

## Chapter VIII – References

- 1 AMERICAN SOCIETY FOR TESTING OF MATERIALS. 1997. *Standard Test Method for Determining Extreme Pressure Properties of Lubricating Grease Using A High-Frequency, Linear-Oscillation (SRV) Test Machine.* (ASTM D5706-97). Annual Book of ASTM Standards.
- 2 ANONYMOUS. 1994. *SKF International. SKF General Catalogue (4000 /IV E).* Gerber & Bruckmann.
- 3 ANONYMOUS. 2001. *ENGEN Product Handbook.* ENGEN South Africa.
- 4 ANONYMOUS. 2002. *Lutrol<sup>®</sup> F68 Technical specifications.* Ludwigshafen: BASF.
- 5 ANONYMOUS. [S.a.]. *Lube-Booster<sup>®</sup> II Technical specifications.* FERRO Petroleum Additives.
- 6 ANONYMOUS. [S.a.]. *More solutions to sticky problems.* Brookfield Engineering Labs. Inc .
- 7 BERGMANN, G., GRAICHEN, F. & ROHLMANN, A. 1993. Hip joint loading during walking and running. Measured in two patients. *Journal of Biomechanics*, vol.26, no.3, p.969-990.
- 8 BÖHMER, V. 2002. *Viscosity Meter.* B(Eng.) Mech. Thesis, University of Pretoria.
- 9 CONN, E.E. & STUMPF, E.L. 1972. *Outlines of Biochemistry*, Third Edition. John Wiley & Sons Inc.
- 10 COOKE, A.F., DOWSON, D. & WRIGHT, V. 1978. The rheology of synovial fluid and some potential synthetic lubricants for degenerate synovial joints. *Engineering in Medicine*, vol.7, no.2, p.66-72.
- 11 DAVIDSON, R.L. *Handbook of Water-Soluble Gums and Resins.* McGraw-Hill Book Company.
- 12 GRAVES, S., DAVIDSON, D. & INGERSON, L. 2002. *Australian Orthopaedic Association National Joint Replacement Registry.* Annual Report 2002. Adelaide:AOA.
- 13 GREGORY, D.J., HABERSTROH, K. & CHA, C.J. 1998. Comparison of the boundary-lubricating ability of bovine synovial fluid, lubricin and Healon. *Biomed Mater Res*, vol.40, p.414-418.

- 14 HARAGUCHI, K., SUGANO, N., NISHII, T., SAKAI, T., YOSHIKAWA, H. & OHZONO, K. 2001. Influence of polyethylene and femoral head surface quality on wear: A retrieval study. *International Orthopaedics*, vol.25, p.29-34.
- 15 HUTCHINGS, I.M. 1999. *Tribology: Friction and wear of engineering materials*, Fifth impression, London: Edward Arnold.
- 16 INTERNATIONAL STANDARD, 2002. *Implants for surgery – Wear of total hip-joint prostheses Part1: Loading and displacement parameters for wear-testing machines and corresponding environmental conditions for test*. (ISO 14242-1:2002).
- 17 JACOBSON, A. 2003. Biotribology: The tribology of living tissues. *Tribology & Lubrication Technology*, vol.59, no.12, p.32-38.
- 18 KATZBAUER, B. 1998. Properties and applications of Xanthan gum. *Polymer Degradation and Stability*, vol.59, p.81-84.
- 19 KESTERIS, U., HARDINGE, K., ILCHMANN, T. & WINGSTRAND, H. 2003. Polyethylene wear in prosthetic hips with loose components. *The Journal of Arthroplasty*, vol.18, no.1, p.10-15.
- 20 LAURENT, T.C. & FRASER, J.R.E. 1992. Hyaluronan. *The FASEB Journal*, vol. 6.
- 21 LU, Z. & MCKELLOP, H. 1997. Frictional heating of bearing materials tested in a hip joint wear simulator. *Proc Instn Mech Engrs*, vol.211, no.H, p.101-107.
- 22 MALCHAU, H., HERBERTS, P., GARELLICK, G., SÖDERMAN, P. & EISLER, T. 2002. *Prognosis of Total Hip Replacement*. Scientific exhibition presented at the 69<sup>th</sup> annual meeting of the American Academy of Orthopaedic Surgeons, February 13-17, 2002, Dallas, USA.
- 23 MAZZUCCO, D., MCKINLEY, G., SCOTT, R.D. & SPECTOR, M. 2002. Rheology of joint fluid in total knee arthroplasty patients. *Journal of Orthopaedic Research*, vol.20, p.1157-1163.
- 24 MCKELLOP, H., SHEN, F., LU, B., CAMPBELL, P. & SALOVEY, R. 2000. Effect of sterilization Method and Other Modifications on the Wear Resistance of Acetabular Cups Made of Ultra-High Molecular Weight Polyethylene: A Hip-Simulator Study. *The Journal of Bone and Joint surgery*, vol.82, no.A12, p.1708-1725.

