

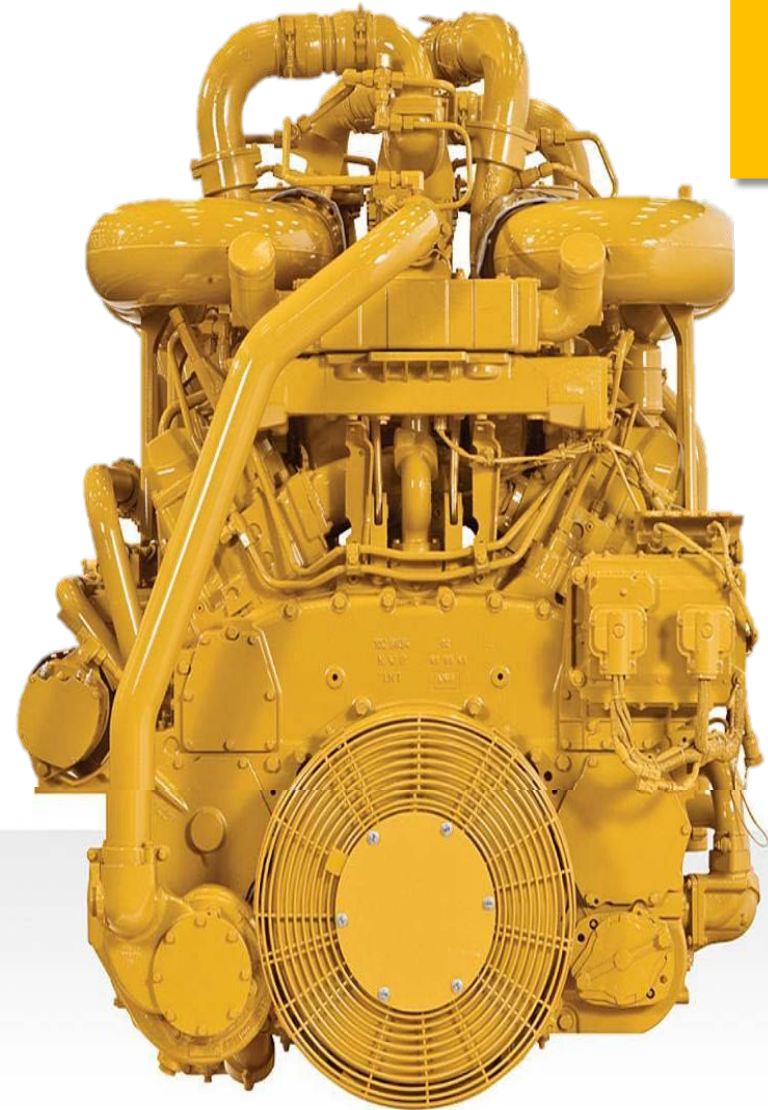
POWER

LARGE POWER SYSTEMS DIVISION

Lean Certification Benefit Review

August 11, 2016

CATERPILLAR®



Be Safe

Every Employee ... Safely Home ... Every Day

be present

SEEK + SHARE + LISTEN + CHAMPION

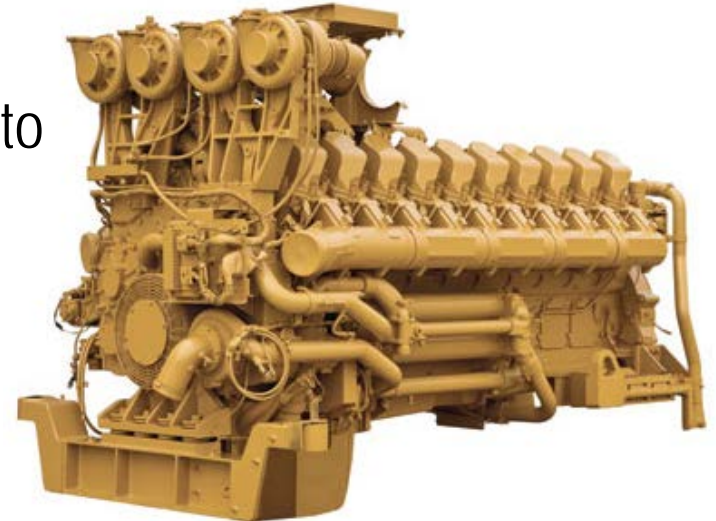
Win the Right Way

VALUES + ETHICS + COMPLIANCE

– Our reputation is built not only on what we achieve, but how we achieve it

Agenda

- Welcome to Caterpillar Remanufacturing Video
- 33/3400 Series Engine Value Stream Transformation
- 3500 Series Reman Engine Transition to Corinth, MS
- Precious Metal Kitting Value Stream Transformation



Global Remanufacturing Footprint



Resources

- Global: **15** facilities worldwide
- **3.9M** ft² of manufacturing (230k m²)
- Workforce approx. **5,000**
- Leverage Cat R&D spend

Products

- **2.2M** units (180+M lbs/90k Ton)
- **~7,600** unique part numbers for sale
- Full line servicing Cat engines & machines
- Remanufacturing services for 3rd party

33/3400 Series Engine Value Stream Transformation



Offerings: Short Blocks, Long Blocks, & Engines

Assembly Lines: 3100, C Series, 33/3400, 3408/12/27/32, & Military

Production: 48 Units/Day, \$9-12M Monthly Revenue

High Mix/Low Volume: 500+ arrangements across 23 engine models

New Product Introduction:

2015 - 94 arrangements

2016 - 60 arrangements

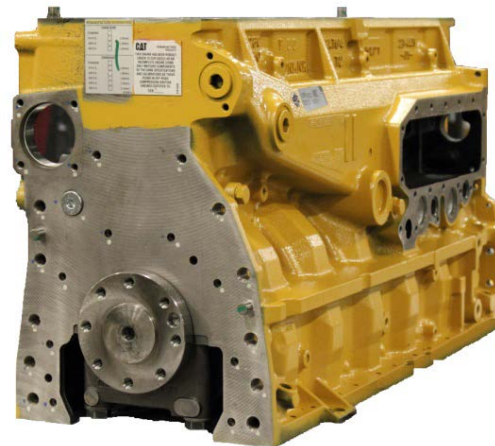
Contamination Control - Level 5

