Test Report

ABC Company PTU Pinion Test

Conducted by: Peak innovations Engineering

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Test Introductions and Objectives

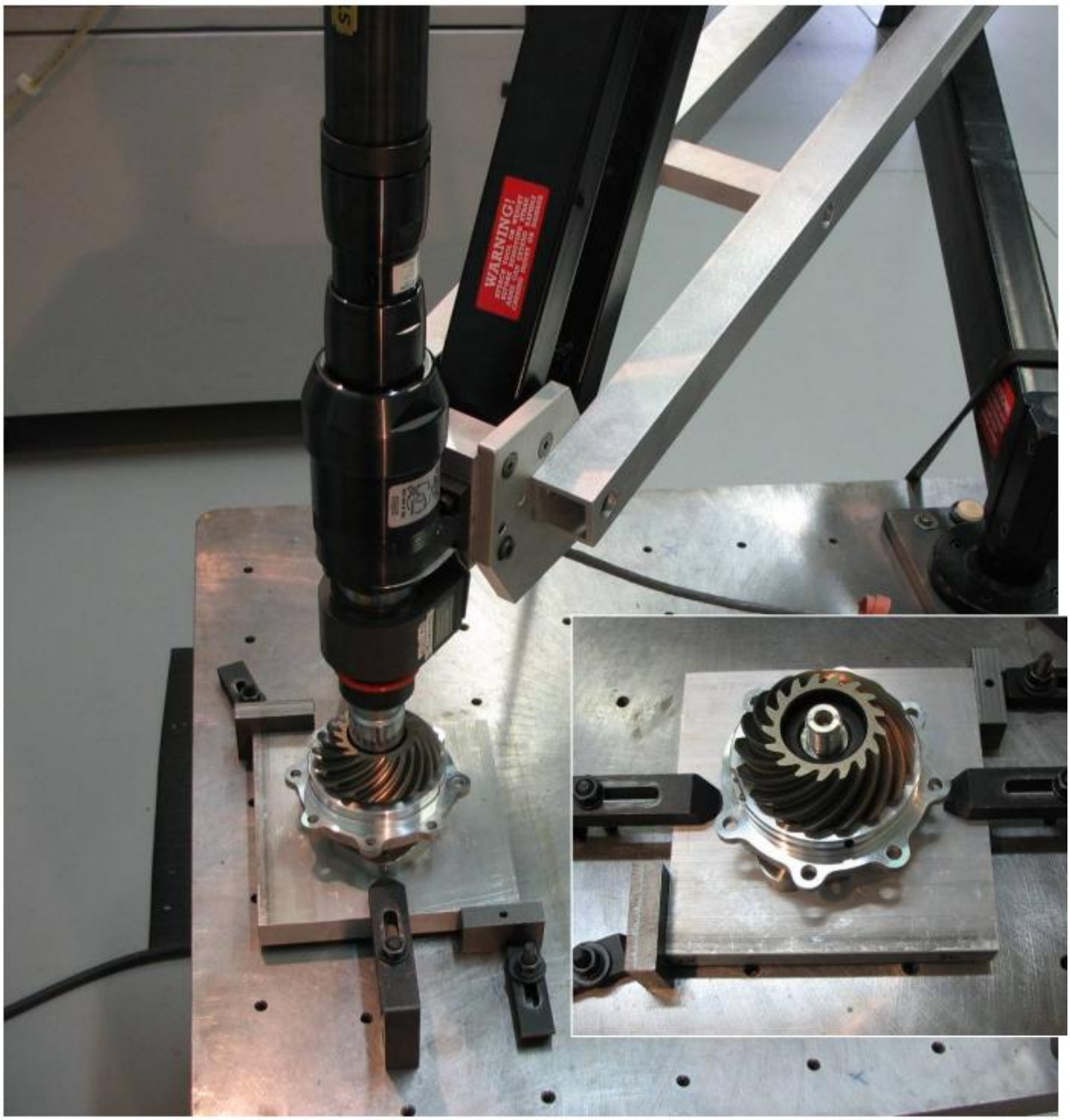
This test report contains the results of joint testing performed for ABC Corporation by Peak innovations Engineering.

