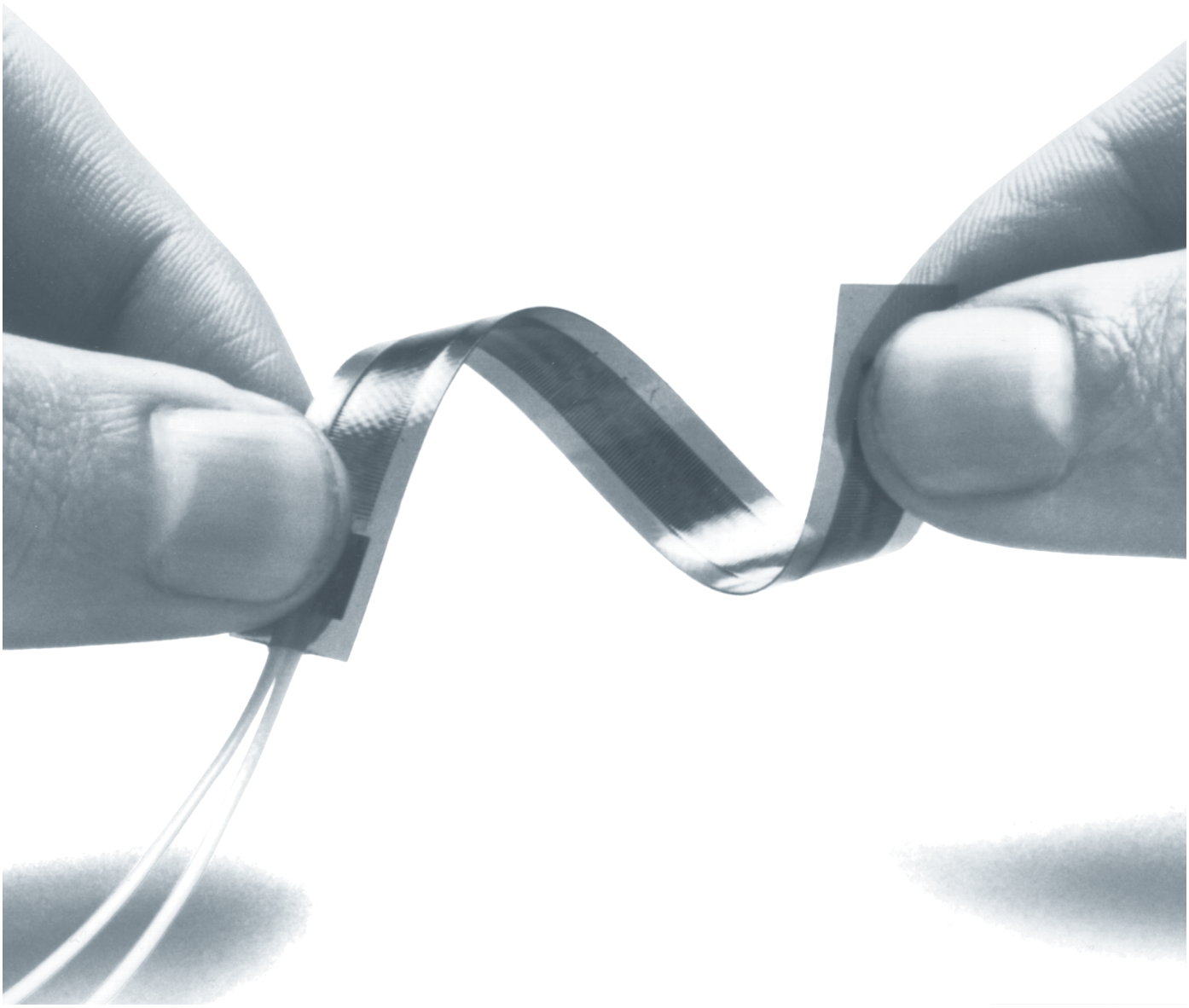
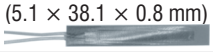
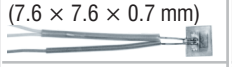
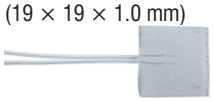
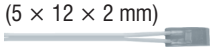
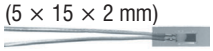
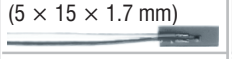
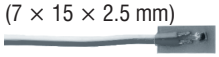
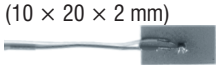
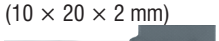


