koslow
SCIENTIFIC TESTING INSTRUMENTS
172 Walkers Lane, Englewood, NJ, 07631 USA
Tel 201.541.9100 Fax 201.541.9330 Email sales@koslow.com
www.koslow.com

Thermo-Electric Alloy Sorter

TE-3000

Instructions

Version 10.7
Conical tip

"The Metal Detectives"

Your **Thermo-Electric Alloy Sorter TE-3000** Contains:

Quantity	Item
1	Thermo-Electric Alloy Sorter TE-3000
1	Certificate of Initial Calibration
1	Instruction Manual
1	Pliers for tip removal
1	Thermo-Electric Probe (hot) hard wired
1	Standard Metal Coupon on chain
1	Alligator Clip (cold) lead with blue jack
1	Wand (cold) lead with blue jack
1	AC power cord SVT, 18 AWG, 3 wire
1	Abrasive Metal Cleaning Sheet
1	Blunt shape tip (flat) installed
1	Large Hard Carry Case
1	Zip-Up Padded Soft Cover with Window
1	List of Alloys Tested – Alphabetical List
1	List of Alloys Tested – Numerical List

APPLICATIONS:

- Reclaim scrap & Sort metal mix-ups
- Stainless Steels, Aluminum, Specialty Steels, Tool Steels, Low Alloy Steels, Titanium
- Inspect receiving and outgoing stock
- Verify alloy before repair or welding
- Use on pipe, tanks, wire, parts of any size or shape
- Detects presence of coatings and platings on conductive alloys
- Non-Destructive

FEATURES:

- Lightweight and Easy to Use
- Duration of test: within seconds
- NIST cert of calibration
- Reliable and reproducible results
- Analog signal jacks output
- Power supply; international 110 to 220 AC volt input, 60 Hz
- Reference Calibration coupon for standardization.

INTRODUCTION

The TE-3000 Thermoelectric Alloy Sorter utilizes the same theory as an ordinary thermocouple, involving the direct conversion of temperature differences into electricity. This principle is also known as the Seebeck Effect. When a heated metal probe makes contact with the test metal, a thermocouple type circuit is formed. The thermal connection of these two junctions; one at an elevated temperature in combination with another at room temperature, generates a very small voltage. The voltage varies with the type of test metal and can be consistently correlated. This thermal property can be used to characterize most metals. Industrial quality control instruments use this as a method to identify metal alloys. This is known as thermoelectric alloy sorting, http://en.wikipedia.org/wiki/Thermoelectric effect. This widely known and approved method (ASTM E977), is used for metal classification and verification. This instrument is also cited in the RB211-72-AG183 for aircraft use.

INSTRUCTIONS

Video instruction available: http://koslow.com/metal_test_kits/ThermoElectric_Alloy_Sorter?cPath=1

1. **Plug the TE-3000 into line power**. The instrument is equipped to operate from 110 Volts AC up to 240 Volts AC, 50/60 Hz. If using the TE-3000 outside the USA, power transformers are not needed. Cord adapters might be necessary for plug configuration. See power requirement label on front panel.

2. Remove protective packaging from metallic probe tip. **Turn on the power switch.** Caution, the probe will get hot. Do not touch the metal shaft or tip. The amber light will remain constant for about one minute. The side holster is helpful for safely securing the hot probe when not in use.

3. **Wait five (5) minutes** for the probe temperature to fully stabilize. At this time, the amber light will blink regularly, signaling the probe is at the correct operational temperature. The display LCD should read 0000 +/- 2.

4. **Operation Check:** Plug in the blue jack of the alligator clip to blue plug. Next attach to the provided reference standard metal coupon Hastelloy C-276. The standard is on a ball chain that is attached to the instrument handle. Keep the standard with the instrument. This daily qualification step shall be performed at the start and finish of each run and at least once during every hour of continuous operation.

5. **Contact the Hot Probe tip to the test metal** for only two seconds. Apply just a little more pressure than when using a ball point pen. (70 psi) The display should read 60 +/- 5. This concludes the Operation Check.

6. **Prepare your test metal**. Test metal and probe tips must be clean and free of scale. Wipe metal surface with cloth or abrade with emery paper.

7. **Attach the alligator clip to your test metal**. Ensure a positive electrical connection. In some testing applications, if the jaw of the alligator clip cannot “bite” the test metal. The side of the clip can be pressed against the test metal. If clip contact is insufficient, try using the slender copper Wand. (Part No. TE-3000-W). Hold the wand tip on to the test metal.

