
KAMATICS ***RELIAMET***[™]
Bearings

Kamatics Corporation

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KAMATICS **RELIAMET**™

Bearings



KAMATICS RELIAMET™ F16

MLG

Kamatics Corporation



KAMATICS RELIAMET

™

767 MLG Mid Pivot

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Kamatics **RELIAMET™**

STOP! ROUTINE REPLACEMENT OF METAL-TO-METAL BEARINGS

Kamatics **Reliamet™** replacements for Metal-to-Metal Bearings:

- Drop-in replacement for metal-to-metal bearings
- Constructed from all corrosion resistant materials.
- Eliminate Lubricant migration from wear zone.
- Self-Lubrication eliminates difficult to access grease locations.

Prevent – fretting, seizing, rotation
and shaft/housing damage

Result- Problem solving
bearing solution!



KAMATICS RELIAMET™
Axle Kingpost Bushing

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RELIAMET™ Features and Benefits

Kamatics Metal to Metal Bearing Replacement with Reliamet™ system:

- Corrosion Resistant materials
- Thin KAron (~.004" [0.10mm]) Liner
 - Performance in Vibration.
 - High load capability, high stiffness, low deflection.
 - Can be used dry (self lube) or lubed
- Fail safe outer race design
 - ToughMet®, Nickel Aluminum Bronze, or Stainless Steel.
 - “KAron reservoir replenishment” design.



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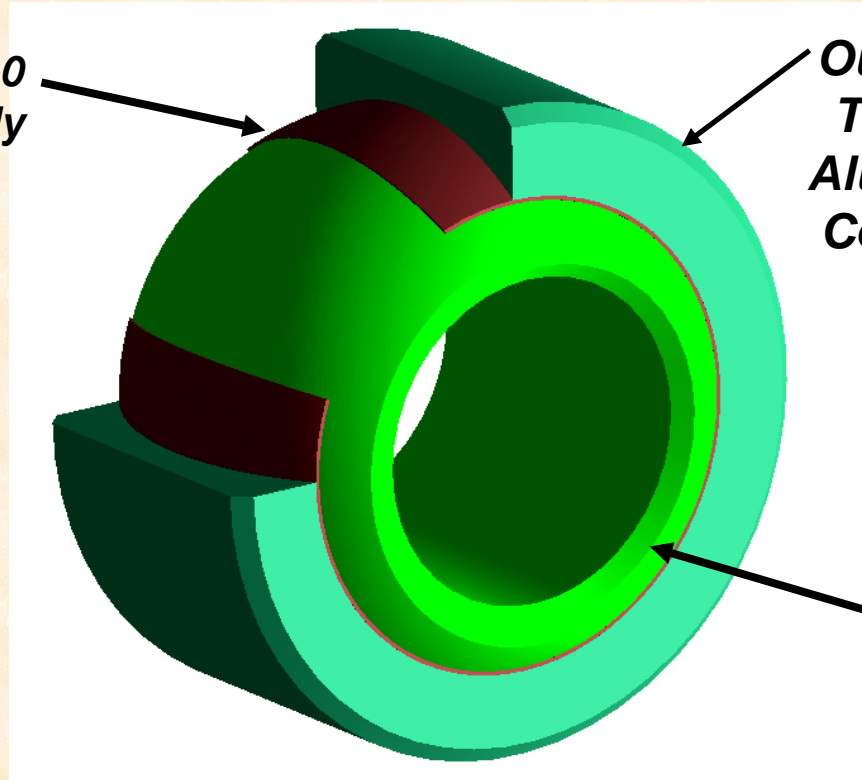
ToughMet® is a trademark of Brush Wellman Engineered Materials

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KARON LINED RELIAMET™

REPLACEMENT BEARINGS

KARON: .004 in (0.10 mm) thick nominally



***Outer Race Material:
ToughMet®, Nickel
Aluminum Bronze, or
Corrosion Resistant
Steel***

***Hardened Corrosion
Resistant Inner Race:
440C, Cronidur 30***

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RELIAMET™ in Design News and MRO Magazines

RELIAMET™

THE METAL TO METAL ALTERNATIVE

Kamatics Corp., who 30 years ago introduced Karon, the injected, machinable alternative to traditional fabric Teflon systems presents **RELIAMET™** The Metal to Metal Alternative. A thin layer of Karon, used together with corrosion resistant metals, provides performance superior to traditional metal to metal bearings.



