F-15 ALLOY / KOVAR – DATASHEET

SUMMARY PROPERTIES

Property	Value
Name	ASTM F-15 Alloy / Kovar
Type	Controlled Expansion Alloy
Chemical Sign	29 Ni-17 Co-53 Fe

COMPOSITION - ASTM ALLOY F-15 / KOVAR

Substance	Symbol	%
Nickel	Ni	29
Cobalt	Co	17
Magnesium	Mg	0.10
Manganese	Mn	0.50
Silicon	Si	0.20
Carbon	C	0.06
Aluminium	Al	0.10
Zirconium	Zr	0.10
Titanium	Ti	0.10
Phosphorus	P	0.025
Sulpur	S	0.025
Iron	Fe	Balance

COEFFICIENT OF THERMAL EXPANSION - ASTM ALLOY F-15 / KOVAR

Range (˚C)	Value (cm/cm. C X 10(-6))
30 to 100	n/a
30 to 200	5.5
30 to 300	5.1
30 to 350	n/a
30 to 400	4.9
30 to 425	n/a
30 to 450	5.3
30 to 500	6.2
30 to 550	n/a
30 to 600	7.9
30 to 700	9.3
30 to 800	10.4
30 to 900	11.5
30 to 1000	n/a

TENSILE STRENGTH & HARDNESS - ASTM ALLOY F-15 / KOVAR

Property	Tensile Strength (PSI)	Hardness (Rockwell B)
Annealed	85,000 max	85 max
1/4 Hard	90,000 to 115,000	90 to 93
1/2 Hard	105,000 to 125,000	94 to 96
Hard	120,000 min	-

MACHINING - ASTM ALLOY F-15 / KOVAR

Kovar / F-15 Alloy is not hardenable by heat treatment. The annealed hardness is up to RB 85 max, increasing up to RB 96 for half hard. In the annealed condition, Kovar / F-15 Alloy is more difficult to machine because it is soft and gummy. Tooling tends to plow the material instead of cleanly cutting into it, and does not easily form chips. Machining is easier if the material is descaled first. Any surface scale oxide tightly adheres to and penetrates the kovar surface to a greater extent than stainless steels.

Coolant used for Kovar / F-15 Alloy
It is important to control heat buildup which is the major cause of warpage. Suggested coolants are Keycool 2000 or Prime Cut. Whatever lubricant is used for machining, it should not contain sulfur. Sulfur can affect the performance of many sealed electronic parts.

Kovar / F-15 Alloy Tooling
All feathered or wire edges must be removed from the tools. Inspect the tools regularly and only use if in optimum condition.

Turning
In the case of using steel cutting tools, use a feed of approximately .010 inch to .012 inch per revolution and a speed up to 35 / FPM. Cutting tool angles would be as follows:

Back rake – Approximately 8˚
Side rake – Approximately 8˚
Nose Radius – Approximately .005˚
Side cutting edge angle – Approximately 15˚
End cutting edge angle – Approximately 7˚

For cutting off, high speed tools give better results than carbide tools, and feeds of approximately .001 inch per revolution should be used. The cutting tools should have a front clearance of about 7˚ with a fairly big tip, typically larger than 25˚ would be desirable.

Drilling Kovar Alloy
Drills should be as short as possible and heavy web type drills with nitrided or electrolyzed surfaces should ideally be used. The drill should be ground to an included point angle of 118˚ to 120˚. During drilling the hole should be cleaned frequently in order to remove any chips, which will gall, and also for cooling purposes.
For example when drilling a 3/16 inch diameter hole, a speed of about 40/FPM could be tried, with feed of around 0.002 inch to 0.0025 inch per revolution. For a ½ inch hole, approximately the same speed could be used with a feed of around 0.0040 inch to 0.005 inch per revolution.

Reaming Kovar Alloy
Reaming speeds should be around 20/FPM, with the feed being around 0.006 inch to 0.0080 inches per revolution. It is recommended that the margin on the land should be about 0.005 inch to 0.010 inch, and the chamfer should be .005 inch to .010 inch and the chamfer angle about 30˚. The tools should be as short as possible, and have a slight face rake of about 5˚ to 8˚.

Tapping Kovar Alloy
When tapping Kovar, it is recommended to use nitrided or electrolyzed tools. The drill used should be slightly larger than a standard drill recommended for conventional threads, because the metal tends to flow into the cut. For automatic machines a two or three fluted tapping tool should be used. For taps below 3/16 inch, a two fluted drill would be most suitable. Grind the face hook angle to 8˚ to 10˚, and the tap should have a 0.003 inch to 0.005 inch chamfered edge. If binding occurs in the hole during tapping, the width of the land may be too great, so the width of the heel may need grinding down. Tapping speed should be around 20/FPM.