8. **Contact the Hot Probe tip against the test metal for two seconds** and read the display numeral. It is important not to keep the probe in contact with the metal for more than two seconds. After two seconds, the readings are erroneous because the values can drift due to heat dissipation. Wait two seconds between tests to allow the probe temperature to stabilize. The sequence for rapid testing is two seconds down (hot tip in contact)- two seconds up (no hot probe contact) and repeat cycle. More than one test may be necessary to obtain a definitive TE Reading.

9. **Compare the displayed TE numeric readings** to acceptable metal standards or to the supplied chart. The supplied chart is suggested values and is useful as a guide. The TE-3000 is an effective instrument as long as the variations of one metal have a 10 point ‘buffer’ from the variations of a second metal. It is also possible that different alloys give the same TE reading. Some materials might give slight variations in TE readings due to heat treatment during alloy formation. Ambient conditions change or are suspected of influencing test results.

UNKNOWN ALLOY IDENTIFICATION

Make a measurement of the unknown alloy in several places on the surface to get a range of numbers. Then compare this reading with the table of Alloy TE Readings. If a match is found, it does not prove the alloy is the one in the table, it only suggests it. More must be known about the possibilities, based on, for example, the alloys in use at your plant. Confirmation of the alloy can often be made with chemical spot tests. An alloy reading between 3 and 14 is probably a 300 series stainless steel and a confirming color spot test for molybdenum would indicate the alloy is SS316. Similarly, a reading of –110 could be a chrome-moly steel or CP titanium. A chemical color spot test for iron would confirm the chrome-moly steel because there is very little, if any, iron in titanium. If the alloy is not found in the table, a chemical lab analysis must be performed. A sample of the alloy should be kept handy, and its TE number recorded.

The TE number has been compared to hardness. Just as it is possible for two different alloys to have the same hardness and, two samples of the same alloy can have different hardness, resulting from different heat treatment. Both the TE number and the hardness are affected by the crystal structure of the alloy.

SAFETY

The tip temperature of your hot probe can reach in excess of 120°C. Mishandling of your TE-3000 can result in a burn or fire.
Do not touch any metal parts of the probe while in operation.
Do not use the TE-3000 for any application other than its intended use.
Do not use the probe with or around flammable items.
Do not leave a hot probe unattended.
Let the hot probe cool to room temperature before changing tips.
Let the probe cool to room temperature prior to storage.
Never attempt to perform repair, replacement, diagnostic, or routine maintenance while unit is plugged in.
Repairs should only be performed by a qualified technician familiar with the product.
Do not modify the probe or use it with damaged parts.

IMPORTANT CONSIDERATIONS

It is very important for the user to consider the possible adverse effects of power, wiring, component, sensor, or software failures in designing any type of control or monitoring system. This is especially important where economic property loss or human life is involved. It is important that the user employ satisfactory overall system design. It is agreed between the Buyer and Koslow, that this is the buyer's responsibility.

SELECTING A LOCATION

Workspace has access to a properly grounded outlet whose output voltage matches that of your plug. Insure adequate space that allows the power cord to hang freely.
Workspace is preferably on an inside wall, or at least away from windows.
Workspace should not be in the direct path of airflow from AC or furnace vent.
Area is free from excess clutter.

HELPFUL HINTS

- Hold the Hot Probe in contact with test metal for only about one second. Lift probe off test metal for two seconds allowing probe temperature to stabilize. Repeat this cycle. Rush testing without pauses may result in reading drift.
- Do not operate TE-3000 close to a fan or point of high air motion. Wind will dissipate the heat from the test area causing poor readings.

PREVENTATIVE MAINTENANCE & CALIBRATION

- Be sure the test metal and the Hot Probe tip remains clean. Use of emery paper or fine abrasive is recommended.
- If tip becomes marred or misshaped, unscrew and replace.
- Confirm that the tip is completely screwed tightly into the probe shaft. Loose tips could give poor readings. Use of a hand held crimping tool is recommended for proper torque without damaging tip. (Part No. TE-3000 F)
- The Thermoelectric Alloy Sorter Model TE-3000 is supplied with an *Initial Certificate of Calibration*. KOSLOW SCIENTIFIC COMPANY suggests yearly calibration services known as a "field" *Certificate of Calibration*. This certificate contains before and after calibration data and the expected manufactures criteria. Aspects of the certificate are N. I. S. T. traceable. Service No. TE-3000-C.

