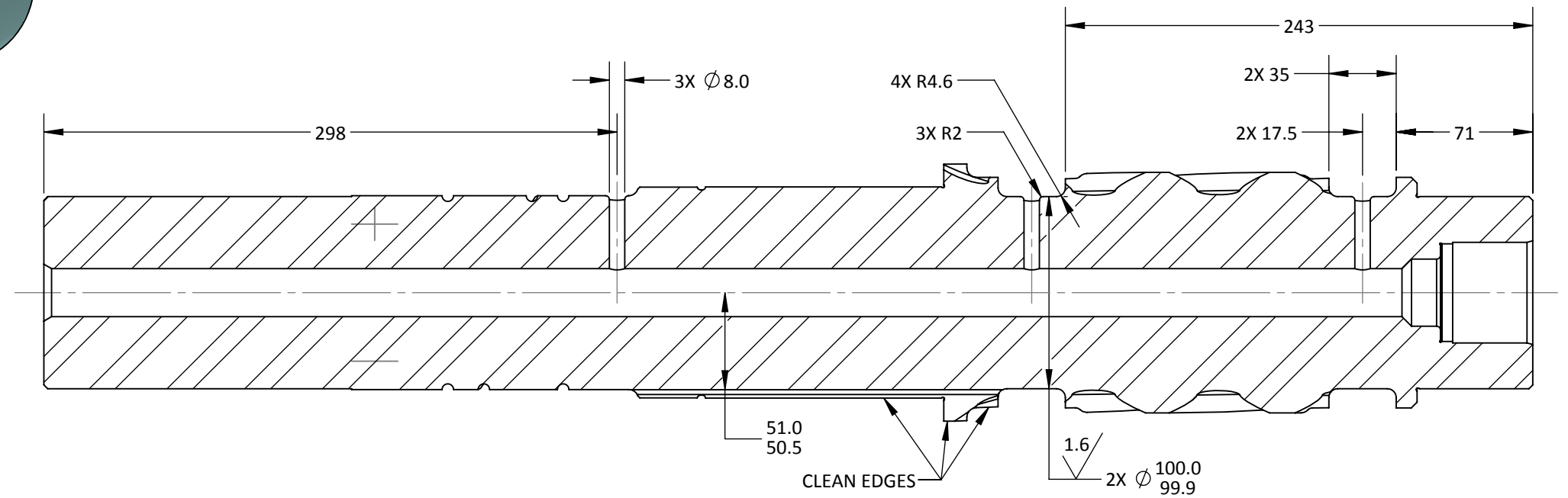
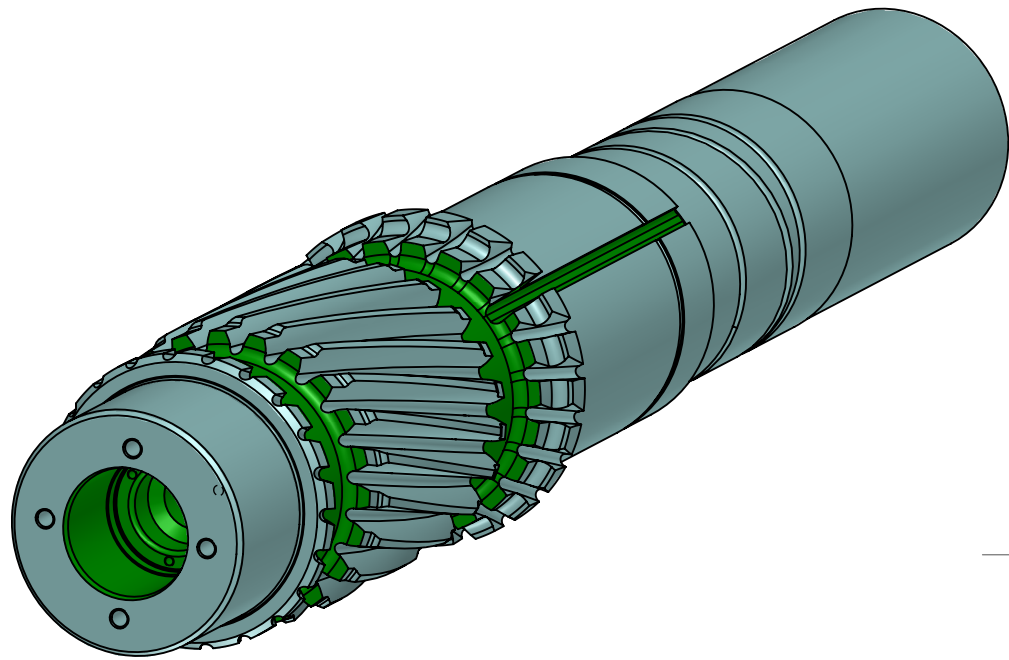