RELIAMET provides:

- High Load/
Vibration Capability
- Low Backlash
- Failsafe Operation
- Extended Life

RELIAMET prevents:

- Fretting Corrosion
- Galling and Seizure

Kamatics Corporation
133 Blue Hills Avenue
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Tel: 860 243 9704
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RELIAMET meets performance requirements of Mil-B-81936

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Technology Update: ToughMet®
Copper Nickel Tin (CuNiSn) Bronze

- **COPPER ALLOY WITH BEARING PROPERTIES SIMILAR TO OR BETTER THAN COPPER BERYLLIUM.**
- **SAFE HANDLING MATERIAL - NO TOXIC/HAZARDOUS MATERIALS**
- **YIELD STRENGTH : UP TO 140,000 psi (1034 MPa).**
- **PROVIDES FAILSAFE, ANTI-GALLING SURFACE.**
- **HARDNESS : UP TO 36 Rc.**
- **EXCELLENT GALVANIC PROPERTIES.**

SPECIFICATION ISSUED
SAE AMS 4596

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Equalizer Bar Tractor Bushing

KAMATICS RELIAMET™

The Reason for KAron / ToughMet®

KAron liner and ToughMet® will significantly extend operating life.

Metal to Metal bearings- High Loads/Vibration/Small motions can cause immediate damage to bearing surfaces.

LUBRICATION MIGRATION FROM WEAR ZONE

Damage Progresses Rapidly - Bearings Cease to Function.

With ToughMet® as the gall resistant substrate metal damage is negligible.

- ✓ **KAron liner embedded in small reservoirs in Bronze surface.**
- ✓ **Reservoirs supply KAron material and continued lubrication.**
- ✓ **Problem solving Metal-to-Metal replacements with or without external lubrication.**

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KAMATICS **RELIAMET**™

Benefits of KAron / ToughMet®

- Failsafe Design**
- High Load Capability**
- Drop-in replacements for Metal to Metal bearings**
- No need for Nitriding or Malcomizing -Corrosion resistance of the outer race is not compromised**
- No migration of Lubrication from the Wear Zone**



KAMATICS **RELIAMET**™
F-16 LANDING GEAR

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RELIAMET™ Applications

- **SPHERICAL BEARINGS**

- B737/CFM56 Thrust Reverser
- Ferranti UK - Metal-to-Metal replacement
- Bell Helicopter - Transmission Mount - proposed
- Typhoon Center Fuselage
- Fairchild Dornier - Flap attachment Bearing
- PZL Swidnik Helicopter- Gear Box Mount
- B747 Flap Spindle Bearing