Section 10: Thermal-Ribbons™

- Thin, flexible RTDs and thermocouples
- Fast response surface sensing in aerospace, medical, and industrial devices
- Rugged laminated construction
- Kapton™, silicone rubber, Mylar™ insulation
- All models available from stock
- See page 9-6 for Thermal-Ribbons designed for pipe mounting.

Thermal-Ribbons and Thermal-Tabs

Install these compact sensors anywhere for accurate point sensing and fast response. All Thermal-Ribbon models conform to EN60751 Class B tolerance when ordered with a PD platinum element. Thermal-Tab models use a thin-film RTD element.

Dimensions W × L × T (max.)	Element options	Insulation	Temp. range	Leadwires	Time constant*	Features	Model
Thermal-Ribbons							
0.20 × 1.50 × 0.030" (5.1 × 38.1 × 0.8 mm) 	FA	Kapton	-200 to 200°C -328 to 392°F	AWG 34, PTFE insulated	0.15 sec.	Wire-wound nickel-iron for high resistance in small package	S38
0.30 × 0.30 × 0.025" (7.6 × 7.6 × 0.7 mm) 	PD	Kapton with foil backing	-200 to 200°C -328 to 392°F	AWG 28, PTFE insulated	0.15 sec.	Wire-wound element	S651
0.75 × 0.75 × 0.04" (19 × 19 × 1.0 mm) 	FA	Mylar	-200 to 150°C -328 to 302°F	AWG 30, PTFE insulated	0.3 sec.	Wire-wound nickel-iron flat element for high resistance	S25
Thermal-Tabs							
0.20 × 0.50 × 0.08" (5 × 12 × 2 mm) 	PD, PF, PW	Kapton with elastomer cover coat	-50 to 155°C -58 to 311°F	AWG 26, PTFE insulated	0.8 sec.	Stocked for immediate shipment	S665
0.20 × 0.60 × 0.08" (5 × 15 × 2 mm) 	PD, PF, PW, PS, NB, NA, NJ	Kapton	-50 to 200°C -58 to 392°F	AWG 26, PTFE or Polyimide insulated	1.0 sec.	Platinum models in stock	S17624
0.20 × 0.60 × 0.08" (5 × 15 × 2 mm) 	PD, PF, PW, PS	Polyimide film	-50 to 260°C -58 to 500°F	AWG 26, PTFE or Polyimide insulated	0.4 sec.	Highest temperature capability	S100820
0.20 × 0.60 × 0.12" (5 × 15 × 3 mm) 	PD, PF, PW	Silicone rubber with elastomer cover and foil backing	-50 to 155°C -58 to 311°F	AWG 24, Silicone insulated	1.3 sec.	Waterproof; suitable for continuous immersion	S667
0.20 × 0.60 × 0.07" (5 × 15 × 1.7 mm) 	PD, PF, PW	Polyimide film	-50 to 200°C -58 to 392°F	AWG 26, PTFE or Polyimide insulated	0.6 sec.	Thinnest profile	S100725
0.30 × 0.60 × 0.10" (7 × 15 × 2.5 mm) 	PD, PF, PW, PS, NB, NA, NJ	Polyimide film	-50 to 200°C -58 to 392°F	AWG 22, PTFE or Polyimide insulated	1.2 sec.	Heavier leadwire for applications requiring ruggedized design	S100724
0.40 × 0.80 × 0.08" (10 × 20 × 2 mm) 	PD, PF, PW, PS, NB, NA, NJ	Polyimide film	-50 to 200°C -58 to 392°F	AWG 26, PTFE or Polyimide insulated	0.9 sec.	Larger surface area for easier handling and max. adhesive bond	S100723
0.40 × 0.80 × 0.08" (10 × 20 × 2 mm) 	PD, PF, PW, PS, NB, NA, NJ	Silicone rubber	-50 to 220°C -58 to 428°F	AWG 26, PTFE or Polyimide insulated	1.5 sec.	High temperature rating, available with wide range of element options	S100721

* In water at 1 m/sec.

