BOMBARDIER Toronto (de Havilland) **PROPRIETARY INFORMATION**	**PPS 14.04** **PRODUCTION PROCESS STANDARD**

Installation of Preload Indicating (PLI) Washers

Issue 13
- This standard supersedes PPS 14.04, Issue 12.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- This PPS is effective as of the distribution date.
- Validation of issue status is the responsibility of the user.

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Core Methods - PPS

Issue 13 - 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.

- Added cautionary note that for installation of PLI washer assemblies it is imperative that the bolt hole be perpendicular to the surface.

- Removed all indication that gaps between washers on one side of the assembly, within specified limits, may be considered acceptable. As of this issue, any torqued PLI assembly with any gap between the washers on any side of the assembly must be referred to Bombardier Toronto (de Havilland) Material Review Board (MRB) or Bombardier Toronto (de Havilland) delegated MRB for disposition.

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1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for installing preload indicating (PLI) washers.

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 General

3.1.1 Unless a specific issue is indicated, the issue of the reference documents specified in this section in effect at the time of manufacture shall form a part of this specification to the extent indicated herein.

3.2 Bombardier Toronto (de Havilland) Process Specifications

3.2.1 PPS 2.20 - Installation of Bolts and Screws.

3.2.2 PPS 13.26 - General Subcontractor Provisions.

3.2.3 PPS 13.28 - Storage Life of Adhesives, Sealants, Paints and Composite Products.

4 Materials and Equipment

4.1 Materials

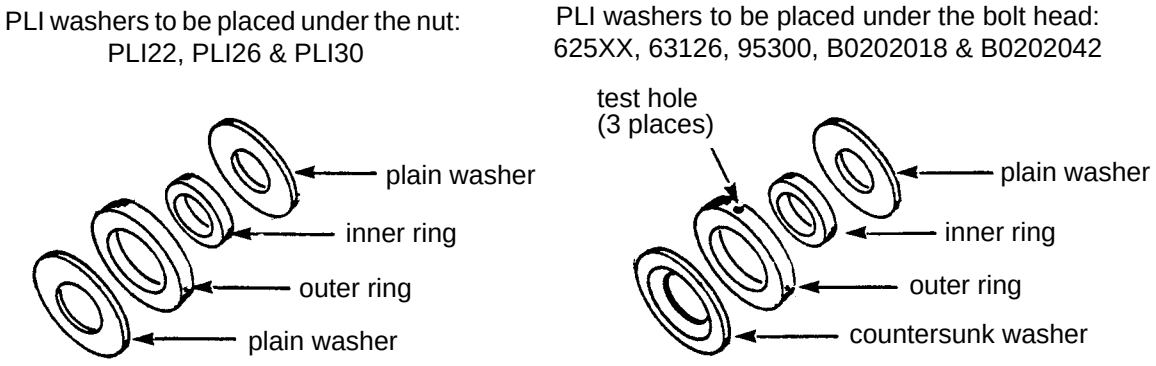
4.1.1 Unless a specific issue is indicated, the issue of the reference documents specified in this section in effect at the time of manufacture shall form a part of this specification to the extent indicated herein.

4.1.2 PLI washer assemblies as specified on the relevant engineering drawing. Refer to Figure 1 for a general description of the PLI washer assemblies. Refer to Figure 2 for a breakdown of the SPS Technologies PLI washer assembly part number. Refer to Figure 3 for a breakdown of the Bombardier PLI washer assembly part number.

4.1.3 Tamper proof sealant, white:

- Dykem Cross Check tamper proof torque mark, p/n 83319 (white)
- Organic Products Co. F-900 or F-925 Torque Seal
- 3M EC-1252 tamper proof sealant

4.1.3.1 Refer to PPS 13.28 for the storage life of tamper proof sealant. The tamper proof sealants specified herein are resistant to splashes of hydraulic fluid (e.g., Skydrol) but are not resistant to immersion. After application, allow tamper proof sealant to cure undisturbed according to the manufacturer's recommendations. Apply tamper proof sealant sparingly, do not apply more than needed, especially in overhead applications.



