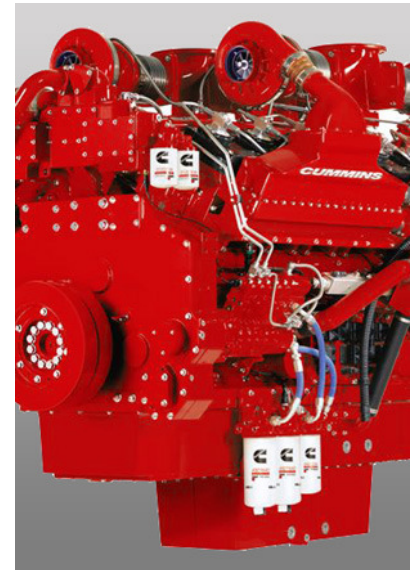
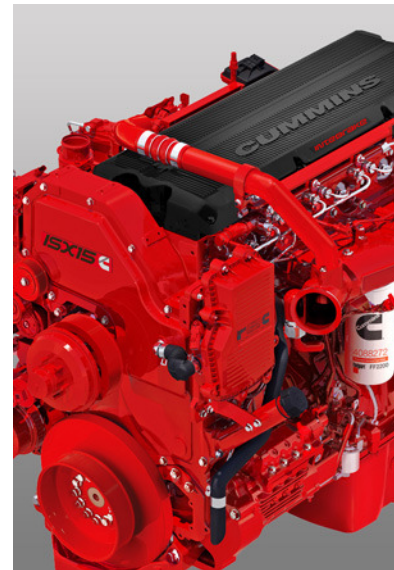
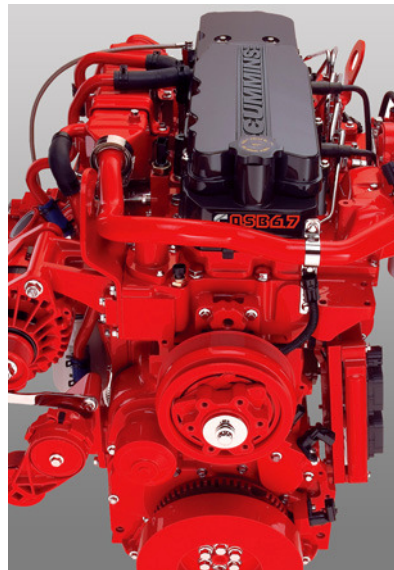
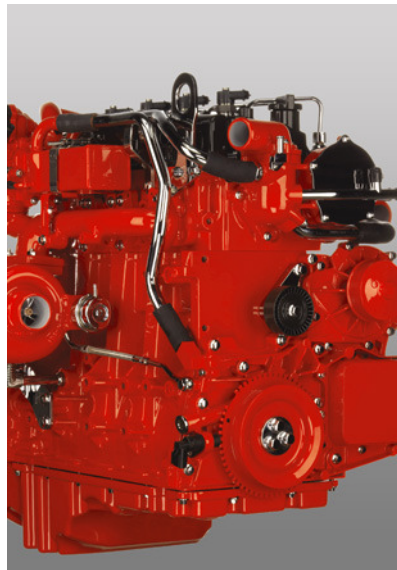




# Cummins ISM Test Batch "E" Crosshead Supply Cummins Part # 3070175

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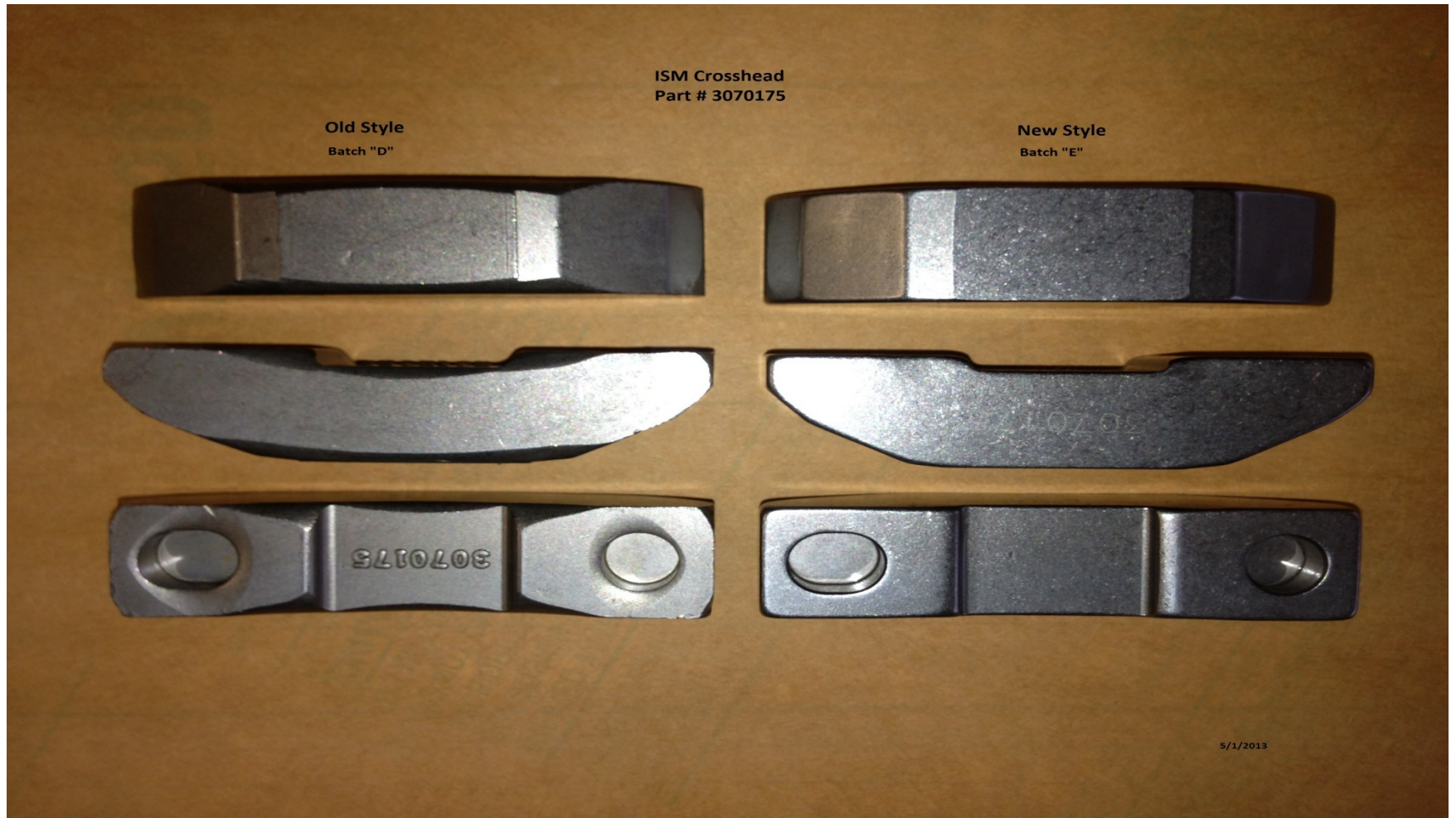


