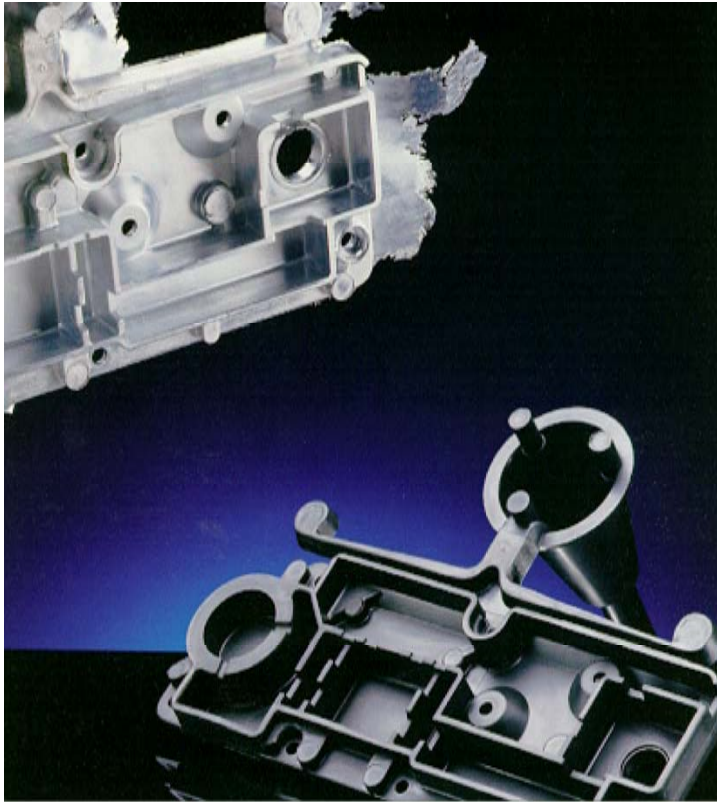


GRIVORY®

Grivory GV The reliable product for metal replacement



Grivory HT Enhanced performance at high temperature

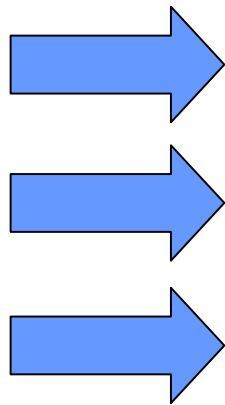


Product Description Grivory GV

Grivory GV is a semi-crystalline thermoplastic engineering material based on polyamide with partially aromatic components.

Grivory GV is glass-fibre reinforced and especially suitable for the production of technical parts by injection moulding.

Grivory GV is characterised by:

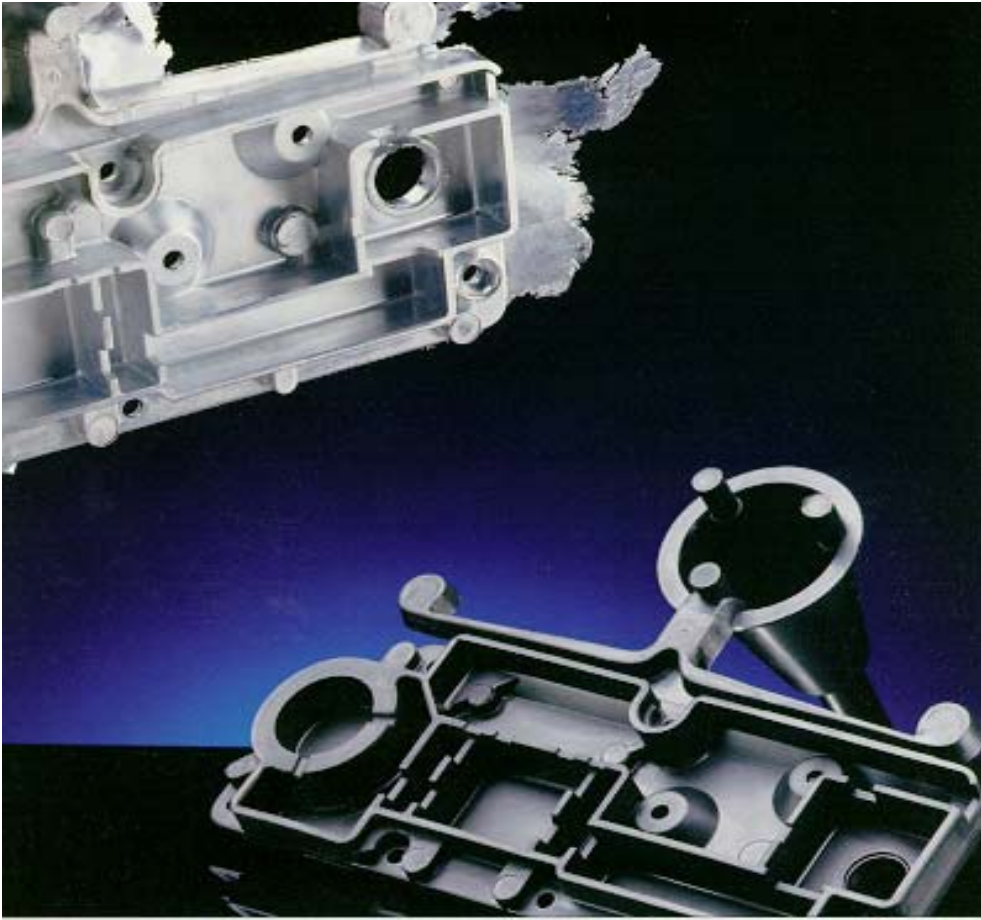


High Stiffness and Strength

Good Dimensional Stability

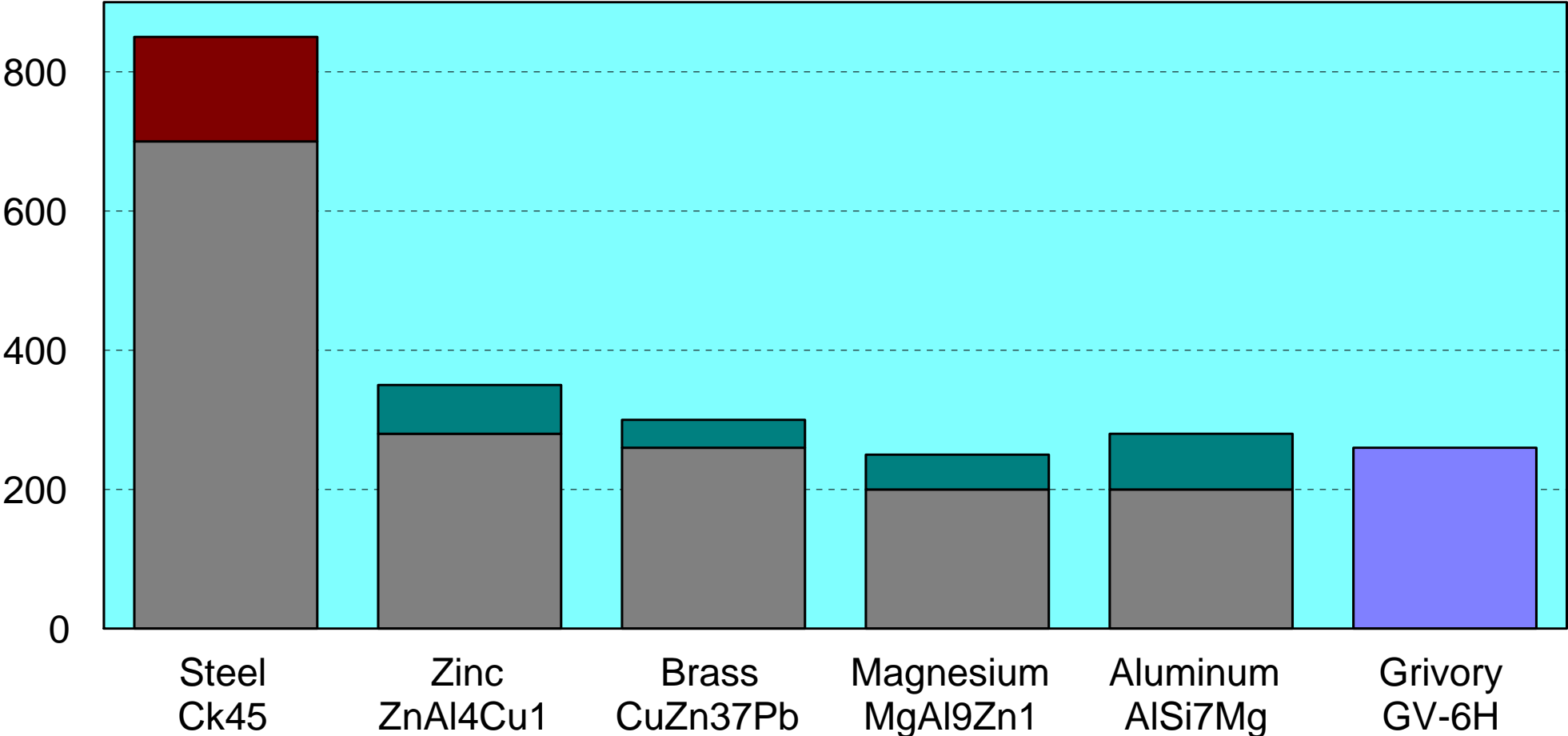
also after moisture absorption

Replacing Die-Cast Metals With Grivory

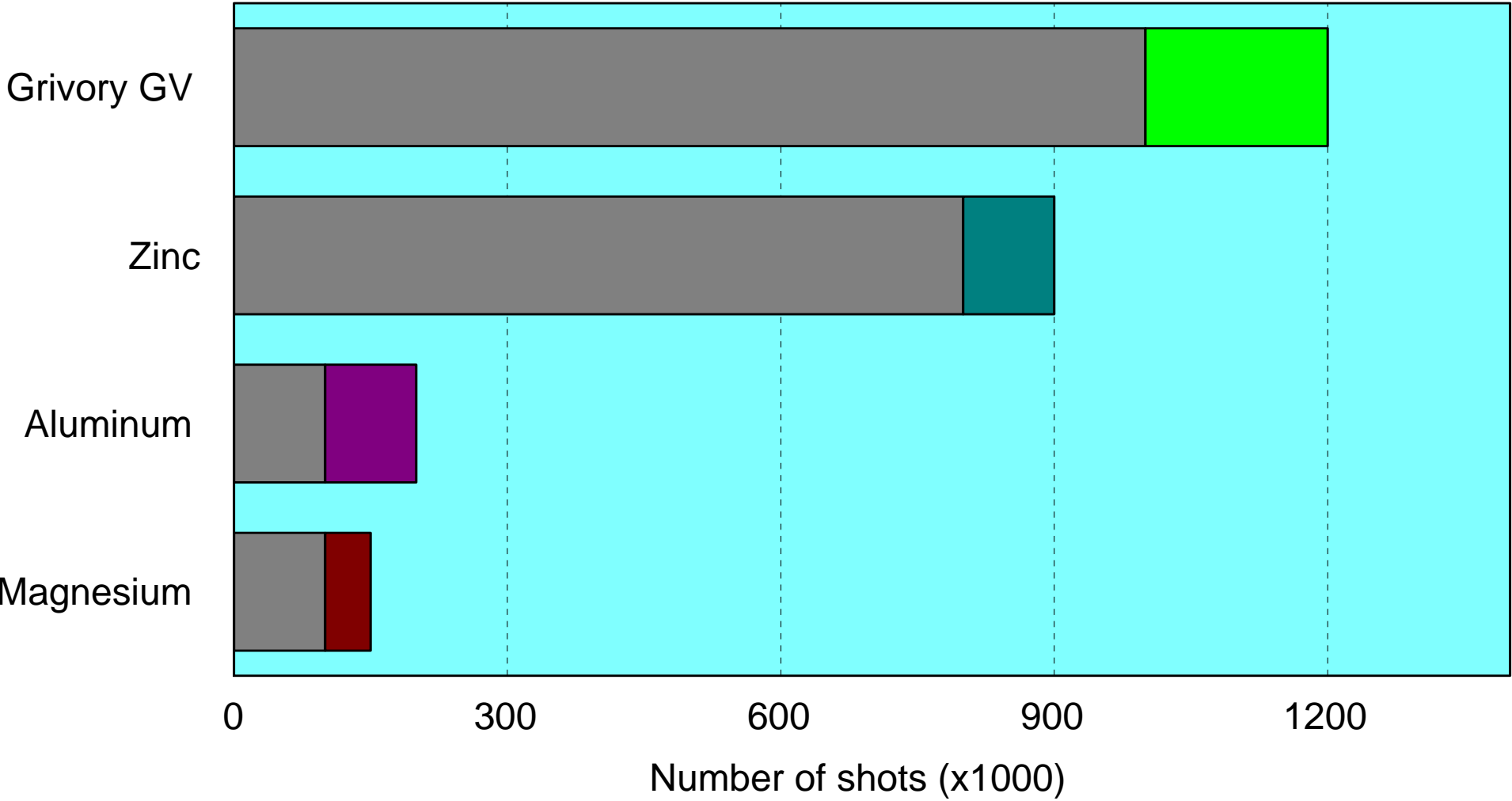


Which Metals can be Replaced by Grivory?

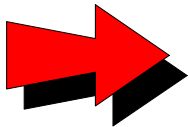
Tensile Strength [MPa]



Grivory Offers Cost Savings due to Longer Service Life of the Tool



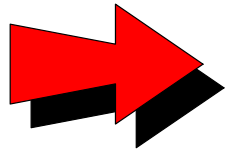
Grivory can be Custom Colored



Grivory can yield cost savings by eliminating finish painting or powder coating.

Grivory Offers Improved Resistance to Chemicals that Attack Die-Cast Metals

- ▶ Salts
 - Zinc Chloride
 - Sodium Chloride
 - Magnesium Chloride
- ▶ Base
 - Sodium Hydroxide

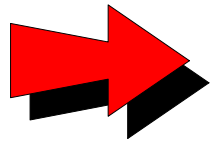


Grivory can yield cost savings by eliminating the need for protective coatings such as anodizing or oxide plating.

Grivory can be Metalized!

- **Physical Vapor Deposition (PVD- process)**
Metal is evaporated under vacuum and forms a thin layer on the part.
