A Multi-Disciplinary Engineering Approach to Selecting Assembly Lubricants

Tom McGuckin – VP, Research, Quality & Safety



Providing Assembly and Cleaning Solutions since 1923



TEMPORARY RUBBER ASSEMBLY LUBRICANTS

Lubricant choice based on convenience. An afterthought.

- Gasoline Soap and water
- Alcohol
- Motor Oil
- Silicone spray

Vaseline

Lubricant choice based on technical specifications.

- ASTM D573: Rubber ASTM D471: Rubber Etc. Deterioration Property – Effect of Liquids
- ASTM D543: Resistance of ASTM D4048: Copper Corrosion Plastics to Chemicals of Lubricating Greases

Lubricant choice is part of the design process to meet ergonomic targets.

- Bore Assembly 110 Newtons
 Sump Motor assembly 225 Newtons
- Fuel Line Assembly 50 Newtons





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TEMPORARY RUBBER ASSEMBLY LUBRICANTS

Lubricity of Dry O-ring with No Lubricant

Lubricity of P-80 Emulsion with O-rings

Click to view video

Click to view video



OEM LUBRICANT APPROVAL PROCESS – Receive requests from other Engineer Groups

HSE ENGINEERS

Composition Evaluation:

- RoHS Materials
- Conflict Materials
- SVHC
- Solvents
- In-house supplier test vs. Third Party Independent testing.

Health & Safety:

- Dermal, Ocular, Oral Toxicity Test Results
- Allergen Statements

Regulatory Information:

- Reach
- RoHS
- ELV End-of-Life Vehicle Directive
- ISO9001:2015
- GHS

 SDS
 - o Labeling



GHS COMPLIANT PRODUCT SAFETY DATA SHEET AND LABEL

Conditions for safe storage

Control parameters:

equipment (PPE)

recommended.

recommended.

Odor: Mild. oily odor

Elash Point: Not applicable

Flammability: Not applicable

Relative Density: 0.98 g/mL

Solubility: Does not apply

Viscosity: ~ 150 cps

10.4 Conditions to Avoid: None

Other informatio

ondition

followed.

pH: 84

applicable

Specific End Uses: See Section 1.2

occupational exposure limit values. Exposure Controls:

Engineering Controls: Not necessary

72

8.1

82

9. 9.1

92

10

10.1

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10.3

10.5

8.2.1

not allow product to freeze. The shelf life of P-80 is two years

from the date of manufacture when stored in the original sealed

EXPOSURE CONTROLS / PERSONAL PROTECTION

Contains no substances with concentrations exceeding

8.2.2 Individual protection measures, such as personal protective

Skin Protection: Rubber, nitrile, or latex gloves are

Eye Protection: Safety glasses with side-shields are

PHYSICAL AND CHEMICAL PROPERTIES.

Odor Threshold: No information found

Evaporation Rate (BuAc=1): Similar to wate

Vapor Pressure (mm Hg): Similar to wate

Vapor Density (Air=1): Similar to water

Oxidizing Properties: Does not apply

STABILITY AND REACTIVITY

recommended storage conditions.

monoxide and carbon dioxide.

Other: Common sense chemical hygiene practice should be

Information on basic physical and chemical properties:

Appearance: Opaque, creamy white to off-white emulsion

Melting Point / Freezing Point: No information found

Initial Boiling Point / Boiling Range: 100 °C (212 °F)

Upper / Lower Flammability or Explosive Limits: Not

Partition Coefficient: n-octanol / water: Not determined

Explosive Properties: Not considered an explosion hazard

% Volatiles by volume @110°C:< 1% (ASTM D2369-01)

Reactivity: Stable under recommended storage conditions.

Chemical Stability: Stable under recommended storage

Possibility of Hazardous Reactions: Stable under

Incompatible Materials: Avoid extended contact with

10.6 Hazardous Decomposition Products: Does not decompose

evaporates, vapors may include nitrogen oxides, carbon

when used as intended. In case of fire where water

uncured paint, copper and its alloys. Avoid contact with

polycarbonate, polymethyl methacrylate, and polyphenylene

oxide as P-80 may cause these plastics to craze over time.

Auto-ignition Temperature: No information found

Decomposition Temperature: No information found

container at the recommended storage temperature.

