BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 2.27

PRODUCTION PROCESS STANDARD

Installation of Lee Plugs and Jets

Issue 9
- This standard supersedes PPS 2.27, Issue 8.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS related questions to PPS.Group@aero.bombardier.com or (416) 375-4365.
- This PPS is effective as of the distribution date.

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	Quality	

Signed original on file. Validation of paper prints is the responsibility of the user.

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1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for installation of Lee Plugs and Jets.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS must 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.

1.1.3 Procedure or requirements specified in a Bombardier BAPS, MPS, LES or P. Spec. **do not** supersede the procedure or requirements specified in this PPS.

2 Hazardous Materials

2.1 Before receipt at Bombardier Toronto (de Havilland), all materials must be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto (de Havilland) 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 the Bombardier Toronto (de Havilland) Environment, Health and Safety Department.

3 References

3.1 PPS 1.09 - Drilling and Reaming.

3.2 PPS 6.12 - Pressure Testing Hydraulic Components, Fuel and Bleed Air Lines on DHC-7 and Subsequent Aircraft including Learjet Model 45.

3.3 PPS 13.26 - General Subcontractor Provisions.

3.4 PPS 15.01 - Part Marking of Aircraft Parts and Assemblies.

3.5 PPS 34.03 - Application of Polyurethane Enamel (F24 & F37).

3.6 PPS 32.02 - Manual Application of Chemical Conversion Coatings.

3.7 PPS 34.41 - Application of Epoxy-Polyamide Enamel (F22).

4 Materials and Equipment

4.1 Materials

4.1.1 Lee hydraulic inserts as specified on the engineering drawing. Protect Lee inserts from dust, dirt, moisture or excessive heat and, if possible, store in their original packaging until they are installed. Refer to Figure 1, Figure 2, Figure 3 and Figure 4 for a part number breakdown for Lee Plug, Lee Plug Jet, Lee Jet & Lee High Watt Jet and Lee Visco Jet inserts, respectively.

