DE HAVILLAND AIRCRAFT OF CANADA LIMITED

PPS 11.10

PRODUCTION PROCESS STANDARD

PROPRIETARY INFORMATION

INHIBITING AND DE-INHIBITING OF PW120 SERIES AND PW150A GAS TURBINE ENGINES

Issue 6
- This standard supersedes PPS 11.10, Issue 5.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS related questions to christie.chung@dehavilland.com or (416) 375-7641.
- This PPS is effective as of the distribution date.

Prepared By: (Christie Chung) May 5, 2020

PPS Group

Approved By: (Stephen Mabee) May 5, 2020

M&P Engineering

Issue 6 - Summary of Changes (over the previous issue)

The following summaries are not detailed and are intended only to assist in alerting PPS users to changes which may affect them. Refer to the applicable sections of this PPS for detailed procedure and requirements.

- Replaced throughout PPS where “Bombardier” is specified with “De Havilland Aircraft of Canada Limited” or “DHC”.
- Specified that AN929-(*) and AN929-(*)D are interchangeable with part number AN929-(*)W as per EO7336.
- Added Disposal of Chemical Wastes section.
- Added Storage section.

TABLE OF CONTENTS

Sections **Page**

Figures

1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for inhibiting (preserving) and de-inhibiting PW120 series and PW150A gas turbine engines (i.e., Pratt & Whitney engine models PW120, PW120A, PW121, PW123 and PW150A).

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS shall be followed to ensure compliance with all applicable specifications. In general, if this PPS conflicts with the engineering drawing, follow the engineering drawing. The requirements specified in this PPS are necessary to fulfil the engineering design and reliability objectives.

1.1.2 Refer to PPS 13.26 for the subcontractor provisions applicable to this PPS.

2 HAZARDOUS MATERIALS

2.1 Before receipt at De Havilland Aircraft of Canada Limited (DHC), all materials shall be approved and assigned Material Safety Data Sheet (MSDS) numbers by the DHC Environment, Health and Safety Department. Refer to the manufacturer's MSDS for specific safety data on any of the materials specified in this PPS. If the MSDS is not available, contact DHC Environment, Health and Safety Department.

3 REFERENCES

3.1 PPS 13.26 - General Subcontractor Provisions.

3.2 PPS 14.01 - Torquing Method and Identification.

3.3 PPS 19.01 - Safetying Devices.

3.4 Engineering Order (EO) 7336 - DM9010.05 Supersession List.

3.5 DASH 8 Maintenance Manual, Volume 8.

3.6 Pratt & Whitney Maintenance Manual 72-00-00.

4 MATERIALS AND EQUIPMENT

4.1 Materials

4.1.1 Desiccant bags (activated), 8 unit size, MIL-D-3464, Type I.

4.1.2 Engine support stand and plywood shipping crate with a transparent window in one end panel to allow viewing of the humidity indicator.

4.1.3 Engine oil, MIL-L-23699.

4.1.4 Heat-sealable envelopes.

4.1.5 Humidity indicators, R2156.

4.1.6 Inhibiting oil, MIL-L-6081, Grade 1010.

4.1.7 Steel strapping, 3/4" wide.

4.1.8 Plastic sheet, suitable for catching and draining oil from engine.

4.1.9 Five imperial gallon and one imperial gallon pails.

4.2 Equipment

4.2.1 Drain fitting, PWC37772.

4.2.2 Cover puller (e.g., PWC37651).

4.2.3 Oil supply rig capable of filtering oil through a 5 micron filter and supplying the filtered oil at 5 to 25 psi and 60°F for engines not installed in aircraft, or locally manufactured rig for engines installed in aircraft (see section 9).

4.2.4 Oven capable of sustaining 260°F ±15°F.

4.2.5 Iron for sealing heat-sealable envelopes.

4.2.6 Strapping tool, 3/4" wide.

4.2.7 Suction device (vacuum) for evacuation of air from heat-sealable envelopes.

4.2.8 AN929-6D and AN929-10D blanking caps & AN806-6D and AN806-10D blanking plugs.

4.2.8.1 AN929-(*)D blanking caps are interchangeable with AN929-(*)W blanking caps as specified by DM9010.05 Supersession List (EO7336).

5 PROCEDURE

5.1 Inhibiting for Shipping or Storage

5.1.1 Inhibit PW120 series and PW150A gas turbine engines for shipping or storage as follows:

Step 1. Inhibit the fuel and oil systems as specified in section 5.3 and section 5.4.

Step 2. Enclose the lower half of the engine in a heat-sealable envelope. Bolt the engine to the mounting brackets and to the engine support stand (see Figure 1).

Step 3. Evenly space 12 activated desiccant bags around the engine.

Step 4. Enclose the remaining portion of the engine in the envelope and heat seal along the top of the envelope using the iron, leaving one corner temporarily unsealed to allow for evacuation of air from the envelope.

Step 5. Evacuate the air from the envelope, fold and heat seal the corner.

Step 6. Install the end plywood section of the storage container so that the opening for the transparent panel is aligned with the humidity indicator (see Figure 2).

Step 7. Install the remaining panels of the storage container with steel strapping.

Step 8. Mark the model, serial number and preservation date on both ends of the container.

