.40	0.90
56	4.5 mm	±0.03	61 cm	6.00	0.95	2.00
57	6.0 mm	±0.05	61 cm	10.50	2.00	3.50
58	8.0 mm	±0.05	61 cm	19.65	5.00	7.00
59	9.0 mm	±0.05	61 cm	25.00	7.50	10.00

*Note: First order response time 63.2%.

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Variation/Limits of Error



Single Element

Code* No.	Sheath Diameter	Sheath Material	Calibration	Insulation	Nominal AWG Gauge	Nominal Wall Thickness in.	Maximum Stock Length ft	Maximum Recommended Operating Temperature °C	(°F)
401/2101	0.020	Alloy 600	K	99.4% MgO	38	0.003	100	871	(1600)
402/2101	0.020	304 SS	K	99.4% MgO	38	0.003	100	871	(1600)
401/2102	0.032	Alloy 600	K	99.4% MgO	34	0.004	150	871	(1600)
401/1103	0.040	Alloy 600	J	99.4% MgO	32	0.006	250	816	(1500)
401/2103	0.040	Alloy 600	K	99.4% MgO	32	0.006	250	871	(1600)
402/1103	0.040	304 SS	J	99.4% MgO	32	0.006	250	816	(1500)
404/2103	0.040	316 SS	K	99.4% MgO	32	0.006	250	871	(1600)
401/2104	0.063	Alloy 600	K	99.4% MgO	28	0.009	1000	1093	(2000)
401/2107	0.125	Alloy 600	K	99.4% MgO	22	0.017	900	1177	(2150)
401/2507	0.125	Alloy 600	K	96% MgO	22	0.017	900	1093	(2000)
401/8107	0.125	Alloy 600	N	99.4% MgO	22	0.017	900	1177	(2150)
402/1507	0.125	304 SS	J	96% MgO	22	0.017	900	816	(1500)
402/2107	0.125	304 SS	K	99.4% MgO	22	0.017	900	871	(1600)
402/2507	0.125	304 SS	K	96% MgO	22	0.017	900	871	(1600)
402/3507	0.125	304 SS	T	96% MgO	22	0.017	500	350	(662)
403/2507	0.125	310 SS	K	96% MgO	22	0.017	900	1093	(2000)
404/2507	0.125	316 SS	K	96% MgO	22	0.017	900	871	(1600)
404/3507	0.125	316 SS	T	96% MgO	22	0.017	500	350	(662)
404/4507	0.125	316 SS	E	96% MgO	22	0.017	900	871	(1600)
418/2107	0.125	Hastelloy® X	K	99.4% MgO	22	0.014	125	1204	(2200)
401/2108	0.188	Alloy 600	K	99.4% MgO	19	0.025	350	1177	(2150)
401/2508	0.188	Alloy 600	K	96% MgO	19	0.025	350	1093	(2000)
402/1508	0.188	304 SS	J	96% MgO	19	0.025	350	816	(1500)
402/2508	0.188	304 SS	K	96% MgO	19	0.025	350	871	(1600)
403/2508	0.188	310 SS	K	96% MgO	19	0.025	350	1093	(2000)
404/1508	0.188	316 SS	J	96% MgO	19	0.025	350	816	(1500)

CONTINUED

*To specify special limits add to code number: /SP

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Single Element
Continued

Code* No.	Sheath Diameter	Sheath Material	Calibration	Insulation	Nominal AWG Gauge	Nominal Wall Thickness in.	Maximum Stock Length ft	Maximum Recommended Operating Temperature °C	(°F)
404/2508	0.188	316 SS	K	96% MgO	19	0.025	350	871	(1600)
401/1511	0.250	Alloy 600	J	96% MgO	16	0.033	220	816	(1500)
401/2111	0.250	Alloy 600	K	99.4% MgO	16	0.033	220	1177	(2150)
401/2511	0.250	Alloy 600	K	96% MgO	16	0.033	220	1093	(2000)
402/1511	0.250	304 SS	J	96% MgO	16	0.033	220	816	(1500)
402/2511	0.250	304 SS	K	96% MgO	16	0.033	220	871	(1600)
403/2511	0.250	310 SS	K	96% MgO	16	0.033	220	1093	(2000)
404/1511	0.250	316 SS	J	96% MgO	16	0.033	220	816	(1500)
404/2511	0.250	316 SS	K	96% MgO	16	0.033	220	871	(1600)
401/2512	0.313	Alloy 600	K	96% MgO	14	0.041	150	1093	(2000)
401/2513	0.375	Alloy 600	K	96% MgO	13	0.052	100	1093	(2000)