Most plastics can be plated using this approach.
- **Galvanic Copper - Nickel Electroplating**
The most durable and desirable approach in which a galvanic copper substrate is deposited upon the plastics surface. Nickel and chrome layers are deposited upon the copper base to yield a durable high luster surface.
- **Painting with conductive lacquer or urethane**
Painted with metal-powder filled "clear" paints for electromagnetic shielding.
Typically done with copper, nickel and silver.

Metal Replacement with Grivory can Result in 30 - 50% More Profit

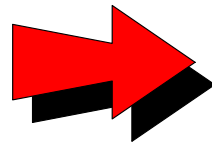


Grivory enables cost-saving due to:

- Less work. deflashing, sand-blasting, cleaning, annealing etc. is not necessary
- No surface treatment. like painting or corrosion protection
- Lower freight charges. cost per unit weight / unit volume
- Longer tool service life. up to five times

Grivory GV-5H Replaces Zinc Die-Cast Linear Gear Drive Housing

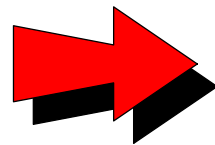
Material	Zinc die-cast	Grivory GV-5H
Weight	1.15 kg	0.27 kg
Post treatment	<ul style="list-style-type: none"> - Boring the bearing seat - cutting of five threads - painting in three colors 	<ul style="list-style-type: none"> - not necessary - directly molded - colored EMS material
Total cost per part	US \$ 8.15	US \$ 3.67



55 % cost reduction means
profit increase of (US) \$670,000
(150,000 parts/years)

Grivory GV-5H Replaces Aluminum Die-Cast Tachometer Housing

Material	Aluminum die-cast	Grivory GV-5H
Weight	0.36 kg	0.21 kg
Material cost/part	\$0.64	\$1.47
Tool costs	\$ 88,000 (US Dollars)	\$ 88,000 (US Dollars)
Parts/tool	100,000	500,000
Number of tools	5	1
Tool costs/part	\$ 0.88 (US Dollars)	\$ 0.18 (US Dollars)
Post treatment	milling, boring and turning	none



45 % cost reduction
(500,000 parts in 5 years)

When Should Grivory be Considered for Metal Replacement?

- ✓ Structural rigidity and dimensional stability are required.
- ✓ Weight reduction.
- ✓ Reduce or streamline the number of manufacturing steps.
- ✓ Improve corrosion resistance.
- ✓ Significantly increase the service life of your tooling.
- ✓ Desire to save money via reducing the total manufacturing cost of the product.

