

### H151 Rev C – ASTM A694-F60 (Modified)

Rev	Date	ECN	Issue	Prepared by	Check/Approved
C	02.01.08	250	Revised/Re-issued	T.S.	J.S.
B	30.01.06	130	Revised/Re-issued	A.K.	N.R.
A	15.03.04	99	Revised/Re-issued	N.R.	J.S.

Product Form	Standard	Grade	Acceptable Class
Forged Bar Blank Ring Closed Die Forging	ASTM A694	F60 (Modified)	-

<b>Scope</b>	This specification outlines the modifications and additional requirements to the relevant ASTM Specifications for the supply of raw material to manufacture Vector International products.								
<b>Other Applicable Specifications</b>	ASTM A370 (Latest Issue) ASTM A388 (Latest Issue)								
<b>Steel Making</b>	Forging manufacture to be in accordance with ASTM A694 (Latest Issue).								
<b>Heat Treatment</b>	Quench and Temper (620°C min) Normalise and Temper (620°C min) – <i>Note: Typically for smaller sections.</i>  Alternative Heat Treatment: Normalise (at 940°C for 2hours), Air Cool, Reheat (870°C for 1hour min), Quench and Temper (620°C min for 1hour) - <i>Note: Suggested for large sections if required or if tempering temperature is increased (see PO for supplemental requirements).</i>								
<b>Chemical Analysis % (Heat)</b>		<b>Min</b>	<b>Max</b>		<b>Min</b>	<b>Max</b>		<b>Min</b>	<b>Max</b>
	<b>C</b>	-	0.22	<b>P</b>	-	0.025	<b>CE</b>	-	0.42
	<b>Si</b>	0.15	0.35	<b>S</b>	-	0.025			
	<b>Mn</b>	0.60	1.35	<b>Ni</b>	-	0.40			
	<i>Note: CE = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15 Cr, Mo, Cu and V to be reported on certification for the purpose of verifying the CE. Nb to be reported.</i>								
<b>Mechanical Properties</b>					<b>Min</b>			<b>Max</b>	
	<b>Tensile(R<sub>m</sub>):</b>				75000psi (517MPa)			-	
	<b>Yield (R<sub>p0.2</sub>):</b>				60000psi (414MPa)			-	
	<b>Elongation (A %):</b>				22			-	
	<b>R. of A (Z %):</b>				30			-	
	<b>Hardness:</b>				-			197BHN	

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<b>Impact Properties</b>	Charpy V. 40J (Ave), 28J (Min) at -46°C. Lateral Expansion to be reported.
<b>Test Sampling</b>	Test coupons must represent production forgings (bars and open die) and should be heat treated with the forgings. Test coupon and forgings to be stacked in the furnace in accordance with good practice to ensure even heat treatment. Test coupons must receive essentially the same forging reduction ratio as the production forgings. Test coupons must be taken from production forging when closed die forgings are used. Mechanical Tests to ASTM A370 after final heat treatment.
<b>Surface Finish and Quality</b>	Forgings to be of sufficient quality for MPI check. MPI on finished machined parts to be undertaken by Vector International Ltd.
<b>Repair of Defects</b>	Weld repair is not acceptable.
<b>Marking</b>	Forgings to be marked with Heat Number, Material Grade and Vector Specification.
<b>Certification</b>	Certification to be in accordance with EN10204-3.1. Chemical Analysis, Mechanical Analysis, Heat Treatment Report / Graphs, Mill Certificate (Wet Stamped).
<b>Notes</b>	1. Refer to PO for supplemental details. 2. Any deviation from this specification must be formally raised as a concession request prior to delivery. Certification must include concession documentation.