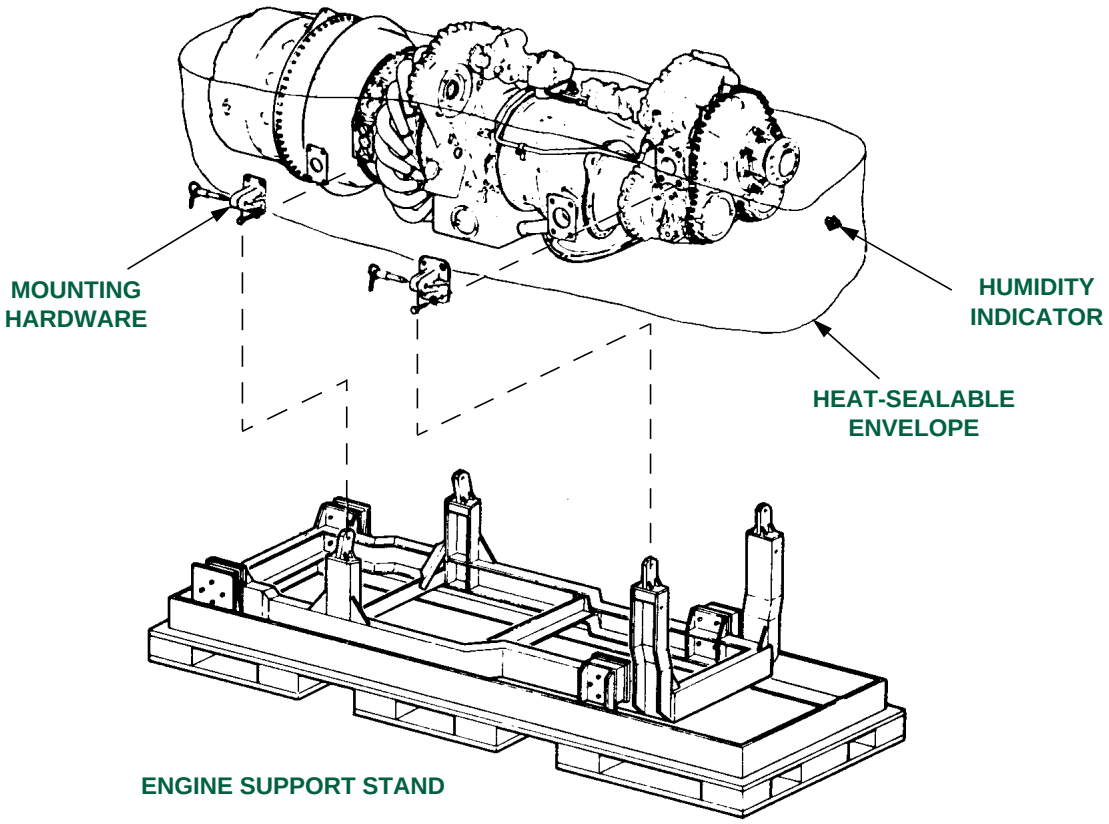

FIGURE 1 - ENGINE MOUNTED ON SUPPORT STAND

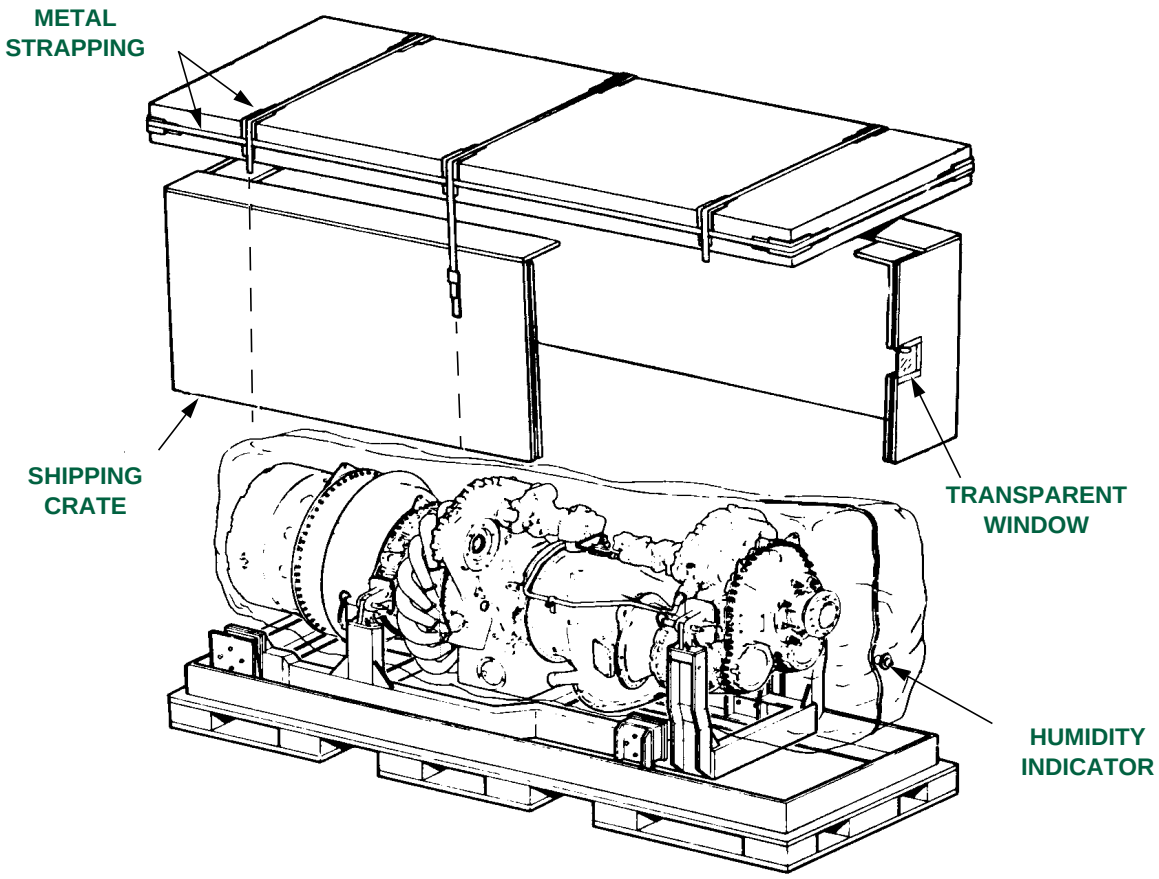

FIGURE 2 - ENGINE IN STORAGE CONTAINER

5.2 Inhibiting Installed Engines

5.2.1 If engines are to be inactive for 7 consecutive days or less, they require no preservation protection provided that the engine is sheltered, humidity is not excessively high and the engine is not subjected to extreme temperature changes which could produce condensation. If these conditions cannot be met, evenly space 12 desiccant bags around the engine, place humidity indicators in the intake and exhaust ducts and seal those ducts with covers that allow observation of the humidity indicators.

5.2.2 If engines are to be inactive for 8 to 28 consecutive days, evenly space 12 desiccant bags around the engine, place humidity indicators in the intake and exhaust ducts and seal those ducts with covers that allow observation of the humidity indicators.

5.2.3 If engines are to be inactive for 29 to 90 consecutive days, in addition to the steps specified in paragraph 5.2.2, inhibit the fuel system according to section 5.3.

5.2.4 If engines are to be inactive for more than 90 consecutive days, in addition to the steps specified in paragraph 5.2.2 and paragraph 5.2.3, inhibit the oil system according to section 5.4 and spray all exposed accessory drives with engine oil.

5.2.5 For engines removed from the aircraft and to be stored for up to 90 days, in addition to the steps specified in paragraph 5.2.2, inhibit the fuel system according to section 5.3.

5.3 Inhibiting Fuel Systems

5.3.1 Inhibit the fuel system as follows:

Step 1. Close the engine fuel supply valve.

Step 2. Pull and lock right essential circuit breakers K2, L2 (fuel shutoff); F2, G2 (firex); and L5 (ignition shutoff). Pull and lock left essential circuit breaker J5 (ignition shutoff).

Step 3. Disconnect and blank off the fuel feed hose to the engine (For all PW120 series engines, see Figure 3. For PW150A engines, see Figure 4).

