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REGAL™
CERMET RESISTOR SERIES — R-300-P SERIES

The REGAL R-300-P Resistor Series is an economical resistor paste designed for applications in high performance cermet trimmers and potentiometers.

The unique chemistry of the REGAL R-300-P Series provides excellent printing characteristics, nearly linear blending of adjacent members and minimal sensitivity towards wide variations in firing conditions. These advantageous features together with excellent fired resistor surface characteristics and low TCR's make this series a logical choice for exacting potentiometer requirements.

PASTE DATA

VISCOSITY: (Brookfield RVT, ABZ Spindle, 10 rpm, 25.5°C±0.5°C)	**R-310-P & R-311-P**	300±50 Pa· s
	R-312-P to R-316-P	225±50 Pa· s
THINNER:		ESL 435

PROCESSING — STIR WELL BEFORE USE

PRINT THICKNESS: A dry resistor film thickness range of 20 to 25 microns is recommended for optimum performance of the R-300-P series. With respect to ESL calibrations, use of different wiper metallurgies and/or higher wiper pressures may require a different dry film thickness to obtain optimum performance with this resistor series.

PRINTING AND DRYING: A 200 mesh stainless steel screen with 12±3 microns emulsion thickness is recommended. Allow wet prints to level at room temperature for 5 to 15 minutes. Then dry at 125° C for 10 to 15 minutes.

SUBSTRATES: The typical resistor performance data is based on tests using 96% alumina substrates (Kyocera A476). Substrates of other compositions may result in variations in resistor performance.

ESL Affiliates
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See Caution and Disclaimer on other side.

FIRING:

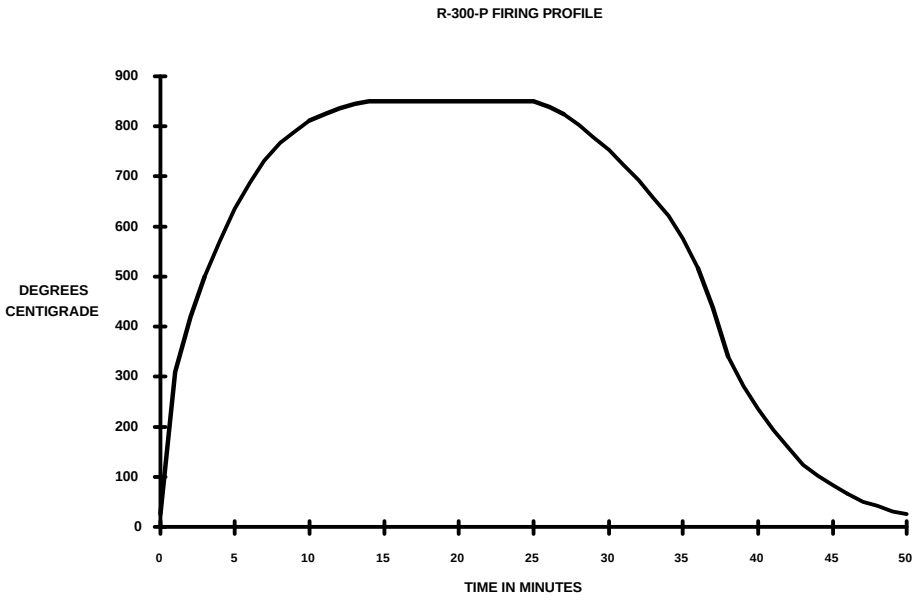
A continuous belt furnace with a total cycle time of 50 minutes and 11 minutes at a peak temperature of 850°C is recommended. See Figure 1. A dry, clean air atmosphere is required with a constant airflow of 20 liters per minute (for 10 cm wide belts) counter current to the substrate movement. The volume of air exchanged each minute should be approximately equal to the total volume of the furnace muffle. High production rates require increased airflows to keep vehicle burn-out products out of the peak firing zones. Avoid contamination of the air with vapors of halogenated solvents, residual compressor oil vapors and soldering flux fumes.

R-300-P SERIES

TERMINATIONS:

Reported resistor properties are with ESL C-951 PtAg conductor composition prefired at 850°C using a resistor geometry 1 mm wide x 4 mm long. Potentiometer properties are reported on a 2 mm wide x 20 mm long resistor. This resistor series is compatible with other ESL conductive compositions such as silver, palladium-silver, platinum-gold, and gold. However, some shifts in resistivity and TCR may result with their usage.