Torque to failure testing was conducted on the PTU Pinion joint for ABC. The reason for the test request was to aid in validating the joint

Photos were taken of the test setup and of the joint after testing. The file name for each rundown is found in the lower left corner of each test trace. Failure modes along with a summary of test equipment utilized are noted in the headers of these traces.

Test Setup

At setup the assembly was restrained on a base plate to prevent rotation during testing. Test parameters, part descriptions, and available part numbers can be found in the headers of test traces. Due to limited part availability, only one assembly was tested.

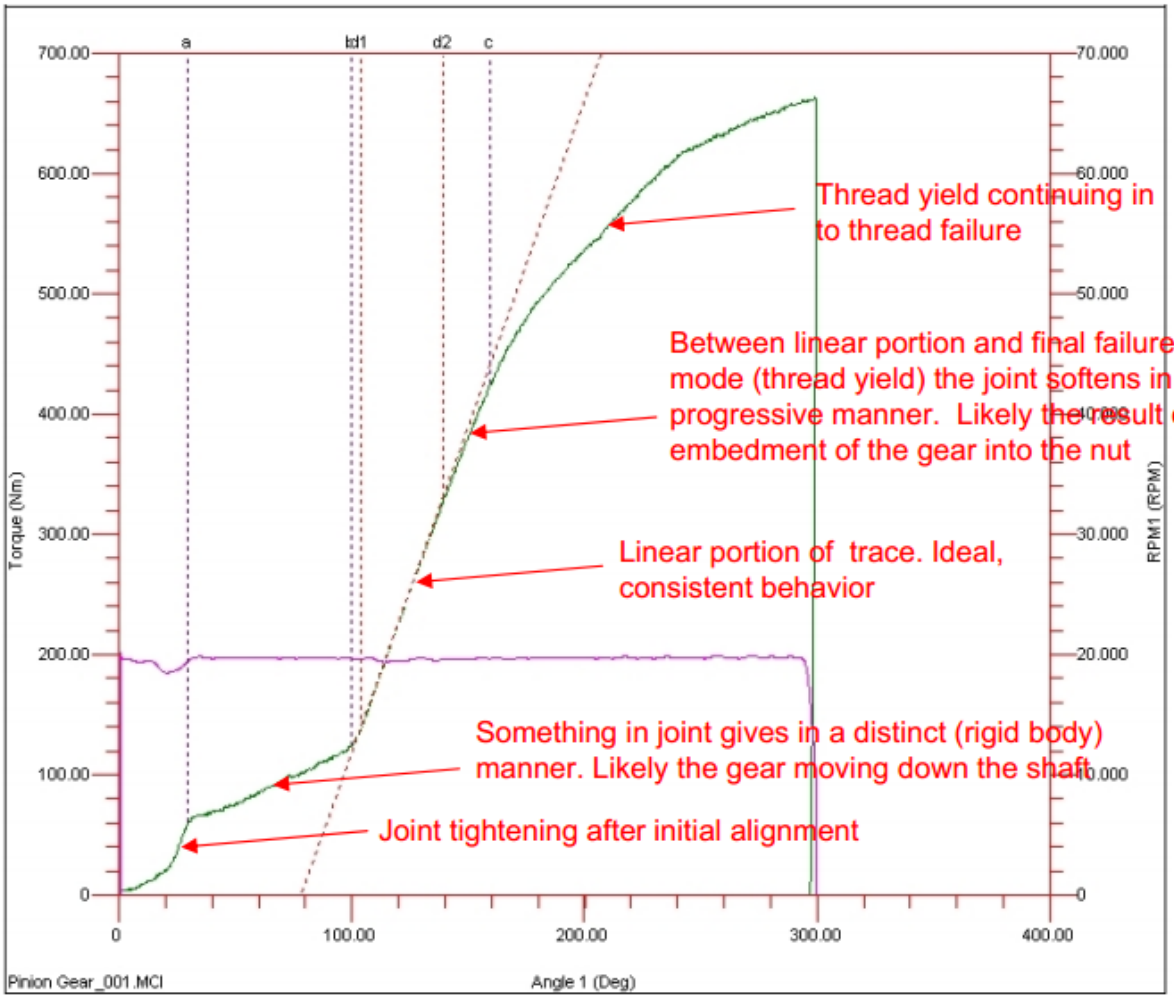


Test setup- Joint shown inset with nut removed

Test Results