Note: Ensure that the inner and outer rings are colour coded with the same colour.

Figure 1 - General Description of PLI Washer Assemblies

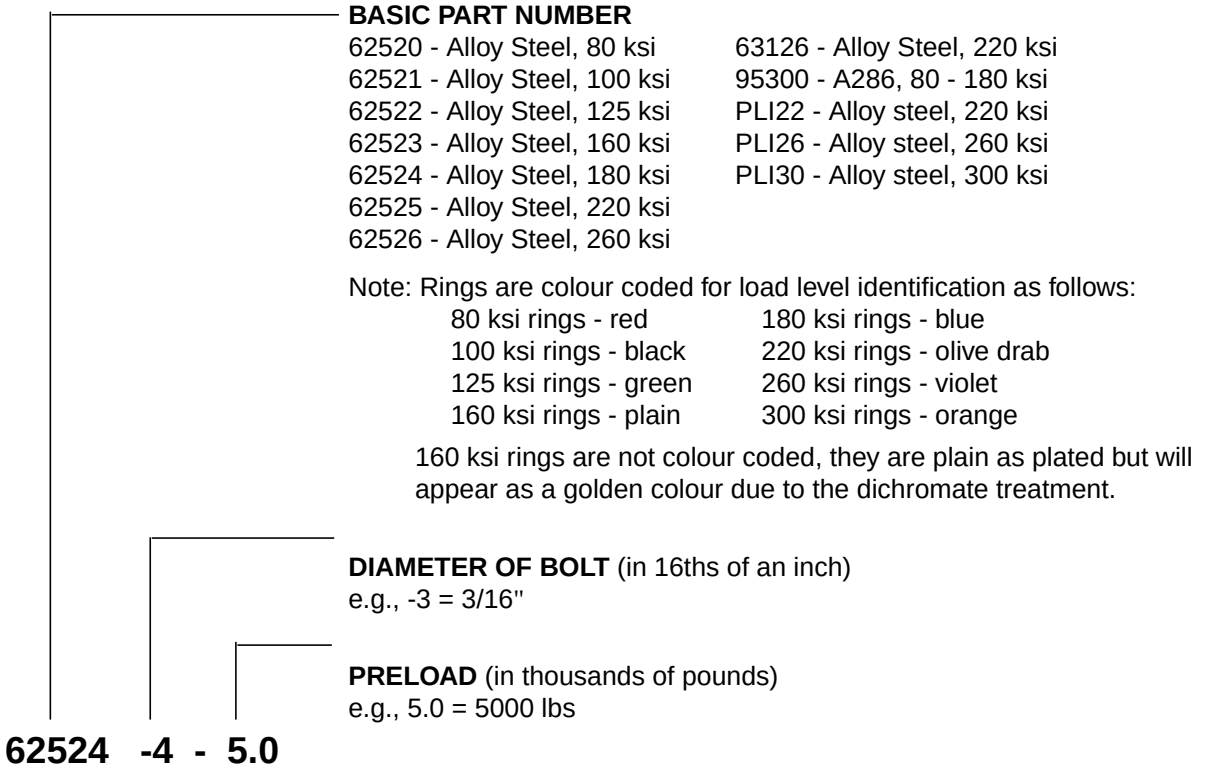
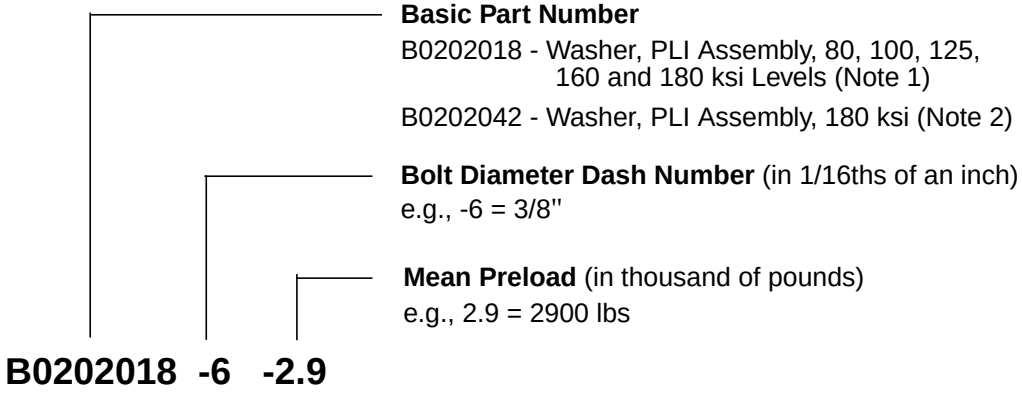