- **BUSHINGS:**

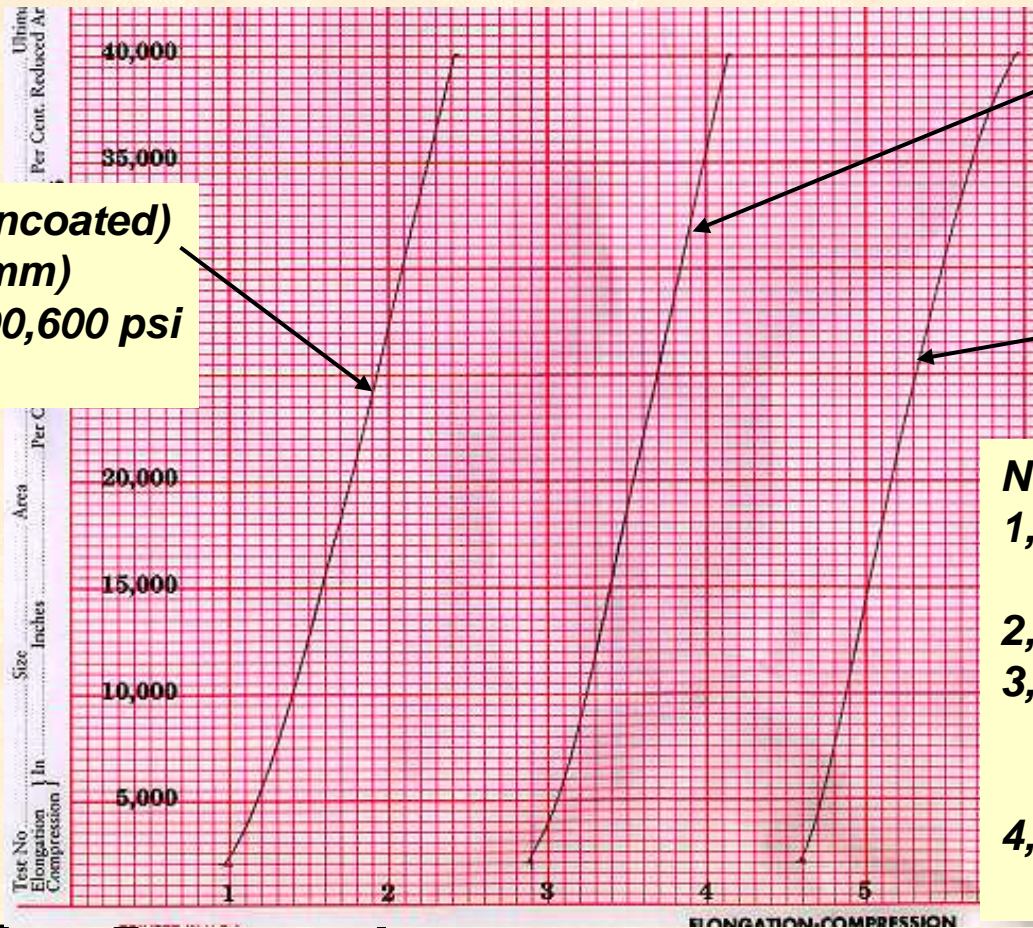
- Boeing 757, 767 MLG Truck Beam Pivot
- F-16 MLG/NLG Bushing Overhaul
- Airbus/Goodrich - A380 Truck Beam Pivot
- A380 Outer Flap
- A380 Z-Coupling
- Embraer 145 NLG Piston Sleeve
- Embraer 170 NLG Piston Sleeve
- Axle Kingpost
- Gulfstream V Aft Truss
- Sundstrand/CRJ700 Flap Actuator bushing
- AB139 Landing Gear conductive bushings
- A321 Z-Link coupling - Flight Test
- 777 Outer Cylinder W/grease
- AAV (Amphibious Assault Vehicle) Thrust Plates and Actuator Collar
- Typhoon Wing Pylon (Aermacchi)
- Oil Rig Thrust Bearing (Schlumberger)

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Load/Deflection Curves KAron/ToughMet® Bronze

Thin KAron deflection is the same as metal-to-metal



ToughMet® (uncoated)
~0.006 " (0.15mm)
Deflection @ 90,600 psi
(625 N/mm²)

ToughMet®/KAron
(0.004")(0.1 mm)
~0.006 " (0.15mm)
Deflection @ 90,600 psi
(625 N/mm²)

Al/Ni/Bz
(uncoated)

Notes:

- 1, 0.75 dia specimen (19.05mm).
- 2, 5% preload
- 3, 40,000 lb (178 kN) load
90,600 psi pressure
(625 N/mm²)
- 4, ToughMet® Rc 32
Al/Ni/Bz Rb 96.4

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KAMATICS **RELIAMET**™

KAron / ToughMet® Testing

Test Specimens:

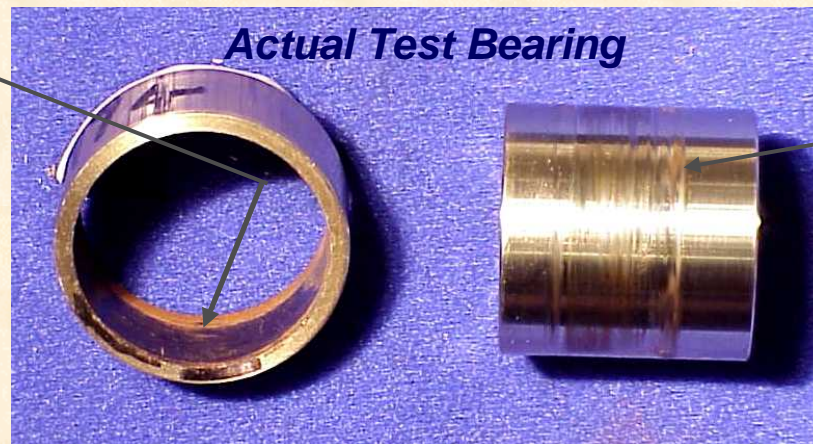
Journal: 1.19" OD x 1.00" ID x .50" Long (30.22 x 25.4 x 12.7 mm) thin KAron/CuNiSn

Mating Shaft: AMS 5630 (440C) Rc 55, 8 RMS surface finish

Test Parameters: (All testing conducted at ~20 cpm)

<u>KAron Type</u>	<u>Thick. in. (mm)</u>	<u>Osc. Angle</u>	<u>Pressure psi (MPa)</u>	<u>No. Cycles</u>	<u>Wear in. (mm)</u>	<u>Comments (Shaft)</u>
V	Grit line	±25°	10,000 (69)	180,000	.002 (0.05)	No distress, slight transfer of CuNiSn

LINER MACHINED TO GRIT LINE PRIOR TO TESTING, SIMULATES EXTREME LINER WEAR



MINOR MATERIAL TRANSFER (NOT MEASUREABLE)

Note: The bearing was still operable when testing was terminated.

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KAMATICS **RELIAMET**™

KAron / ToughMet® Testing

Test Specimen:

*MS14104-08 size, 1.00" OD x .50" ID x .50" ORace width (25.4 x 12.7 x 12.7 mm)
Ball Material = 440C Cres, ORace material = CuNiSn / .003" Karon F liner on OD*

Test Parameters: (Testing conducted at ~20 cpm)

<u>KAron Liner</u>	<u>Thick. in. (mm)</u>	<u>Osc. Angle</u>	<u>Pressure psi (MPa)</u>	<u>No. of Cycles</u>	<u>Wear in. (mm)</u>	<u>Comments</u>
V	.003(0.075)	±25°	10,000 (69)	50,000	.002 (0.050)	No distress, minor x'fer CuNiSn

*Thin Film KAron on ToughMet®
Approximates metal to metal
bearing with Failsafe number of
cycles with little wear.*

Actual Test Bearing



*Minor material transfer.
(Not measurable)*

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KAron / ToughMet® Testing Against Tungsten Carbide Cobalt

Test Specimens:

Bushing = 1.19" OD x 1.0" ID x .50" wide (30.23 x 25.4 x 12.7 mm) thin KAron on CuNiSn

Shaft = .990" OD x 1.0" wide (25.15 x 25.4 mm) 17-4PH with BMS10-67 Type 17 CL 4, Tungsten Carbide Cobalt HVOF coating, 4 rms ground finish

Test Parameters: (All testing conducted at ~26 cpm)

<u>KAron Liner</u>	<u>Thick. in. (mm)</u>	<u>Osc. Angle</u>	<u>Pressure psi (MPa)</u>	<u>No. of Cycles</u>	<u>Wear in. (mm)</u>	<u>Comments (Shaft)</u>
V	.006 (0.15)	±20°	10,000 (69)	186,000	.0005 (0.013)	Very low wear
V	"	"	20,000 (138)	200,000	.0015 (0.038)	Low wear
V	"	"	40,000 (276)	100,000	.005 (0.178)	No distress, minor x'fer CuNiSn