Step 4. For PW123 engines, disconnect and cap the downstream end of the pressure line at the joint located outboard of the scavenge filter.

For PW120, PW120A, PW121 and PW150A engines, disconnect the line at the top of the fuel flow transmitter and cap the downstream end.

For all PW120 series engines, in addition to the above, disconnect the motive flow pressure line at the hydro mechanical metering unit (H.M.U.) and plug both ends of the line and cap the H.M.U. union.

For PW150A engines, disconnect the line at the top of the fuel flow transmitter and cap the downstream end. Also cap both ends of the motive flow pressure line at the Fuel Control Unit (F.C.U.).

Step 5. Connect the oil line from the supply rig (or locally manufactured rig) to the fuel inlet on the fuel heater (on the F.C.U. for PW150A engines).

Ensure preservative oil does not enter the engine where it could come into contact with the T6 thermocouple probe assembly. Oil contamination of thermocouple probes could cause complete failure of the ITT temperature indicating system.

Ensure that foreign material does not enter the fuel system.

Step 6. For PW123 engines, connect the purge hose to the pressure line at the joint outboard of the scavenge filter location.

For PW120, PW120A and PW121 engines, connect the purge hose to the bottom fitting of the fuel flow transmitter.

For PW150A engines, connect the purge hose to the top fitting of the fuel flow transmitter.

Step 7. With the ignition off, motor the engine using the electric starter. Move the H.M.U. lever (move the condition lever for PW150A engines) from the closed position to the open position (until oil flows from the purge hoses) and then back to the closed position. Observe starter limitations.

Step 8. Remove the oil hose and cap both ends of the line at the joint.

Step 9. Cap the inlet reducer to the fuel filter. For PW150A engines, omit this step.

Step 10. Using red tags, tag the fuel feed line, the motive flow line and the fuel supply line near each cap with the date of preservation.