4.2 Equipment

4.2.1 Lee Plug installation/removal tool kit, SD8905.

4.2.2 Lee Jet installation/removal tool kit, SD8904.

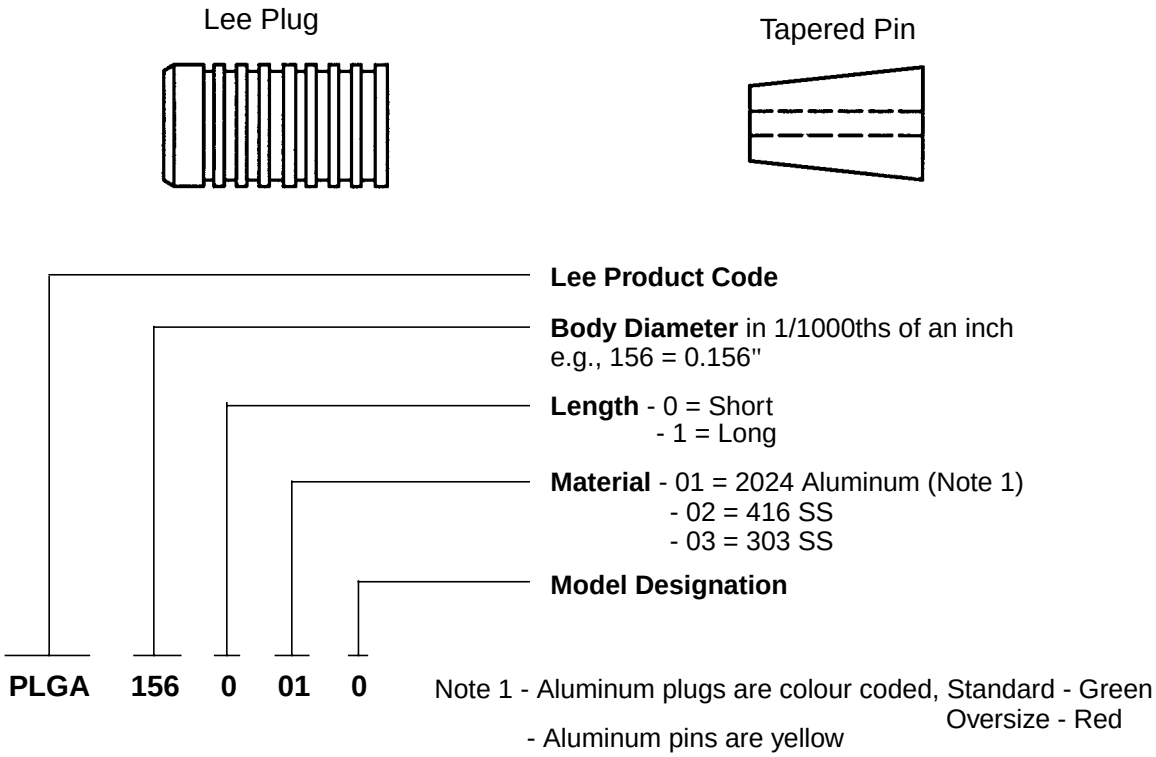

Figure 1 - Lee Plug Part Number Breakdown

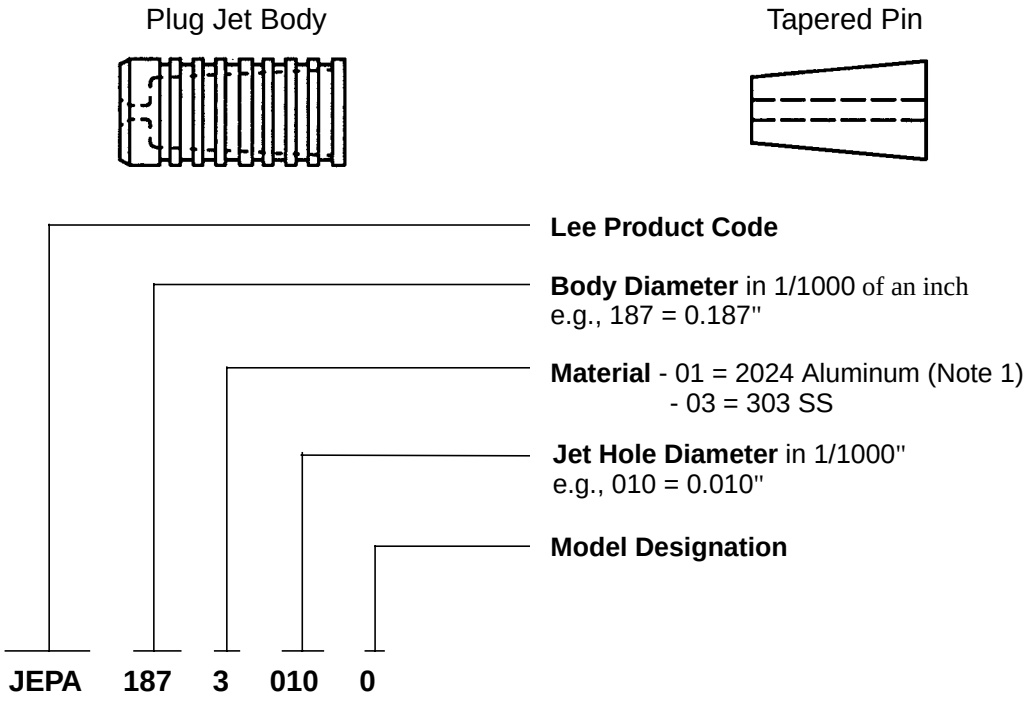

Figure 2 - Lee Plug Jet Part Number Breakdown

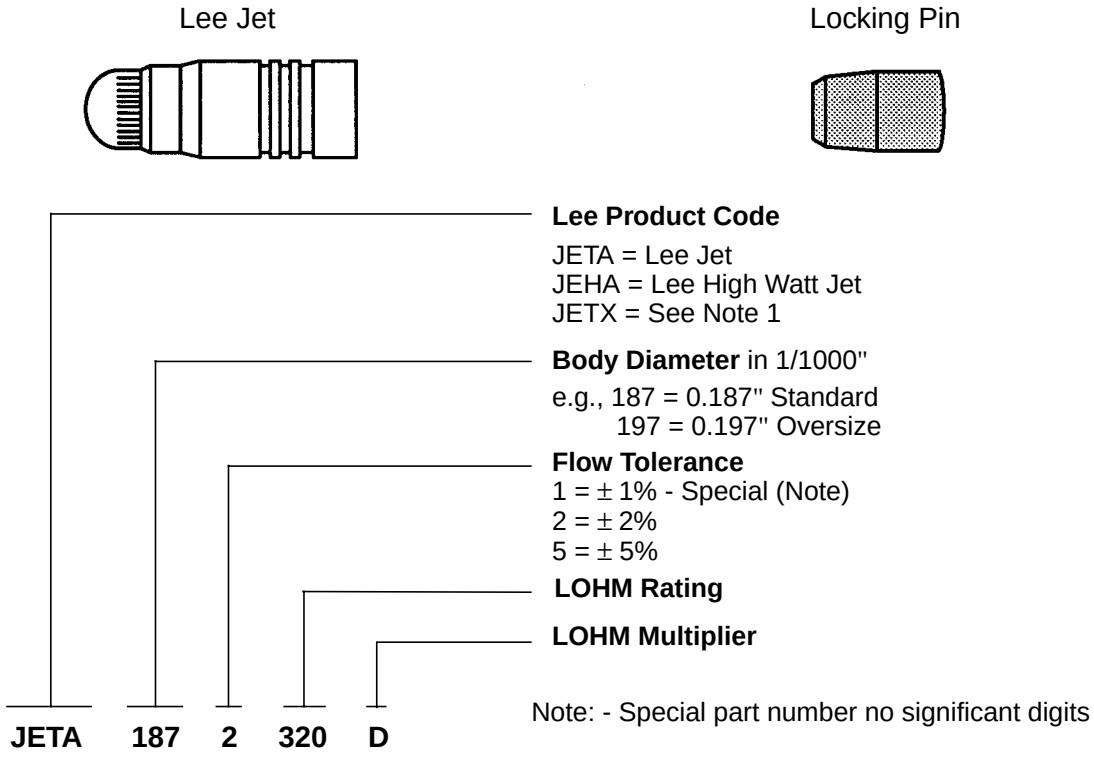

Figure 3 - Lee Jet and Lee High Watt Jet Part Number Breakdown

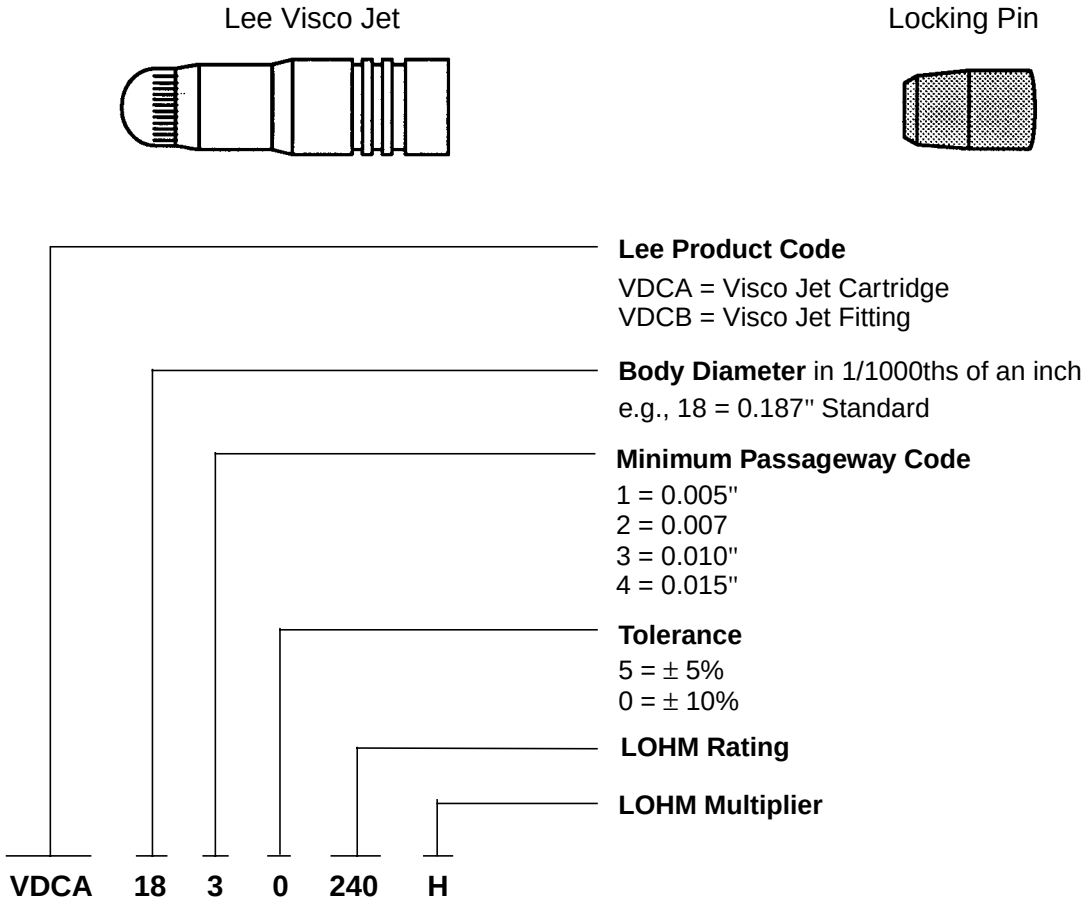

Figure 4 - Lee Visco Jet Part Number Breakdown

5 Procedure

5.1 General

5.1.1 Lee hydraulic inserts are cylindrical plugs, jets, or restrictors which are inserted into fluid system components to prevent, restrict or control fluid flow. After insertion in the component, a tapered pin driven into the hollow body of the insert results in a controlled expansion of the body which cause a series of annular rings or lands on the outside of the insert to bite into the surrounding material to seal and retain the insert in the component.

5.1.2 It is important that the procedure specified herein is followed closely, as the ability of the insert to perform its primary function in the component is directly related to the quality of the prepared hole and the care taken during installation.

5.1.3 Lee inserts are pre-waxed by the manufacturer to facilitate proper installation. Protect the inserts from dust, dirt, moisture or excessive heat. Keep inserts in their original packaging until they are installed. Under no circumstances are inserts to be degreased, solvent washed or applied with any form of additional lubricant to either the insert body or tapered pin.