Effective Date: January 10, 2018

1.1

12

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1.4

211

212

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23

3.1

3.2

Mixtures:

57)

SAFETY DATA SHEET (SDS) Replaces Revision: September 21, 2016

International Products Corporation

P-80[®] Rubber Lubricant Emulsion Temporary Rubber Assembly Lubricant

- IDENTIFICATION OF THE SUBSTANCE OR MIXTURE 4. FIRST AID MEASURES Product Identifier: P-80[®] RUBBER LUBRICANT EMULSION 4.1 Description of first aid measures Temporary Rubber Assembly Lubricant Inhalation: No specific treatment is necessary since P-80 is CAS Number: Not applicable to mixtures unlikely to be hazardous by inhalation Ingestion: Rinse mouth. Consult a physician EC Number: Not applicable to mixtures REACH Registration Number: Not applicable to mixtures Skin Contact: Remove contaminated clothing. Gently wash skin Chemical Formula: Not applicable to mixtures with soap and water. Get medical attention if irritation develops Relevant Identified Uses of the substance or mixture and or persists. Eye Contact: Immediately flush eyes with plenty of water for at uses advised against them: Provides temporary lubrication to aid assembly of rubber and least 15 minutes, lifting lower and upper eyelids occasionally. Get plastic components. For industrial purposes only. medical attention if irritation develops or persists 42 Most important acute and delayed symptoms and effects: Details of the supplier of the safety data sheet International Products Corporation No data available. 4.3 Indication of immediate medical attention and special 201 Connecticut Drive Burlington, NJ 08016, USA treatment Tel: (609) 386-8770 / Fax: (609) 386-8438 Symptomatic treatment E-mail: mkt@ipcol.com / Website: www.ipcol.com EU Distributor FIRE-FIGHTING MEASURES International Products Corp. 5.1 Extinguishing media Unit 5, Green Lane Business Park Use extinguishing media appropriate for surrounding fire. 238 Green Lane London, SE9 3TL, United Kingdom 52 Special hazards arising from the substance or mixture Tel: 020-8857-5678 Fax: 020-8857-1313 Ambient fire may liberate hazardous vapors. In case of fire where E-mail: saleseurope@ipcol.com water evaporates, vapors may include nitrogen oxides, carbon Emergency Phone Number: 24-Hour CHEMTREC Tel: monoxide and carbon dioxide (800) 424-9300 (USA and Canada) 53 Advice for Firefighters: (703) 527-3887 (Calls from outside the USA) Wear self-contained breathing apparatus for fire-fighting. HAZARD(S) IDENTIFICATION ACCIDENTAL RELEASE MEASURES Classification of the Substance or Mixture Personal Precautions, Protective Equipment and Emergency 61 GHS Classification in accordance with 29 CFR 1910 (OSHA): Procedures: This mixture is not classified as hazardous. For non-emergency personnel: 6.1.1 Classification according to the EC 1272/2008 (CLP): Wear appropriate personal protective equipment as specified in This mixture is not classified as hazardous according to the Section 8. CLP regulation 612 For emergency responders: Label Elements: Remove persons to safety. Isolate hazard area and deny entry. Signal Word: Not applicable Ventilate closed spaces before entering. Wear suitable protectiv Hazard Statements: Not applicable equipment. Safety Statements: Not applicable 6.2 Environmental Precautions: Pictogram: Not applicable Do not allow to enter soil or surface waterways Methods and materials for containment and cleaning up: Precautionary Statements 63 P302+350: IF ON SKIN: Gently wash with soap and water. P-80 can be treated in sewage / wastewater treatment facilities. P305 + P351 + P338: IF IN EYES: Rinse cautiously with water Spills will present a slip hazard. Clean up spills with absorbent for several minutes. Remove contact lenses, if present and material or mop. Dried P-80 spills will be sticky. Clean up easy to do. Continue rinsing residue with soap and water Other Hazards: Reference to other sections: 64 See Section 8 and 13. COMPOSITION / INFORMATION ON INGREDIENTS HANDLING AND STORAGE Substances: Not applicable Precautions for Safe Handling: 7.1 Protective Measures: Wear personal protective clothing. (See No ingredients are present at concentrations above Section 8.) P-80 requires no special ventilation. occupational exposure limits. Ingredient CAS No. EC No. Index No. Range Plant-derived oils Mixture Not Classified 10 – 20% Advice on General Occupational Hygiene: Do not eat, drink and / or smoke in work areas; wash hands after use. Not intended for dilution. Not intended for heating. Use at room Oils are listed in Annex IV as exempt from REACH temperature. Mix or shake P-80 before use. Routine cleaning of the P-80 work area with a disinfectant is recommended for This product does not contain substances of very high maximum product life. concern (Regulation (EC) No 1907/2006 (REACH), Article · Keep container closed when not in use to prevent bacteria contamination · Bacterial contamination can occur by repeatedly subjecting P-80 to dirty environments or combining used P-80 with fresh P-80
 - Bubbling compressed air through P-80 may cause bacteria contamination