FIGURE 1



R-300-P SERIES

TYPICAL RESISTOR PROPERTIES[a]

	R-310-P	R-311-P	R-312-P	R-313-P	R-314-P	R-315-P	R-316-P
RESISTIVITY (Ω/sq.):	1.5	10	100	1 k	10 k	100 k	1 M
SHIPPING TOLERANCE (%):	±20	±10	±10	±10	±10	±10	±10
TCR (ppm/°C):	±150	±100	±50	±50	±50	±50	±50
SHORT TIME OVERLOAD[b] (V/mm^2):	0.4	3	10	28	77	100	141

TYPICAL POTENTIOMETER PROPERTIES[c]

CRV:							
	< 1.0%	< 0.5%	< 0.3%	< 0.3%	< 0.3%	< 0.3%	< 0.3%
	< 1.0%	< 0.5%	< 0.3%	< 0.3%	< 0.3%	< 0.3%	< 0.3%
CONTACT NOISE:							
	< 1.0%	< 0.5%	< 0.3%	< 0.3%	< 0.3%	< 0.3%	< 0.3%
	< 1.0%	< 0.5%	< 0.3%	< 0.3%	< 0.3%	< 0.3%	< 0.3%
ROTATIONAL LIFE:							
	< 2.0%	< 1.0%	< 0.5%	< 0.2%	< 0.2%	< 0.2%	< 0.2%

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a. Resistor Geometry: 1 mm width x 4 mm length. ESL C-951 PtAg terminations prefired at 850°C, 96% alumina substrate.

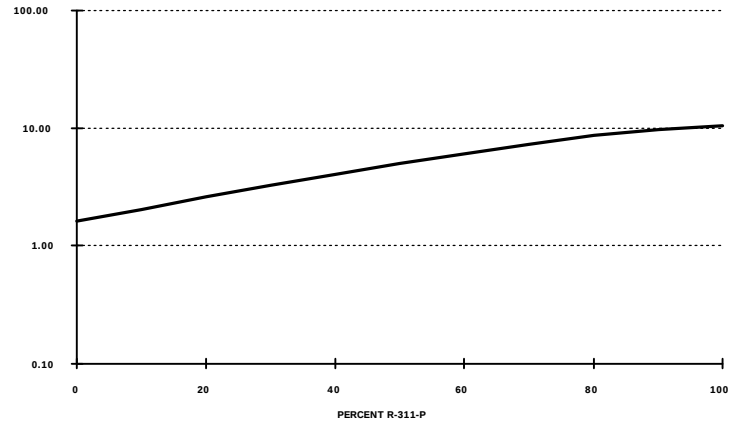
b. STOL: Voltage required, 5 seconds duration, to induce a resistance change of 0.5% at 25°C.

c. Ten finger Palliney 8 wiper, 10 grams/finger weight, 2 mm wide x 20 mm long resistor.