*To specify special limits add to code number: /SP

Double Element—Adjacent Conductors

Code* No.	Sheath Diameter	Sheath Material	Calibration	Insulation	Nominal AWG Gauge	Nominal Wall Thickness in.	Maximum Stock Length ft	Maximum Recommended Operating Temperature °C	(°F)
401/2507/050	0.125	Alloy 600	K	96% MgO	24	0.017	900	1093	(2000)
404/1507/050	0.125	316SS	J	96% MgO	24	0.017	900	816	(1500)
402/1508/050	0.188	304 SS	J	96% MgO	21	0.025	350	816	(1500)
401/2511/050	0.188	Alloy 600	K	96% MgO	18	0.033	220	1093	(2000)
401/4511/050	0.250	Alloy 600	E	96% MgO	18	0.033	220	871	(1600)
404/1511/050	0.250	316 SS	J	96% MgO	18	0.033	220	816	(1500)

*To specify special limits add to code number: /SP

XACTSEAL

Watlow developed a premium sealant for sealing the exposed ends of XACTPAK sheathed type material against moisture penetration. At room temperature, thin layers of the sealant air-dry in approximately one hour. It may be baked at up to 120°C (250°F) to accelerate drying. The sealant comes ready to use from its own container; use G.E. #1500 or equivalent should a thinner be needed. XACTSEAL is a temporary sealant. For long term storage we recommend that the ends of the cable be seal welded.

Code No.	Description
8010	4 oz dispenser can

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Mineral Insulated Metal-Sheathed RTD Cable

This cable is used for making rugged RTD probes. Special spacing allows room for elements to be placed between conductors. Dimensions are shown below.

1 2 3 4 5 6 7 8 9 10
4 _ _ / 9 _ _ _ / _ _ _

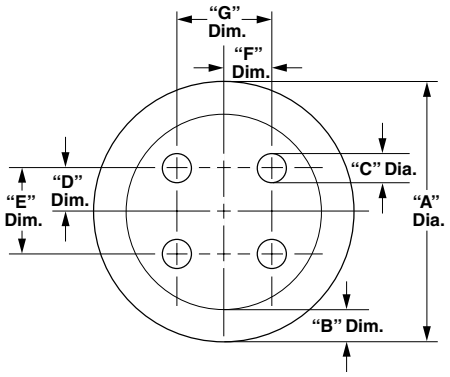
2-3. Sheath Material
01 = Alloy 600
04 = 316 SS

4. Wire
9 = Nickel 201

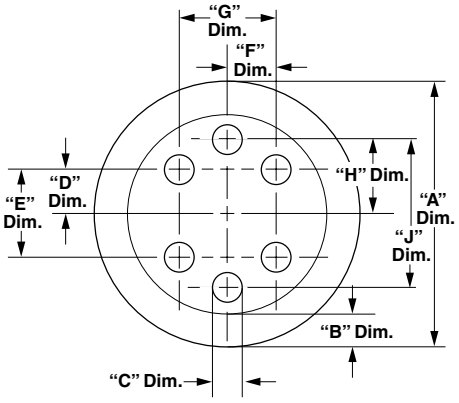
5. Wire Insulation
1 = 99.4% MgO
5 = 96% MgO

6-7. Sheath O.D.
07 = 0.125 inch diameter
08 = 0.188 inch diameter
11 = 0.250 inch diameter
12 = 0.313 inch diameter