- 25 O'KELLY, J., UNSWORTH, A., DOWSON, D., HALL, D.A. & WRIGHT, V. 1978. A study of the role of synovial fluid and its constituents in the friction and lubrication of human hip joints. *Engineering in Medicine*, vol.7, no.2, p.73-83.
- 26 OONISHI, H., KUNO, M., TSUJI, E. & FUJISAWA, A. 1997. The optimum dose of gamma radiation-heavy doses to low wear polyethylene in total hip prostheses. *Journal of Material Science: Materials in Medicine*, vol.8, p.11-18.
- 27 PAUL, J.P. 1976. Loading on normal hip and knee joints and on joint replacement. *Engineering in Medicine*, vol.2, p.53-70.
- 26 ROWETT, H.G.Q. 1973. *Basic anatomy and physiology*. Second edition. Norwich: Jarrold & Sons Ltd.
- 27 SAIKKO, V., AHLROOS, T., CALONIUS, O. & KERÄNEN, J. 2001. Wear simulation of total hip prostheses with polyethylene against CoCr, alumina and diamond-like carbon. *Biomaterials*, vol.22, p.1507-1514.
- 28 SOKOLOFF L. 1978. *The joints and synovial fluid Volume I*. Academic Press Inc. ISBN 0 12 655101 4.
- 29 SUTTIE, J.W. 1972. *Introduction to Biochemistry*. Holt Rinehart and Winston Inc.
- 30 TIPPER, J.L., FIRKINS, P.J., BESONG, A.A., BARBOUR, P.S.M., NEVELOS, J., STONE, M.H., INGHAM, E. & FISHER, J. 2001. Characterisation of wear debris from UHMWPE on zirconia ceramic, metal-on-metal and alumina ceramic-on-ceramic hip prostheses generated in a physiological anatomical hip joint simulator. *Wear*, vol.250, p.120-128.
- 31 UNSWORTH A. 1995. Recent developments in the tribology of artificial joints. *Tribology International* , vol.28, no.7, p.485-495.
- 32 WANG, A., ESSNER, A., STARK, C. & DUMBLETON, J.H. 1995. Comparison of the size and morphology of UHMWPE wear debris produced by a hip joint simulator under serum and water lubricated conditions. *Biomaterials*, vol.17, p.865-871.

## Appendix A – Bilateral Patient

The lubricity test results shown in this section of the report are for a 54-year-old patient that had undergone a bilateral hip replacement.