*20,000 psi,
200,000 cycles*



*40,000 psi,
100,000 cycles*

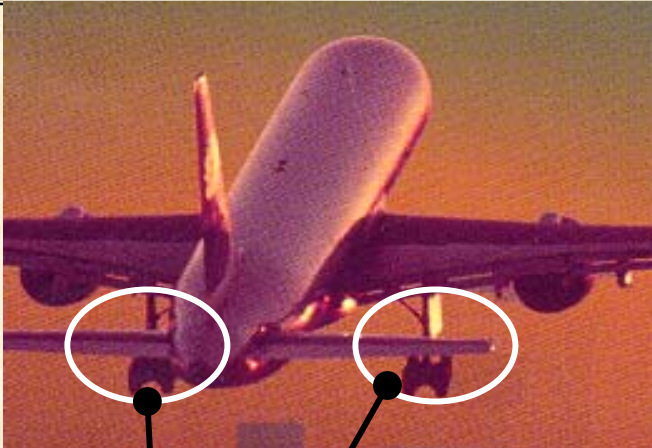
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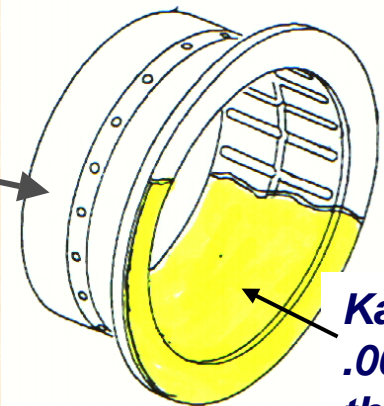
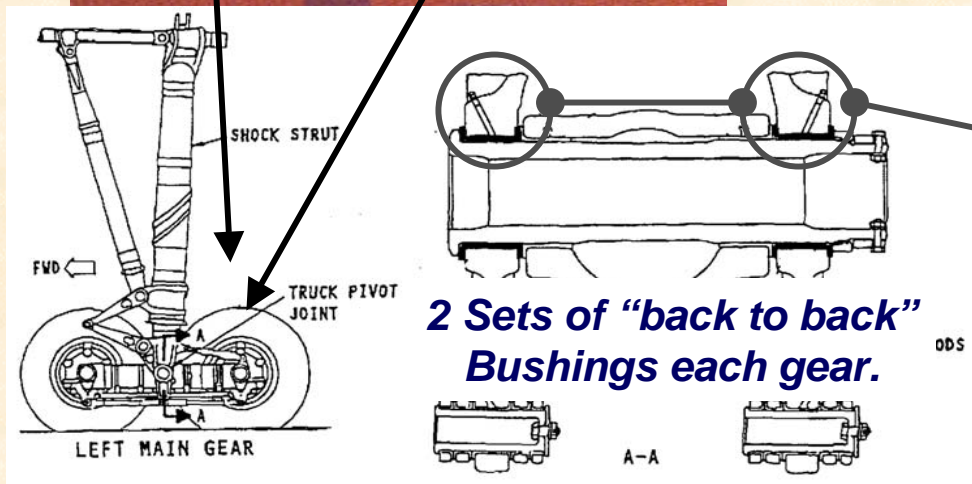
757 TRUCK BEAM



Originally a greased beryllium copper bearing system. Severe impact loading from rough runways caused grease to be expelled from the load zone. Severe damage occurred to the bearings.

Karon V applied to the ID and flange face to act as a lubricant during high impact occurrences.

Flight evaluated with excellent results.