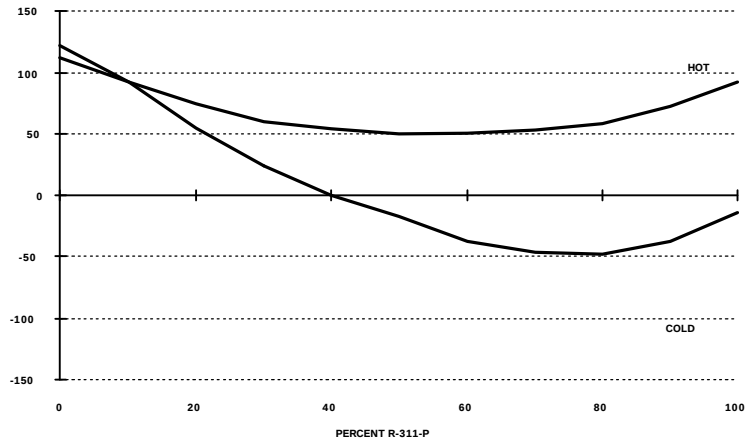
R-300-P SERIES

BLENDING CURVES FOR R-310-P / R-311-P

RESISTANCE VERSUS PERCENT BLEND



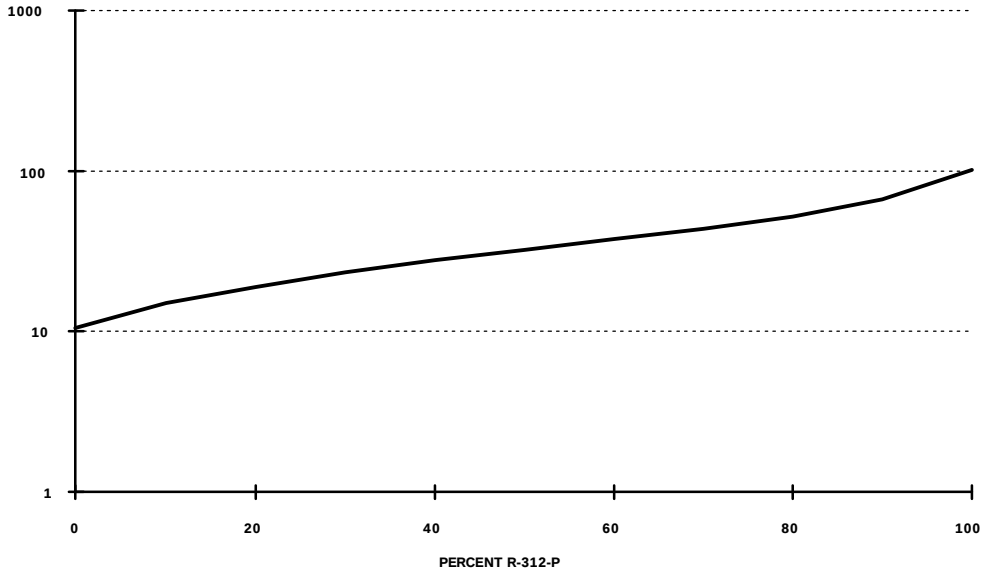
TCR VERSUS PERCENT BLEND



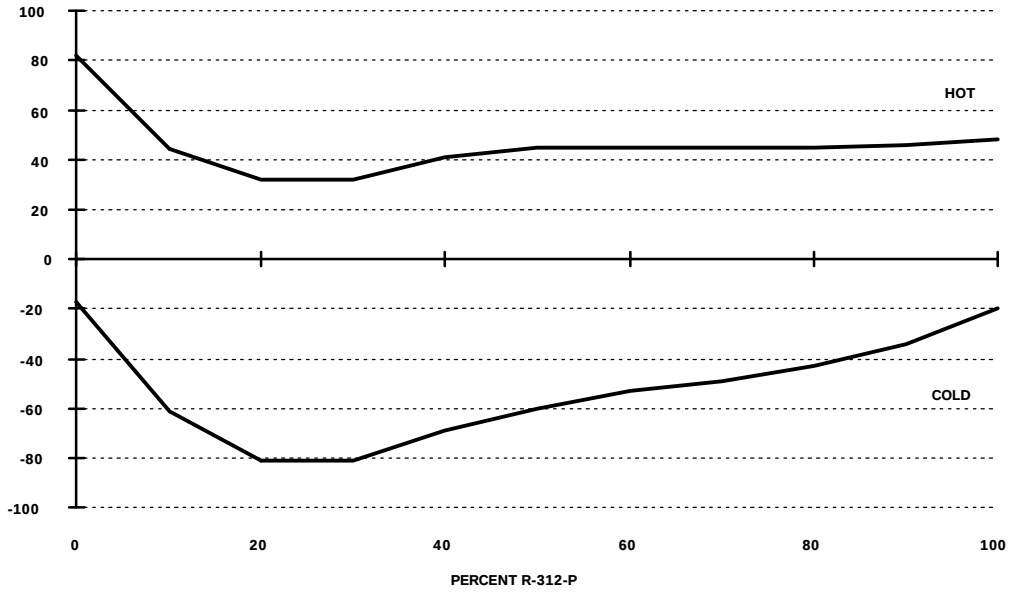
R-300-P SERIES

BLENDING CURVES FOR R-311-P / R-312-P

RESISTANCE VERSUS PERCENT BLEND



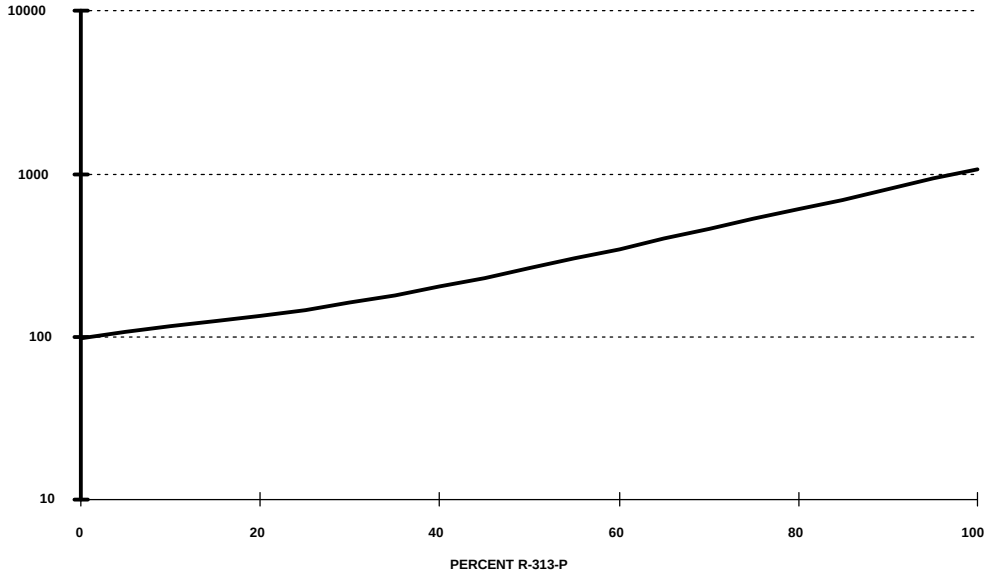
TCR VERSUS PERCENT BLEND



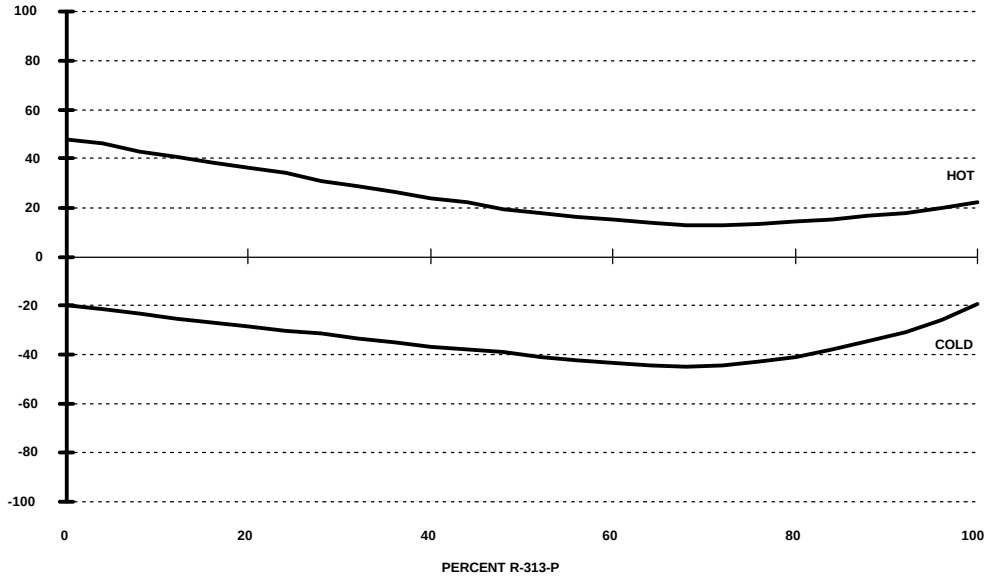
R-300-P SERIES

BLENDING CURVES FOR R-312-P / R-313-P

RESISTANCE VERSUS PERCENT BLEND



