



Standard Specification for Thermostat Component Alloys¹

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1. Scope

1.1 This specification describes requirements for alloys to be used as components in the manufacture of bonded multi-component thermostat metal strip. More specifically it describes alloys having composition, and thermal expansion suitable for application in thermostat metal sheet and strip.

2. Referenced Documents

2.1 ASTM Standards:

A 480 Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip²

B 63 Test Method for Resistivity of Metallic Conducting Resistance and Contact Materials³

B 388 Specification for Thermostat Metal Sheet and Strip³

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials⁴

E 228 Test Method for Linear Thermal Expansion of Solid Materials with a Vitreous Silica Dilatometer⁵

3. Ordering Information

3.1 Orders for this material under this specification shall include the following information:

3.1.1 Alloy type,

3.1.2 Size,

3.1.3 Surface finish,

3.1.4 Marking and packaging, and

3.1.5 Certification, if required.

4. General Requirements

4.1 The material shall be free of scale, slivers, cracks, seams, corrosion and other defects as best commercial practice will permit. Surfaces shall be uniform and sufficiently clean so that commonly used methods of surface preparation, or pre-bond cleaning will allow bonding of the entire mating surfaces. Since surface condition can vary for different alloys and because bonding practices vary, product surface condition can be agreed upon between supplier and purchaser.

¹ This test method is under the jurisdiction of ASTM Committee B-2 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.10 on Thermostat Metals.

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² *Annual Book of ASTM Standards*, Vol 01.03.

³ *Annual Book of ASTM Standards*, Vol 02.04.

⁴ *Annual Book of ASTM Standards*, Vol 03.01.

⁵ *Annual Book of ASTM Standards*, Vol 14.02.

5. Chemical Composition

5.1 The material shall be manufactured to the chemical compositions shown in Table 1.

5.2 The manufacturer will insure uniformity of composition throughout a heat lot to provide uniform thermal expansion and electrical resistivity properties.

6. Thermal Expansion Requirements

6.1 Samples tested in accordance with 6.2 shall exhibit thermal expansion properties described in Table 2.

6.2 One test sample representing each heat lot shall be machined to a suitable specimen configuration, heat treated in accordance with instructions in Table 2, and Test Method E 228.

7. Electrical Resistivity

7.1 The electrical resistivity measured at room temperature as in Test Method B 63 on suitably prepared and annealed specimens shall conform to Table 3.

8. Temper

8.1 This product will be supplied in the annealed condition.

8.2 Hardness shall be measured on representative samples from each heat treat lot and reported as Rockwell B hardness.

8.3 Hardness values shall conform to the requirements in Table 4 tested as in Test Methods E 18.

9. Dimensions and Permissible Variations

9.1 Permissible variations in thickness and width shall adhere to those described in Specification A 480. These are shown in Table 5.

9.2 Edge camber shall conform to Specification A 480. (Edge camber for widths $>1\frac{1}{2}$ in. shall be a maximum $\frac{1}{4}$ in. on any 8-ft length.)

9.3 Maximum deviation across the width of the strip at a given location shall not exceed 3 % of the nominal thickness.

9.4 Slitting burr shall be no greater than 10 % of the thickness.

10. Certification

10.1 The manufacturer shall provide the purchaser with a certification containing the following information:

10.1.1 Alloy type,

10.1.2 Specification number,

10.1.3 Dimensions,

- 10.1.4 Chemical composition by heat number,
- 10.1.5 Coefficient thermal expansion,
- 10.1.6 Hardness,
- 10.1.7 Quantity shipped,
- 10.1.8 Purchase order number,
- 10.1.9 Resistivity (optional), and
- 10.1.10 Manufacturer's name.

- 11.2.3 Heat number,
- 11.2.4 Size,
- 11.2.5 Shipped weight, and
- 11.2.6 Purchaser's order number.

11. Packaging and Marking

11.1 Packaging and unit size shipped shall be subject to agreement between purchaser and supplier. Packaging will be sufficient to prevent damage or spoilage in transit.

11.2 Marking shall contain the following information:

- 11.2.1 Manufacturer's name,
- 11.2.2 Alloy type,

12. Investigation of Claims

12.1 Where any material fails to meet the requirements of the specification, the material so designated shall be handled in accordance with a mutual agreement between purchaser and seller.

13. Keywords

13.1 alloys; chemical composition; components; controlled thermal expansion; electrical resistivity; hardness; temper; thermostat metal strip

TABLE 1 Suggested Compositions For Thermostat Alloys All Elements Indicated As Weight Percent

NOTE 1—Composition requirements show major elements as being nominal. These nominal requirements indicate they are to be adjusted by the manufacturer so that the alloys meet the requirements for thermal expansion shown in Table 2. Other elements not shown, may be present in residual amounts. These shall not be present in sufficient quantity as to significantly affect the performance in the intended application.

Alloy Description	T-10	T-22	T-18	T-19	T-14	T-25	T-50
Carbon	0.1 max	0.12 nom	0.15 max	0.5 nom	0.5 max	0.15 max	0.15 max
Manganese	72.0 nom	0.60 max	0.80 max	1.0 nom	9.0 nom	1.0 max	0.60 max
Silicon, max	0.25	0.30	0.50	0.40	0.30	1.0	0.40
Phosphorus, max	0.030	0.025	0.025	0.025	0.025	0.025	0.025
Sulfur, max	0.030	0.025	0.025	0.025	0.025	0.025	0.025
Chromium	0.25 max	3.0 nom	11.0 nom	2.0 nom	...	8.0 nom	0.50 max
Nickel, nom	10.0	22.0	18.0	19.0	14.0	25.0	50.0 nom
Copper	18.0 nom	...	...	...	...	...	...
Aluminum	...	...	...	...	5.0 nom	...	...
Cobalt	...	...	...	...	...	...	0.50 max
Iron	1.0 max	balance	balance	balance	balance	balance	balance
Alloy Description	T-45	T-42	T-40	T-39	T-36	T-99	
Carbon, max	0.15	0.15	0.15	0.15	0.15	0.15	
Manganese, max	0.60	0.60	0.60	0.60	0.60	0.35	
Silicon, max	0.40	0.40	0.40	0.40	0.40	0.35	
Phosphorus, max	0.025	0.025	0.025	0.025	0.025	0.015	
Sulfur, max	0.025	0.025	0.025	0.025	0.025	0.010	
Chromium, max	0.50	0.50	0.50	0.50	0.25	0.50	
Nickel, nom	45.0	42.0	40.0	39.0	36.0	99.5	
Copper	...	...	...	...	...	0.25 max	
Aluminum	...	...	...	...	...	...
Cobalt, max	0.50	0.50	0.50	0.50	0.50	0.50	
Iron	balance	balance	balance	balance	balance	0.40 max	