5.1.4 Lee Plugs and Lee Plug Jets are identical in form and differ only in their design function. The plug is used to blank off or seal a fluid passageway and the plug jet has a close tolerance hole in the plug body to control or restrict fluid flow in the passageway. To simplify instructions consider the term Lee PLugs used herein to include Lee Plug Jets.

5.1.5 Lee Jets, Lee High Watt Jets and Visco Jet inserts are similar in form consisting of a cartridge type insert incorporating screens, check valves, springs and chambered orifices to provide specific fluid control in fluid system components. To simplify instructions consider the term Lee Jet used herein to include all Lee cartridge type inserts.

5.1.6 For parts requiring anodizing, anodize after hole preparation.

5.2 Insert Hole Preparation

5.2.1 Refer to the engineering drawing for the location, angle, diameter and depth of insert mounting holes. Drill and ream holes according to PPS 1.09. Ream insert mounting holes to final size using a reamer ground to 45° seat angle with a 0.003" maximum fillet radius (see Figure 5). Ream holes for oversize (O/S) inserts 0.010" larger than the standard hole tolerance and to the same depth as the standard insert hole.

5.2.2 Check all finished holes to ensure that they are within the tolerances specified on the engineering drawing. Also ensure that the installation hole finish is within 32 to 63 micro inches circular lay with no longitudinal scratch marks and the maximum allowable tapered, bell-mouthed or out-of-round condition is no more than 0.0003".