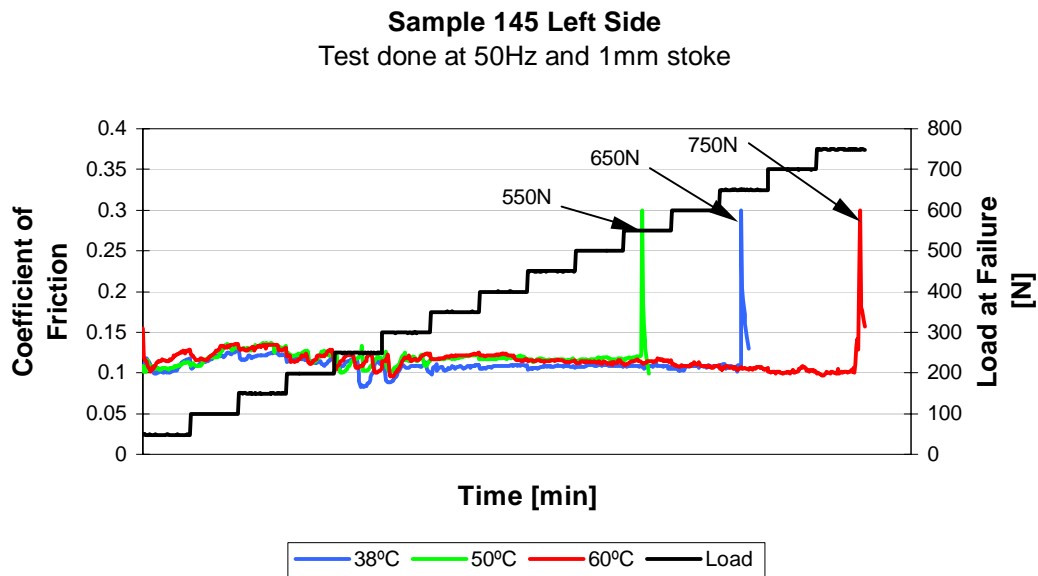


Figure A.1 – The lubricity test results for the left side of the bilateral patient. The loads at failures found were 650N, 550N and 750N for 38°C, 50°C and 60°C respectively.

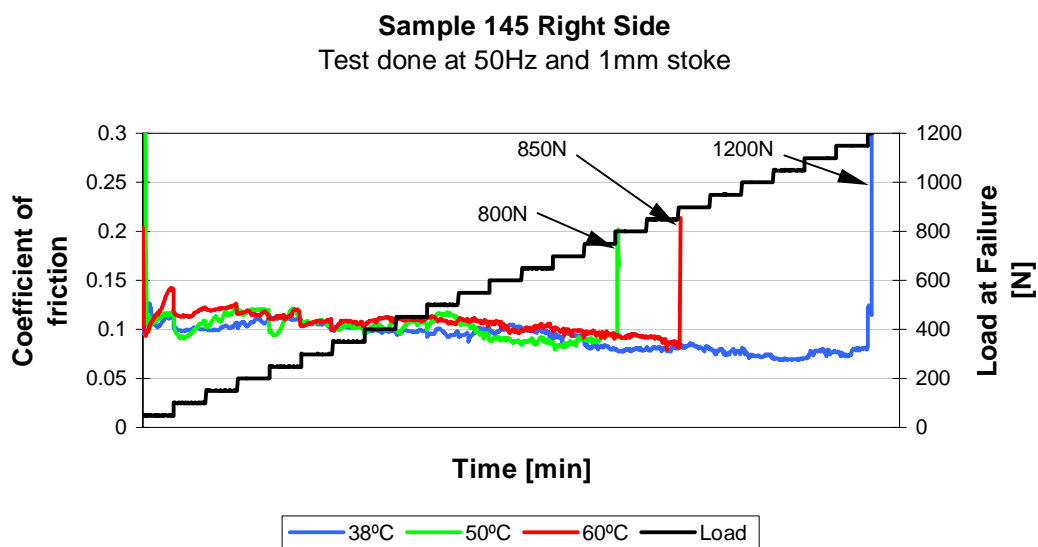


Figure A.2 – The lubricity test results for the right side of the bilateral patient. The loads at failures found were 1200N, 800N and 850N for 38°C, 50°C and 60°C respectively.

# Appendix B – Poloxamer 188

BASF South Africa (Pty.) Ltd.

Reg. No. 1964/0326/07

**BASF**

Head Office: P.O. Box 2801, Halfway House 1685. Telephone: (011) 254-2400 Fax: (011) 254-2431  
852 Sixteenth Road, Midrand.