P-80[®] Rubber Lubricant Emulsion

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- TOXICOLOGICAL INFORMATION Recommended storage temperature is 2-30°C (36-86°F). Do 11.1 Information on toxicological effects: Acute Toxicity: Non-toxic – LD50 Oral – rat > 5g/kg Skin Corrosion / Imitation: Not an irritant. Serious eve damage/Irritation: Not an irritant Respiratory or Skin sensitization: No data available Germ Cell Mutagenicity: No data available. Carcinogenicity: No data available. Reproductive toxicity: No data available STOT - single exposure: No data available. STOT - repeated exposure: No data available. Aspiration Hazard: No data available
 - Persistence & Degradability: All ingredients are biodegradable
 - Bioaccumulative Potential: No data available
 - Mobility in Soil: No data available Results of PBT and vPvB Assessment: This mixture does not 12.4 12.5 meet the PBT/vPvB criteria of REACH, Annex XIII.

12.3

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- 12.6 Other adverse effects: No data available DISPOSAL CONSIDERATIONS
- 13.1 Waste treatment methods: Product: Offer surplus and non-recyclable solutions to a licensed disposal company. Contaminated Packaging: Follow local regulations. European Waste Code: 16 03 06

TRANSPORT INFORMATION

- 14.1 UN Number: Not applicable UN Proper Shipping Name: Not applicable.
- 14.2 Transport hazard class: Not applicable 14.3
- Packing Group: Not applicable. 14.4 14.5 Environmental Hazards: Not a marine pollutant
- Special Precautions for use: Not applicable.
- 14.6 14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable.

REGULATORY INFORMATION

15.1 Safety, health, and environmental regulations/legislations specific to the substance or mixture:

~~				
	TSCA STATUS	All ingredients	are listed on	TSCA inventory
	SARA TITLE III	302/303 EHS	None	
	SARA TITLE III	,304,HS	None	
	SARA 311/312		None	

SARA TITLE III,313 None CANADA DSL All incredients are listed WHMIS Classification Not controlled

European Inventory of Existing Commercial Chemical Substances (EINECS) The components of this product are on the EINECS inventory

- or are exempt from inventory Germany – Water Hazard Class
- Chemical Safety Assessment

No chemical safety assessment has been carried out by the manufacturer

OTHER INFORMATION

Additional Information: The above information is believed to be accurate but International Products Corporation (IPC) does not claim it to be all inclusive. It should only be used as a guide. It is provided for the purpose of hazard communication. It does not represent any guarantee of the properties of the product

P-80 EMULSION SDS-EU 161205

ITEM # P-5324/P-5394

19.0 kg net wt.

P-80° EMULSION TEMPORARY RUBBER ASSEMBLY LUBRICANT

MANUFACTURED IN THE USA

BIODEGRADABLE, NON-FLAMMABLE, SAFE AND READY TO USE.

P-80[®] Emulsion is specifically formulated to provide temporary lubrication that makes rubber easy to install, remove, or otherwise manipulate. The lubricant provides a high degree of lubricity when wet, but because P-80® Emulsion does not contain silicon or other persistent ingredients, once dry the slipping action goes away. P-80[®] Emulsion is free of petroleum distillates and alcohol, so it will not dry, crack or otherwise harm rubber parts, P-80® Emulsion is an excellent lubricant when rubber needs to be cut, machined, pressed, trimmed, turned or ground. Uses include easing the assembly of hoses, bushings, seals, o-rings, grommets, grips and other rubber and soft plastic parts. P-80[®] Emulsion is safe to use on most natural and synthetic rubbers, metals, and plastics,