⚠ T (max.) is over the lead bulge.

See next page for information on how to order.

Waterproof model

Model S667 is waterproof and suitable for continous immersion. Use it to monitor the temperature of water in a tank or container, or on equipment that must withstand wash-down or immersion.

Check with Minco for suitability in other liquids.

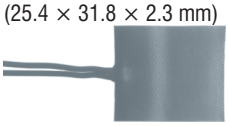
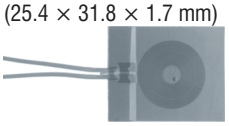
Leadwire insulation codes	
S25, S38, S651, S665, S667	Leave blank
A17624, S100721, S100723, S100724, S100725, S100820	T = PTFE insulated wires K = Polyimide insulated wires

IN STOCK

All models in the following lead lengths:
24": S651
36": S38, S25
40" PD or PF only: S100723, S100724, S100725, S100820, S17624
40" with 60" max. PD or PF only: S665, S667

Discoil™ Thermal-Ribbons

Discoil RTD elements are wound in a single plane for faster time response.

Dimensions W × L × T (max.)	Element options	Insulation	Temp. range	Leadwires	Time constant*	Features	Model
0.79 × 1.87 × 0.055" (20 × 47.5 × 1.4 mm) solder pad version shown 	PD, PE	Kapton (Clear polyester available)	-73 to 200°C -100 to 392°F	(Optional) AWG 24, PTFE insulated	0.10 sec.	Only 0.010" thick over element, fast time response, platinum PD accuracy available	S17422
1.00 × 1.25 × 0.090" (25.4 × 31.8 × 2.3 mm) 	PB11, PB22	Silicone rubber with Kapton backing	-62 to 220°C -80 to 428°F	AWG 24, silicone rubber insulated	0.2 sec.	High temperature rating, platinum PD accuracy available	S32
	PD12, PE22						S385
1.00 × 1.25 × 0.065" (25.4 × 31.8 × 1.7 mm) 	FA	Kapton	-200 to 200°C -328 to 392°F	AWG 26, PTFE insulated	0.15 sec.	High resistance nickel-iron element	S39

* In water at 1 m/sec.

Sensing element specifications**		Code
Platinum 391, 100 Ω ±0.11% at 0°C		PB11
Platinum 391, 100 Ω ±0.22% at 0°C		PB22
Platinum 385, 100 Ω±0.12% at 0°C	(EN60751, Class B)	PD, PD12
Platinum 385, 100 Ω ±0.36% at 0°C		PE
Platinum 385, 100 Ω ±0.22% at 0°C		PE22
Platinum 385, 1000 Ω ±0.12% at 0°C		PF
Platinum 375, 1000 Ω ±0.12% at 0°C		PW
Platinum 385, 10,000 Ω ±0.12% at 0°C		PS
Nickel-iron 518, 604 Ω ±0.26% at 0°C		FA
Nickel 618, 100 Ω±0.22% at 0°C	(DIN43760 NI100, Class B)	NB
Nickel 672, 120 Ω±0.50% at 0°C		NA
Nickel 618, 1,000 Ω±0.22% at 0°C	(DIN43760 NI1000, Class B)	NJ

** See tables for element options on each model.

How to order Thermal-Ribbons and Thermal-Tabs

S17624	**Model number from table on previous page**
PD	**Sensing element from table on previous page**
Z	**Number of leads:** Y = 2 leads Z = 3 leads (N/A on S25, S38 or S667) X = 4 leads (N/A on S25, S38 or S665/S667)
T	**Leadwire insulation code from table on previous page**
24	**Lead length in inches:** S665/S667: 60" max.
A	**Adhesive backing:** A = No adhesive B = Pressure-sensitive adhesive (PSA)
S17624PDZT24A ← Sample P/N	

⚠ PSA reduces temperature range to -20 to 177°C (-4 to 350°F) and adds 0.005" (0.1 mm) to thickness.