90% First Test Pass at Test Cell

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Caterpillar: Confidential Yellow

CAT[®] Production System



CATERPILLAR[®]

33/3400 Series Engine Value Stream Transformation

Results to Date:

PQVC	Metric	Baseline	Goal	YTD
PEOPLE	Hammer elimination (uses in all ECB Asy)	129	100%	75 42% Reduction
QUALITY	Loose and Leaks Warranty	\$351K	50% reduction	\$200K
	Workmanship Warranty	\$530K	50% reduction	\$267K
	BIQ Findings - Workmanship	33 per month	50% reduction	33% 22/mo
VELOCITY	Kit Optimization	People travel 56,649 ft/ shift	50% reduction	In-process
	Improve Throughput	15.8 Hrs/ Eng	30% imp.	12.4 Hrs/ Eng 22% Imp.
COST	VA/ NVA Analysis (Var. Labor Efficiency)	Man Hrs/ Unit = 16.2 hrs	30% reduction	14.7 Hrs/ Unit (6% Imp.)
	Reduce WIP Inventory	202K parts lineside	50% reduction	In-process

Completed Milestones:

- 75 hammers eliminated (42% reduction)
- Improvement in handling of heavy parts
- Provided a Manufacturing Execution bridge solution
- Spent **\$333K** in Capital to improve torque processes
- Warranty reduction expected to decrease **\$467K annually**
- Improved workmanship defects by **33%**
- Improved labor efficiency by **6%** (Hrs/ Unit metric) - **\$100K annually**

3500 Series Reman Engine Transition to Corinth, MS

ME team utilized the tools presented in the Lean Certification training while developing a Manufacturing Execution System yielding:

- Waste Elimination
- Value Stream Mapping
- Line Balancing
- Quality control

Operator Interface

The screenshot shows the 'Main Menu' with 'Line: 3500' and 'Arrangement: 20R6116'. A table lists operations from 801-0810 to 801-2000, all categorized as 'Front Housing Sub'. A pop-up window for 'Operation 801-0010' shows a table of parts:

Part No.	Description	Qty	Unit	Part Lvs	Location
162000	WAS	1		1088 LVS	
237500	SCAL-O-TRNG	2		1088 LVS	

Arrangement Operation Creation

The screenshot shows the 'Edit/Create Engine' interface. It includes an 'Engine Reference Table' with filters for Line (3500), Arrangement (20R6116), and Station (S002-Pump Subs). A table lists operations from S02-0010 to S02-0330. A 'Create New Engine' form is also visible.

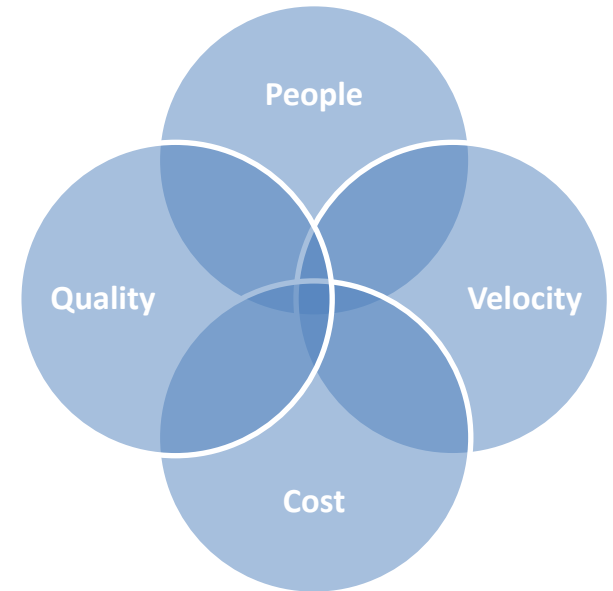
Special Work Instructions

3500 Cylinder Head – Lifter Install

Insert lifters into cylinder head by pressing firmly into place from the bottom of the lifter bore.

MES Reman Application Benefits

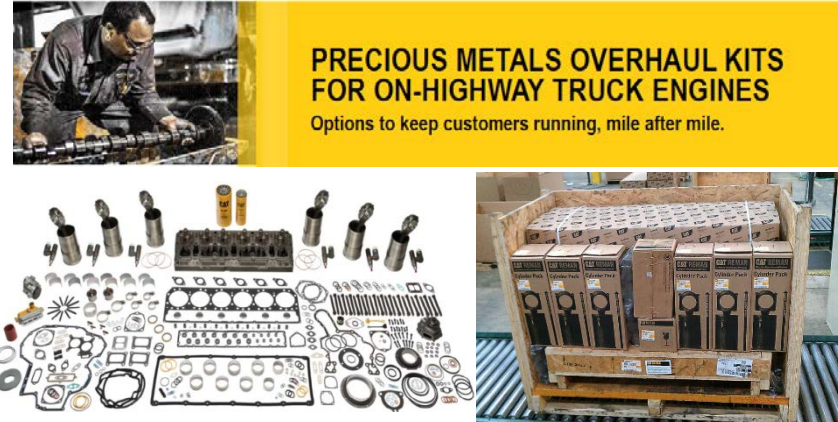
- Improve Quality through accurate information control
- Reduce NPI time to market through efficient process creation and validation
- Lower period cost to maintain Change Management



Realized Benefit

- \$50K engineering labor efficiency due to reduction in grief resolution

Precious Metal Kitting Value Stream Transformation



Results of Project

- As a result of transitioning kitting process from Large Engine Facility to Warehouse, 19K square feet of floor space became available for large block Machining Center of Excellence.
- Reduced process WIP by \$1.2M by eliminating second inventory location at Large Engine Facility
- \$204 K in labor savings annually with efficiency improvements

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What questions do you have?