Figure 2 - SPS Technologies PLI Washer Assembly Part Number Breakdown



Note 1. B0202018 rings are colour coded for load level identification as follows:

80 ksi rings - red
100 ksi rings - black
125 ksi rings - green
160 ksi rings - plain
180 ksi rings - blue

160 ksi rings are not colour coded, they are plain as plated but will appear as a golden colour due to the dichromate treatment.

Note 2. For B0202042 PLI washers, DYKEM yellow #81705 will have been applied to the outer ring only. Following heat curing of the dye, the colour on the outer ring may vary. The part number on the outer ring overrides any colour variation.

Figure 3 - Bombardier PLI Washer Assembly Part Number Breakdown

4.2 Equipment

4.2.1 Suitable box end or socket type wrenches for tightening bolt/PLI washer assemblies.

4.2.2 Torque check tool (e.g., TS.759.14.12).

5 Procedure

5.1 General

5.1.1 PLI washers are designed to accurately induce a predetermined preload in a bolted joint assembly.

5.1.2 B0202018, B0202042, 625XX, 63126 and 95300 PLI washer assemblies consist of 2 concentric rings sandwiched between a close tolerance plain washer and a close tolerance countersunk washer and are to be used under the bolt head.

5.1.3 PLI22, PLI26 and PLI30 PLI washer assemblies are comprised of 2 concentric steel rings sandwiched between 2 close tolerance plain steel washers and are to be used under the nut.

5.1.4 B0202042 PLI washer assemblies are intended to be used with B0201089-16-38( ) bolts only. If the engineering drawing specifies use of any bolt other than a B0201089-16-38( ) with a B0202042 PLI washer assembly, refer to Liaison Engineering for disposition.

5.2 Preparation of Work

5.2.1 Prepare holes for the bolts as specified by the engineering drawing and PPS 2.20.

5.2.1.1 For installation of PLI washer assemblies it is imperative that the bolt hole be perpendicular to the surface.

5.3 Installation

5.3.1 Install 625XX series, 63126, B0202018 and B0202042 PLI washers under the bolt head, with the countersink side of the countersunk washer against the head of the bolt to provide clearance for the bolt shank fillet radius (see Figure 4).