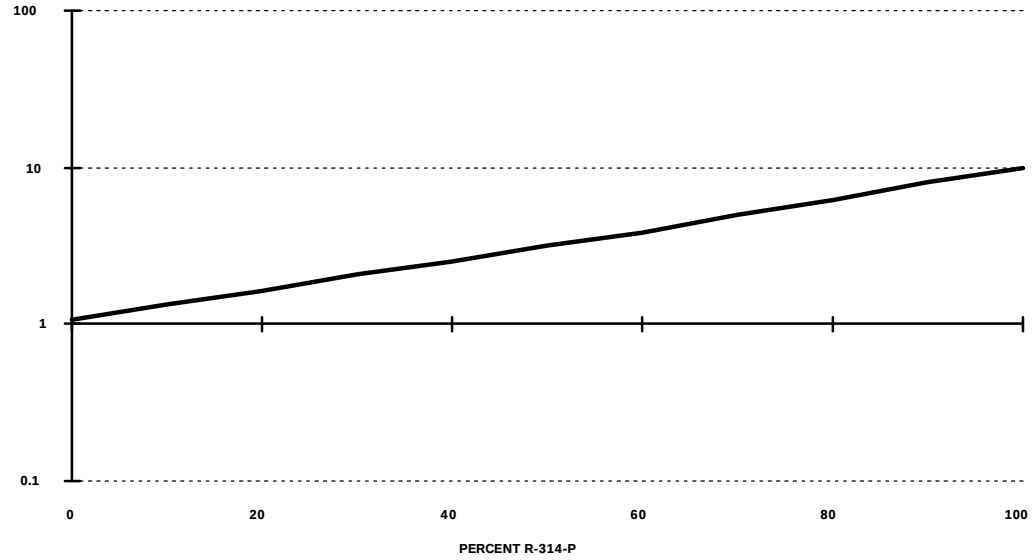
TCR VERSUS PERCENT BLEND



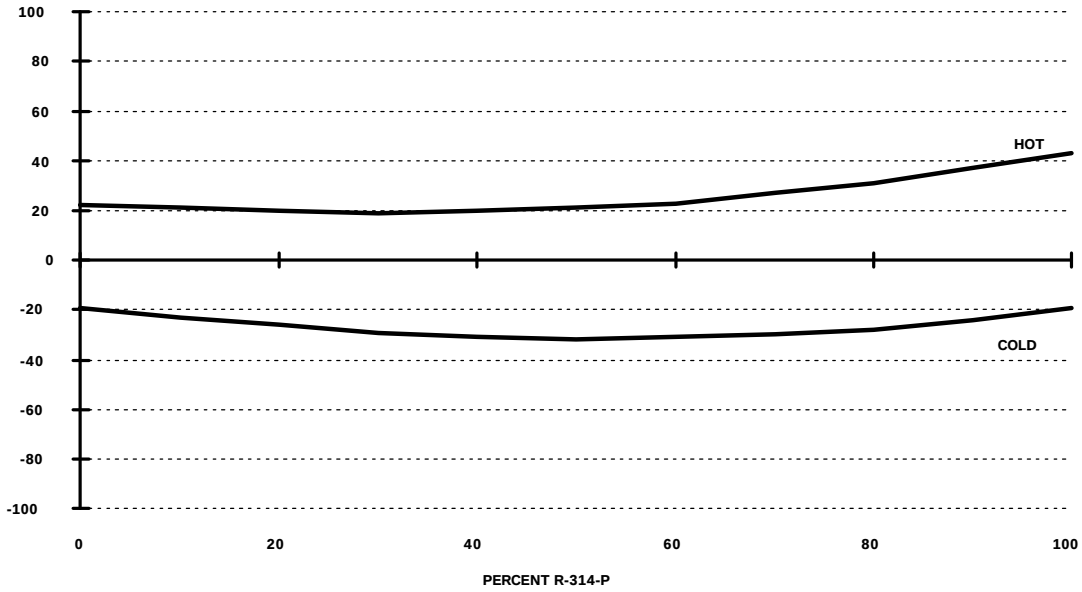
R-300-P SERIES

BLENDING CURVES FOR R-313-P / R-314-P

RESISTANCE VERSUS PERCENT BLEND



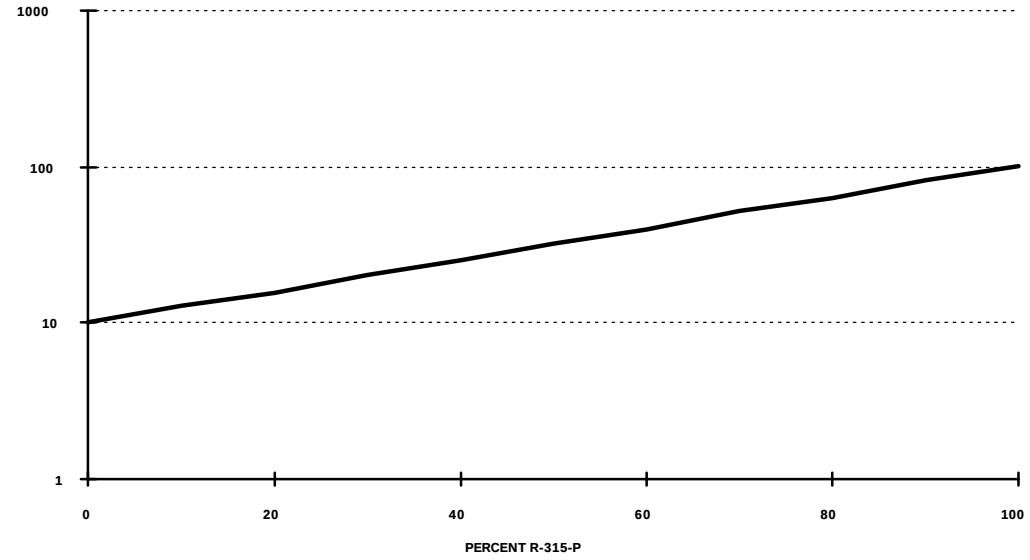
TCR VERSUS PERCENT BLEND



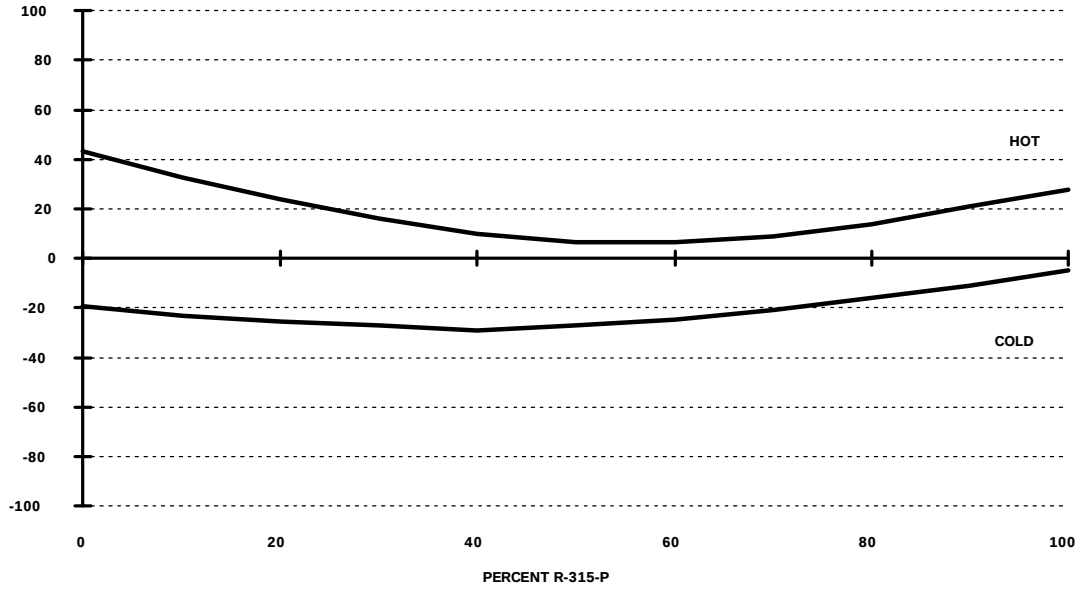
R-300-P SERIES

BLENDING CURVES FOR R-314-P / R-315-P

RESISTANCE VERSUS PERCENT BLEND



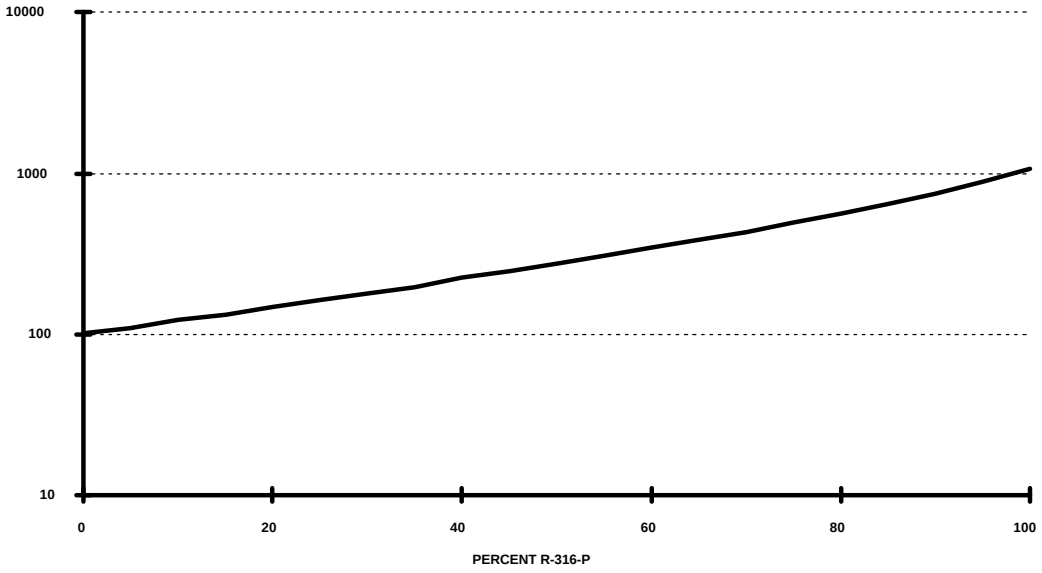
TCR VERSUS PERCENT BLEND



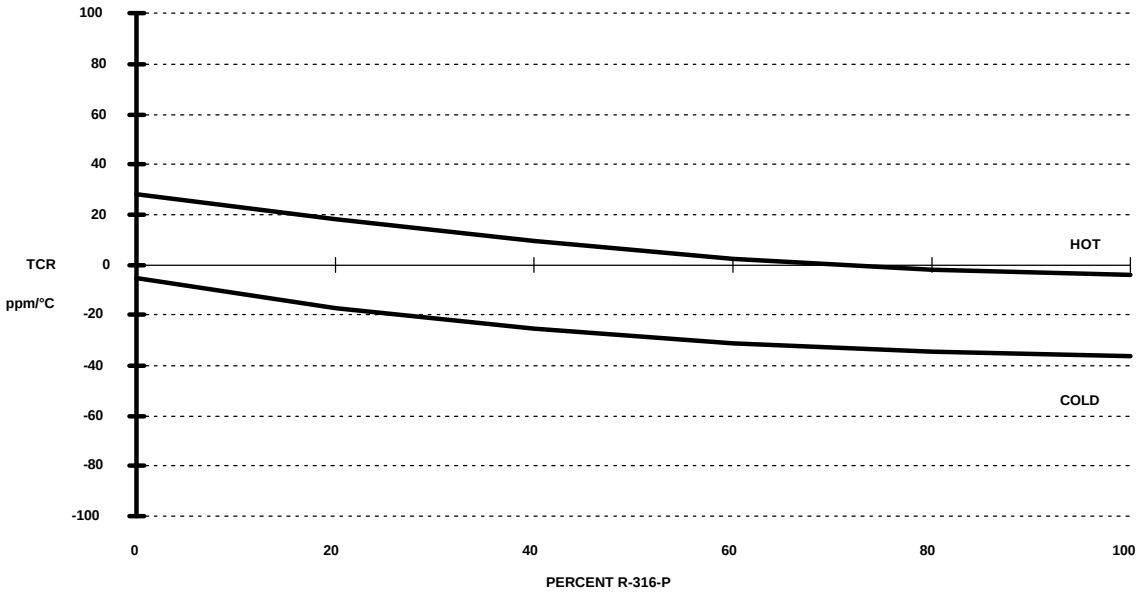
R-300-P SERIES

BLENDING CURVES FOR R-315-P / R-316-P

