

QUALITY ASSURANCE PROVISIONS (QAP)

(PRODUCT ASSURANCE PAM 702-155)

1. COMMAND AGENCY: **U. S. ARMY TANK AUTOMOTIVE RESEARCH, DEVELOPMENT & ENGINEERING CENTER, WARREN, MI 48397-5000**
2. THESE QAPS FORM PART OF DRAWING / SPECIFICATION **12463162** AS SPECIFIED IN THE CONTRACT. INSPECTION SHALL BE CONDUCTED AS SPECIFIED HEREIN AND IN ACCORDANCE WITH REFERENCED DOCUMENTS. THIS INCLUDES GENERAL QUALITY ASSURANCE PROVISIONS (STA FORM 458), WHICH FORMS A PART OF THIS QAP.

3.

PART I - LIST OF APPLICABLE DOCUMENTS

DRAWINGS

10879904 BACKLASH FIXTURE

10880113 TEMPLATE GAGE

STANDARDS

MIL-STD-130 IDENTIFICATION MARKING OF US MILITARY PROPERTY

SPECIFICATIONS

MIL-PRF-2104 LUBRICATING OIL, INTERNAL COMBUSTION ENGINE, COMBAT/TACTICAL SERVICE

MIL-PRF-21260 LUBRICATING OIL, INTERNAL COMBUSTION ENGINE, PRESERVATIVE

MIL-S-45180 SEALING COMPOUND, GASKET, HYDROCARBON FLUID WATER RESISTANT

MIL-PRF-46167 LUBRICATING OIL, INTERNAL COMBUSTION ENGINE, ARCTIC

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REVISIONS

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| 8. QAP FOR: FINAL DRIVE ASSEMBLY | | | | | | | | | | 9. CODE 19207 | | | | | | | | | |
| | | | | | | | | | | M992A2/M109A2/A5/A6 | | | | | | | | | |
| 10. SUBMITTED BY: BARNES & REINECKE, INC. | | | | | | | | | | <i>Linia Y. Yanni</i> | | | | | | | | | |
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PART II - INSPECTION REQUIREMENTS

TABLE I - CLASSIFICATION OF QUALITY CONFORMANCE CHARACTERISTICS

| <u>CLASS</u> | <u>CHARACTERISTIC</u> | <u>ZONE</u> | <u>INSPECTION METHOD</u> |
|------------------------|--|-------------|--------------------------|
| <u>CRITICAL</u> | NONE | | |
| <u>MAJOR</u> | <u>AQL 1.0% DEFECTIVE</u> | | |
| 101 | COMPLETENESS OF ASSEMBLY | ALL | VISUAL |
| 102 | TWO BEARINGS (7527970) INSTALLED AS SHOWN (NOTE 5) | F7 | VISUAL |
| 103 | FUNCTIONAL CLEARANCE CHECK FOR MATING HUB (SIMULATED), TO ASSURE THAT HUB MOUNTED ON SHAFT (10936276-1) WILL HAVE CLEARANCE TO REVOLVE WITH HOUSING AT MMC | --- | GAGE 10880113 |
| <u>MINOR</u> | <u>AQL 2.5% DEFECTIVE</u> | | |
| 201 | COTTER PIN INSTALLED AS SHOWN (NOTE 10) | D3 | VISUAL |
| 202 | ALL BEARING LUBRICATED AND FREE FROM DIRT AND FOREIGN MATERIAL (NOTE 2) | ALL | VISUAL |
| 203 | SEALING COMPOUND APPLIED ON SEALS O.D. (NOTE 4) | F4 | VISUAL |
| 204 | INDICATED OIL SEAL SOAKED BEFORE INSTALLATION (NOTE 4) | F4 | VISUAL |
| 205 | HOUSING FILLED WITH LUBRICANT (NOTE 16) | C17 | VISUAL/TACTILE |
| 206 | SEALANT APPLIED TO ALL GASKETS (4 PLACES) | F9/G7/G6/E3 | VISUAL |
| 207 | IDENTIFICATION MARKING PER MIL-STD-130 (NOTE 15) | A15 | VISUAL |
| 208 | WORKMANSHIP | ALL | VISUAL & TACTILE |

TABLE II - 100% INSPECTION

1. **BACKLASH TEST.** EACH FINAL DRIVE ASSEMBLY SHALL BE SUBJECTED TO THE BACKLASH CHARACTERISTIC LISTED BELOW. SUCCESSFUL COMPLETION OF THE TEST IS REQUIRED BEFORE THE ASSEMBLY IS SUBMITTED TO THE GOVERNMENT FOR ACCEPTANCE.