REV	CHANGED FROM	BY	DATE	APRD
B	REMOVED 110DIA STEP. REVIEWED PER 1509-ENC-004	JFC	10/26/12	
C	UPDATE BORDER AND NREL DRW REVIEW	CPS	3/5/13	
D	CHANGE LG TO USE 254509 END CAP	CPS	4/18/13	
E	REPAIR DANGLING NOTES	JMG	10/18/13	
F	CHANGES PER MANUFACTURER REVIEW AND INSTRUMENTATION	CPG	3/19/14	
G	NOTE 1 - MATERIAL AGMA GRADE 2 WITH CLEANLINESS CERTIFICATION	CH	4/2/14	
H	CLARIFIED MPI NOTE, REMOVED REDUNDANT NOTE 3	CH	4/4/14	
I	CHANGES PER MFG REVIEW	CPG	1/15/16	

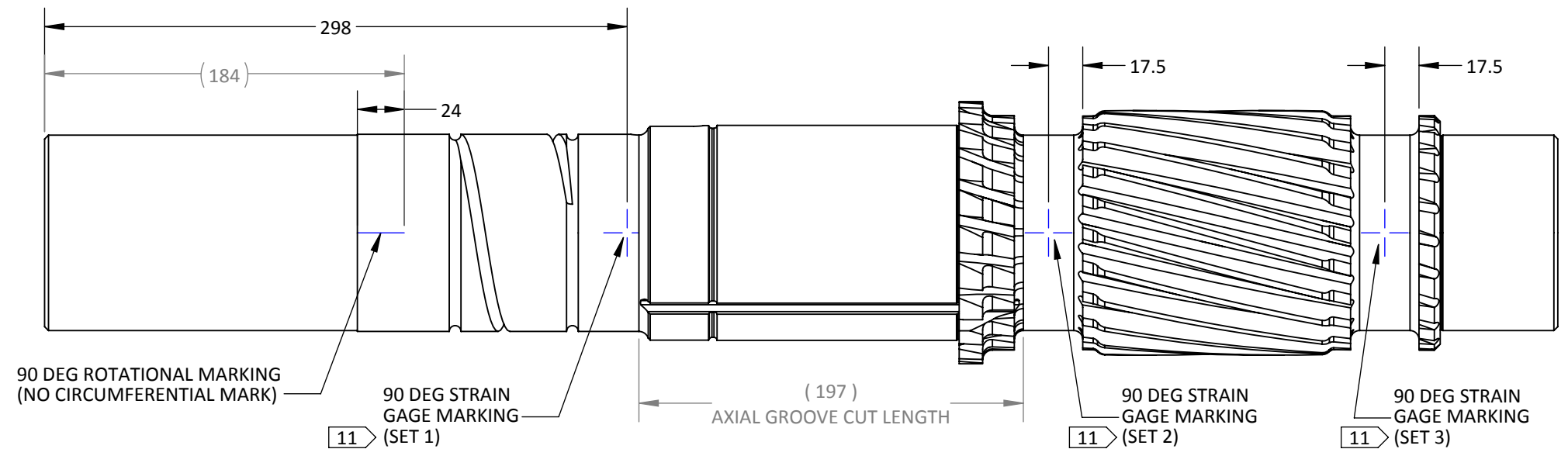
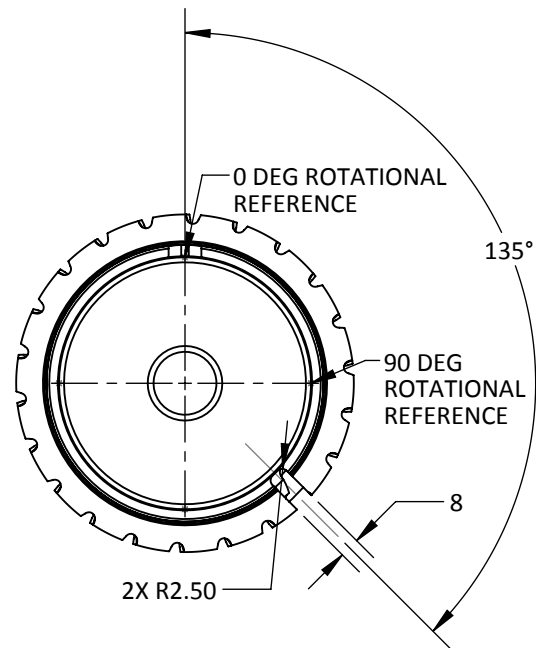
REPORT ERRORS & CHANGES REMOVE ALL BURRS AND SHARP EDGES DIMENSIONS ARE IN MILLIMETERS. UNSPECIFIED TOLERANCES: DECIMALS: FINISH: ANGLES:		
X. ±1.0	3.2	≤ ± 0.5°
.X ±0.5	√μm Ra	
.XX ±0.25		
COPYRIGHT ©		
NOT TO BE REPRODUCED OR USED TO MAKE OTHER DRAWINGS OR MACHINERY		
DRAWN	JMG	DATE: 9/20/12
CHECKED	NJB	THIRD ANGLE PRJ