Below is an annotated torque-angle- RPM trace of the rundown. A time limit caused the controller to shut-off in 3 seconds. So the ending event of this trace was tool shut-off. The nut was immediately tightened a second time resulting in failure due to thread strip at a maximum torque of 813.1N-m at an additional angle of 120 degrees.

Torque and angle values each of the picked points can be found on a subsequent page.



Torque-Angle-RPM trace aligned at 3 N-m (angle=0 at 3 N-m)

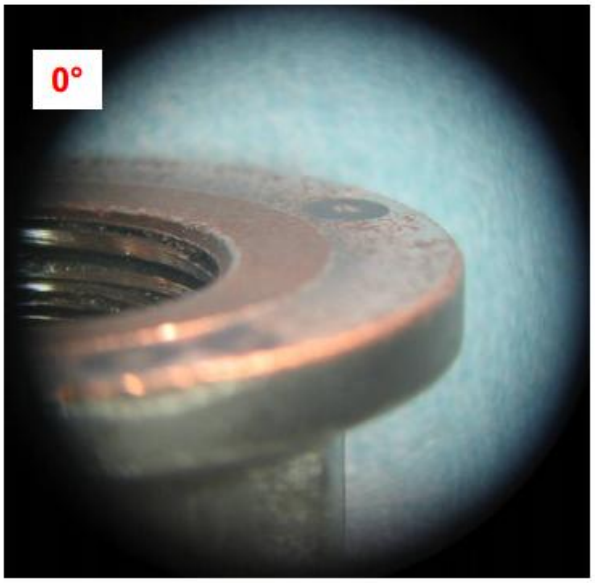
Joint Failure

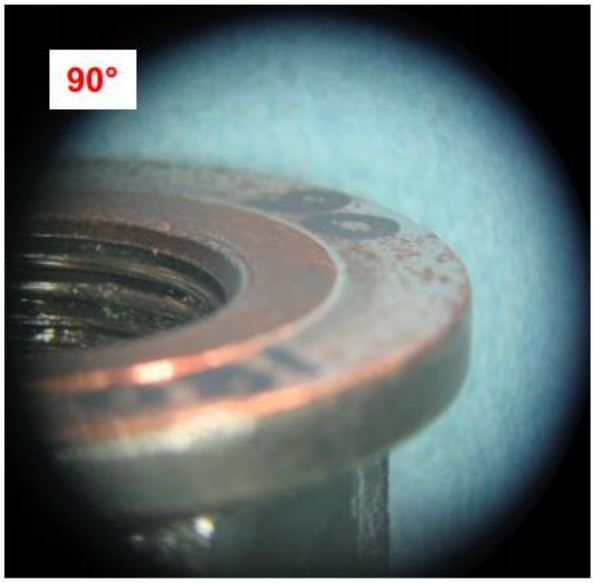
The torque-angle trace showed that failure was by thread strip, primarily in the nut. Because the trace also showed a yield event prior to thread strip, separating the failed joint was desirable to see if the cause of this even could be determined. After much effort, the nut and gear was removed from the shaft. The mating surfaces are shown below and in more detail on the following page.