DIRECTIONS: Shake or stir before use. Apply just enough P-80® Emulsion to create a thin film of lubricant on the rubber or plastic part. Use the minimum amount necessary to achieve required lubrication. This can be done manually or automatically with a bath, dip, brush, spray, sponge, or squirt technique. Apply more if the film dries before installation is complete. Avoid storing in sunlight. Recommended storage temperature is 2-30°C (36-86°F). Prevent freezing. Keep container closed when not in use. NOTE: Not classified as hazardous according to GHS. Avoid extended contact with uncured paint, or copper and its alloys. Avoid contact with polycarbonate, polymethyl methacrylate and polyphenylene oxide as P-80[®] Emulsion may cause these plastics to craze over time. For commercial use only. Safety Data Sheet (SDS) is available upon request. Chemical substance identities withheld as trade secrets. NJ Trade Secret Registry No 561377-5000P.



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COLLABORATION

Once a Lubricant is approved and a Toxicity number is assigned, it can be considered for use.

Ergonomic Engineer

- 1. Friction and Effort Reduction
- 2. Production Rates
- 3. Health & Safety Hazards
- 4. Quality & Consistency



Design Engineer

- 1. Design Tolerance
- 2. Part Breakage
- 3. Production Rates
- 4. Dry Time
- 5. Material Compatibility





Lubricant Engineer

- 1. Toxicity Approval
- 2. Regulatory Compliance
- 3. Performance
- 4. Cost
- 5. Quality & Traceability



DESIGN ENGINEERS

Test Methods:

- Lubrication Tests Force Gauges
 - Tests using control samples and customer's assembly components
- Coefficient of Friction

 ASTM D1894

Dry Time:

- PVT Testing
- Assembly Steps
- Production Rates

Compatibility:

- Metal Compatibility

 ASTM F483
- Elastomer Compatibility

 ASTM D471
- Plastic Compatibility

 ASTM D543
- Automotive Fluid Compatibility
 - o Antifreeze
 - o Automatic Transmission Fluid
 - o Brake Fluid
 - o Motor Oil
 - o Power Steering Fluid
 - o Gasoline



COMPATIBILITY

P-80 Lubricants Metal Compatibility

	PROPERTY	1 Day, %Δ				14 Days, %Δ					
METAL		P-80® Emulsion	P-80® Thix	P-80® GRIP- IT	P-80® Redi- Lube	Tap Water	P-80® Emulsion	P-80® Thix	P-80® GRIP- IT	P-80® REDI- LUBE	Tap Water
ALUMINUM	%Δ Mass	0.00	0.00	<u>- 0.15</u>	- 0.01	0.00	0.00	0.00	<u>- 0.44</u>	- 0.02	- 0.05
1100	∆ Appearance	No change	No change	<u>Darker</u> overall	No change	Several pinpoints	No change	No change	<u>Black</u>	No change	Pinpoints
*BRASS ALLOY	%Δ Mass	- 0.01	- 0.35	- 0.04	- 0.01	0.00	- 0.02	- 0.36	<u>- 0.47</u>	- 0.02	0.00
260	∆ Appearance	No change	Dull finish	Faded Appearance	No change	Dark spots	Faded appearance	Darker outlines	<u>Faded</u> appearance	Dark spots	Dark spots
*BRONZE ALLOY	%Δ Mass	- 0.01	- 0.01	- 0.04	- 0.01	0.00	- 0.02	- 0.02	<u>- 0.50</u>	- 0.03	0.00
220	∆ Appearance	No change	No change	Faded appearance	No change	Dark spots	Faded appearance	Dark spots	<u>Faded</u> appearance	Dark spots	Dark spots
1008 COLD	%Δ Mass	0.00	0.00	- 0.01	0.00	- 0.04	0.00	0.00	- 0.06	- 0.01	<u>- 0.47</u>
ROLLED STEEL	∆ Appearance	No change	No change	No change	No change	No change	No change	No change	Pinpoints	No change	<u>Rust spots</u>
*COPPER ALLOY	%Δ Mass	- 0.01	- 0.01	- 0.05	- 0.01	0.00	- 0.02	- 0.02	<u>- 0.51</u>	- 0.01	0.00
CA 110	∆ Appearance	No change	No change	Faded appearance	No change	Darker outlines	Faded appearance	Dark spots	<u>Faded</u> appearance	Dark spots	Darker outlines
MONEL 400	%Δ Mass	0.00	0.00	0.00	0.00	0.00	- 0.01	- 0.01	0.00	- 0.01	0.00
	Δ Appearance	No change	No change	No change	No change	No change	No change	No change	No change	No change	No change
304 STAINLESS	%Δ Mass	0.00	0.00	0.00	0.00	0.00	- 0.01	0.00	0.00	0.00	0.00
STEEL	Δ Appearance	No change	No change	No change	No change	No change	No change	No change	No change	No change	No change
	%Δ Mass	0.00	0.00	0.00	0.00	0.00	0.00	- 0.01	0.00	0.00	0.00
ALLOY, 8% Mh	∆ Appearance	No change	No change	No change	No change	No change	No change	No change	No change	No change	No change