HOT PROBE TIPS

A variety of tip configurations are available. The standard TE-3000 is furnished with a blunt shaped tip. Conical, Spherical and Bullet tips ranging from 3/16 to 1/4 inch in diameter are designed for positive and repeatable metal contact at perpendicular or tangent angles. Custom tips can be fabricated to your specifications.

Replace probe tips when the tip is marred, misshaped, or no longer providing stable readings. Confirm that the tip is completely screwed tightly into the probe shaft. Loose tips could give poor readings. Use of a hand held crimping tool is recommended for proper torque without scratching tip. Do not tamper with machine screws on the probe shaft.

<u>Tip Removal</u>

1. Remove power from the TE-3000 by unplugging.
2. Allow equipment to cool.
3. Hold pliers (Koslow Part No. TE-3000-F) in a horizontal position.
4. Insert old probe's tip into circular jaw of pliers.
5. Twist probe handle counter-clockwise until the tip can fall out.
6. Discard or recondition old tip.

New Tip Insertion

1. Insert new tip by hand. Twist clockwise. Be careful not to damage the threads. The new tip should be inserted about halfway by hand. A very small drop of silicone can be used to lubricate the screw threads.
2. Next hold pliers in a horizontal position. (Koslow Part No. TE-3000-F)
3. Hold TE probe (in other hand) vertically. Tip up. Cord down.
4. Align the tip into the circular jaw of the pliers. Gently squeeze the probe tip. Do not crush the probe tip.
5. Rotate the handle part of the probe only. The pliers should not rotate. The pliers should remain perpendicular to the probe. The tip should be installed firmly. Small scratches on the tip will not inhibit performance.

SIGNAL JACKS

The TE-3000 is supplied with a black and a red female banana jack on the face of the instrument. These terminals can be used to interface with automation equipment, PLC's (Programmable Logic Controls) and data logging equipment. The output signal is an analog DC millivolt signal. Four foot SPC data output lead wire cables are sold separately. Connect to your PC using an input tool. The blue jack is used only for the alligator clip.

PARTS REORDER INFORMATION

Parts	Part No.
Metal Standards Collection a 24 piece alloy sample kit	**1900**
Conductive (Cold Plate) Copper Block for use with bearings	**TE-3000 HD**
Protective Padded Soft Case (standard)	**TE-3000 K**
Conductive Wand (standard)	**TE-3000 W**
Spherical Ball Shaped Tip (for angled point of contact testing)	**TE-3000 TS**
Flat Blunt Shape Tip (for perpendicular point of contact testing) (standard)	**TE-3000 TB**
Metal Reference Standard on ball chain (C276) (standard)	**TE-3000 S**
Replacement Conical Probe Tips, Package of 5 Tips	**TE-3000 TC**
Pliers for tip installation and removal (standard)	**TE-3000 F**
Annual Certificate of Calibration	**TE-3000 C**
Hard Cary Case with protective foam (standard)	**TE-3000 HC**
TE-Tool Supply Kit: Contains two of each Assorted Tips, Installation Pliers, Signal Jack Leads, Probe Holster, Abrasive Sheet, neatly packed in a hard kit case for convenient storage.	**TE-3000 Z**

For current prices and availability, call (201) 541-9100. http://www.koslow.com/metal-alloy-id/thermoelectric-alloy-sorter-te-3000.html