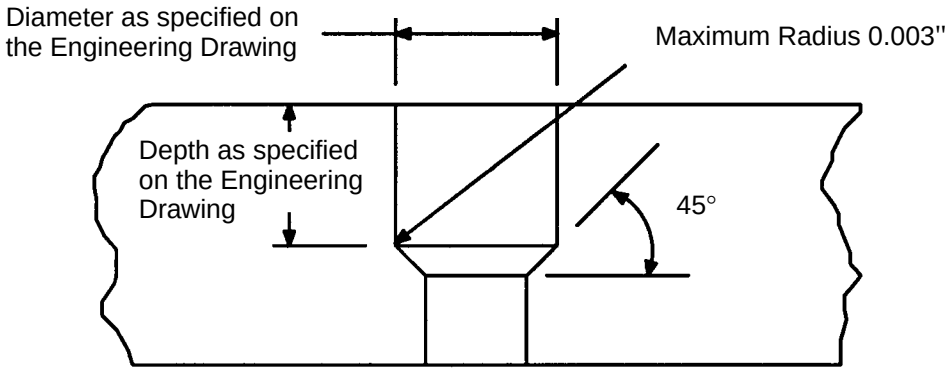

Figure 5 - Hole Preparation - General

5.3 Installation of Lee Plugs

5.3.1 Install Lee plugs as follows (see Figure 6):

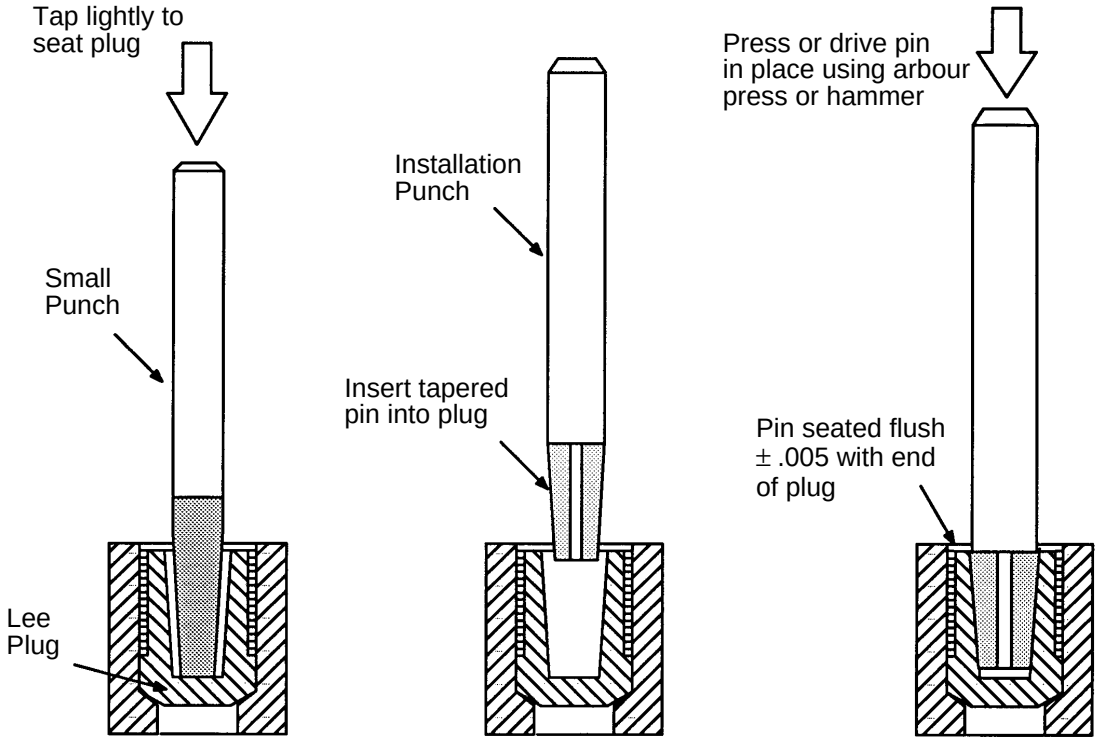

Figure 6 - Installation of Lee Plugs

Step 1. Ensure that the reamed hole is clean and dry.

Step 2. Check that the plug part number corresponds to the part number called up on the engineering drawing or shop order.

Step 3. Insert the plug and push it into the mounting hole until it is firmly seated on the support shoulder. If required, lightly tap the plug in place using a small punch that bottoms at the base of the plug I.D., to ensure positive seating of the plug on the support shoulder.

Step 4. Insert the pin, small end first, into the tapered hole of the plug and press or drive the pin in place using the punch listed in Table 1 for the size Lee plug being installed. If a press is used, a hand arbour press is recommended so that the operator can feel when the pin is flush with the plug as the punch bottoms against the back of the plug. Apply only sufficient pressure to seat the pin flush with the plug. If a hammer is used, a few sharp blows will quickly set the pin flush with the body, whereas a succession of light blows will tend to mushroom the end of the pin. Support the part when driving the pin. Do not apply additional lubrication to the plug or pin.

Step 5. Check that the installed pin is flush within 0.005" of the end of the plug.

5.4 Removal of Lee Plugs

5.4.1 If necessary, remove Lee Plugs as follows (see Figure 7):

Step 1. Drill out the pin completely using the tap drill listed in Table 1.

Step 2. Tap the plug body using the tap set listed in Table 1 for the size Lee Plug. Use a standard plug type tap for threading of the plug body, followed by a bottoming type tap to ensure sufficient thread engagement of the extraction bolt to pull the plug body out of the component.

Step 3. Select the appropriate striker and extraction bolt from Table 1 for the size Lee Plug. Assemble the striker onto the bolt and carefully thread the bolt into the tapped plug body. Fully tighten the bolt in the plug using finger pressure only.

Step 4. Using the sliding striker on the extraction bolt, tap the plug back out of the hole. The recommended technique for using the sliding striker and extraction bolt is to support the bolt by firmly gripping it near the insert with one hand while flipping the striker against the bolt head to produce a series of sharp impact blows. Ensure that the striker is not pushed sideways during removal as this may bend or break the extraction bolt. Discard the Lee plug after removing.

Step 5. After plug removal, examine the insert hole for roughness or longitudinal scratches. If the bore of the hole appears satisfactory and the hole diameter is within the original drawing tolerance, it is acceptable to use a new plug without rework of the hole. If the hole appears damaged or is out of tolerance, refer to Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) MRB delegated MRB for written approval to install an oversize plug.

Table 1 - Lee Plug Installation/Removal Tools - Tool Kit SD8905

LEE PLUG DIA. (Note 1)	INSTALLATION PUNCH DIA.	TAPPING DATA (Note 2)		EXTRACTION TOOLS	
		TAP DRILL	TAP SET	STRIKER	BOLT
0.156"	9/64" (0.140")	No. 13 (0.113")	6-40 UNF	CUTA1015403B	CUTA2075503B
0.187"	11/64" (0.171")	No. 29 (0.136")	8-36 UNF		CUTA2095503B
0.218"	13/64" (0.205")	No. 22 (0.157")	10-32 UNF		CUTA2105403B
0.250"	15/64" (0.234")	No. 8 (0.199")	1/4-20 UNF		CUTA2115503B

Notes 1. Contact the PPS group for tooling information for Lee plug sizes not listed.
2. Each tap set consists of a plug type tap and a bottoming type tap.