LUBRICANT ENGINEERS

Formulation:

- Chemistry
- Stability & Shelf Life
- Consistent Quality
- QC Parameters

Performance:

- Effectiveness
- Drying Time
- Temporary vs Permanent



ERGONOMIC ENGINEERS

Reduce Injuries and Stress

Concerns with Repetitive Assembly Tasks:

- Muscle Effort Monitoring
- Hand and Arm Vibration
- Contact Pressure Measurement
- Anthropometric analyses
- Dynamic Postural Testing
- Worker Equipment and Instrument Design

Achieve Maximum Reduction of Friction:

- Force Gauge Instruments
- Measurable Results with Thresholds
- Actual Parts, when possible





CASE STUDY

Collaborative Engineering Effort for the Design of Piston and Bores

Automotive Manufacturer

- Process Engineers
- Design Engineers
- Safety/Quality Managers
- Ergonomic Engineers
- Lubricant Engineers

O-Ring Manufacturer

Design Engineers

Lubricant Manufacturer

- Chemists
- Regulatory Personnel





CUSTOMER-SPECIFIC APPLICATION TESTING

Customer Testing/Efficacy

Effort for Design of Pistons and Bores for Specific Car Model

- Automotive Manufacturer
- O-Ring Manufacturer
- International Products Lubricant Manufacturer





Assembled view of O ring to test jig

COORDINATION OF EFFORTS

Work with Lubricant, Quality, Safety, Ergonomic and Design Engineers



Cause and Effect diagram for assembly force of an O ring sealed joint

REACH Compliant

ERGONOMIC CRITERIA: < 110 NEWTONS

Testing: Lubrication Design of Experiment Data

StdOrder	RunOrder	Lubrication	Bore Diameter	Operator	Peak Assembly Force (N)	
22	1	P-80 Emulsion	31.72	Two	51.2	
14	2	P-80 Emulsion	31.72	Two	49.4	
2	3	Dry	31.72	Two	294.6	
10	4	Dry	31.72	Two	304	
17	5	Dry	31.72	One	264.6	
18	6	Dry	31.72	Two	294.8	
24	7	P-80 Emulsion	38.07	Two	53.4	
8	8	P-80 Emulsion	38.07	Two	54.6	
12	9	Dry	38.07	Two	303.2	
3	10	Dry	38.07	One	225.4	
9	11	Dry	31.72	One	330.8	
16	12	P-80 Emulsion	38.07	Two	53.4	
19	13	Dry	38.07	One	270.4	
21	14	P-80 Emulsion	31.72	One	45.4	
13	15	P-80 Emulsion	31.72	One	45.6	
5	16	P-80 Emulsion	31.72	One	45.4	
4	17	Dry	38.07	Two	295.4	
20	18	Dry	38.07	Two	285.4	
6	19	P-80 Emulsion	31.72	Two	49	
11	20	Dry	38.07	One	276.4	
23	21	P-80 Emulsion	38.07	One	54.2	
1	22	Dry	31.72	One	348.2	
7	23	P-80 Emulsion	38.07	One	51.8	
15	24	P-80 Emulsion	38.07	One	55.6	



ADDITIONAL ASSESMENTS

Testing: Lubrication Design of Experiment Results





Ergonomic Target: < 110 Newtons



ERGONOMIC ASSESMENT

Testing: Lubrication Design of Experiment Results



Ergonomic Target: < 110 Newtons



COMMONLY USED ASSEMBLY LUBRICANTS

- Petroleum Distillates and Silicone –
 Permanent lubrication, compatibility issues.
- Soap and Water –

Quality and consistency problems, may slip when rewet, corrosion.