THERMO-ELECTRIC SEPARATIONS OF ALLOYS – ALPHABETICAL LISTING*

ALLOY	TE	Chrome	Nickel	Moly	Copper	Vanadium	Tung.	Cobalt	Carbon	Iron	Other
0-1	95	0.5					0.5		0.9	98	
1 ¼ CR	84	1.25		0.25						99	
1117	95								0.14	100	
1141	130								0.4	100	
17-4 PH	72	16	4		4					76	
200 SS	-3	18	5						0.15	77	
300 SS	4	18	8							74	
316 SS	4	18	8	205						72	
329 SS	55	27	5	1.5					0.1	66	
430 SS	128	17	0	0							
4140	110	1		0.15					0.4	98	
4340	60	0.8	1.85	0.25					0.4	97	
440C	140	17								83	
52100 Lescalloy	95	1.5							1	96.8	Mn 0.35
904L	9	27	5	1.5					0.1	66	Alum.
A-2	120	5		1					1	93	
A-286	3	15	26	1.25						55	Ti,CB
A-36	94										
AL BRONZE	16				90					3	7 Alum.
ALLOY 20 CB3	20	20	34	2.5	3.5					40	
ALLOY 52	-410		51						0.4	49	
ALUMEL	-184		95								
ALUMINUM	10									0	100 TI,CB
BE CU	5				98					0	2 Beryl
BE CU, LEAD.	18				98					0	2 Beryl.
BE/CU	32				98					0	2 Beryl.
BRASS 60:40	24				60					0	40 Zinc
BRASS 70%CU	29				70					0	30 Zinc
BRASS 90:10	27				90					0	10 Zinc
CADMIUM	75									0	100 Cadm.
CARBON 1018	115								0.2	100	
CARBON 1020	94										
CARBON 1050	95								0.5	99	0.7 Mang.
CAST IRON	-48									94	
COLD ROLLED	80-120*									100	
CONSTANTAN	-465		46		54						
COPPER ETP	37				99					1	
CORTEN B	82									100	
CU/NI 90:10	-150		10		90					-96	2,2 AL,MN
D-2	125	12		1		1			1.5	85	
GOLD, 14K	22										60 Gold
GOLD, 24K	45									0	100 Gold
H-11	118	5		1.5			0.4			93	
HASTE C-276	60	15	60	16			4			5	
HASTELLOY 22	55	22	56	13			3	2.5		4	
HASTELLOY B	135	1	64	28				2.5		5	
HASTELLOY X	37	22	50	9			0.6			18	
HAYNES 25	45	20	10				15	52		3	
HOT ROLLED	135										
INCOLOY 825	32	21	42	3	2.25				0.03	32	
INCOLOY 825	24	21	42	3	2.25				0.03	32	
INCONEL 600	125	15	76							9	
INCONEL 625	60	22	61	9						4	3.65 Columb
INCONEL 718	50	19	52	3						21	5 Columb.
KOVAR	-375		29					17	0.15	54	Mang.
LEAD	10										100 Lead
M-2	125	4		5		2	16		0.85	72	
M-2	140	4		5		2	6				

ALLOY	TE	Chrome	Nickel	Moly	Copper	Vanadium	Tung.	Cobalt	Carbon	Iron	Other
M-50	130	4		4		1				91	
M-7	140	4		8.75		2	1.75			84	
MONEL 400	-225		66.5		31.5					2	3.73
MONEL 500	-275		66.5		29.5				0.13	0	0.2 Alum.
NAVAL BRASS	23				60					0	40 Zinc
NICKEL	-185		99.5							1	
NIOBIUM	14										
PHOS. BRONZE	23				95					0	5 Tin
SILVER/CU	45				10					0	90 Silver
TANTALUM	-3										
TI CP	110									0	100 Titan.
TI GAL. –4V	-46					4				0.3	6 Alum.
TIN	10									0	100 Tin
TI-PD	127									2	98 Titan.
TITANIUM/AL	-50										96 Titan.
TUNGSTEN	35						100				
ZINC	56									0	100 Zinc
ZIRCONIUM702	96										100 Zircon.
ZIRCONIUM705	89										2.5Niob.

*ALLOY SEPARATIONS CHART

The TE readings in the above chart are reflective of actual results of metal samples, but may not necessarily reflect results observed in the field. The readings included in this chart are intended to be used as a reference, to aid the instrument user in determining the efficacy of the *Thermo-Electric Method,* for your application.

LIMITATIONS

Some alloys differ only slightly in one or two elements and the change in voltage on the tester is too slight to produce a different reading. Some alloys have elements in them which may offset one another to produce nearly identical readings over all. Alloys of identical chemical makeup, but in different physical hardness structure, usually have different readings.