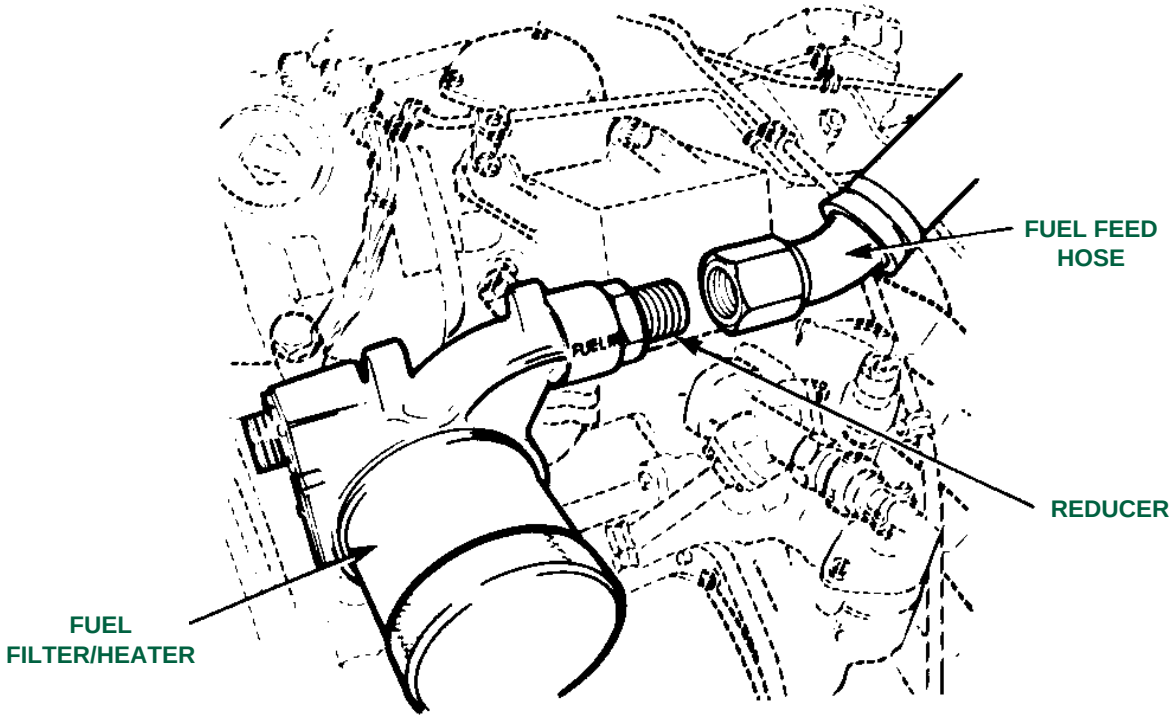

FIGURE 3 - PW120 SERIES ENGINES FUEL FEED HOSE CONNECTION

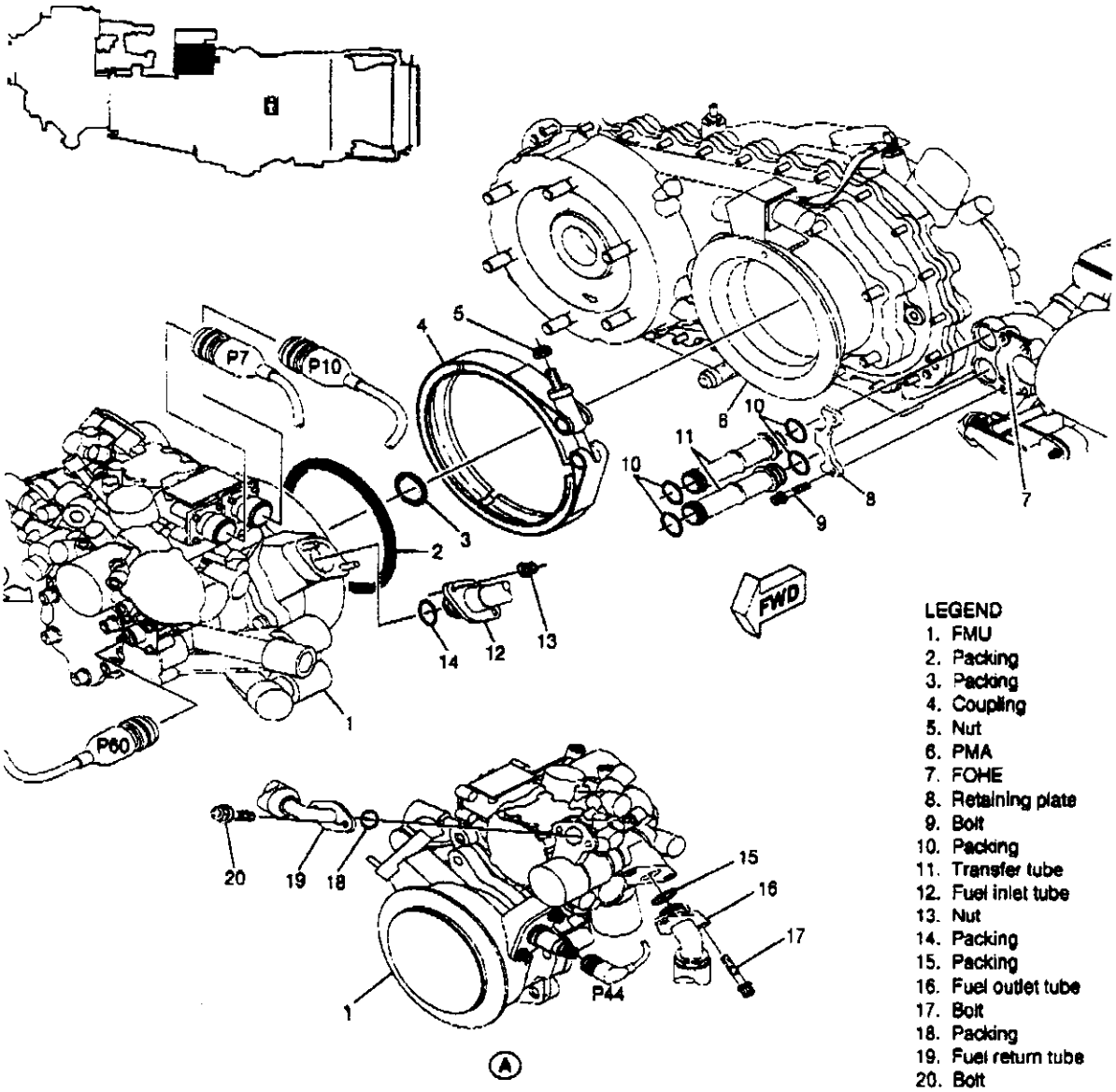

FIGURE 4 - PW150A ENGINES FUEL FEED HOSE CONNECTION

5.4 Inhibiting Oil Systems

5.4.1 Inhibit PW120, PW120A and PW121 engine oil systems as follows (see Figure 5):

Step 1. Lower the engine cowl and install protective cover. Hang an appropriately sized plastic sheet from the cowl in such a manner as to catch and funnel oil dripping from the engine into a 5 Imp. gallon (25 L) pail.

Step 2. Loosen the propeller drain cover nuts to the ends of the studs without removing the top nut. Gently pull out the cover from the reduction gearbox using the cover puller until oil just begins to flow. Control the flow of oil using light finger pressure.

Step 3. Remove the 2 nuts or bolts (as applicable) from each of the mounting plates of the reduction gearbox chip detector and the turbomachinery chip detector.

Step 4. Gently pull each chip detector mounting plate assembly out until oil just begins to flow (do not remove the chip detector itself). If the assembly is removed too quickly, the oil will burst outwards in a heavy stream. The rate of oil flow can be controlled by the amount that the assembly is pulled out. Take care to catch the internal screen that will fall out when the assembly is removed.

Step 5. Allow the oil to drain to a slow drip.

Step 6. Submit an oil sample to the DHC Materials Laboratory for analysis of acidity number and moisture content. If the total acid number is 0.2 mg KOH/g greater than the level given in the Pratt & Whitney Maintenance Manual 72-00-00 or the water content is more than 800 ppm by weight or volume, add and re-circulate new oil to the engine and then, drain the new oil as above.

Step 7. Lubricate a new packing for the propeller drain cover with oil and install the packing on the cover.

Step 8. Re-install the cover, washers and nuts on the reduction gearbox.

Step 9. Torque the nuts to 32 - 36 inch pounds according to PPS 14.01.

Step 10. Re-install the chip detector mounting plate assembly in the reduction gearbox and turbomachinery gearbox.

Step 11. Torque the nuts to 32 - 36 inch pounds according to PPS 14.01.

Step 12. If required, lockwire each chip detector boss according to PPS 19.01.

Step 13. Tag the oil filler cap with the date of preservation.

Step 14. Drain oil cooler to a slow drip (e.g., 1 drip/5 seconds).