| <u>NUMBER</u> | <u>CHARACTERISTIC</u> | <u>INSPECTION METHOD</u> |
|---------------|-----------------------|--------------------------|
| 104 | .005 - .012 BACKLASH | REF. PART IV, PARA 1 |

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PART II - INSPECTION REQUIREMENTS (CONTINUED)

TABLE II - 100% INSPECTION (CONTINUED)

2. **RUN - IN REQUIREMENTS.** EACH FINAL DRIVE ASSEMBLY SHALL BE SUBJECTED TO THE RUN - IN REQUIREMENTS LISTED BELOW. SUCCESSFUL COMPLETION OF THE TEST IS REQUIRED BEFORE THE ITEM IS SUBMITTED TO THE GOVERNMENT FOR ACCEPTANCE.

| <u>NUMBER</u> | <u>CHARACTERISTIC</u> | <u>INSPECTION METHOD</u> |
|---------------|---|----------------------------------|
| 105 | RUN - IN TEST (PERFORMANCE, NOISE LEVEL, OVERHEATING AND OIL LEAKAGE) | VISUAL (REF. PART IV, PARA 2) |

TABLE III - SPECIAL SAMPLING INSPECTION

1. **INITIAL PRODUCTION INSPECTION.** ONE (1) OF THE FIRST ITEMS PRODUCED SHALL BE SELECTED AT RANDOM AND SUBJECTED TO EXAMINATIONS AND TESTS BY THE CONTRACTOR. THE ITEM SHALL BE PRODUCED UNDER MANUFACTURING METHODS TO BE USED IN PRODUCTION. INITIAL PRODUCTION INSPECTION SHALL BE ACCOMPLISHED TO DETERMINE CONFORMANCE TO ALL REQUIREMENTS OF DRAWING 12463162.

1.1 **MANUFACTURING PROCESS CHANGE.** WHENEVER A CHANGE IS MADE IN THE MANUFACTURING PROCEDURE USED IN PRODUCTION, ONE (1) OF THE FIRST ITEMS PRODUCED UNDER THE NEW PROCESS SHALL BE GIVEN A COMPLETE INSPECTION AS SPECIFIED IN PARAGRAPH 1.

1.2 **FAILURE.** FAILURE OF THE ITEM TO MEET INITIAL PRODUCTION APPROVAL REQUIREMENTS SHALL BE CAUSE FOR REJECTION AND PARAGRAPH 1 SHALL APPLY UNTIL ACCEPTABLE ITEMS ARE PRODUCED.

2. **IN-PROCESS INSPECTION (TORQUE CONTROL.** DURING NORMAL ASSEMBLY OPERATIONS, TORQUING PROCEDURES USED IN PRODUCTION SHALL BE OBSERVED AND RECORDED TO DETERMINE CONFORMITY TO THE FOLLOWING CHARACTERISTICS.

| <u>CLASS</u> | <u>CHARACTERISTIC</u> | <u>ZONE</u> | <u>INSPECTION METHOD</u> |
|--------------|---|-------------|----------------------------|
| 301 | TORQUE NUT 10898039 TO 450 + 25 LB-FT | E3 | CERTIFIED TORQUE EQUIPMENT |
| 302 | TORQUE SCREWS B1821AH038F100N 35-40 LB-FT (8 PLACES/12 PLACES) | C7/C3 | CERTIFIED TORQUE EQUIPMENT |
| 303 | TORQUE SCREWS B1821AH050F150N 75-80 LB-FT (7 PLACES) | B3 | CERTIFIED TORQUE EQUIPMENT |

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PART II - INSPECTION REQUIREMENTS (CONTINUED)

TABLE III - SPECIAL SAMPLING INSPECTION (CONTINUED)

| <u>CLASS</u> | <u>CHARACTERISTIC</u> | <u>ZONE</u> | <u>INSPECTION METHOD</u> |
|--------------|---|-------------|----------------------------|
| 304 | TORQUE SCREWS B1821AH038F075N 35-40 LB-FT (4 PLACES) | C8/C3 | CERTIFIED TORQUE EQUIPMENT |

2.1 **FREQUENCY**. A MINIMUM OF FOUR (4) EACH INDIVIDUAL TORQUING PERFORMANCES FOR EACH TORQUE REQUIREMENT SHALL BE OBSERVED AT RANDOM INTERVALS DURING EACH PRODUCTION SHIFT TO ASSURE THAT THE TORQUING PROCEDURE IS ADEQUATE TO ATTAIN THE TORQUE VALUES SPECIFIED.