- Solvents -

Health and safety issues. Efficacy problems.

New Ester-Based Technology –
 Effective, temporary and biodegradable.



EFFICIENCY OF LUBRICANTS

Lubrication Over Time



Comparison of Lubricants





LUBRICATION COMPARISON CHART

ESTER BASED TEMPORARY RUBBER ASSEMBLY LUBRICANTS	TRADITIONAL RUBBER ASSEMBLY LUBRICANTS
Provide lubricity and reduce friction.	Provide lubricity and reduce friction.
Temporary lubrication, once dry will not reactivate, resulting in tight fitting parts.	Continual lubrication, can reactivate in presence of water — resulting in problems with quality and consistency of finished product.
Will not dry out rubber or corrode metal parts.	Can dry out rubber and corrode metal parts.
Any residue is non-conductive.	Many additives are conductive.
Non flammable, negligible VOCs.	May contain VOCs. May be flammable.
Excess lubricant washes away easily.	In some cases may be difficult to wash away excess lubricant.
Compatible with elastomers and plastics. Will not swell rubber.	May not be compatible with elastomers and plastics. Can swell rubber.
Treated surfaces can be coated and painted afterwards.	May interfere with downstream coating and painting processes.
Environmentally friendly and non-hazardous.	Environmental and health hazards can exist.



COORDINATION OF EFFORTS

Design: Lubrication vs Dry-Time



Reduction of friction data was created using a force gauge comparing both the dry and wet removal forces of hoses on an end cap. The equipment used; Mecmesin AFG 1000N force gauge, a Mecmesin Multi Test 2.5-d automatic test stand, and accessories to hold the cap and hose in place. The test stand is set to a fixed speed and path distance to control variability.



PROPERTIES AND PRODUCT ADVANTAGES

Properties	P-80 [®] Emulsion	P-80 [®] RediLube	P-80 [®] Emulsion IFC	P-80 [®] THIX	P-80 [®] THIX IFC	P-80 [®] Grip-It
Chemistry:		Water-soluble surfactants				
Appearance:	(Dpaque white emulsic	ght beige gel	Clear solution		
pH:	8.3	8.7	8.7	8.2	8.6	10.8
Viscosity, 25 deg C:	110 cps	20 cps	120 cps	10000 cps	11000 cps	20 cps
% Reduction:	% Reduction: ~ 70% ~ 50%		~ 70%	~ 70%	~ 70%	~ 40%
Dry Time:	Less than one hour	20 minutes or less	Less than one hour	More than one hour	More than one hour	20 minutes or less
Application:	Traditional elastomers	Non-porous elastomers & plastics	21CFR 178.3570	Longer dry time or vertical application	21CFR 178.3570	Fast dry time and tacky residue





THE NEXT GENERATION OF DRY FILM LUBRICANTS P-80° Dry Film Pre-Lube

Temporary Elastomer Assembly Lubricant Apply Now ~ Assemble Later, even after one year!

Coat





Dry

- Effective same lubricity as P-80 Emulsion
- Dust-free
- Worker-Safe
- Biodegradable
- Economical
- Reduce chemical inventory
- Incidental food contact version



Inventory

Reactivate

Assemble





- P-80 Emulsion in an encapsulated shell
- Dry film lasts over one year
- Reactivate with water
- Lubrication ends after assembly



LUBRICANT EVALUATION QUESTIONS

- Is the product compatible with all of the materials it comes in contact with?
- Can supplier provide test results or assist with application-specific testing?
- How safe is the product?
- How is the quality and consistency of the product measured?
- Does it contribute to increased productivity and result in fewer injuries and part failures?
- Is it temporary?



SUMMARY

The Goal of Assembly Lubricants:

To satisfy the concerns of all engineering groups for a particular assembly.

No one-size-fits all:

IPC offers four different industrial formulas of P-80° to address various assembly situations.



Thank You!

Contact us for additional information **Booth 6019**

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