MAKE FROM MODEL: 1509-GS-020-A		
National Renewable Energy Laboratory		
TITLE: SHAFT, PINION, HIGH SPEED		
SIZE B	DWG. NO. 254517	REV I
SCALE: 1:4	WEIGHT: 49.45 kgs	SHEET 1 OF 3

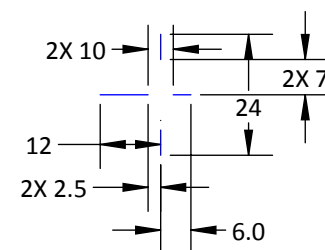
NOTES:
SEE PAGE 3



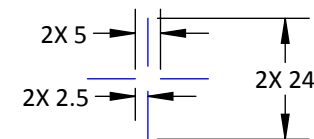
SECTION A-A



STRAIN GAGE MARKINGS AT 298MM

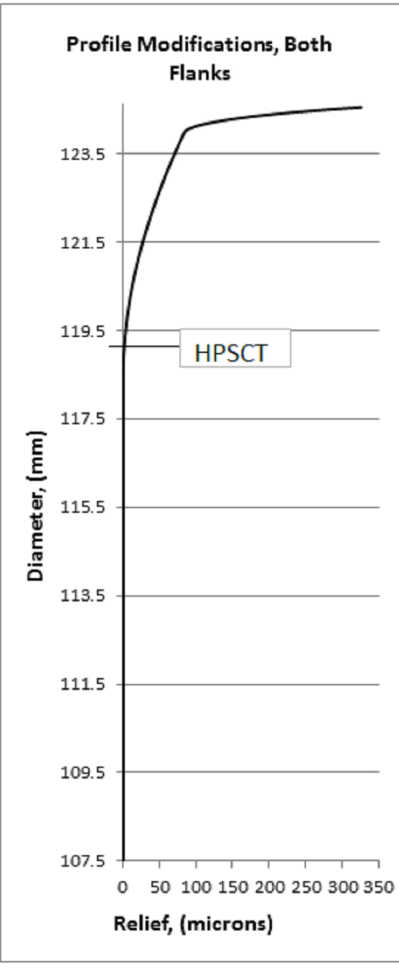


STRAIN GAGE MARKINGS AT 17.5MM

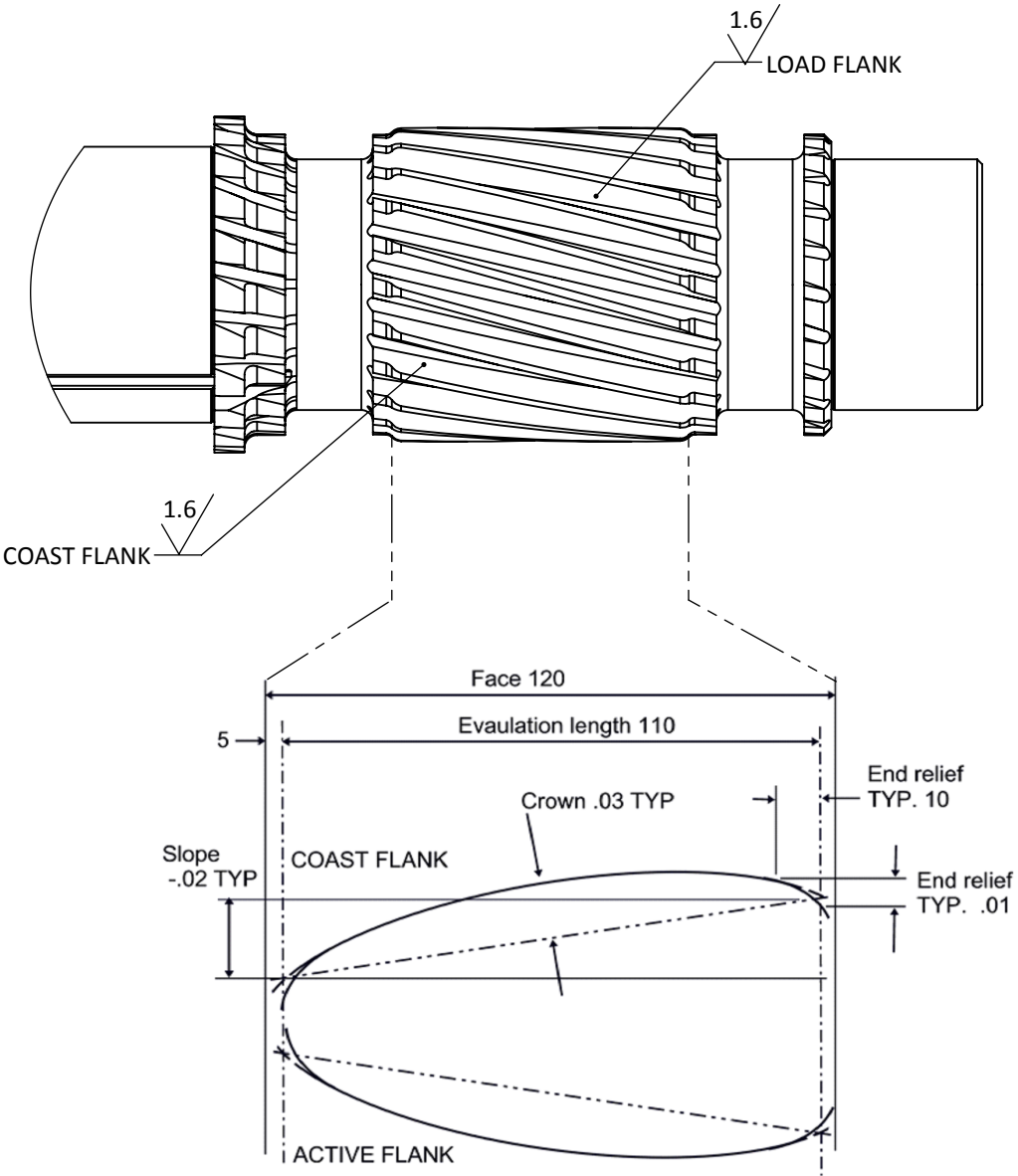


REPORT ERRORS & CHANGES REMOVE ALL BURRS AND SHARP EDGES DIMENSIONS ARE IN MILLIMETERS. UNSPECIFIED TOLERANCES: DECIMALS: FINISH: ANGLES: X. ±1.0 3.2 $\sqrt{\mu\text{m Ra}}$ < ± 0.5° .X ±0.5 .XX ±0.25 COPYRIGHT © NOT TO BE REPRODUCED OR USED TO MAKE OTHER DRAWINGS OR MACHINERY			National Renewable Energy Laboratory		
DRAWN JMG DATE: 9/20/12 CHECKED NJB THIRD ANGLE PRJ			TITLE: SHAFT, PINION, HIGH SPEED		
SCALE: 1:3			SIZE B	DWG. NO. 254517	REV I
WEIGHT: 49.45 kgs			SHEET 2 OF 3		

External Involute Helical Gear Data	
Number of Teeth	22
Normal Module (mm)	5.0000
Normal Pressure Angle	20.0000
Whole depth Constant (REF)	2.350
Oper pitch diameter (mm)	114.0000
Gen Pitch diameter (mm)	113.3675
Base diameter (mm)	106.1454
Major Diameter (REF) (mm)	124.5368
Form Diameter with Gear (mm)	107.5240
Root Diameter (REF) (mm)	101.7898
Min Tool Tip Radius (mm)	2.100
Addendum Modification X1	0.1200
Hand of Helix	Right
Gen Helix Angle	14.0000
Lead (mm)	1428.4577
Number of teeth in Mate	88
Center Distance (mm)	285.0000
Normal cir BL w/ Gear (max/min) (mm)	0.3 / 0.2
Quality per AGMA 2015-1	A 5
Quality Datum Surface	A
Trans Cir TT on Gen Dia. (max/min) (mm)	8.839 / 8.792
Size over 8.8 balls (max/min) (mm)	127.52 / 127.422
Span over 3 teeth (max/min) (mm)	39.26 / 39.217



