



# IPD CHROMOLY STEEL LINER FOR C18/C32 APPLICATIONS

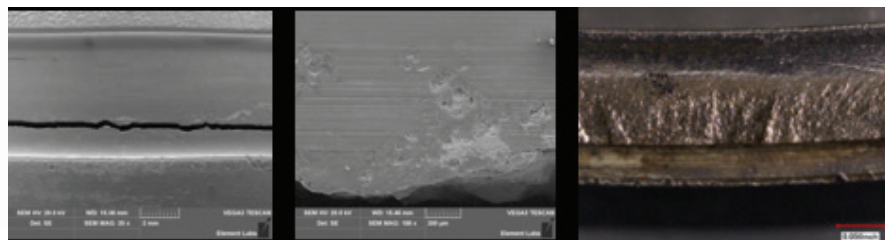


## AN IPD INNOVATIVE ENGINEERING SOLUTION

IPD develops an improved liner using a unique material to address a known field issue and proves their new Chromoly Steel Liner, 5560701, works best to keep Caterpillar® engines running.

### THE PROBLEM:

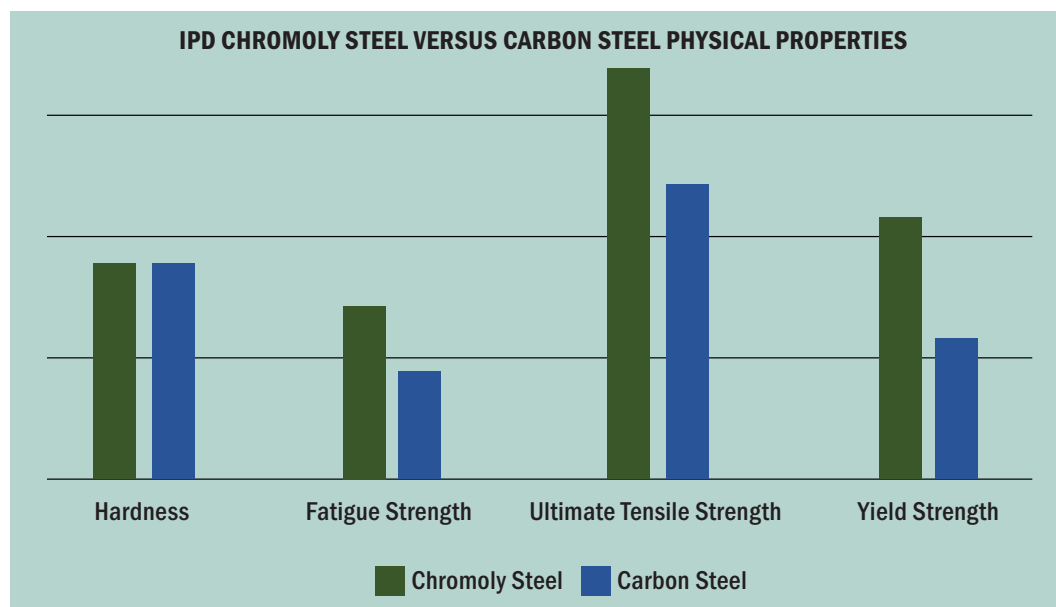
Historically, the C18/C32 cylinder liner, 3221126, was constructed from basic carbon steel and had cracking issues in the upper o-ring groove. Simulation and field tests showed this crack formed at approximately 100 hours of engine operation with standard carbon steel material used at the time. Digital stereomicroscope photographs and scanning electron microscope (SEM) micrographs showed a fatigue fracture origin of the failed liner. Investigations and simulation confirmed cracking initiated from the o-ring groove due to piston forcing function.



SEM photos of the fatigue crack in the standard carbon steel liner

### ENGINEERING ANALYSIS:

IPD Engineering examined failed field hardware and used computational FEA (Finite Element Analysis) to understand why the crack formed and evaluated potential solutions. The simulation and field data indicated that the initial crack formed after only 10 hours and the larger crack formed by 100 hours of use. IPD tested a few ideas to reduce the stress or eliminate the crack, but the real magic bullet was changing the liner material to a carbon steel that contained added chromium and molybdenum for fatigue strength and toughness. Subsequent multiple successful field tests have resulted in no cracking.