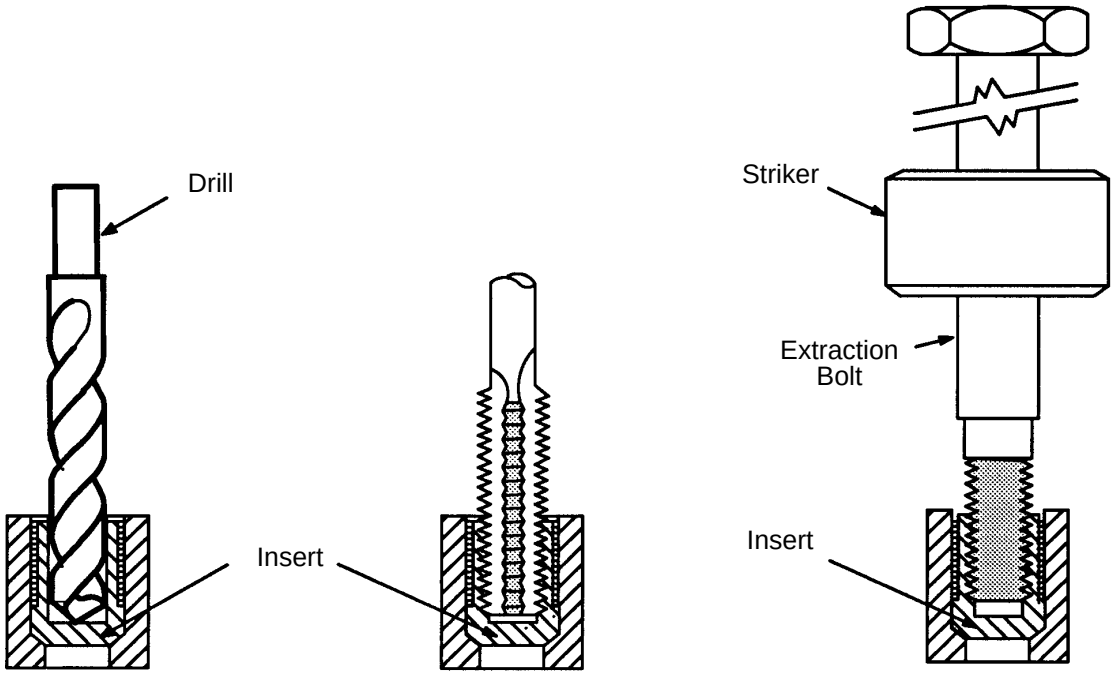

Figure 7 - Removal of Lee Plugs

5.5 Installation of Lee Jets

5.5.1 Install Lee jets as follows (see Figure 8):

Step 1. Ensure that the reamed hole is clean and dry.

Step 2. Check that the insert part number corresponds to the part number called up on the engineering drawing or shop order.

Step 3. Select the insert body installation bolt from Table 2 for the size and type of Lee Jet.

Step 4. Thread the installation bolt fully into the insert body and back it out 1/2 turn. Push the insert fully into the mounting hole until it bottoms against the support shoulder.

Step 5. Lightly tap the bolt head with a small hammer to ensure that the body remains fully seated. Do not use a pin or drift punch to seat the insert as permanent damage to the insert will result.

Step 6. Unthread the bolt from the insert while maintaining a slight inward pressure to ensure that the insert body remains fully seated.

Step 7. Select the pin installation tool from Table 2 for the size and type of Lee Jet.

Step 8. Thread the locking pin fully onto the insertion tool. Check that pin is correctly placed on tool so that the chamfered end will enter the insert body first. Ensure that pin is firmly seated (finger tight) against the tool shoulder and that it remains in this position during installation as the shoulder controls pin insertion flushness. Do not apply additional lubricant to the insert body or pin.

Step 9. Press or drive the pin in place using a hand operated arbour press or a hammer until the installation tool shoulder is felt to bottom against the back of the insert body. When a hammer is used, a few sharp blows will quickly set the pin flush with the body. Support the part when driving the pin.

Step 10. Unthread the insertion punch from the pin.

Step 11. Check that the installed pin is flush within 0.005" of the end of the insert body.