5.3.2 Install PLI22, PLI26 and PLI30 PLI washers under the nut (see Figure 4).

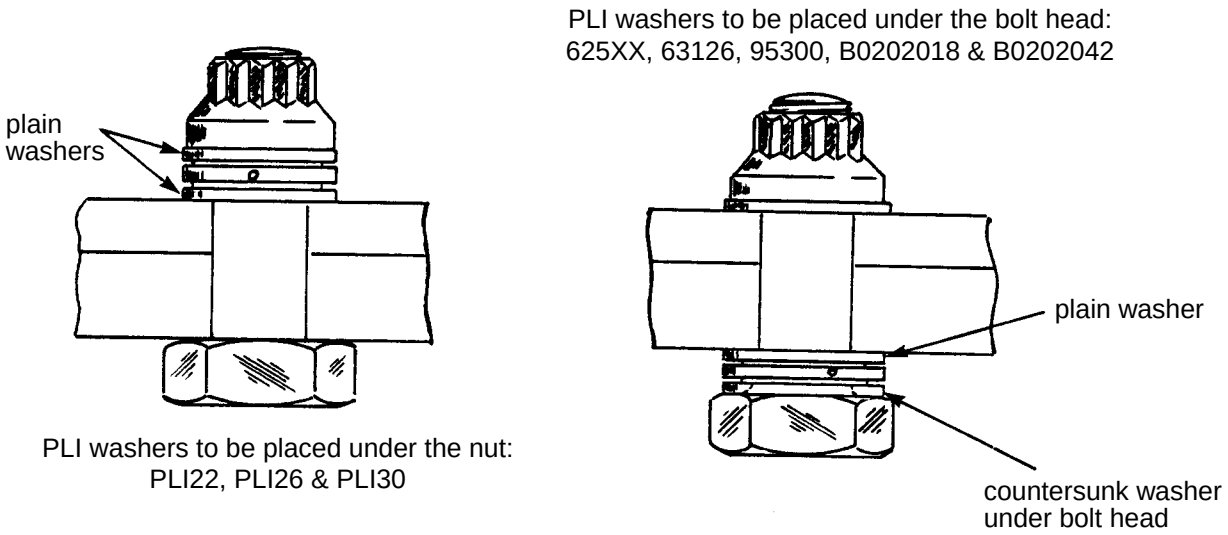


Figure 4 - PLI Washer Installation (Typical)

5.4 Torquing

5.4.1 After assembly, torque PLI washer assemblies as follows:

Step 1. Pre-torque by tightening the bolt until the washers are felt to bottom or bind against the inner preload indicating ring, with the outer ring remaining loose (see Figure 5-A).

Step 2. Insert a TS.759.14.12 torque check tool in one of the outer ring test holes and move slightly back and forth during final torquing until the outer ring definitely binds between the washers (see Figure 5-B). At this point the required preload has been reached and cease torquing immediately. **Do not over torque**. If necessary, in place of a TS.759.14.12 check tool it is acceptable to use an Allen key hex wrench or twist drill which is a close fit to the size of the outer ring test hole (e.g., if a TS.759.14.12 check tool is not available).

Step 3. Ensure that the torqued PLI washer assembly has no gaps between the washers on any side of the assembly. Refer installed PLI washer assemblies with gaps to Bombardier Toronto (de Havilland) Material Review Board (MRB) or Bombardier Toronto (de Havilland) delegated MRB for disposition.

Step 4. Identify the torqued PLI washer assembly with a torque stripe mark. Apply the torque stripe witness mark using white tamper proof sealant (ref. para. 4.1.3) in a 1/8" wide stripe extending across the fastener and onto the adjacent structure approximately as shown in Figure 6.