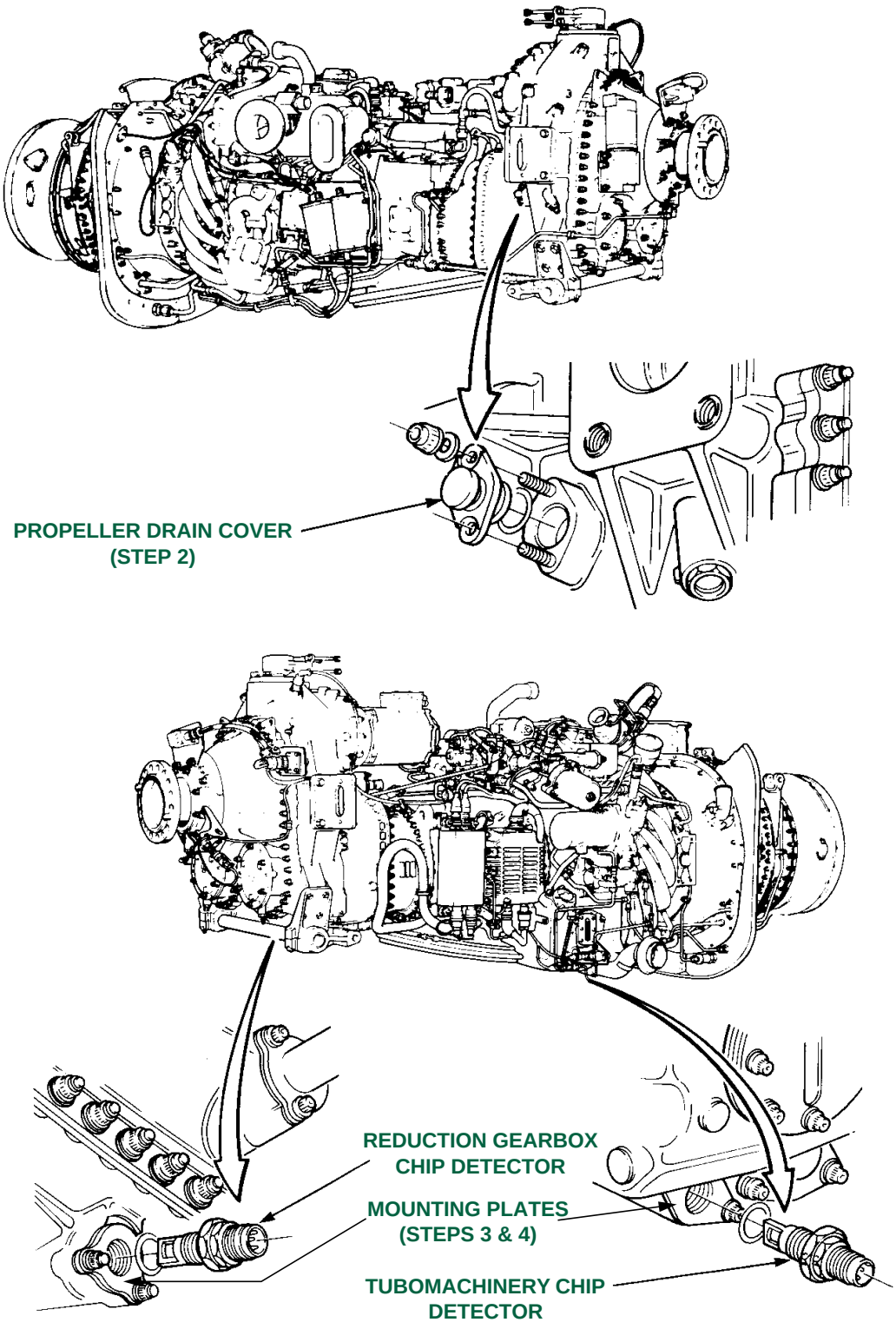

FIGURE 5 - OIL DRAINING PW120, PW120A & PW121 ENGINES

5.4.2 Inhibit the PW123 engine oil system as follows (see Figure 6):

Step 1. Lower the engine cowl and install protective cover. Hang an appropriately sized plastic sheet from the cowl in such a manner as to catch and funnel oil dripping from the engine into a 5 Imp. gallon (25 L) pail.

Step 2. Loosen the bolts in the turbomachinery drain plug mounting plate (not the plug itself) just past the locking element (leaving a few threads still engaged).

Step 3. Carefully pull the mounting plate assembly out past the O-ring until oil begins to flow out. Control the rate of oil flow by the amount that the assembly is pulled out.

Step 4. Loosen the nuts from the propeller oil reservoir drain cover on the reduction gearbox. If necessary, remove the lower nut only. Gently pull out the cover until the oil begins to drain. Control the rate of oil flow with finger pressure on the cover.

Step 5. Remove the 2 nuts from the mounting plate of the reduction gearbox chip detector.

Step 6. Gently pull the mounting plate assembly out until oil begins to flow (do not remove the chip detector itself). If the assembly is removed too quickly, the oil will burst out in a heavy stream. The rate of oil flow can be controlled by the amount that the assembly is pulled out. Eventually, the entire assembly can be removed. Take care to catch the internal screen that will fall out when the assembly is removed.

Step 7. Allow the oil to drain to a slow drip.

Step 8. Submit an oil sample to the DHC Materials Laboratory for analysis of acidity number and moisture content. If the total acid number is 0.2 mg KOH/g greater than the level given in the Pratt & Whitney Maintenance Manual 72-00-00 or the water content is more than 800 ppm by weight or volume, add and re-circulate new oil to the engine and then, drain the new oil as above.

Step 9. Re-install the screen and chip detector assembly in the reduction gearbox.

Step 10. Torque the nuts to 32 - 36 inch pounds according to PPS 14.01.

Step 11. Lockwire the chip detector boss to the engine according to PPS 19.01.

Step 12. Re-install the plug mounting plate in the turbomachinery housing and torque the bolts to 32 - 36 inch pounds according to PPS 14.01.

Step 13. Lockwire the plug according to PPS 19.01.

Step 14. Lubricate a new packing with oil and install it on the propeller drain cover.

Step 15. Re-install the cover, washers and nuts on the reduction gearbox.

Step 16. Torque the nuts to 32 - 36 inch pounds according to PPS 14.01.

Step 17. Tag the oil filler cap with the date of preservation.

Step 18. Drain oil cooler to a slow drip (e.g., 1 drip/5 seconds).