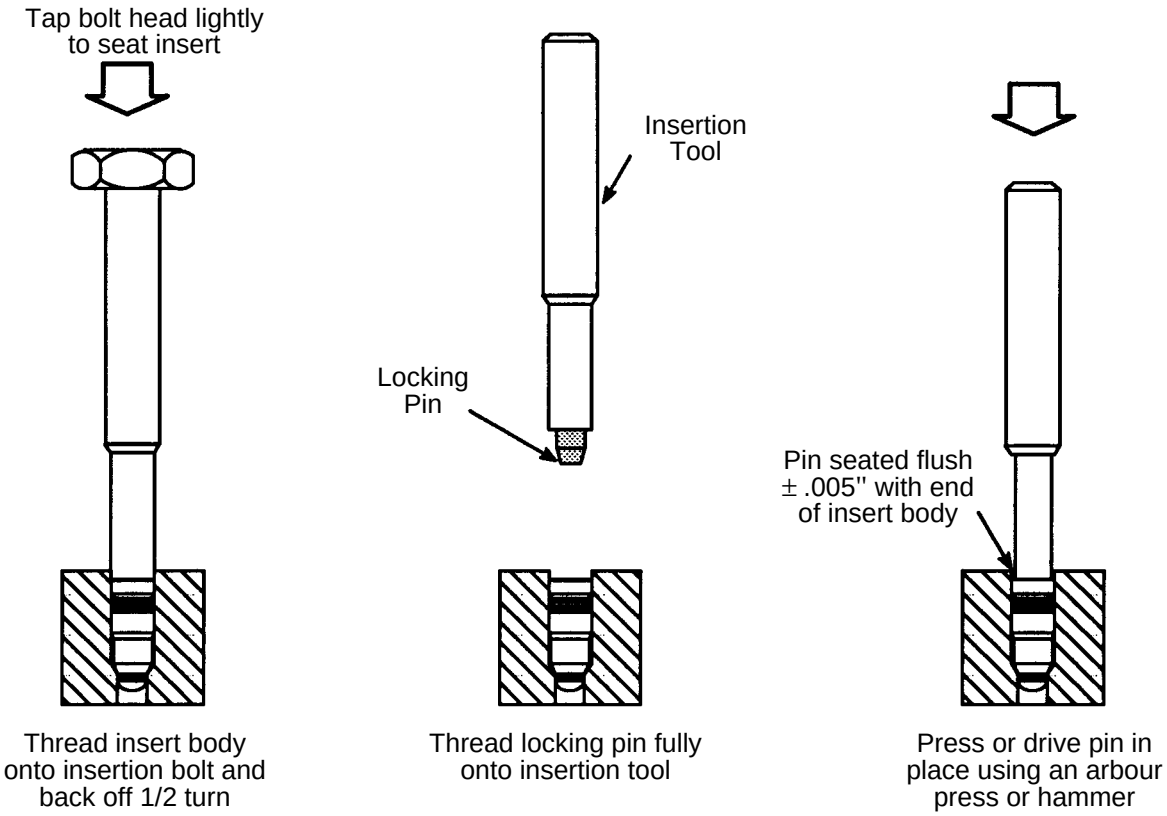

Figure 8 - Installation of Lee Jets

Table 2 - Lee Jet Installation Tools - Tool Kit SD8904

LEE JET			INSTALLATION TOOL	
TYPE	**CODE**	**SIZE**	**BOLT**	**PIN TOOL**
Lee Jet	JETA JETX	0.187"	CUTX0101010A	CUTX0101370A
Visco Jet	VDCA			
High Watt Jet	JEHA	0.187"	CUTX0101060A	

5.6 Removal of Lee Jets

5.6.1 If necessary, remove Lee jets from components as follows (see Figure 9):

Step 1. Select the pin jacking tool from Table 3.

Step 2. Run the drive nut up the drive shaft threads until the extractor stud threads are fully clear of the extractor guide sleeve (Note: this is a left hand thread). Do not turn the drive nut past the point where it is felt to bottom against the drive shaft, as this will push the extractor guide out of the nut retaining grove.

Step 3. Carefully thread the extractor stud into the locking pin using light finger pressure until slight turning resistance is felt as the stud shoulder bottoms against the insert. Do not over-tighten the extractor stud.

Step 4. Hold the "T" handle to prevent the stud from turning and run the drive nut down the drive shaft threads until the extractor guide sleeve rest against the insert body.

Step 5. While holding the "T" handle firmly to prevent rotation, use an open end wrench to turn the drive nut in a counter clockwise direction until reduction in wrenching force indicates pin is free. Withdraw the pin from the hole with extraction tool and discard the pin. **Do not permit the "T" handle to turn with the wrench as this will break the extractor stud.**

Step 6. Select the a striker and extraction bolt from Table 3 for the type and size Lee Jet. Assemble the striker onto the bolt and carefully thread the bolt into the insert body. Fully tighten the bolt in the insert using finger pressure only.

Step 7. Using the sliding striker on the extraction bolt, tap the Jet back out of the hole. The recommended technique for using the sliding striker and extraction bolt is to support the bolt by firmly gripping it near the insert with one hand while **flipping** the striker against the bolt head to produce a series of sharp impact blows. Ensure that the striker is not pushed sideways during removal as this may bend or break the extraction bolt.

5.6.2 Lee Jets are re-usable, unless damaged during removal or removed due to an unserviceable condition. Pack the removed Lee Jet in a clean plastic bag suitably identified and retain the Lee Jet for re-installation in the component it was removed from.

5.6.3 After removal of the Jet, examine the insert mounting hole for roughness or longitudinal scratches. If the bore of the hole appears to be satisfactory and the hole diameter is within the original drawing tolerance, a new jet or the old jet (if serviceable) may be installed without rework of the hole. If the hole appears damaged or is out of tolerance, refer to Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB for written approval to install an oversize jet.