RESISTANCE VERSUS PERCENT BLEND



TCR VERSUS PERCENT BLEND



TYPICAL FIRING SENSITIVITY
R-311-P

NORMALIZED RESISTIVITY
AND TCR (ppm/°C, HOT AND COLD)
(10 MINUTE SOAK TIME)

RESISTOR	**RESISTOR FIRING**	**PEAK RESISTOR FIRING TEMP**					
TERMINATIONS	**CYCLE TIME**	**830°C**		**850°C**		**870°C**	
		R	**TCR**	**R**	**TCR**	**R**	**TCR**
C-951	60 MINUTES	0.913	150/55	0.972	113/8	0.989	92/-3
C-951	30 MINUTES	0.824	177/88	0.848	158/61	0.823	166/79
9695	60 MINUTES			0.985	109/4		
9695	50 MINUTES			1.031	84/-24		
	ESL CALIBRATION			1.000	87/-21		

NOTES:
1. Normalizing Resistivity: (1 mm x 4 mm), 4 squares = 10.54 Ω/sq. ESL calibration: ESL C-951 PtAg terminations, 11 minute soak time, 850°C, 50 minutes firing cycle.
2. TCR, ESL calibration, (ppm/°C, Hot/Cold, +125°C/-55°C) = 87/-21

TYPICAL FIRING SENSITIVITY
R-312-P

NORMALIZED RESISTIVITY
AND TCR (ppm/°C, HOT AND COLD)
(10 MINUTE SOAK TIME)

RESISTOR	**RESISTOR FIRING**	**PEAK RESISTOR FIRING TEMP**					
TERMINATIONS	**CYCLE TIME**	**830°C**		**850°C**		**870°C**	
		R	**TCR**	**R**	**TCR**	**R**	**TCR**
C-951	60 MINUTES	0.901	49/3	0.980	66/-13	1.057	82/23
C-951	30 MINUTES	0.885	73/6	0.864	73/24	0.898	95/51
9695	60 MINUTES			0.886	65/3		
9695	50 MINUTES			0.929	56/-13		
	ESL CALIBRATION			1.000	48/-20		

NOTES:
1. Normalizing Resistivity: (1 mm x 4 mm), 4 squares = 101.08 Ω/sq. ESL calibration: ESL C-951 PtAg terminations, 11 minute soak time, 850°C, 50 minutes firing cycle.
2. TCR, ESL calibration, (ppm/°C, Hot/Cold, +125°C/-55°C) = 48/-20

TYPICAL FIRING SENSITIVITY
R-313-P

NORMALIZED RESISTIVITY
AND TCR (ppm/°C, HOT AND COLD)
(10 MINUTE SOAK TIME)