Karon Liner
.005" (0.127mm)
thick applied
directly over
BeCu substrate

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FULL SCALE B757 TRUCK BEAM TEST

Boeing conducted full scale test 757 MLG truck

Test Configuration -

→ Thin KAron V liner (0.005") on NiAlBr bushing

Test Results -

→ After 2,000 cycles (landings) simulating poor condition Russian runways (PV value is 10 times normal runways)

→ KAron V lined bushings:

Dry - worn to NiAlBr interface (~0.005" wear)

Lubed – Like New appearance - low wear (0.001")

→ No bushing rotation in the housing

→ After 3,000 cycles – Lubed Thin KAron lined bushings still in good condition!!

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B757 TRUCK BEAM TEST

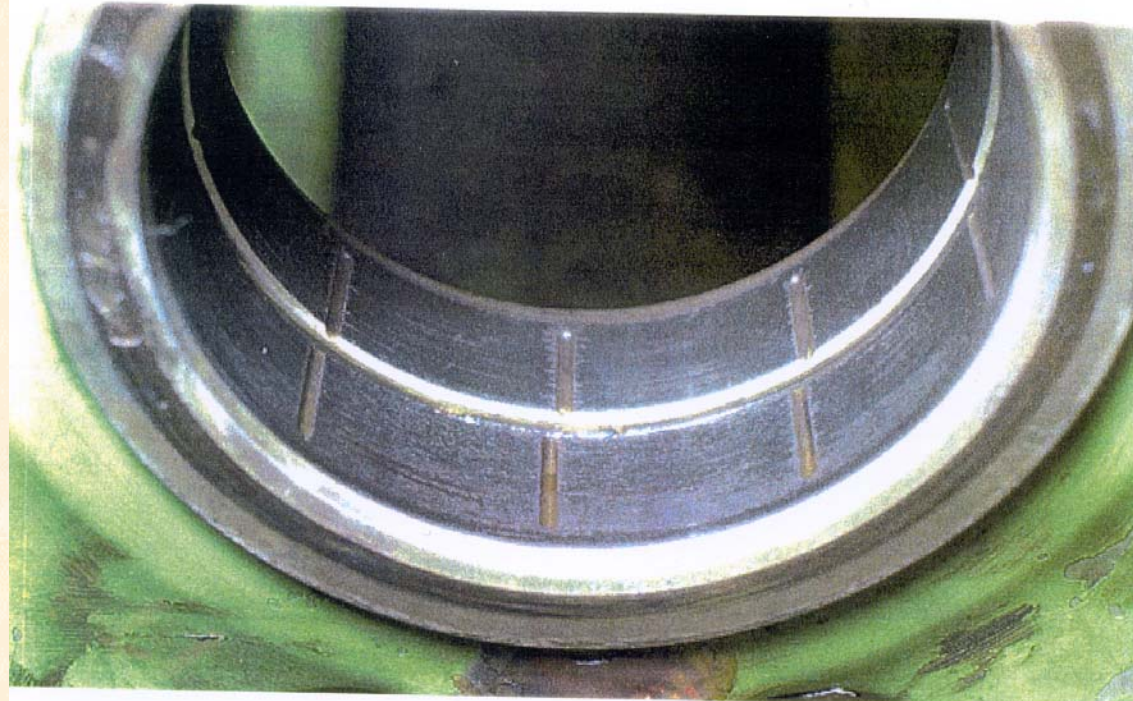
3,000 CYCLES

Boeing Full Scale Test



- Greased thin KAron on AlNiBr Substrate
 - KAron Liner - good condition 3,000 flight cycles ON "rough" runways
- Kamatics Corporation**

Boeing Full Scale Test



Lubricated Inner Cylinder Fork Bushings after 3,000 flights

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Kamatics is a worldwide supplier of technologically advanced aerospace, hydropower and other industrial products such as:

- ✓ **KAron™ and Katherm™** Self-lubricated Bearing Systems.
- ✓ **Kaflex™** Coupling for High Performance Power Transmission Applications.
- ✓ **Reliamet™** Metal to Metal replacement bearing systems.
- ✓ **Fiberlon™** Bearings and other Advanced Composites for Aerospace, Wire and other industries.

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