Profile Mods			
Position, LA, (mm)	Degrees of Roll	Diameter, (mm)	Relief, (microns)
8.582	9.264	107.524	0.0
26.368	28.466	118.524	0.0
26.838	28.974	118.945	0.6
27.309	29.482	119.373	2.3
27.780	29.991	119.807	5.2
28.251	30.499	120.247	9.2
28.722	31.007	120.692	14.4
29.193	31.515	121.143	20.8
29.663	32.024	121.600	28.3
30.134	32.532	122.062	36.9
30.605	33.040	122.530	46.7
31.076	33.549	123.003	57.7
31.547	34.057	123.481	69.8
32.018	34.565	123.965	83.0
32.063	34.615	124.012	85.7
32.109	34.664	124.060	91.0
32.155	34.714	124.107	99.1
32.201	34.763	124.155	109.9
32.247	34.813	124.202	123.7
32.293	34.862	124.250	140.5
32.338	34.912	124.298	160.6
32.384	34.961	124.345	184.3
32.430	35.011	124.393	212.0
32.476	35.060	124.441	244.1
32.522	35.109	124.489	281.4
32.568	35.159	124.537	324.9



NOTES:

1. MATERIAL: SAE E9310; ALT. E9310H, 4820, 4820H, 18 CRNIMO, 7-6 17 CRNIMO 7 STEEL BAR OR FORGING. MATERIAL SHALL CONFORM TO EN-10084 AND ISO GRADE MQ, OR AGMA 2001-D04 GRADE 2 WITH MATERIAL CLEANLINESS CERTIFIED TO ASTM E45 METHOD 'A' TO MEET
- | A | | B | | C | | D | |
|------|-------|------|-------|------|-------|------|-------|
| Thin | Heavy | Thin | Heavy | Thin | Heavy | Thin | Heavy |
| 3 | 3 | 2.5 | 1.5 | 2.5 | 1.5 | 2 | 1.5 |
2. PROVIDE INSPECTION REPORTS OR PROOF ACCORDING TO THE PROVISIONS EN-10204-3.1.
3. -
4. ULTRASONIC TESTING: TESTING OF FORGINGS MUST FOLLOW THE PROVISIONS OF EN-10228-3 LEVEL 3 (AGMA A-388- TO AN EQUIVALENT 3 mm FLAT BOTTOMED HOLE IS AN ACCEPTABLE ALTERNATIVE.)
5. CRACK TESTING: MAGNETIC PARTICLE TEST GROUND SURFACES TO ISO 6336-5 GRADE MQ (ALT: AGMA 2001-D04 GRADE 2). NO CRACKS ALLOWED.
6. HEAT TREAT: CARBURIZE TEETH 1.2/1.8 EFFECTIVE CASE DEPTH, HARDEN TO 58/61 RC, CORE HARDNESS 28/40 RC. MIN. @ MID-TOOTH ROOT DIA. REMAINDER OF SURFACES OPTIONAL. PROCESS PER AGMA 2001-D04 GRADE 2. CASE DEPTH IS ON FINISHED GEAR TEETH, AFTER GRINDING. KEEP THREADS SOFT
7. IDENTIFY WITH PART NUMBER, REV LEVEL, SUPPLIER INITIALS, JOB NUMBER, AND SHOP ORDER NUMBER
8. GROUND TOOTH FLANKS AND FULL ROOT FILLET MUST BLEND WITHOUT GRIND NOTCH
9. HELICAL GEAR TEETH MUST MEET GRIND TEMPER REQUIREMENTS OF AGMA 2007 CODE GRADE FB-1
10. RADIAL ALIGNMENT OF GEAR TEETH TO OTHER FEATURES NOT REQUIRED. ALL UNSPECIFIED FILLETS-R3, UNSPECIFIED CHAMFERS-1x45°
11. STRAIN GAGE SET 1 MARKINGS AT 0, 45, 90, 180, 225, AND 270 DEG. SET 2 AND SET 3 MARKINGS AT 0, 90, 180, AND 270 DEG.

REPORT ERRORS & CHANGES
REMOVE ALL BURRS AND SHARP EDGES
DIMENSIONS ARE IN MILLIMETERS.
UNSPECIFIED TOLERANCES:
DECIMALS: FINISH: ANGLES:
X. ±1.0 3.2 $\sqrt{\mu\text{m Ra}}$ $\angle \pm 0.5^\circ$
.X ±0.5
.XX ±0.25
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DRAWN JMG DATE: 9/20/12
CHECKED NJB THIRD ANGLE PRJ

National Renewable
Energy Laboratory

TITLE:
SHAFT, PINION, HIGH SPEED

SIZE
B

DWG. NO.
254517

REV
I

SCALE: 1:3

WEIGHT: 49.45 kgs

SHEET 3 OF 3