8-10. Variation
001 = 6-Wire
003 = 4-Wire



4 Conductor RTD MIMS Cable



6 Conductor RTD MIMS Cable

A Diameter	B Wall Thickness	C Diameter	Spacing Nominal			
			D Dim.	E Dim.	F Dim.	G Dim.
0.125 +0.002 -0.001	0.015 ± 0.002	0.014 ± 0.002	0.022	0.045	0.025	0.050
0.188 +0.002 -0.001	0.023 ± 0.002	0.020 ± 0.002	0.034	0.068	0.037	0.074
0.250 +0.003 -0.001	0.030 ± 0.005	0.027 ± 0.003	0.045	0.090	0.050	0.100
0.313 +0.003 -0.001	0.038 ± 0.005	0.032 ± 0.003	0.056	0.112	0.062	0.124

A Dim.	B Dim.	C Dim.	D Dim.	E Dim.	F Dim.	G Dim.	H Dim.	J Dim.
0.125 +0.002 -0.001	0.015 ± 0.002	0.014 ± 0.002	0.022	0.045	0.025	0.050	0.034	0.068
0.188 +0.002 -0.001	0.023 ± 0.002	0.020 ± 0.002	0.034	0.068	0.037	0.074	0.052	0.104
0.250 +0.003 -0.001	0.030 ± 0.005	0.027 ± 0.003	0.045	0.090	0.050	0.100	0.068	0.137
0.313 +0.003 -0.001	0.038 ± 0.005	0.032 ± 0.003	0.056	0.112	0.062	0.124	0.085	0.170

Mineral Insulated, Metal-Sheathed Cable

XACTPAK Cable

Made-to-order Mineral Insulated (MI) Cable

In addition to our full line of metal-sheathed, mineral-insulated thermocouple cable, we will also manufacture metal-sheathed, mineral-insulated signal cable with copper, stainless steel or other conductor materials to meet many specialized requirements. (MI) cable incorporating one or more conductors can be made from a large variety of sheath and insulation materials. Properly selected combinations of materials provide (MI) cable with these outstanding performance features:

- It is totally impervious to moisture.
- It can withstand extremes of temperature and pressure.
- It can endure highly oxidizing or corrosive conditions.
- It adapts well to nuclear applications because of its low neutron capture cross section which is unaffected by radiation heating. (Selected sheaths and calibrations.)
- It can be easily formed to a radius equal to approximately twice its diameter without insulation breakdown. It maintains its shape after forming.

1	2	3	4	5	6	7	8	9	10	11	12
4			/				/			/	

2-3. Sheath Material

01 = Alloy 600	18 = Hastelloy® X
02 = 304 SS	19 = Inconel® 601
03 = 310 SS	25 = Inconel® 625
04 = 316 SS	32 = Haynes® Alloy 230
05 = 347 SS	38 = Alloy HR-160
13 = 446 SS	42 = Alloy 718
16 = 321 SS	99 = Miscellaneous

4. Calibration

1 = J	4 = E
2 = K	8 = N
3 = T	9 = Misc.

5. Insulation

0 = Unused	7 = Hafnia oxide
1 = Magnesium oxide 99.4%	8 = Unassigned
2 = Alumina oxide 99.6%	9 = Miscellaneous
5 = Magnesium oxide 96%	

6-7. Sheath O.D. [inch (mm)]

01 = 0.020	11 = 0.250	19 = 0.025	58 = (8.0 ± 0.05)
02 = 0.032	12 = 0.313	51 = (0.5 ± 0.02)	59 = (9.0 ± 0.05)
03 = 0.040	13 = 0.375	52 = (1.0 ± 0.02)	99 = Miscellaneous
04 = 0.063	14 = 0.430	53 = (1.5 ± 0.02)	
05 = 0.090	15 = 0.500	54 = (2.0 ± 0.03)	
06 = 0.114	16 = 0.010	55 = (3.0 ± 0.03)	
07 = 0.125	17 = 0.011	56 = (4.5 ± 0.03)	
08 = 0.188	18 = 0.0126	57 = (6.0 ± 0.05)	

8-10. Variation

Leave blank = No variation
001 = Dual diagonal
050 = Dual adjacent
051 = Triple element

Examples
401/2107
401/2107/SP
402/1511/050/SP

11-12. Limits of Error

Standard = Leave blank
Special limits = SP