BRANCHES:  
Cape Town  
Durban  
Port Elizabeth

Despatch Note/Packing Slip

Nº 19220

CONSIGNEE <i>Tersius Opperman</i> <i>University of Pretoria</i>  <i>084 744 0911</i>		MAIL: Air <input type="checkbox"/> Sea <input type="checkbox"/>	DATE OF DESPATCH	
		FREIGHT: Air <input type="checkbox"/> Sea <input type="checkbox"/>	<i>20-05-03</i>	
		RAIL: Goods <input type="checkbox"/> Express <input type="checkbox"/>	METHOD OF TRANSPORT	
		OTHER:	<i>Collection</i>	
		PAID <input type="checkbox"/>	FREIGHT/POSTAGE	
TO PAY <input type="checkbox"/>				
REMARKS FOR LABELS OR DOCUMENTS				
No. & TYPE OF PACKAGES	CONTENTS & VALUE	MARKS No.	WEIGHT	
			NETT	GROSS
<i>1x white plastic bottle</i>	<i>lutrol F68</i>	<i>lot 090001</i>		<i>500g</i>
ORDERED BY:	DATE	DEPT.	DANGEROUS CODES	
<i>R Mascher</i>	<i>20/5</i>	<i>M.E.</i>		
SIGNATURE				
<i>Roz Mascher</i>				
DATE:	PACKED BY:	RECEIPT No:	COSTS:	
	<i>T. OPPERMAN</i>	<i>UP</i>	<i>EM</i>	

BASF Aktiengesellschaft

**BASF**

**Safety data sheet**

according to 91/155/EEC

Page 1 of 3

BASF Safety data sheet  
Date / revised: 23.03.2001  
Product: LUTROL\* F 68

ME 00387 (D/E)  
version 3 01

(Print date: 26.09.2002)

**1. Substance/preparation and company name**

LUTROL\* F 68

Company:

BASF Aktiengesellschaft  
Unternehmensbereich Feinchemie  
67056 Ludwigshafen  
Telephone: 0621-60-46077  
Telefax number: 0621-60-8607434

Emergency information:

BASF works fire brigade BASF Ludwigshafen  
Telephone: 0621-60-43333  
Telefax number: 0621-60-92664

**2. Composition/information on ingredients**

Chemical nature

Block copolymer, based on: polyoxyethylene, polyoxypropylene

CAS-No. 9003-11-6

EINECS-No. - | Polymer; starting  
materials listed in: EINECS |

INCI-name: Poloxamer 188

**3. Possible hazards**

Advice on critical hazards to man and the environment: none

**4. First aid measures**

No special measures necessary.

**5. Fire fighting measures**

Suitable extinguishing media: water, dry extinguishing media, foam,  
carbon dioxide (CO<sub>2</sub>)

Special protective equipment: In case of fire, wear a self contained  
breathing apparatus.

Further information: Dispose of fire debris and contaminated  
extinguishing water in accordance with local regulations.

**6. Accidental release measures**

Personal precautions: No special measures necessary.

Methods for cleaning up: Sweep/shovel up.

**7. Handling and storage**

Handling

Protection against fire and explosion: Handle in accordance with good  
industrial hygiene and safety practice.

BASF Safety data sheet  
Date / revised: 23.03.2001  
Product: LUTROL\* F 68

ME 00387 (D/E)  
version 3.01

Storage

Keep tightly closed in a dry and cool place.

**8. Exposure controls and personal protection**

Additional information on the lay-out of technical plant  
( see 7 )

Components with workplace control parameters  
none

Personal protective equipment

Not necessary.

General safety and hygiene measures: The usual precautions for the handling of chemicals must be observed.

**9. Physical and chemical properties**

Form: beads, wax-like  
Colour: white  
Odour: faint specific odour

Change in physical state  
Melting point/melting range: 52 'C

Flash point: 260 'C

Bulk density: 1055 kg/m3 (approx.)

Solubility in water: > 100 g/l

pH value: 5-7.5 (at 10 g/l H2O)

**10. Stability and reactivity**

Hazardous reactions: None provided product is correctly processed.