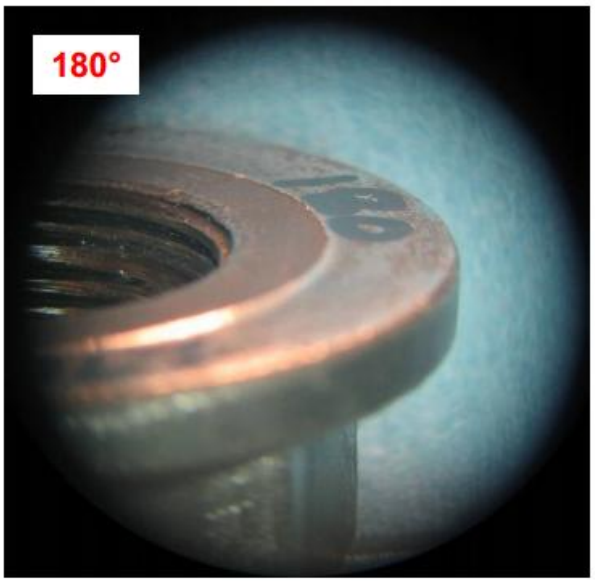
Mating Joint Surfaces

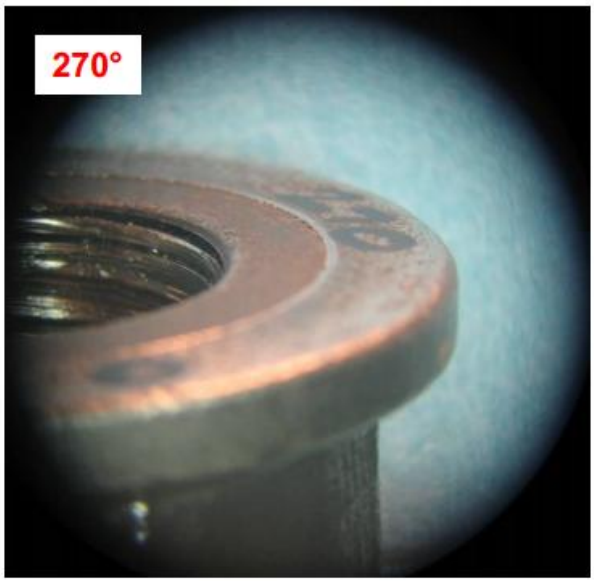
Joint Failure

Examination of the nut showed embedment and more specifically embedment on a plane not square to the shaft axis. The photos below show the contact plane at 90 degree intervals with the location without embedment 0 degrees. The maximum offset between the contact surface and the inner nut surface at 180 degrees was approximately 0.15mm.









Observations

- The torque required to move the gear to contact with the shaft (point b) does not contribute to clamp load. If this value is variable, joint capacity will also vary
- It appears that the nut did not contact the gear in a flush manner. If pressure against the nut face varied by angular orientation, the axial load (and therefore the tightening torque) at which embedment would start is reduced. It appears likely that if the shaft axis was normal to the plane of the gear pocket, the linear portion of the trace could be raised from point d2 to the start of thread yield, point c