2.2 **TORQUE EQUIPMENT CALIBRATION**. THE CONTRACTOR SHALL HAVE AVAILABLE TO THE GOVERNMENT, GOVERNMENT, A CALIBRATION PROCEDURE FOR THE TORQUE EQUIPMENT TO BE USED IN PRODUCTION. THE PROCEDURE SHALL CONTAIN REQUIREMENTS TO ESTABLISH A STANDARD OF QUALITY CONTROL FOR ACCURACY AND FREQUENCY OF CALIBRATION WITH RECORDED RESULTS OF CALIBRATION OPERATIONS. THE CALIBRATION PROCEDURE SHALL SUFFICE FOR THE REMAINDER OF THE CONTRACT, PROVIDING MANUFACTURING PROCESSES AND TORQUING TECHNIQUES HAVE NOT BEEN CHANGED.

2.3 **FAILURE**. FAILURE OF THE TORQUING PROCEDURE OR EQUIPMENT TO ACCOMPLISH THE SPECIFIED TORQUE REQUIREMENTS SHALL BE CAUSE FOR REJECTION OF ALL ASSEMBLIES OR MAJOR ITEMS CONTAINED IN THE PRODUCTION LOT. TORQUING OPERATIONS PERFORMED SUBSEQUENT TO FAILURE WILL NOT BE OBSERVED FOR ACCEPTANCE UNTIL TORQUING PROCEDURES AND EQUIPMENT HAVE BEEN CORRECTED. ACCEPTANCE OF TORQUING OPERATIONS SUBSEQUENT TO FAILURE SHALL NOT RESUME UNTIL FOUR (4) CONSECUTIVE (EACH CHARACTERISTIC) TORQUING OPERATIONS SUCCESSFULLY MEET THE SPECIFIED REQUIREMENTS.

PART III - CERTIFICATION REQUIREMENTS

| <u>NUMBER</u> | <u>CHARACTERISTIC</u> | <u>CERTIFICATION METHOD</u> |
|---------------|---|-----------------------------|
| 401 | LUBRICANT OIL (MIL-PRF-21260/MIL-PRF-2104/ MIL-L-46167) | CERTIFIED MATERIAL REPORT |
| 402 | SEALING COMPOUND (MIL-S-45180) | CERTIFIED MATERIAL REPORT |
| 403 | ASSEMBLY OF ROLLER BEARING MS19073-37 AND SPUR GEAR 10898041-1 | CERTIFIED PROCESS REPORT |

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PART IV - TEST METHODS AND PROCEDURES

1. **BACKLASH CHECK.** THE DRIVE ASSEMBLY SHALL BE INSTALLED ON THE BACKLASH TEST FIXTURE (P/N 10879904) AS REQUIRED. APPLY 25 LB. FT. TORQUE IN BOTH DIRECTIONS TO ASSURE PROPER TOOTH CONTACT. WITH INDICATOR CLAMPED IN PLACE, AND GEAR SHAFT ZEROED OUT IN A CLOCKWISE DIRECTION, ROTATE INPUT SHAFT BY HAND IN A COUNTERCLOCKWISE DIRECTION, UNTIL CONTACT IS MADE. ZERO TORQUE INDICATOR READING BY THIS POINT SHALL BE .005 TO .012.

2. **RUN - IN TEST.**

A. MOUNT FINAL DRIVE IN THE SAME POSITION AS IN THE VEHICLE (LINES CONNECTING INPUT AND OUTPUT SHAFT CENTER LINES AT 35° - 40° FROM VERTICAL). FILL WITH LUBRICANT (MIL-PRF-21260, M21260-I-SAE 10W TO INSPECTION PLUG LEVEL..

B. OPERATE AT 600-800 RPM ON INPUT SHAFT FOR 6-8 MINUTES. REVERSE ROTATION AND OPERATE AT 600-800 RPM ON INPUT SHAFT FOR 6-8 MINUTES.

C. INCREASE INPUT SHAFT SPEED TO 1400-1600 RPM AND OPERATE FOR 3-5 MINUTES. REVERSE ROTATION AND OPERATE AT 1400-1600 RPM ON INPUT SHAFT FOR 3-5 MINUTES.

D. INCREASE INPUT SHAFT SPEED TO 2800-3000 RPM AND OPERATE FOR 1 TO 3 MINUTES. REVERSE ROTATION AND OPERATE AT 2800-3000 RPM ON INPUT SHAFT FOR 1 TO 3 MINUTES.

E. DURING THE RUN-IN, CHECK FOR IRREGULARITIES IN NOISE LEVEL, OVERHEATING, AND LEAKAGE. DRAIN OIL AFTER TEST.

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