RESISTOR	**RESISTOR FIRING**	**PEAK RESISTOR FIRING TEMP**					
TERMINATIONS	**CYCLE TIME**	**830°C**		**850°C**		**870°C**	
		R	**TCR**	**R**	**TCR**	**R**	**TCR**
C-951	60 MINUTES	0.740	68/51	0.992	32/-1	1.197	6/-45
C-951	30 MINUTES	0.731	92/82	0.928	64/38	1.088	51/4
9695	60 MINUTES			0.971	37/5		
9695	50 MINUTES			1.107	33/-2		
	ESL CALIBRATION			1.000	31/-4		

NOTES:
1. Normalizing Resistivity: (1 mm x 4 mm), 4 squares = 1.039 kΩ/sq. ESL calibration: ESL C-951 PtAg terminations, 11 minute soak time, 850°C, 50 minutes firing cycle.
2. TCR, ESL calibration, (ppm/°C, Hot/Cold, +125°C/-55°C) = 31/-4

TYPICAL FIRING SENSITIVITY
R-314-P

NORMALIZED RESISTIVITY
AND TCR (ppm/°C, HOT AND COLD)
(10 MINUTE SOAK TIME)

RESISTOR	**RESISTOR FIRING**	**PEAK RESISTOR FIRING TEMP**					
TERMINATIONS	**CYCLE TIME**	**830°C**		**850°C**		**870°C**	
		R	**TCR**	**R**	**TCR**	**R**	**TCR**
C-951	60 MINUTES	0.857	62/42	1.002	47/24	1.208	35/1
C-951	30 MINUTES	0.992	76/62	1.080	65/36	1.186	70/46
9695	60 MINUTES			1.030	43/15		
9695	50 MINUTES			1.048	40/14		
	ESL CALIBRATION			1.000	43/19		

NOTES:
1. Normalizing Resistivity: (1 mm x 4 mm), 4 squares = 9.927 kΩ/sq. ESL calibration: ESL C-951 PtAg terminations, 11 minute soak time, 850°C, 50 minutes firing cycle.
2. TCR, ESL calibration, (ppm/°C, Hot/Cold, +125°C/-55°C) = 43/19

TYPICAL FIRING SENSITIVITY
R-315-P

NORMALIZED RESISTIVITY
AND TCR (ppm/°C, HOT AND COLD)
(10 MINUTE SOAK TIME)

RESISTOR	**RESISTOR FIRING**	**PEAK RESISTOR FIRING TEMP**					
TERMINATIONS	**CYCLE TIME**	**830°C**		**850°C**		**870°C**	
		R	**TCR**	**R**	**TCR**	**R**	**TCR**
C-951	60 MINUTES	1.069	22/-7	0.899	39/8	0.828	53/35
C-951	30 MINUTES	1.094	23/-6	0.937	41/21	0.809	81/79
9695	60 MINUTES			0.926	37/13		
9695	50 MINUTES			0.997	35/8		
	ESL CALIBRATION			1.000	31/-1		

NOTES:
1. Normalizing Resistivity: (1 mm x 4 mm), 4 squares = 93.33 kΩ/sq. ESL calibration: ESL C-951 PtAg terminations, 11 minute soak time, 850°C, 50 minutes firing cycle.
2. TCR, ESL calibration, (ppm/°C, Hot/Cold, +125°C/-55°C) = 31/-1

TYPICAL FIRING SENSITIVITY
R-316-P

NORMALIZED RESISTIVITY
AND TCR (ppm/°C, HOT AND COLD)
(10 MINUTE SOAK TIME)

RESISTOR	**RESISTOR FIRING**	**PEAK RESISTOR FIRING TEMP**					
TERMINATIONS	**CYCLE TIME**	**830°C**		**850°C**		**870°C**	
		R	**TCR**	**R**	**TCR**	**R**	**TCR**
C-951	60 MINUTES	1.683	-24/-72	0.953	7/-22	0.600	35/18
C-951	30 MINUTES	1.713	-34/-84	1.007	0/-35	0.591	26/12
9695	60 MINUTES			1.056	9/-25		
9695	50 MINUTES			0.992	0/-29		
	ESL CALIBRATION			1.000	2/-28		

NOTES:
1. Normalizing Resistivity: (1 mm x 4 mm), 4 squares = 1.024 MΩ/sq. ESL calibration: ESL C-951 PtAg terminations, 11 minute soak time, 850°C, 50 minutes firing cycle.
2. TCR, ESL calibration, (ppm/°C, Hot/Cold, +125°C/-55°C) = 2/-28