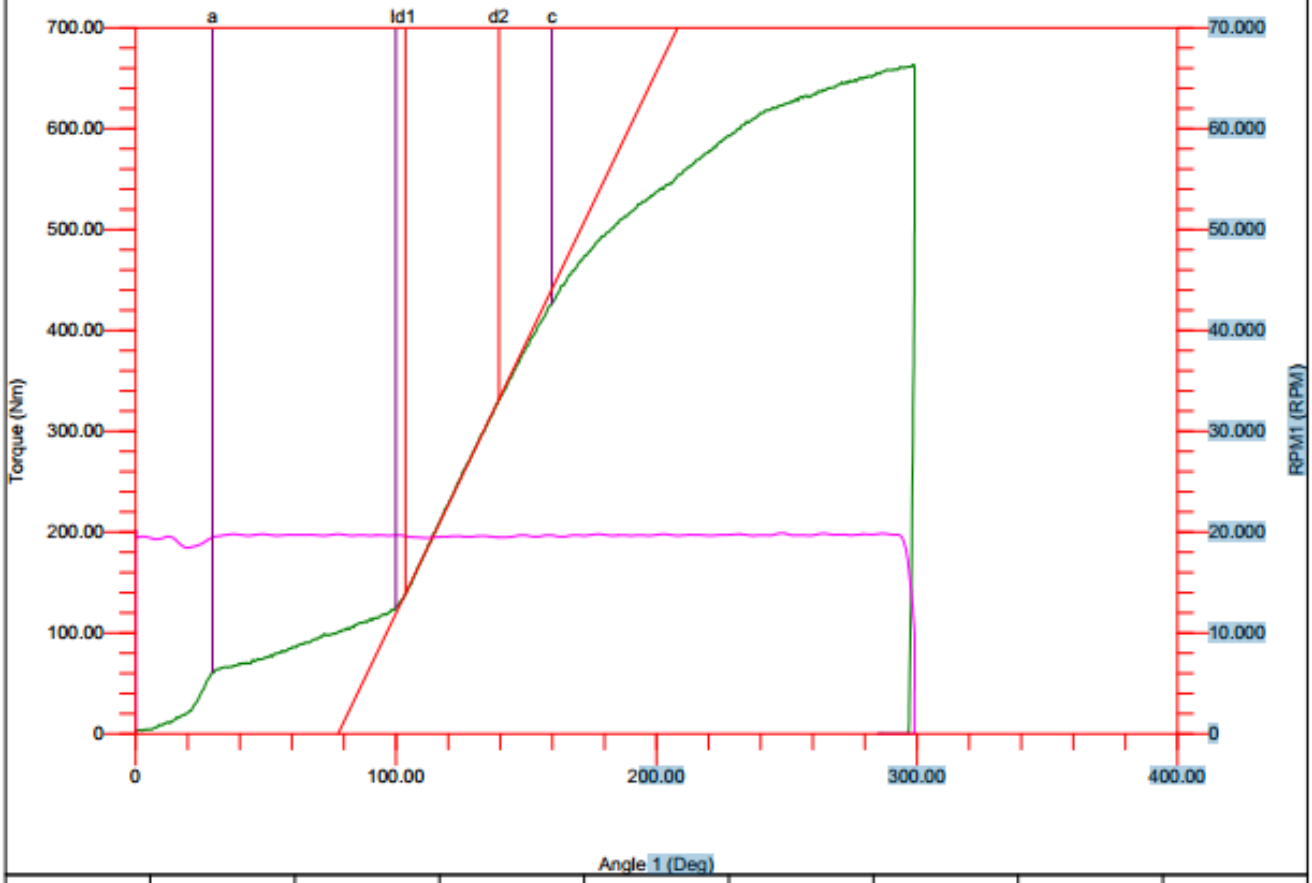
VW PTU Pinion

EQUIPMENT LIST
Recorder: MC900 ID#CO-03
Driver: Stanley E55LB5-2005 ID#TA-26
Transducer: RS 3,000 ft-lb ID#ST-22
Controller: Stanley ID#CD-05

JOINT INFO / REQUESTOR / LAB TECH
Test Order No: N/A
Requestor: [redacted]
Technologist: Joe Angel/Dave Archer
Test Date: 12/16/08

TEST PARTS: Fixtured pinion assembly by client.
DRIVEN FASTENER: M20 Hex Flange Nut
DRIVE STRATEGY: Single stage at 20 RPM to failure.

MODES: Failure by thread strip. Timer halted this rundown. subsequent addtional torque led to thread failure at a peak torque of 813.13 N-m at 119.6 addtional degrees rotation.
OBSERVATIONS: See body of report.



Axis	Channels	Units	_Start gear sea	_End gear sea	Start Thread Yi	d1_Yield	d2_Yield	Yield/Deg
X	Angle 1	Deg	29.500	99.900	159.80	103.60	139.50	1.000
Y1	Torque	Nm	60.969	124.61	426.58	138.77	331.74	5.379
Y2	RPM1	RPM	19.470	19.680	19.680	19.580	19.480	0.0028