

# Process Specification for the Application of Liquid Lubricants

---

**Engineering Directorate**

**Structural Engineering Division**

**June 2020**



National Aeronautics and  
Space Administration

**Lyndon B. Johnson Space Center**  
Houston, Texas

# Process Specification for the Application of Liquid Lubricants

<b>Prepared by:</b>	Signature on File Jay Bennett Materials and Processes Branch/ES4	06/24/2020 Date
<b>Reviewed by:</b>	Signature on File John Figert Materials and Processes Branch/ES4	06/24/2020 Date
<b>Approved by:</b>	Signature on File Brian Mayeaux Materials and Processes Branch/ES4	06/24/2020 Date

REVISIONS		
VERSION	CHANGES	DATE
--	Original version	5/13/96
A	Extensively rewritten to incorporate modern format, addition of example greases and oils, and addition of burnish option.	8/6/99
B	Changed Division name. Revised Section 6.1 (Work Instructions) and Section 9.0 (Training).	10/2004
C	Updated document numbers in Section 4.0 (References)	1/2007
D	Updated signatories and format, minor changes to Section 3 (Usage), and added definitions.	6/2020

**1.0 SCOPE**

This process specification applies to the application of all types of liquid lubricants, such as oils and greases, to hardware manufactured by NASA-JSC.

**2.0 APPLICABILITY**

This specification is applicable whenever called out by the engineering drawing or any referencing documentation.

**3.0 USAGE**

This process specification shall be called out on the engineering drawing by identifying the surface(s) to be coated with a drawing note using the following general format:

**APPLY BRAYCO 601EF LUBRICANT PER NASA/JSC PRC-8002**

A flag note may help define location or surface.

In many applications in mechanisms, only a thin layer of grease is desired. A thin layer will function as a corrosion preventative, an assembly aid, or a run-in aid when a thick layer would cause a contamination or thermal seizure concern. For these design cases, add the following note to the above callout:

**APPLY A LIGHT COAT OF BRAYCO 601EF AND REMOVE EXCESS GREASE WITH A LINT-FREE CLOTH.**

Specific procedures from section 6 or other alternate procedures may be added to the drawing callout to clarify or delineate the exact lubrication procedure required.

A complete description of the lubricant shall be called out in the parts list on the engineering drawing, as in the following examples:

Part number	Description	Material	Specification
BRAYCOTE 601EF	PFPE GREASE		
BRAYCOTE 602EF	PFPE GREASE W/MOS2		
BRAYCO 815Z	PFPE OIL		
KRYTOX 240AC	PFPE GREASE		

*Note: The material and specification columns in a parts list on an engineering drawings are typically left blank for aerospace lubricants, but procurement and performance specifications may be necessary for commercial (non-aerospace) lubricants, or when tighter control on procurement or performance is required. Inclusion of a procurement specification does not authorize the substitution of a different brand and product number, even if the substitute meets the same specification.*

#### **4.0 REFERENCES**

The following references were used to develop this process specification:

SOP-007.1	<i>Preparation and Revision of Process Specifications</i>
JPR 8500.4	<i>Engineering Drawing System Manual</i>

The following documents are called out as an extension of the requirements given in this specification:

JPR 5322.1	<i>Contamination Control Manual</i>
------------	-------------------------------------

#### **5.0 MATERIAL REQUIREMENTS**

None.

#### **6.0 PROCESS REQUIREMENTS**

##### **6.1 Work Instructions**

All work shall be performed to written procedures. The work instructions shall contain sufficient detail to ensure that the manufacturing process produces consistent, repeatable products that comply with this specification.

For work performed at JSC facilities, these work procedures consist of Detailed Process Instructions (DPI's).

For contracted work, the contractor shall be responsible for preparing and maintaining, and certifying written work procedures that meet the requirements of this specification.

**6.2 General Requirements**

- 6.2.1 Prior to lubricant application, parts shall be cleaned to a level compatible with the subsystem in which the parts will be installed.
- 6.2.2 Tools, hands of personnel and gloves coming in contact with parts and materials shall be visibly clean per JPR 5322.
- 6.2.3 When visually examined, lubricants shall be free from contamination, i.e., grit, dirt, metal chips or other foreign material. Lubricant containers shall be kept closed when contents are not being used.