When Should Grivory be Considered for Metal Replacement?



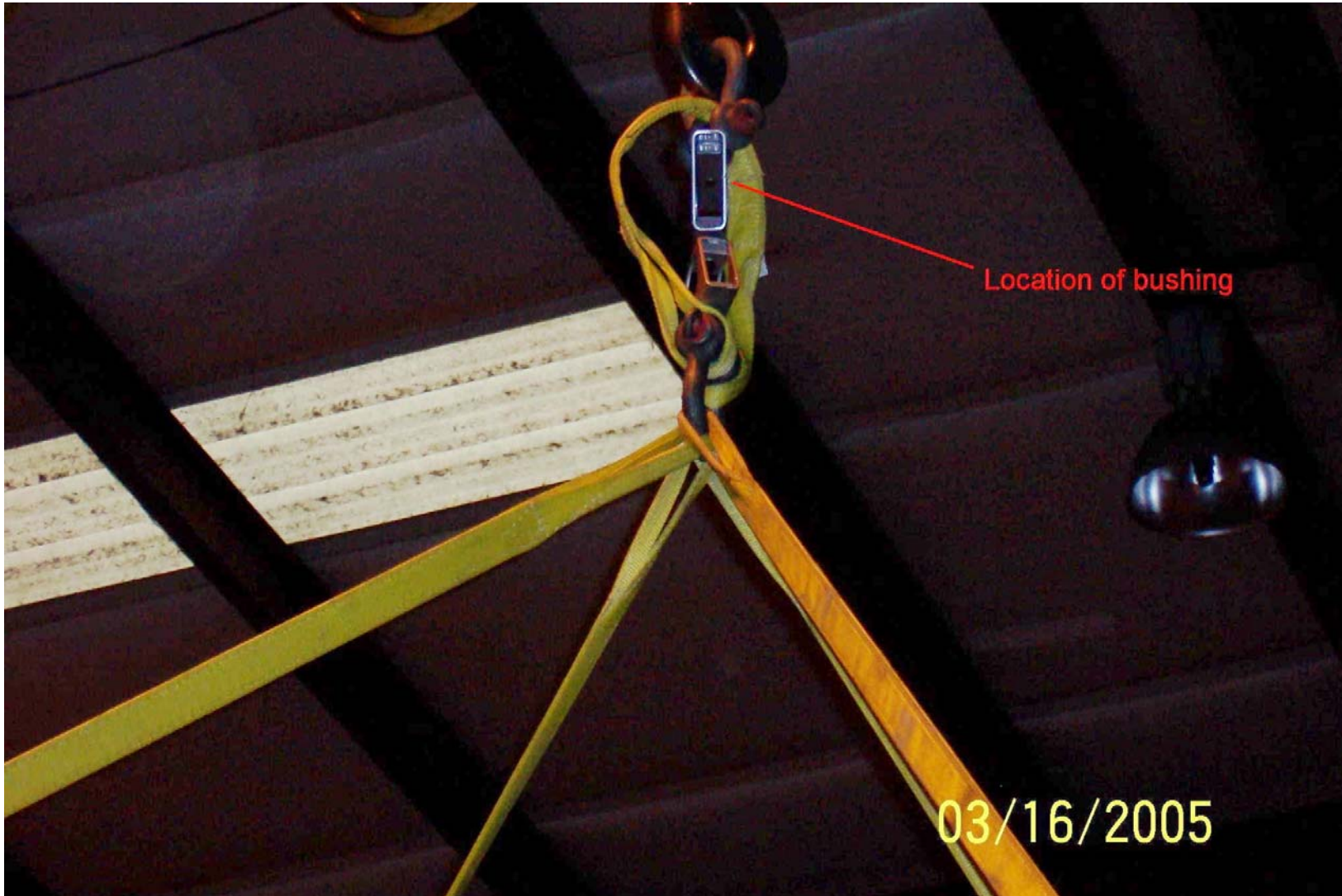
When Should Grivory be Considered for Metal Replacement?



When Should Grivory be Considered for Metal Replacement?



When Should Grivory be Considered for Metal Replacement?



When Should Grivory be Considered for Metal Replacement?





Strength in Detail