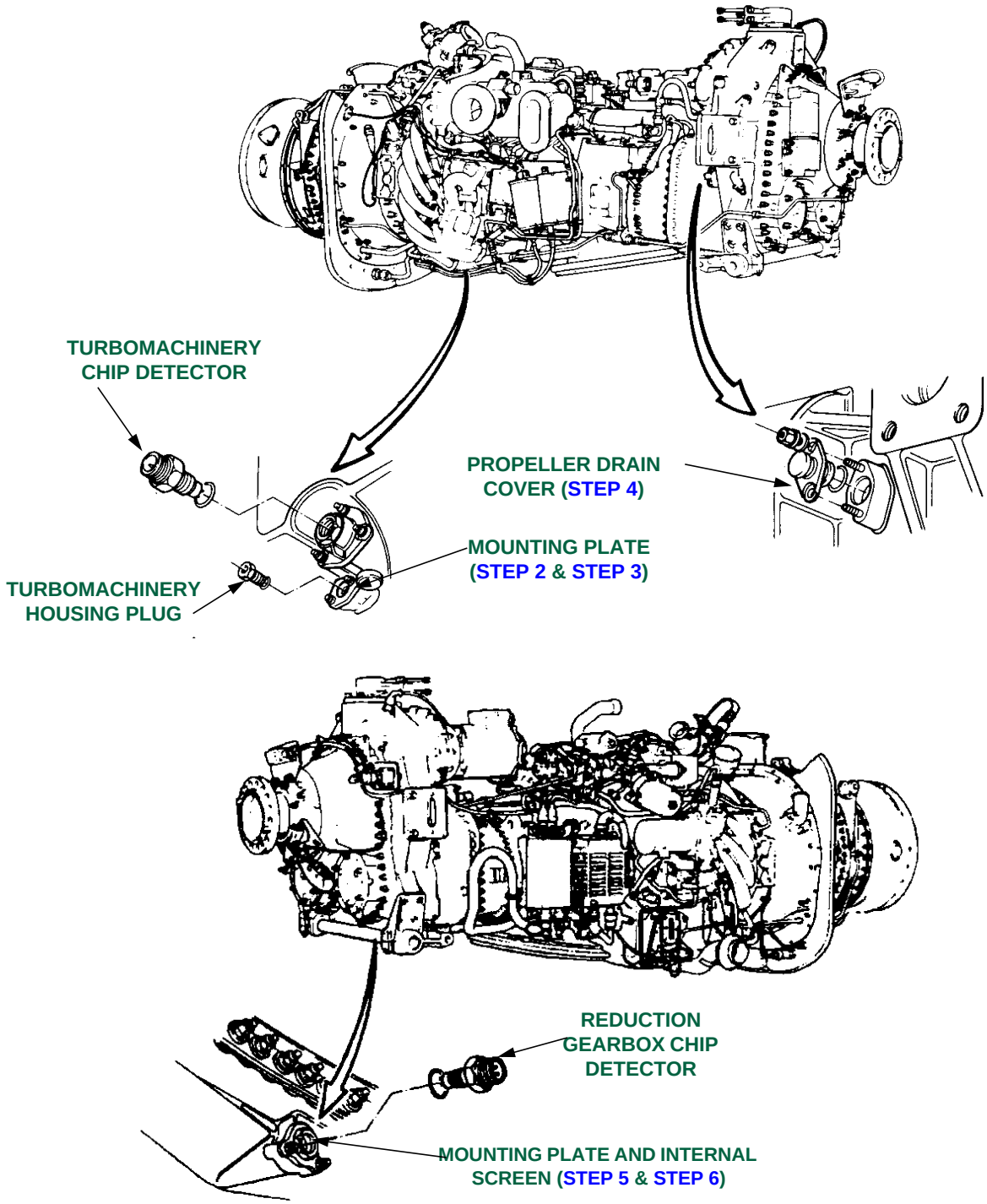

FIGURE 6 - OIL DRAINING PW123 ENGINES

5.4.3 Inhibit PW150A engine oil systems as follows (see Figure 7):

Step 1. Lower the engine cowl and install protective cover. Hang an appropriately sized plastic sheet from the cowl in such a manner as to catch and funnel oil dripping from the engine into a 5 Imp. gallon (25 L) pail.

Step 2. Remove the 2 nuts or bolts (as applicable) from each of the mounting plates of the reduction gearbox (RGB) chip detector and the turbomachinery drain cover.

Step 3. Gently pull the RGB chip detector mounting plate assembly and the turbomachinery drain cover out until oil just begins to flow (do not remove the chip detector itself). If the assembly is removed too quickly, the oil will burst outwards in a heavy stream. The rate of oil flow can be controlled by the amount that the assembly is pulled out. Take care to catch the internal screen that will fall out when the assembly is removed.

Step 4. Allow the oil to drain to a slow drip.

Step 5. Submit an oil sample to the DHC Materials Laboratory for analysis of acidity number and moisture content. If the total acid number is 0.2 mg KOH/g greater than the level given in the Pratt & Whitney Maintenance Manual 72-00-00 or the water content is more than 800 ppm by weight or volume, add and re-circulate new oil to the engine and then, drain the new oil as above.

Step 6. Lubricate a new packing for the RGB chip detector and the turbomachinery drain cover with oil and install the packing on the cover.

Step 7. Re-install the RGB chip detector mounting plate and the turbomachinery drain cover, washers and nuts.

Step 8. Torque the nuts to 32 - 36 inch pounds according to PPS 14.01.

Step 9. Re-install the RGB chip detector.

Step 10. Tag the oil filler cap with the date of preservation.

Step 11. Drain oil cooler to a slow drip (e.g., 1 drip/5 seconds).