Hazardous decomposition products: None provided product is correctly processed.

**11. Toxicological information**

Acute toxicity

LD50/oral/rat: > 15000 mg/kg  
LD50/dermal/rabbit: > 20000 mg/kg

Primary skin irritation/rabbit/OECD test: non-irritant  
Primary mucous membrane irritation/rabbits' eyes/OECD test:  
non-irritant

Other information

Ames-test: no mutagenic effect

**12. Ecological information**

BASF Safety data sheet  
Date / revised: 23.03.2001  
Product: LUTROL\* F 68

ME 00387 (D/E)  
version 3.01

Elimination information

Test method: adsorption test on activated sludge (BASF test)  
Method of analysis: DOC reduction  
Degree of elimination: 3% (DOC reduction)  
Evaluation: hard to eliminate

Behaviour and environmental fate

Inhibition of degradation activity in activated sludge is not to be anticipated during correct introduction of low concentrations.

Ecotoxic effects

Toxicity to fish (acute):  
Test method: OECD 203/ ISO 7346/ EEC 84/449/V, C.1  
LC50/Brachydanio rerio/: >10000 mg/l/96h  
LC0 (48 h): 10000mg/l

Toxicity to bacteria: Pseudomonas putida  
Test method: DIN 38412 Part 8  
EC10 (16 h): >10000mg/l  
EC50 (16 h): >10000mg/l  
EC90 (16 h): >10000mg/l

Further ecological information

No negative ecological effects are expected according to the present state of knowledge.

**13. Disposal considerations**

Product: Must be dumped or incinerated in accordance with local regulations.

**14. Transport information**

Not classified as hazardous under transport regulations.

**15. Regulatory information**

Labelling according to EEC Directives

Not subject to labelling.

National legislation/regulations

Water hazard class: 1 VwWvS (Germany) of 17.5.1999, Annex 3

**16. Other information**

A backslash in the left hand margin indicates an amendment from the previous version.

The information contained herein is based on the present state of our knowledge and does not therefore guarantee certain properties. Recipients of our product must take responsibility for observing existing laws and regulations.



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FAX NO 002727112542602

P.O. BOX 2801

2002-02-05  
GKA/M320  
Dr. Leyendecker  
0621-60-45308  
CERTIFICATE NO 1773  
PAGE 1 OF 31685 MIDRAND  
South Africa**INSPECTION CERTIFICATE 3.1 B ACCORDING TO EN 10204**

LUTROL F 68	ARTICLE NO	50001260
0,50kg PE-Bottle	PRODUCT NO	010293 01
Purchase Order/Customer Product#	COLLI NO	321 2372
50001260	LOT/NO	09000101
	LOT/QTY	1.000 KGE
	TOTAL	1.000 KGE

Schwermetalle / Heavy Metals	max. 20 mg/kg
Propylenoxid / Propylene Oxide (CGC)	<5 mg/kg
pH-Wert / pH-value 100g/l in Wasser / in water Ph.Eur.	7.0
Aussehen der Loesung/Appearance of solution 100g/l in water Ph.Eur.	Entspricht / conforms
1,4-Dioxan / 1,4-Dioxane (CGC)	<5 mg/kg
Ethylenoxid / Ethylene Oxide (CGC)	<1 mg/kg
APHA-Farbzahl / Color APHA (50/50 in CH3OH)	17 APHA
Identitaet / Identification (IR)	Entspricht / conforms
Identitaet / Identification (Hydroxylzahl / hydroxyl value)	Entspricht / conforms
Restloesemittel / residual solvents (Trocknungsverlust / loss on drying) Ph.Eur., class 3	0.2 g/100g
Ungesaetzigtheit / Unsaturation (Hg-acetat-Meth.)	0.028 meq/g
Molekulargewicht / Average Molecular weight	9048 g/mol