How to order Discoil Thermal-Ribbons

S32	**Model number from table above**
PB22	**Sensing element from table above**
Z	**Number of leads:** Y = 2 leads Z = 3 leads (Platinum only) X = 4 leads (PD only) W = Solder pads (S17422 only)
36	**Lead length in inches** (Specify 0 for solder pads, optional on S17422 only)
A	**Adhesive backing:** A = No adhesive B = Pressure-sensitive adhesive (PSA)
S32PB22Z36A ← Sample P/N	

IN STOCK

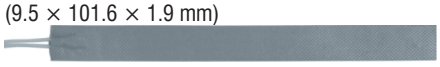
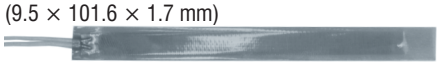
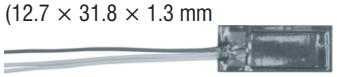
All models in the following lead lengths:
36": S32, S39, S385
40": S17422

Custom Thermal-Ribbon designs

Minco can custom-wind elements in virtually any shape and size. One Thermal-Ribbon model measures 2 feet square and averages temperature readings over its entire surface. We can even profile elements to give more weight to temperature readings in selected zones. Look to Minco for custom design solutions to unique temperature sensing problems.

Strip Sensing Thermal-Ribbons

These models average temperatures along their length to eliminate point measurement errors. Wrap them around cylinders or adhere them to flat surfaces.

Dimensions W × L × T (max.)	Element options	Insulation	Temp. range	Leadwires	Time constant*	Features	Model
0.375 × 4.00 × 0.075" (9.5 × 101.6 × 1.9 mm) 	PB22	Silicone rubber with Kapton backing	-62 to 220°C -80 to 428°F	AWG 26, PTFE insulated	0.6 sec.	Platinum PD accuracy	S34
	PD12, PE22						S386
0.375 × 4.00 × 0.065" (9.5 × 101.6 × 1.7 mm) 	FA	Kapton	-200 to 200°C -328 to 392°F		0.2 sec.	Wire-wound nickel-iron for high resistance, thin element	S35
	FA	Mylar	-100 to 150°C -148 to 302°F		0.3 sec.	Wire-wound nickel-iron, low cost	S2
0.50 × 1.25 × 0.050" (12.7 × 31.8 × 1.3 mm 	PA, PE, CA, NA	Kapton	-73 to 200°C -100 to 392°F		0.17 sec.	Easy motor installations	S3238

* In water at 1 m/sec.

Sensing element specifications**	Code
Platinum 392, 100 Ω ±0.5% at 0°C	PA
Platinum 391, 100 Ω ±0.22% at 0°C	PB22
Platinum 385, 100 Ω ±0.12% at 0°C (EN60751, Class B)	PD12
Platinum 385, 100 Ω ±0.5% at 0°C	PE
Platinum 385, 100 Ω ±0.22% at 0°C	PE22
Nickel-iron 518, 604 Ω ±0.26% at 0°C	FA
Copper 427, 10 Ω ±0.20% at 25°C	CA
Nickel 672, 120 Ω ±0.3% at 0°C	NA

** See table for element options on each model.

How to order

S34	**Model number from table (except S3238)**
PB22	**Sensing element from table at top**
Y	**Number of leads:** Y = 2 leads Z = 3 leads (required on CA) X = 4 leads (PD only)
36	**Lead length in inches:** 36" stocked (42" on S2)
A	**Adhesive backing:** A = No adhesive B = Pressure-sensitive adhesive (PSA)
S34PB22Y36A ← Sample P/N	

Model S3238

Model S3238 is specially designed to sense stator temperatures in motors and generators. An alternative to the "stick" sensors in Section 8, the S3238 mounts on the end turns of stator windings and provides an easy way to add overtemperature protection when the stator is not being rewound.

