

Rover K-series information

Gleaned from the internet and others:	Sut (MPa)	Sy (MPa)	Sut (ksi)	Sy (ksi)
Original through-bolt material spec 9.8	900	720	130.5	104.4
Revised through-bolt material spec 10.9	1000	900	145	130.5
ARP replacement stud AISI 8740			200	180
Factory manual make-up procedure: 20 Nm (14.75 lb-ft) torque, then 180 deg turn, then 180 deg turn				
"Other sources" make-up procedure: 20 Nm (14.75 lb-ft) torque, then 90 deg turn, then 90 deg turn				
Revised head gasket kit from SAIC P/N ZUA000530				
has make-up procedure: 20 Nm (14.75 lb-ft) torque, then 180 deg turn, then 135 deg turn				

Assuming that the original and revised stepped bolt dimensions are the same...

From MM bolt measurements:	Longitudinal spring constants:						
	dia (in)	A (sq-in)	E (psi)	L (in)	k (lb/in)	1/k1	1/k2
large portion	0.345	0.093482	3.00E+07	1.95	1,438,185	6.95E-07	
small portion	0.318	0.079423	3.00E+07	12.25	194,504		5.14E-06
small, total length (ref)	0.318	0.079423	3.00E+07	14.2	167,794		
ARP stud	0.333	0.087092	3.00E+07	15	174,184		

Then, equivalent spring constants are -----

	ke (lb/in)	ke (lb/mm)
Rover	171,333	6,745
ARP	174,184	6,858

Thread torque/preload calculations

		Rover K 9mm 1.25mm pitch (bolt)	ARP K 9mm 1mm pitch	ARP K 9mm 1mm pitch
torque applied =	lb-ft	14.75	50	14.75
d = thread pitch diameter =	in	0.314961	0.314961	0.314961
p = thread pitch =	in	0.049213	0.03937	0.03937
mu(t) = thread friction coef. =		0.09	0.09	0.09
a = thread slope angle =	deg	30	30	30
ds = shoulder diameter =	in	0.615	0.615	0.615
mu(s) = shoulder friction coef. =		0.09	0.09	0.09
theta = shoulder slope =	deg	0	0	0
axial load	k(thread) =	0.049	0.045	0.045
axial load	k(shldr) =	0.055	0.055	0.055
Preload = 2T/(k(t) + k(f)) =	lb/bolt	3,404	11,905	3,512
Shank stress (psi)		42,858	136,690	40,323
Added load due to subsequent rotation;				
		180x180	180x135	180x135 (assumed)
	lb/bolt	8,432	7,378	7,501
Total make-up load	lb/bolt	11,836	10,782	11,012
Longitudinal stress (psi) (neglecting torsional stress)		149,021	135,751	126,446