**6.3 Lubrication of Straight or Tapered Threaded Parts (Static Service)**

- 6.3.1 Lubricant shall be applied only to the male threads immediately prior to installation. The lubricant shall not be applied to flared sealing surfaces or to the ends of fittings.
- 6.3.2 The lubricant shall be applied to the external threads in a streak across all threads, except omit lubricant from the first two threads. Each lubricant shall be applied per section 6.3.3 and shall be flush with the crest of the threads. Excess lubricant shall be removed to avoid contamination of the system.
- 6.3.3 Number of application points shall vary with the size of the fitting. Where more than one application is required, the application points shall be equally spaced around the circumference of the threads. The number of application points for the various thread sizes shall be as shown in Table 1.

Table 1: Grease Application Points

Thread Size inches, Diameter	Number of Application Points	Approximate Width of Streak, inch
Up to 0.5	1	0.12 to 0.25
0.6 to 1.0	1	0.37
1.1 to 1.7	2	0.5
1.8 to 2.5	3	0.5
2.6 to 3.0	4	0.5
over 3.0	5	0.5

- 6.3.4 There shall be no visible indication of lubricant on the end faces of threaded parts and sealing surfaces of flared fittings prior to connecting fittings.
- 6.3.5 To avoid galling during torqueing of coupling nuts, a thin layer of lubricant shall be uniformly applied to the thrust surface of the tubing sleeve.

6.3.6 Dynatube/Dual Seal fittings that do not have dry film lubricated threads shall have lubricant applied to the male threads before mating. When the mating nut can be slid back to expose the thrust surface (backside of the sealing surface), it shall also be lubricated. Use only a minimum amount of lubricant, and remove any observable excess. If required to remate a previously-lubricated female fitting ("B nut") with a new unlubricated male fitting, lubricate the male fitting per paragraph 6.3.2 and reassemble to the female.

#### **6.4 Lubrication of Static Seals (O-Rings)**

6.4.1 Where a lubricant is to be applied to a dry O-ring to facilitate installation, it shall be distributed uniformly over the surface of the O-ring. Excess lubricant shall be removed until there is no visible accumulation of lubricant on the O-ring.

6.4.2 Where a lubricant is needed to retain an O-ring in its groove while installing a mating part, the lubricant shall be uniformly applied to the groove surfaces, and the amount shall not exceed 10 percent of the total groove volume.

#### **6.5 Lubrication of Static Seal (Gasket Type)**

##### **6.5.1 Flat Seals**

The sealing surface of flat seals to be used between flat surfaces without grooves shall be coated and thoroughly wetted with the lubricant. There shall be no excess globules of the lubricant.

##### **6.5.2 Flat Mating Surfaces**

Lubricant for flat mating surfaces without gasket type seal shall be spread uniformly on both surfaces in a thin layer. There shall be no excess material at the edges prior to joining the mating parts.

#### **6.6 Lubrication of Plain Sliding Surfaces**

Plain sliding surfaces such as bushings, etc., shall be thoroughly coated with lubricant during installation, or the clearance volume shall be packed prior to operation. There shall be no excess globules on the outside of the mating surfaces.

## **6.7 Lubrication of Ball, Roller and Needle Bearings**

The races and bearings shall be packed with lubricant to approximately one-third the clearance volume unless otherwise specified.

## **6.8 Grease Gun Application**

When grease is injected by a gun into a fitting until it extrudes around the bearing outlets, the extruded grease shall be removed.

## **6.9 Lubrication of Metal Sliding Surfaces (Plain bearings, Poppets, etc.)**

Mating parts shall be thoroughly coated with a uniform film of lubricant. There shall be no excess lubricant after parts are assembled. Care shall be taken to prevent lubricant from entering vent, bleed or pilot openings where blockage could occur.

## **7.0 PROCESS QUALIFICATION**

None associated with the general usage of this specification.

Specialized designs requiring long life, high loads, or temperature extremes should develop design specific lubricant qualification test programs that include lubricant application processes.

## **8.0 PROCESS VERIFICATION**

### **8.1 In-Process Control**

The lubrication procedure shall require strict in-process controls, since the lubricated part cannot be inspected after final assembly.

### **8.2 Visual Inspection**

Visual inspections shall be performed with the unaided eye (without magnification).

## **9.0 TRAINING AND CERTIFICATION OF PERSONNEL**

This process shall be performed by personnel qualified through training or experience and certified by their supervision to conduct the process.



## 10.0 **DEFINITIONS**

Grease	A colloidal dispersion of a thickener and an oil.
PFPE	Perfluoropolyalkylethers (PFPE) is a type of liquid lubricant used in the aerospace industry. PFPE has very low outgassing compared to other fluids in high vacuum environments such as space.
PTFE	Polytetrafluoroethylene (PTFE) is a strong, tough, waxy, nonflammable synthetic resin produced by the polymerization of tetrafluoroethylene. PTFE is commonly known by trade names such as Teflon.