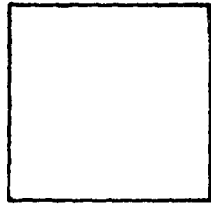


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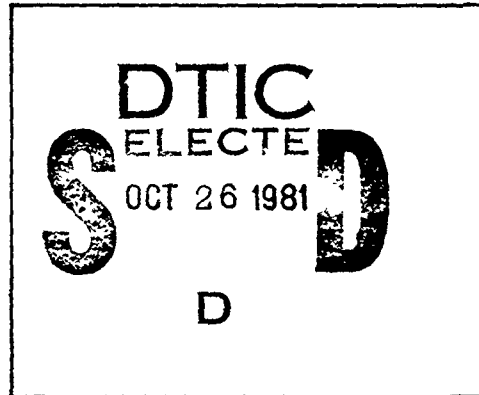
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REPORT NO. 344/44

TRANSVERSE PROPERTIES OF MONEL METAL

~~WORKSHEET~~

By

P. R. Kosting

October 8, 1936
WATERTOWN ARSENAL
WATERTOWN, MASS.

344/44

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Oct. 8, 1936

Transverse Properties of Monel Metal

Object

To compare transverse and longitudinal properties of Monel metal.

Conclusion:

When testing for acceptance no change should be made in yield strength and tensile strength values, but ductility values should be lowered if transverse bars are used instead of longitudinal bars.

Recommendation:

When using transverse specimens for acceptance work, the following data should be used in connection with specification QQ-C-541, Copper-Nickel Alloy, for Type 1, Class C, forged bars and rounds.

Transverse Tests of Monel Metal
QQ-C-511 - type 1, Class C

<u>Size</u> <u>inches</u>	<u>T.S.¹</u> <u>p.s.i.</u>	<u>Y.S.¹</u> <u>p.s.i.</u>	<u>Elong.²</u> <u>%</u>	<u>Red. of³</u> <u>Area %</u>
5-6 incl.	90,000	70,000	18.0	30.0
over 6-9 incl.	85,000	65,000	18.0	30.0
over 9-12 incl.	80,000	60,000	20.0	35.0

- 1 No change from longitudinal tests
- 2 Changed from longitudinal tests
- 3 Not mentioned in Spec. QQ-C-541

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Data

The data given in Table I were taken from acceptance and experimental reports on Monel metal to indicate not only the customary margin of safety for metal submitted for test on government specifications, but also change in properties due to change in position of test specimen with respect to axis of metal.

Discussion

In general, observed ductility values tended to exceed required values by a considerable margin. However, the difference between observed and required values occasionally is very small as indicated in the Table.

Only recently have comparisons been made of longitudinal and transverse properties of the same sample of metal. Sufficient observations have not been made to set up our own standards. Actual differences in per cent elongation run from +2% to -4.5% for regular quality metal and to -11% for machining quality metal of the Monel type. The International Nickel Company asks for a reduction of seven (7) units on stock up to 9" diameter and for a reduction of ten (10) units on stock up to 12" diameter in elongation values. It is believed that this should be granted them.

Values for reduction of area are very markedly lowered if tests are carried out in the transverse direction and compared with longitudinal tests. However, Federal Specifications do not require that reduction of area values be observed.

Respectfully submitted


P. R. Kosting

T A B L E I

Transverse and Longitudinal Properties of Monel

Yield Strength p.s.i.

Report	Specimen	Speci- fication	Diameter	Direction	Divider	Yield Strength p.s.i.				El. R.A.
						0.5% set	0.2% set	0.05% set	0.0% set	
344/69	3140		3 1/4 x 6 1/4	L	88,000				95,250	21
344/68	A3140-2	46-M-7e	1/2" plate	L				58000	90,000	25
	B3140-2		1/4" "	L				71000	89,000	23 1/2
344/59	P2099B1	WXS 11(1)	5 1/2" O.D. x 4 1/2" I.D.	(L)	59,000			55000	90000	18
	(&)			68,000				88500	88500	39.3
	(T)			65,500				93000	93000	37.5
344/10	Cylinder B	QQ-C-541	5 1/8 O.D. x 4 1/4 I.D.	()	62,000				88000	35.0
				()	35,000				80000	80000
344/15	5473D1	Spec.	5 1/8"						80000	46.0
344/17	9408-B2-1	Spec.	5 1/8"						83500	35.0
344/21	K Monel	Spec.	1 1/8"	L					80000	44.0
				T	141000				80000	32.0
344/22	K Monel	Spec.	2"	L	139000				86750	40.5
				T					80000	35
344/36	G Monel	Spec.	8"	L					164000	17.2
				T					98000	12.7
344/61	R Monel	Spec.	4"	L					149500	21.4
				T					92500	23
				L					151600	26.0
				T					93800	47.5
				L					98400	48.0
				T					116500	22.9
				L	102000	100,000			85000	20.0
				T	101000	97000			117000	26.0
				L		36000	34700		72000	45
				T						71.5

TABLE I (cont)

Report	Specimen	Specification	Diameter	Direction	Divider	0.5% set	0.2% set	0.05% set	0.0% set	T.S. El.	R. A.	
Monel	W.A.470.1/3797	QQ-C-541 type 1 Class C	5" -6"	T	type 1 Class C	36,100	70,000	34,200	29,000	70500	33.6	38.4
			6" -9"	T		35,250	65,000	34,000	30,500	67000	23.6	35.4
			9" -12"	T		70,000	60,000			90000	18.0	30.0
			3" -6"	L		65,000	70,000			85000	18.0	30.0
			6" -9"	L		60,000	65,000			80000	20.0	35.0
			9" -12"	L		70,000	60,000			90000	25.	
				L		65,000	65,000			85000	25.	
				L		60,000	60,000			80000	30.	

L - Longitudinal T - Transverse

P.R.K. 9/30/36