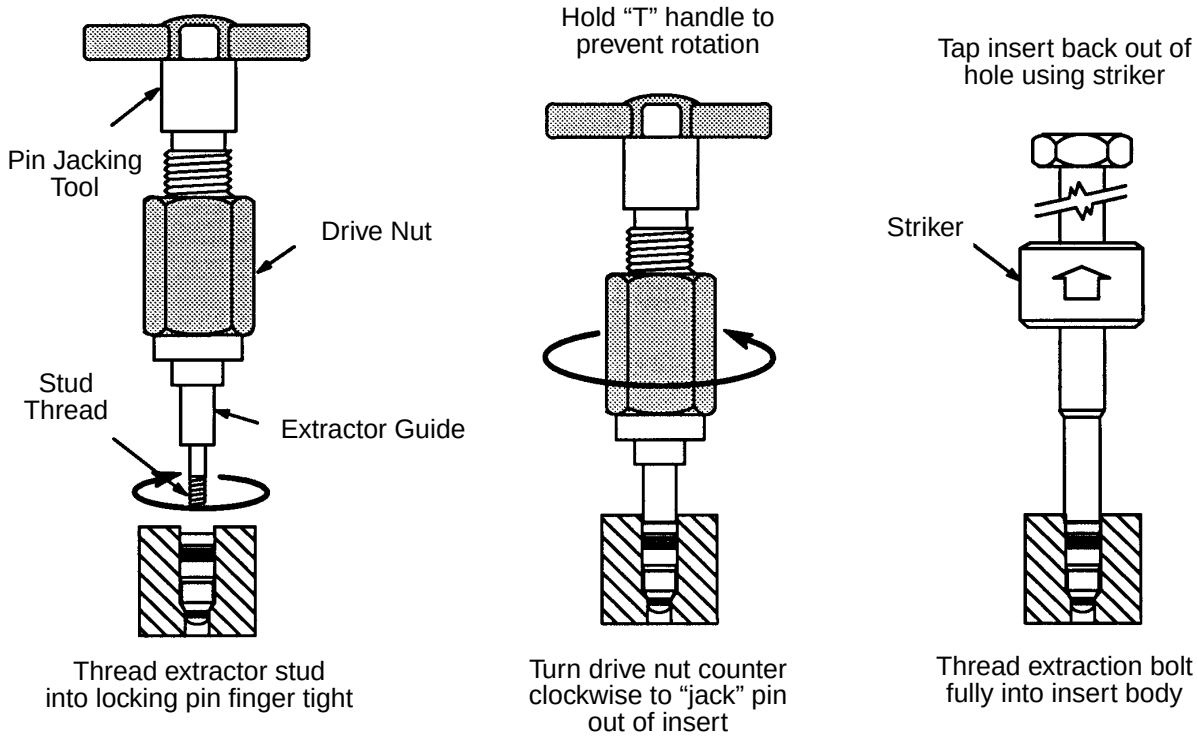

Figure 9 - Removal of Lee Jets

Table 3 - Lee Jet Extraction Tools - Tool Kit SD8904

LEE JET			PIN JACKING TOOL	EXTRACTION TOOL	
TYPE	CODE	SIZE		BOLT	STRIKER
Lee Jet	JETA JETX VDCA	0.187"	CUTA1870204B	CUTX0101010A	CUTA1015403B
Visco Jet					
High Watt Jet	JEHA	0.187"		CUTX0101060A	

5.7 Installation of Oversize Plugs and Jets

5.7.1 It is necessary to obtain Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB written approval to install an oversize Plug or Jet.

5.7.2 Use oversize Plugs or Jets only when the hole diameter exceeds the drawing tolerances or when the bore of the hole has been damaged during removal of a Plug or Jet (e.g., longitudinal scratches).

5.7.3 Use standard size pins for oversize Plugs or Jets. The pin installation procedure and tooling are same as for standard size inserts.

5.8 Post Installation Procedure for Fluid Line Fittings

Step 1. Proof pressure test all fluid line fittings that have been modified by the insertion of a Lee Jet restrictor, to a pressure of 3000 psi according to PPS 6.12. Apply flow pressure to the fitting from the opposite end to which the insert was installed (i.e., so that the pressure tends to push the insert out of the fitting) and maintain for 2 minutes.

Step 2. Permanently identify the fluid line fittings incorporating Lee Jet restrictors with the part number according to PPS 15.01, by engraving with a vibration pencil.

Step 3. Touch-up the engraved part mark and surrounding area with chemical conversion coating according to PPS 32.02. After the application of chemical conversion coating, mask off the part mark.

Step 4. Paint all **modified** fittings with F24 polyurethane enamel (yellow) according to PPS 34.03 or with F22 epoxy-polyamide enamel according to PPS 34.41, as applicable, to prevent inadvertent usage of the modified fitting in a standard installation. Mask off fitting ends and threads during painting.

6 Requirements

6.1 Ensure that the insert body is flush or below flush with the outer surface of the component or part it is installed in.

6.2 Ensure that the locking pins are flush within ± 0.005" of the end of the insert body.

7 Safety Precautions

7.1 Observe general shop safety precautions when performing the procedure specified herein.

8 Personnel Requirements

8.1 Personnel must have a good working knowledge of the applicable procedure and requirements as specified herein and must have exhibited their competency to their supervisor.