## Overview of ISM crosshead production and testing at CTC

- Parts ordered and produced at Cummins Supplier in single batch production run (supplier change since Batch D was produced)
- Parts delivered to Cummins Tech Center for Metallurgical testing
- 20 samples selected randomly from 20 different boxes of 3600 count on pallet
- 4 samples tested for destructive micro hardness, Metallurgist suggested no more need tested because uniformity in exceeding specifications.



# Macro Photos of ISM crossheads comparison



# Cummins Metallurgical Lab Conclusions

- The cross heads met the chemical composition as per Cummins spec
- The surface hardness on the valve pad ranged from 92.1 to 93 HR15N which met valve pad hardness requirement of 88-93 HR15N as per print spec
- The valve pad and the valve pocket met the effective case depth requirements of 0.012” and 0.009” respectively.
- All crossheads met micro hardness Spec Limit = min 50 HRc @ 229 Micron



## ISM crossheads “A” – “D” micro-hardness results

Part	Location	HRc at 100 um	HRc at 200 um	HRc at 300 um
A	Pocket	63.1	62.6	62.2
	Wear Plate	62.2	62.2	62.9
B	Pocket	63.4	62.9	61.2
	Wear Plate	61.7	61.5	58.5
C	Pocket	62.9	62.5	61.9
	Wear Plate	62.6	61.5	62.6
D	Pocket	62.4	61.5	61
	Wear Plate	62.2	60.1	58.9

*Specification: 50 min. HRc at 229 um*



# ISM crossheads “A”- “D” surface hardness results

All values taken at HR15N

A	1	2	3	Avg
1	91.7	92.1	92.6	92.1
2	92.8	92.7	93.5	93.0
3	92.4	92.4	92.5	92.4
4	93	92.9	93	93.0

B	1	2	3	Avg
1	92	92.3	92.8	92.4
2	93.1	92.7	92.6	92.8
3	92.5	93.1	92.5	92.7
4	92.2	92.4	92.9	92.5

C	1	2	3	Avg
1	92.2	92.4	92.5	92.4
2	93.2	92.7	92.9	92.9
3	92.3	92.6	92.1	92.3
4	93	93	92.5	92.8

D	1	2	3	Avg
1	92.3	92.1	92.9	92.4
2	92.7	92.4	91.8	92.3
3	92.2	92.6	93.1	92.6
4	92.5	92.5	92.7	92.6



# ISM (20 ) crossheads surface hardness

Location	Sample No.	Reading 1 (HR 15N)	Reading 2 (HR 15N)	Reading 3 (HR 15N)	Average hardness (HR 15N)
Bag A	1	92.3	92.4	91.9	92.2
Bag A	2	92.5	94.3	93	93.3
Bag A	3	92.5	93	92.6	92.7
Bag A	4	92.8	92.9	92.5	92.7
Bag A	5	92.1	92.5	92.6	92.4
Bag B	1	92.8	92.1	92.3	92.4
Bag B	2	91.9	92.3	92.5	92.2
Bag B	3	92.3	92.8	92.4	92.5
Bag B	4	92.2	92.6	92.3	92.4
Bag B	5	92.2	93	92.4	92.5
Bag C	1	92.4	92.1	92.1	92.2
Bag C	2	92.9	92.9	92.6	92.8
Bag C	3	91.6	91.9	92.5	92.0
Bag C	4	92.4	92.3	92.3	92.3
Bag C	5	91.8	92.3	92.2	92.1
Bag D	1	92.1	92.2	92.2	92.2
Bag D	2	92.3	92.3	92.5	92.4
Bag D	3	92.2	92.5	92.4	92.4
Bag D	4	92.1	92	91.9	92.0
Bag D	5	92.3	92.2	92.2	92.2