How to order

S3238	**Model number S3238**
PA	**Sensing element from table above**
Y	**Number of leads:** Y = 2 leads Z = 3 leads (required on CA) X = 4 leads
T	**Lead insulation:** T = PTFE K = polyimide TS = SS braid over PTFE
36	**Lead length in inches** 36" stocked
U	**Lead configuration:** T = Twisted U = Untwisted
A	**Adhesive backing:** A = No adhesive B = Pressure-sensitive adhesive (PSA)
S3238PAYT36UA ← Sample P/N	

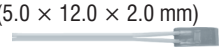
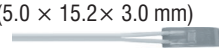
⚠ PSA reduces temperature range to -20 to 177°C (-4 to 350°F) and adds 0.005" (0.1 mm) to thickness.

IN STOCK

All models in stock with 36" leads, except 42" leads on S2FA

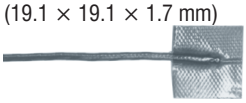
Thermistor and Thermocouple Thermal-Ribbons

Thermistor Thermal-Ribbon

Dimensions W × L × T (max.)	Element options	Insulation	Temp. range	Leadwires	Time constant*	Features	Model
0.20 × 0.47 × 0.079" (5.0 × 12.0 × 2.0 mm) 	TF, TK	Kapton with elastomer cover coat	-50 to 125°C (-58 to 257°F)	AWG 26, PTFE insulated	0.8 sec.	Small, low-cost	TS665
0.20 × 0.60 × 0.118" (5.0 × 15.2× 3.0 mm) 		Silicone rubber with elastomer cover and foil backing		AWG 24, Silicone insulated	1.3 sec.	Waterproof, suitable for continous immersion	TS667

* In water at 1 m/sec.

Thermocouple Thermal-Ribbon

Dimensions W × L × T (max.)	Junction type	Insulation	Temp. range	Leadwires	Time constant*	Features	Model
0.75 × 0.75 × 0.065" (19.1 × 19.1 × 1.7 mm) 	E, J, K, or T	Kapton	-200 to 200°C (-328 to 392°F)	AWG 24, solid PTFE insulated	0.6 sec.	Surface mounting	TC40

* In water at 1 m/sec.

Thermistor TS665, TS667

Model TS665 and TS667 offer extremely sensitive NTC thermistors for applications with small temperature changes. Model TS667 also features waterproof construction, making it suitable for continous immersion.

Sensing element specifications**	Code
NTC thermistor, 50k Ω ±1% at 25°C	TF
NTC thermistor, 10k Ω ±1% at 25°C	TK

** See table for element options.

How to order

TS665	**Model number from table**
TF	**Element from table**
Y	**Number of leads:** Y = 2 leads
40	**Lead length in inches:** 40" stocked, 60" maximum
A	**Adhesive backing:** A = No adhesive, B = Pressure-sensitive adhesive (PSA)
TS665TFY40A ← Sample P/N	

Thermocouple TC40

TC40 is a patch-style thermocouple that adheres to all types of surfaces for quick and easy mounting.

How to order

TC40	**Model number**
J	**Junction type:** E, J, K, or T
T	**Covering over leadwires:** T = PTFE only, S = Stainless steel braid
36	**Lead length in inches:** 36" stocked for type J, K, T
A	**Adhesive backing:** A = No adhesive, B = Pressure-sensitive adhesive (PSA)
TC40JT36A ← Sample P/N	

⚠ **PSA reduces temperature range to -20 to 177°C (-4 to 350°F) and adds 0.005" (0.1 mm) to thickness.**

IN STOCK

TS665 stocked in 40" lead length
TC40 types J, K, T stocked in 36" lead length

Installation and Accessories

Thermal-Ribbons lend themselves to a variety of installation methods. You should avoid repeated bending during the installation process, and Thermal-Ribbons should not flex in use unless they are specifically designed to do so. Take care to secure leadwires so they do not pull against sensor bodies. Leadwires should be routed along the sensed surface a short distance so that they do not sink heat away from the sensing element.