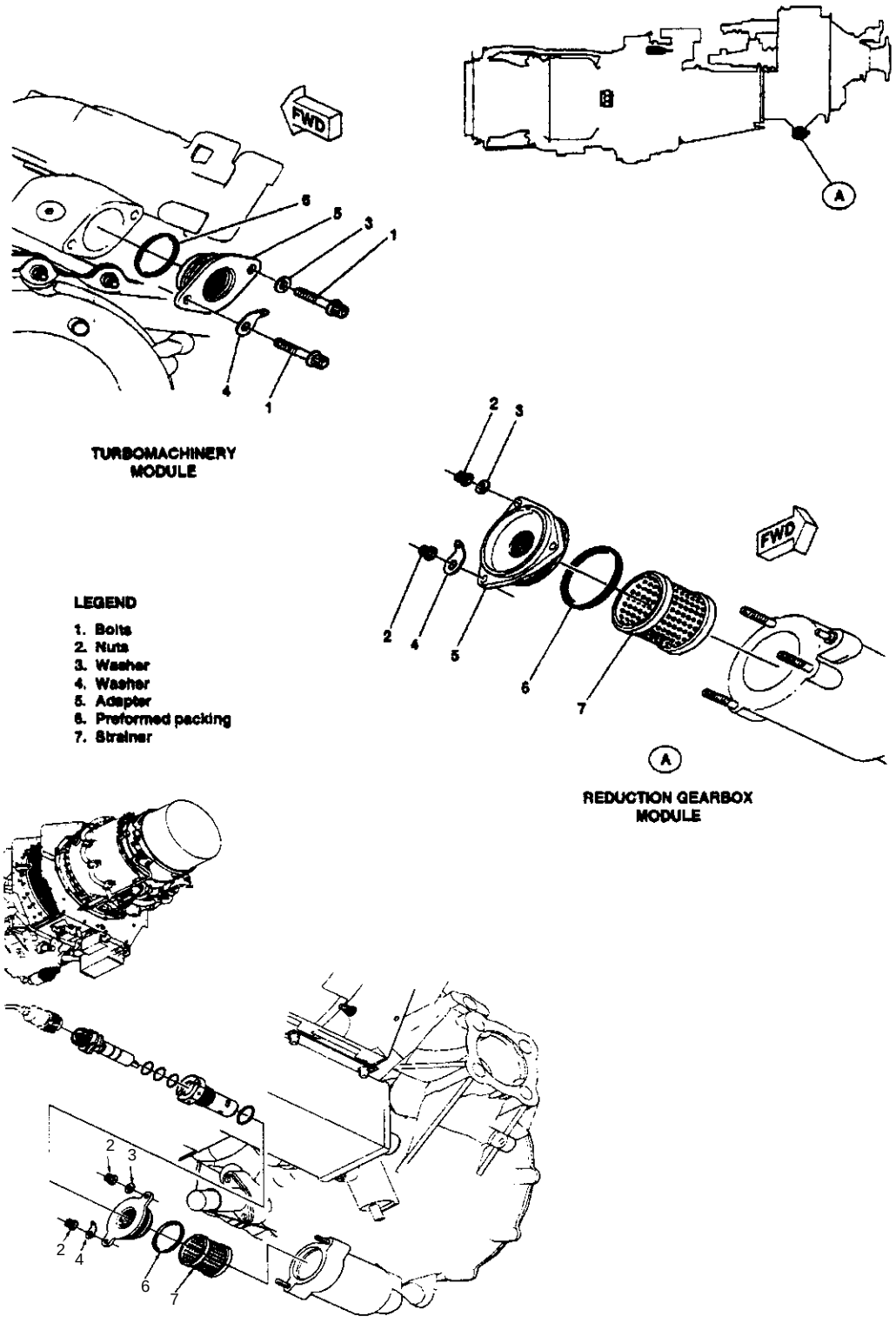

FIGURE 7 - OIL DRAINING PW150A ENGINES

5.5 Re-Activating Desiccant and Humidity Indicators

5.5.1 Re-activate pink humidity indicators and the associated desiccant as follows:

Step 1. Place humidity indicators in a 250°F ±5°F oven until the indicator turns blue.

Step 2. Place desiccant in a 260°F ±15°F oven for 12 hours.

Step 3. Allow the humidity indicators and desiccant to cool to room temperature.

Step 4. Place the humidity indicators and desiccant in separate, evacuated, heat-sealed polyethylene envelopes for later use.

5.6 De-Inhibiting Engines

5.6.1 De-inhibit PW120 series and PW150A gas turbine engines as follows:

Step 1. Remove desiccant, shipping covers, caps and plugs from the engine.

Step 2. If the desiccant has turned pink, check the engine for signs of corrosion.

Step 3. Fill engine with oil. If the old engine oil is not of the same brand (e.g., changing from Esso to Mobil engine oil), drain before filling with new oil.

Step 4. Perform a hydro mechanical fuel control unit de-inhibiting motoring run according to the DASH 8 Maintenance Manual, section 71-00-00.

6 REQUIREMENTS

6.1 Inhibiting and de-inhibiting of PW120 series and PW150A engines shall conform to the procedures specified herein.

6.2 Check the humidity indicators on inhibited engines as follows:

- if stored outdoors, every two weeks
- if stored indoors, every 30 days

6.3 Replace humidity indicators that have turned pink along with all of the used desiccant that the humidity indicator represents.

7 DHC SAFETY PRECAUTIONS

7.1 The safety precautions specified herein are specific to DHC to meet Canadian Federal and Provincial government environmental, health and safety regulations.

7.2 Observe standard plant safety precautions when performing the procedure specified herein.

8 PERSONNEL REQUIREMENTS

8.1 Personnel responsible for inhibiting and de-inhibiting PW120 series and PW150A engines shall have a good working knowledge of the applicable procedure and requirements as specified herein and shall have exhibited their competency to their supervisor.

9 MAKING A SUPPLY RIG FOR INSTALLED ENGINES

9.1 Use a 7/16" drill to drill a hole through the centreline of an AN929-10D or AN929-10W blanking cap. Tap the hole with a 1/8" NPT-27 tap and thread an AN841 hose nipple into the blanking cap. Attach a 12" to 18" long Tygon tube to the hose nipple.

9.2 To supply oil to the engine, drop the free end of the Tygon hose into a 1 gallon pail of inhibiting oil propped on the engine strut and connect the threaded end to the fuel inlet on the fuel heater as specified in paragraph 5.3.1.

10 DISPOSAL OF CHEMICAL WASTES

10.1 Dispose of all chemical wastes according to national legislation and local regulations. At DHC, dispose of chemical wastes according to EHS-OP-005.

10.2 At DHC, dispose of chemical contaminated work clothes, rags, etc., into Red Containers labelled “Waste Rags”.

11 STORAGE

11.1 Always use the oldest stock first (i.e., first in/first out (FIFO) basis).