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1685 MIDRAND  
South AfricaGKA/M320  
Dr.Leyendecker  
0621-60-45308  
CERTIFICATE NO 1773  
PAGE 2 OF 3**INSPECTION CERTIFICATE 3.1 B ACCORDING TO EN 10204**

LUTROL F 68	ARTICLE NO	50001260
0,50kg PE-Bottle	PRODUCT NO	010293 01
Purchase Order/Customer Product#	COLLI NO	321 2372
50001260	LOT/NO	09000101
	LOT/QTY	1.000 KGE
	TOTAL	1.000 KGE

pH-Wert / pH-value	6.7
25 g/l in Wasser / in water	
Wasser / Water	0.18 g/100g
(Karl- Fischer- Titration)	
Trübungspunkt / Cloud point	>100 Grad Celcius
100g/l in Wasser/ in water	
Butylhydroxytoluol /	110 mg/kg
Butylhydroxitoluene	
Polyoxyethylen-Gehalt /	82.0 g/100g
Weight percent oxyethylene	
Asche / total ash	0.1 g/100g
Restloesemittel / Residual solvents	<50 mg/kg
(Ethylenglykol / Ethyleneglycol)	
Ph.Eur., Class 2	

Andere im USP/NF genannte fluechtige organische Verunreinigungen (Benzol, Chloroform, Methylenchlorid, Trichlorethylen) sind synthesebedingt nicht enthalten.  
Nur die Restloesemittel Ethylenglykol und 1,4-Dioxan der Klasse 2 und Restloesemittel der Klasse 3 des Ph.Eur. 3.Ed Supplem.2000 koennen enthalten sein. Die Konzentrationen der Klasse 2 liegen unterhalb der im Ph.Eur., Kapitel 5.4 genannten Grenzwerte und der Gehalt an Klasse 3 liegt unterhalb 0,5 %.

Other organic volatile impurities cited in USP/NF (Benzene, Chloroform, Methylene Chloride, Trichloroethylene) are not present due

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1685 MIDRAND  
South Africa

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CERTIFICATE NO 1773  
PAGE 3 OF 3

**INSPECTION CERTIFICATE 3.1 B ACCORDING TO EN 10204**

LUTROL F 68	ARTICLE NO	50001260
0,50kg PE-Bottle	PRODUCT NO	010293 01
Purchase Order/Customer Product#	COLLI NO	321 2372
50001260	LOT/NO	09000101
	LOT/QTY	1.000 KGE
	TOTAL	1.000 KGE

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to synthesis.  
Only class 2 solvents ethylene glycol and 1,4-dioxane and class 3 solvents of EP 3.Ed Supplem.2000 are likely to be present. The concentrations of class 2 solvents are below the limits given in EP, chapter 5.4. and class 3 solvents are below 0,5 %.

Das Produkt erfuehlt die Anforderungen der Monographie Poloxamer des NF 19 und EP 3.Ed.  
The product meets the requirements of the monograph poloxamer of NF 19 and EP 3.Ed.

QS-Referenz-Nr. / QC-Reference-No.	01C05577
Analysiert am / Analyzed on	27.07.2001
Mindestens haltbar bis / Best before	07.2003

BASF Aktiengesellschaft

GKA Analytik

Qualitaetskontrolle / Quality Control

gez. / sig. H.Fischer

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This Certificate of Analysis has been produced electronically and is valid without signature.

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## Appendix C – Lube-Booster II



### LUBE-BOOSTER® II

#### I. PRODUCT DESCRIPTION

**LUBE-BOOSTER® II** is a water soluble, polymer based lubricity additive for formulating synthetic and semi-synthetic fluids for ferrous and non-ferrous applications. It is used in diversified operations including general purpose machining, multi-metal machining, and especially in combination with EM-706 in drawing, stamping and machining of aluminum alloys.