Listed below are some standard installation methods.

Pressure sensitive adhesive

PSA (option B in part number) is the simplest mounting method, but it is restricted to flat surfaces and temperatures below 177°C (350°F). PSA is usually factory applied to the mounting surface of the Thermal-Ribbon. To install, just remove the backing paper and press in place.

#6 RTV cement

Room temperature vulcanizing cement for mounting silicone rubber Thermal-Ribbons to flat or curved surfaces. It is available in 3 oz. (89 ml) tubes. Contact Minco for other adhesives usable with Kapton™ or Mylar™ Thermal-Ribbons.

#21 Polyimide tape

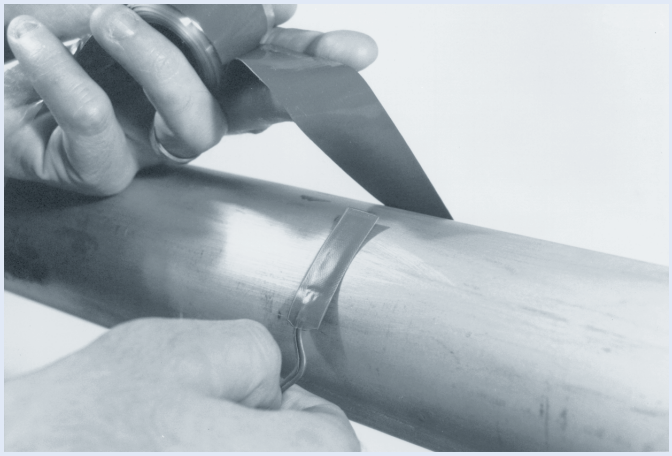
High temperature tape with silicone based adhesive. Useful for quick mounting of Thermal-Ribbon or Thermal-Tab sensors to flat surfaces. Makes a strong but removable bond to most smooth and clean surfaces. Maximum operating temperature is 150°C. 0.5 inch wide × 108 ft. long roll.

#20 stretch tape

High temperature silicone rubber tape for mounting Thermal-Ribbons to pipes or other cylinders as shown below. It comes in 1" wide rolls, 6 or 36 feet long.

Shrink bands

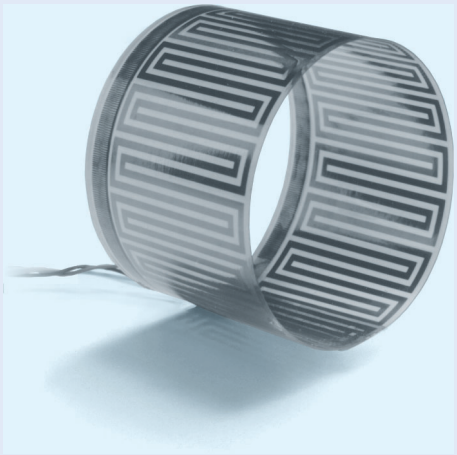
Minco shrink bands are pre-stretched plastic strips with adhesive at both ends. Use them to mount Thermal-Ribbons to cylinders. Simply wrap the band around the sensor and cylinder, secure the ends, and heat to shrink in place. To order, specify band width and cylinder diameter.



Thermal-Ribbons for fluid sensing

Need to monitor temperature of liquids in pipes or tanks? Thermal-Ribbons make a practical, economical alternative to traditional immersed sensors. They mount directly on pipe surfaces, so there's no need to drain systems and install thermowells. And tests show that Thermal-Ribbons respond as quickly and as accurately as invasive sensors. Request Minco Application Aid #16 for a comparison of Thermal-Ribbons versus thermowells.

See page 9-6 to order Thermal-Ribbon models designed specifically for pipe mounting.



Thermofoil™ heater-sensors

Minco manufactures flexible etched-foil heaters for precision temperature control of aerospace, medical, and industrial devices. We can build combination heater-sensors containing Thermal-Ribbons integral to the heating element. We can also etch Thermal-Ribbon RTDs from resistive foil.

Request Bulletin HS-202 for complete heater and heater-sensor information.

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