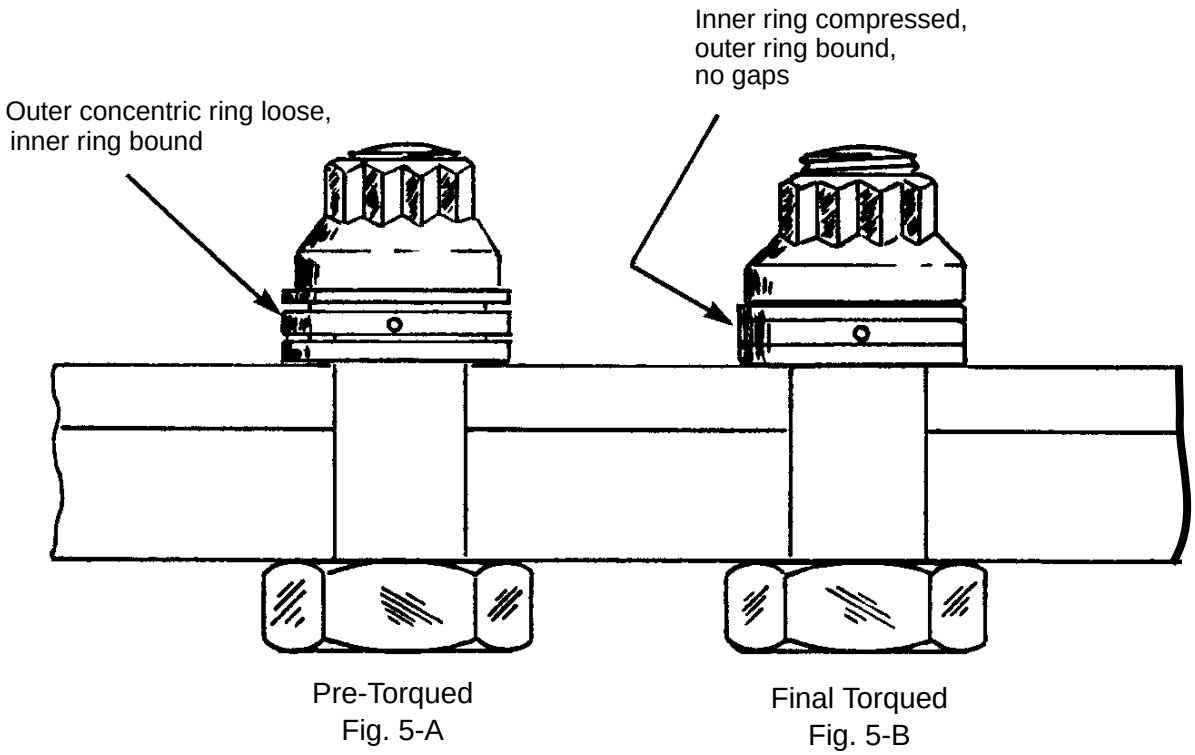


Figure 5 - Torquing PLI Washer/Bolt Assemblies

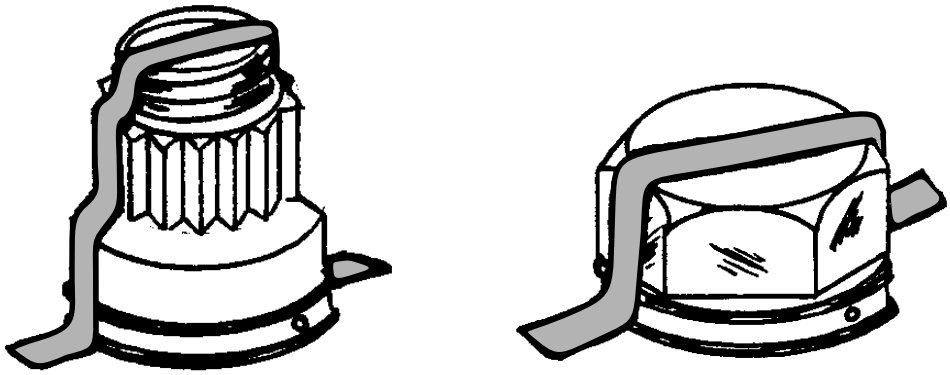


Figure 6 - Torque Stripe Marking of PLI Washer/Bolt Assemblies

6 Requirements

6.1 There must be no gap between the outer concentric ring and the washers on any side of the PLI washer assembly; the outer ring must be bound between the washers.

6.2 If an identification stripe on a PLI washer/bolt assembly is found to be misaligned, indicating movement of the fastener after final torquing, remove and discard that PLI washer assembly and install a new PLI washer assembly according to the procedure specified herein.

6.3 Ensure that the completed installation conforms to the requirements of PPS 2.20.

7 Safety Precautions

7.1 The safety precautions specified herein are specific to Bombardier Toronto (de Havilland) to meet Canadian Federal and Provincial government environmental, health and safety regulations. It is recommended that other facilities consider these safety precautions; however, suppliers, subcontractors and partners are responsible for ensuring that their own environmental, health and safety precautions satisfy the appropriate local government regulations.

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

7.3 Ensure sufficient ventilation when applying tamper proof sealant, especially in confined areas.

7.4 Avoid skin and eye contact with tamper proof sealant. Wear chemical resistant protective gloves when applying tamper proof sealant. If skin contact occurs, wash the affected area immediately and thoroughly with soap and water. If eye contact occurs, immediately flush eyes with large quantities of water at an eye-wash station; after initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Report any contact with tamper proof sealant to the Health Centre. Take care when applying tamper proof sealant in overhead applications to avoid applying excess sealant, as drips may result.

8 Personnel Requirements

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

9 Special Points to Note

9.1 PLI washers are not re-usable. If a bolt assembly has been loosened, use a new washer assembly.