#### II. TYPICAL PROPERTIES

PROPERTY	TYPICAL VALUE
Active, %	95
Water, %	5
Appearance, 77°F (25°C)	Clear
Appearance, 36°F (2°C)	Opaque
Viscosity, SUS @ 100°F (37.8°C)	2,300
Color, ASTM	4
Specific Gravity, 77°F (25°C)	1.00
Flash Point, COC, °F (°C)	>375 (>191)
Acid Number, mg KOH/g	65
Base Number, mg KOH/g eq.	76
pH, 2.5% (Buffer 7.0)	8.1
Temperature Stability (36°F, 130°F)	Reconstitutes itself @ R.T.
Refractive Index, 77°F (25°C)	1.4734

**Ferro Corporation - Petroleum Additives, 3000 Sheffield Avenue, Hammond, Indiana 46327 (219) 931-2630 • FAX (219) 931-0895**

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**III. PERFORMANCE PROPERTIES**

**FOAMING**

**LUBE-BOOSTER® II** at 1% in tap water (8 grains/gallon) exhibits low foaming properties; foam formed after shaking in a glass cylinder is unstable and breaks within 5 seconds.

**COMPATIBILITY WITH VARIOUS METALS<sup>1</sup>**

Cold rolled steel <sup>2</sup> SAE 100	Pass
Aluminum 2024T4	Pass
1 1/2 side galvanized steel <sup>3</sup>	Stain <sup>4</sup>
Copper	Stain <sup>4</sup>

<sup>1</sup> 1% **LUBE-BOOSTER® II** in tap water (8 grains/gal), 24 hrs @ 100°F

<sup>2</sup> Q-Panel Co

<sup>3</sup> 1 1/2 hot dip galvanized G 60/AOI Chrysler Control & Audit Panel, Advanced Coating Technology Co.

<sup>4</sup> Likely to be caused by free amine present in the product; suitable inhibitor should be included in formulations intended for galvanized steel and copper applications.

**RESIDUE**

**LUBE-BOOSTER® II**, after 16 hours at 130°F (54.4°C), remains a smooth, flowable liquid.

**HARD WATER STABILITY**

**LUBE-BOOSTER® II** has moderate hard water stability.

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**ENVIRONMENTAL DATA**

Effluent Concentration at:

	0.1%	1.0%
BOD (5 day, mg/l)	827	9,800
COD (mg/l)	2,030	20,500
Ratio BOD:COD	1:3*	1:2*
TOC (mg/l)	360	1,270
Freon Extractables (mg/l)	250	1,270

- Biodegradable

**ECOLOGICAL PROFILE**

**LUBE-BOOSTER® II** utilizes straight-chain chemistry in order to preserve a biodegradable profile. BOD:COD ratios of less than 1:3 are generally preferred to achieve biodegradability. Use of double and triple bonded chemistries are minimal to nil in order to accommodate degradation. TOC values show a low organic load which minimizes impact on the industrial effluent and improves the likelihood of compatibility with traditional waste-treatment schemes currently in place. **LUBE-BOOSTER® II** is compatible with most publicly owned waste treatment (POWT) systems. Freon extractables indicate low values at typical effluent concentrations. **LUBE-BOOSTER® II** does not contain nitrite, chlorine, sulfur, phosphorous, heavy metals or petroleum oil.

**IV. APPLICATION INFORMATION**

**IN FORMULATING PRODUCT**

Lubricity additive for formulating machining fluids on ferrous and non-ferrous metals (4-8%); lubricity additive for synthetic drawing compounds on ferrous and non-ferrous metals (6-12%).

**TANK-SIDE ADDITION**

In heavy-duty applications, where high lubricity and excellent surface finish are required, **LUBE-BOOSTER® II** can be added directly to the machine tank, "tank side." The required amount should be determined experimentally.

**Ferro Corporation - Petroleum Additives, 3000 Sheffield Avenue, Hammond, Indiana 46327 (219) 931-2630 • FAX (219) 931-0885**

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**V. HANDLING AND STORAGE**

Store in closed, original container at 40°-100°F. Exposure to temperatures in excess of 150°F can cause darkening of the product.

**VI. PACKAGING INFORMATION**

Available in 440 lb (200 kg) net new, lined steel drums, bulk rail and truck quantities.

10/96

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