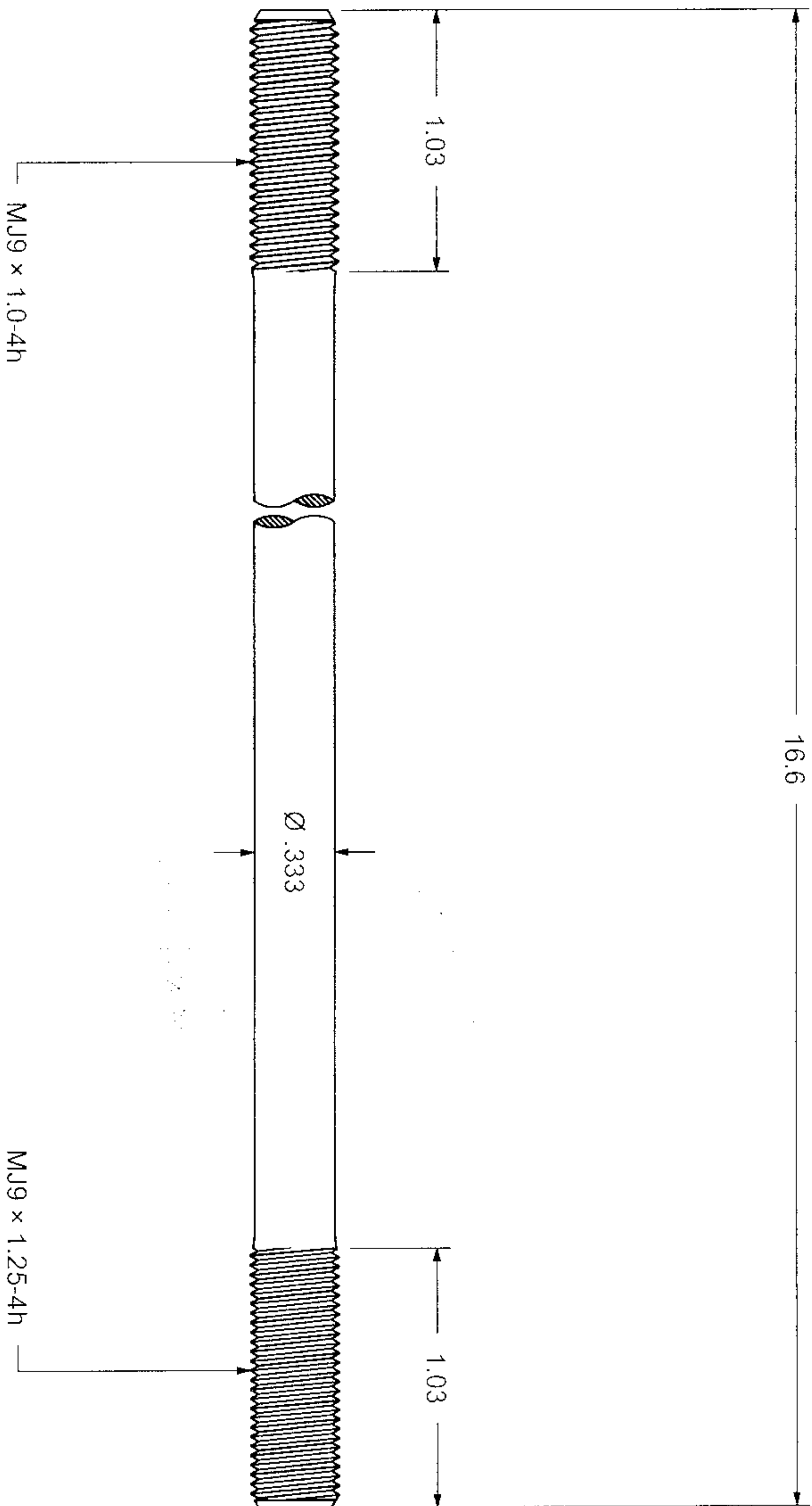
Thermal expansion estimate -

Assume 15" length, dT = 180 F, block/head modeled as tubular aluminum column 35mm OD x 10 mm ID

The thermally induced extension of the bolts is then about 0.016" which would add about

170,000 x 0.016 = 2720 lb load or, 2720/11,000 = 24% load = 24% stress increase

184,786	168,331	169,495	156,792
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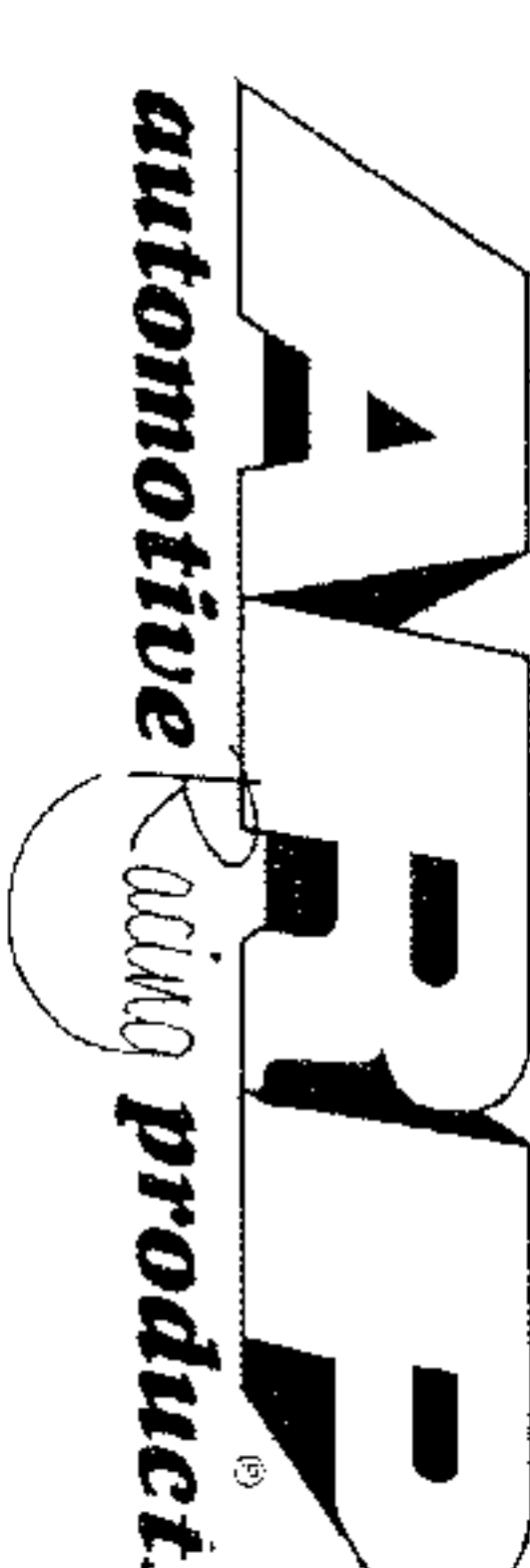


AIN12-1 (12-point nut)

- M9 x 1.0
- .615" flange OD
- .375" total height
- AIN 812 N (gun washer)
- .812" OD (13/16)

NOTES

1. BREAK SHARP EDGES .003"-.012"
2. HEAT TREAT PER AMS-H-6875
3. ROLL THREADS AFTER HEAT TREAT
4. REFERENCE (REF) DIMENSIONS FOR DESIGN PURPOSES ONLY - NOT INSPECTION CRITERIA.

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES. DIMENSIONS APPLY AFTER PLATING. ALL DIMENSIONS ARE FINISHED SIZE.		DRAWN BY: DATE		
TOLERANCES: XX = ± .010 XXX = ± .005	∠ = ± 2°	D.R.D.	10/23/13	
MATERIAL: 8740		CHECKED BY: M.C.	10/24/13	
FINISH: BLACK OXIDE		APPROVED	DATE	
SURFACE FINISH: EXCEPT AS NOTED	32/√	M.H.	10/25/13	
		REF:		
		P		
PART NUMBER		PART DESCRIPTION		
AI16.600-1L		ROVER K SERIES HEAD STUD		
UNCONTROLLED				
DO NOT SCALE DRAWING				