THERMO-ELECTRIC SEPARATIONS OF ALLOYS – NUMERICAL LISTING*

ALLOY	TE	Chrome	Nickel	Moly	Copper	Vanadium	Tung.	Cobalt	Carbon	Iron	Other
CONSTANTAN	-465		46		54						
ALLOY 52	-410		51						0.4	49	
KOVAR	-375		29					17	0.15	54	Mang.
MONEL 500	-275		66.5		29.5				0.13	0	0.2 Alum.
MONEL 400	-225		66.5		31.5					2	3.73
NICKEL	-185		99.5							1	
ALUMEL	-184		95								
CU/NI 90:10	-150		10		90					-96	2,2 AL,MN
TITANIUM/AL	-50										96 Titan.
CAST IRON	-48									94	
TI GAL. –4V	-46					4				0.3	6 Alum.
200 SS	-3	18	5						0.15	77	
TANTALUM	-3										
A-286	3	15	26	1.25						55	Ti,CB
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904L	9	27	5	1.5					0.1	66	Alum.
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TIN	10									0	100 Tin
LEAD	10										100 Lead
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AL BRONZE	16				90					3	7 Alum.
BE CU, LEAD.	18				98					0	2 Beryl.
ALLOY 20 CB3	20	20	34	2.5	3.5					40	
GOLD, 14K	22										60 Gold
PHOS. BRONZE	23				95					0	5 Tin
NAVAL BRASS	23				60					0	40 Zinc
INCOLOY 825	24	21	42	3	2.25				0.03	32	
BRASS 60:40	24				60					0	40 Zinc
BRASS 90:10	27				90					0	10 Zinc
BRASS 70%CU	29				70					0	30 Zinc
INCOLOY 825	32	21	42	3	2.25				0.03	32	
BE/CU	32				98					0	2 Beryl.
TUNGSTEN	35						100				
HASTELLOY X	37	22	50	9			0.6			18	
COPPER ETP	37				99					1	
GOLD, 24K	45									0	100 Gold
SILVER/CU	45				10					0	90 Silver
HAYNES 25	45	20	10				15	52		3	
INCONEL 718	50	19	52	3						21	5 Columb.
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329	55	27	5	1.5					0.1	66	
ZINC	56									0	100 Zinc
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ZIRCONIUM705	89										2.5Niob.
A-36	94										
CARBON 1020	94										
CARBON 1050	95								0.5	99	0.7 Mang.
0-1	95	0.5					0.5		0.9	98	
1117	95								0.14	100	
52100 Lescalloy	95	1.5							1	96.8	Mn 0.35
ZIRCONIUM702	96										100 Zircon.

ALLOY	TE	Chrome	Nickel	Moly	Copper	Vanadium	Tung.	Cobalt	Carbon	Iron	Other
4140	110	1		0.15					0.4	98	
TI CP	110									0	100 Titan.
CARBON 1018	115								0.2	100	
H-11	118	5		1.5			0.4			93	
A-2	120	5		1					1	93	
INCONEL 600	125	15	76							9	
M-2	125	4		5		2	16		0.85	72	
D-2	125	12		1		1			1.5	85	
TI-PD	127									2	98 Titan.
430 SS	128	17	0	0							
1141	130								0.4	100	
M-50	130	4		4		1				91	
HOT ROLLED	135										
HASTELLOY B	135	1	64	28				2.5		5	
M-2	140	4		5		2	6				
440C	140	17								83	
M-7	140	4		8.75		2	1.75			84	

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SCHEDULED CALIBRATION LOG

DUE DATE	DATE CALIBRATION PERFORMED	NOTES	INITIALS

The above log is to properly maintain and service your Alloy Sorter. It is imperative to keep current with your calibration schedule.

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K O S L O W . C O M

Instructions for Returning a Koslow Instrument for Calibration

We appreciate your confidence in Koslow test kits. We recommend an annual factory calibration for your kit.

You provide:

1. Pack your kit in a padded corrugated carton.
2. Include the Qualification Standard (one inch square metal sheet)
3. Ship your kit complete to the address below.
4. Return Authorization Number for the outside of the shipping carton:
   RMA 1113-68
5. Include in the carton a paper with your contact information (phone and email) and purchase order. No need to send documentation in advance of the instrument.

Koslow Scientific Company
Attn: Calibration Dept.
172 Walkers Lane
Englewood, NJ 07631 USA

Return Authorization Number 1113-68

We provide the following:

1. A Certificate of Calibration includes: Electronics verification traceable to N.I.S.T. and “As Found” before data and “As Left” after data.
2. A maintenance checklist to keep the kit complete.
3. You will be notified of any additional costs of parts missing or damaged with a formal quotation.
4. Calibration services are performed within three business days.