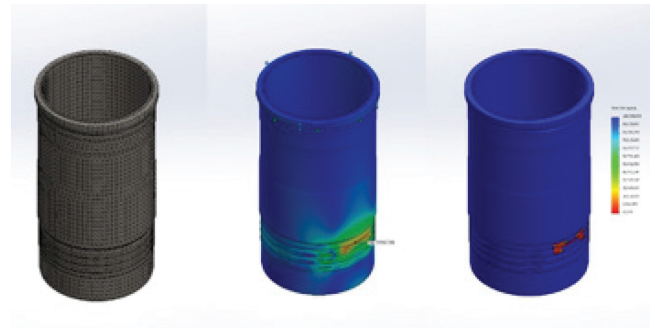


# IPD CHROMOLY STEEL LINER FOR C18/C32 APPLICATIONS

## THE SOLUTION:

A material change from high carbon steel to chromoly steel has significantly resolved the cracking issue. The C18 liner with chromoly steel does not crack in the upper o-ring groove with the same loading and environmental conditions. The change to chromoly increases the margin of safety and eliminates the fatigue cracks. *A steel cylinder liner offers additional strength and ductility over a traditional carbon steel liner. It's simply a better, stronger liner.*

**IPD is the first company to offer improved chromoly steel liners, 5560701.** We have sold thousands with solid results and zero problems. They look like our old high carbon steel liner, 3221126, only the material properties are different. This is just one example of the quality parts and innovation you can expect from IPD.



Model

Stress Results

Crack Prediction

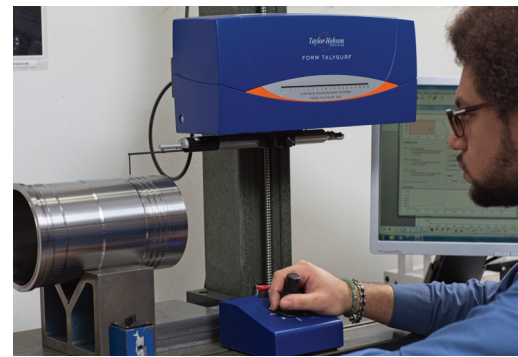
## CRITICAL CHARACTERISTICS OF A QUALITY CYLINDER LINER

### Dimensional:

- ✓ Flange Height/Radius
- ✓ Liner Inner/Outer Diameter
- ✓ Hone Pattern/Depth
- ✓ ID/Groove Surface Finish
- ✓ Groove Radius

### Material Properties:

- ✓ Tensile/Fatigue Strength
- ✓ Hardness
- ✓ Case Hardness Depth
- ✓ Flange Radius Roller Burnish



IPD Engineering validates steel cylinder design using contour measuring machine.

## IPD C18/C32 Liner Kit Options:

	Application	Liner	Piston	Pin	Retainer	Ring Set
PLG3687816	C18	5560701	3687816	1807350	2502940	C18RS1
PLG3687817	C18	5560701	3687817	1807350	2502940	C18RS1
PLG3687818	C18	5560701	3687818	1807350	2502940	C18RS1
PLG3724884	C18	5560701	3724884	1807350	2502940	C18RS3
PLG3196717	C18	5560701	3196717	1807350	2302569	C18RS1
PLG3687815	C18	5560701	3687815	1807350	2502940	C18RS1
PLG3724970	C32	5560701	3724970	1807350	2502940	C18RS3
PLG3758134	C32	5560701	3758134	1807350	2502940	C18RS3
PLG3758261	C32	5560701	3758261	1807350	2502940	C18RS3
PLG3196716	C32	5560701	3196716	1807350	2302569	C18RS1
PLG3294509	C32	5560701	3294509	1807350	2302569	C18RS1
PLG3306090	C32	5560701	3306090	1807350	2302569	C18RS2
PLG3675160	C32	5560701	3675160	1807350	2302569	C18RS2
PLG3675181	C32	5560701	3675181	1807350	2302569	C32RS1



## IPD

23231 Normandie Ave.  
Torrance, CA 90501 USA  
+1.310.530.1900

ISO 9001: 2015 Certified

[ipdparts.com](http://ipdparts.com)