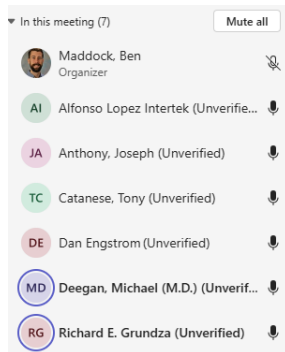


**Sequence VH O&H Meeting**  
**February 25<sup>th</sup>, 2025 at 3PM EST via MS Teams**

**Attendees:**



**Overview:**

1. Hardware
2. Operation
3. Fuel
4. Other

---

**Notes:**

**1. Hardware**

- Runs per camshaft
  - o TMC has requested labs to provide camshaft run number values for all reference results
  - o Proposal: Complete by March 31<sup>st</sup>, 2025 to allow labs the time to balance with fuel approval matrix and standard workload

**2. Operation**

- In-person lab meeting to discuss VH / VJ occurred on February 11<sup>th</sup> in San Antonio
  - o Proposal: Request that test labs target a surface finish that meets the following criteria

Parameter	Sequence VH		
	Nominal Observed	Proposed Range	
		Min	Max
Rpk	7	4	10
Rk	25	19	31
Rvk	34	31	37
Rz	108	94	122
MR2	84	70% min	
Ra	10	9	11
Crevice Volume (100-MR2)xRvk/200	-	0.39	2.36

- See presentation
- o Feedback

- Labs are receptive to agreeing on tighter spec without validity implications but struggled to agree on the right target
- If you impart a shift in the test based on limited data, we could end up in worse spot
- Labs should consider a refined honing procedure once additional data is available and follow-up build workshop conducted

Lab	How often are brushes changed?	Load	Stokes	Typical Ra (µin)
Procedure	Undefined	25 to 30	45	8 to 13
A	?	20 to 25	45	10 to 12
B	?	30	25	9 to 10
D	With honing fluid, every 15h	28	45	10 to 12
E	Never	20 to 25	30	11 to 13
G	Never	20	10	9 to 10

- From 2024 Build Workshop:
  - Added additional slides showing Crevice Volume by lab
- Lab B calibration attempt with -4 fuel batch
  - Severe average engine varnish and fuel dilution in the 20s
  - Labs discussed options for how to incorporate the lab into the fuel approval matrix with no defined criteria agreed on

### 3. Fuel

- M-000054 Fuel Batch Approval
  - Full tank adjustment in process
  - Indresh is currently in India but picked up a call
  - Fuel is expected to be ready to ship within 10 days
  - Tentative forecast (best case):
    - 3/5 – Fuel is ready for shipping
    - 3/10 - Labs start RO 940 run
    - 3/20 - Review 940 data
    - 3/24 – Labs start remaining Row 1
    - 4/3 – Review row 1 data
    - 4/7 – Release row 2 & 3
    - 5/8 – Completed fuel approval matrix
- Lab calibrations?

### 4. Other

- FCS Order through TEI
  - “The Pistons and Rings were ordered on November 1st. The lead time for the rings is 69 days and 127 days for the pistons.”
  - Rings expected January 9<sup>th</sup>, 2025
    - Arrived early but missing some from one size.
  - Pistons expected March 8<sup>th</sup>, 2025
- Pencool 2000 shortage
  - PenRay discontinued their entire PenCool line (2000, 3000, 4000 and the associated filters). They do not offer an alternative.

- ii. Alternatives
  - 1. Nalcool NalFleet 2000
  - 2. DELO Extended Life coolant
  - 3. Motorcraft, Dexcool, Peak
- iii. Labs to check inventory and consult internal experts
  - 1. SwRI, IAR and Afton reported at least 6 months inventory available
  - 2. This topic will be shelved until later in the year

#### Historical Logbook

Date	Topic	Description	Comments
2/12/24	-	O&H formed.	
2/29/24	Hardware	Cam cap anaerobic sealant	IL24-1
3/5/24	Hardware	Cam bearings resolved with King Bearing supply to TEI.	Incl. SwRI bearing analysis
3/12/24	Fuel	N-000010-1+ CofA data integrity review.	Included lab samples to Saybolt
3/26/24	Fuel	Quarterly samples now from test cell	
4/9/24	Hardware	Piston oil hole size differences by piston size not statistically significant to APV	
4/16/24	Operation	Build Workshop conducted	IL24-3 and IL24-4
5/21/24	Fuel	AO content depletion in transit	
5/21/24	Operation	Honing data analysis uninterpretable due to measurement differences	This will be revisited after 2025 fuel approval matrix
6/4/24	Hardware	OHT3G-096-1 brushes explained	IIIG efforts
7/9/24	Operation	OSCR raters group imprecision reviewed	
8/27/24	Hardware	FCS order placed on pistons and rings	
8/27/24	Operation	N-10-1 approval vs PM statistical analysis	
1/7/25	Fuel	RVP adjustments vs fuel dilution	

## Surface Finish – Sequence VH

February 25, 2025

Passion for Solutions<sup>®</sup>

# Sequence VH Surface Finish

 **Objective:** Improve precision of the Sequence VH by converting the labs to bearing ratio curve surface parameters

## Process

- ▶ Current: Ra = 8 to 13  $\mu$ in
- ▶ Observe what's typical in the Sequence IIH and apply that range to the available VH data
- ▶ Consider Ford's guidance on surface finish requirements
- ▶ Lab agreement to target a tighter specification without validity implications. Set new targets into the procedure following the fuel approval matrix

## What do we get?

- ▶ A tighter dataset to reduce lab bias and set a new procedural window that complies with modern surface finish parameters and Ford's best practice

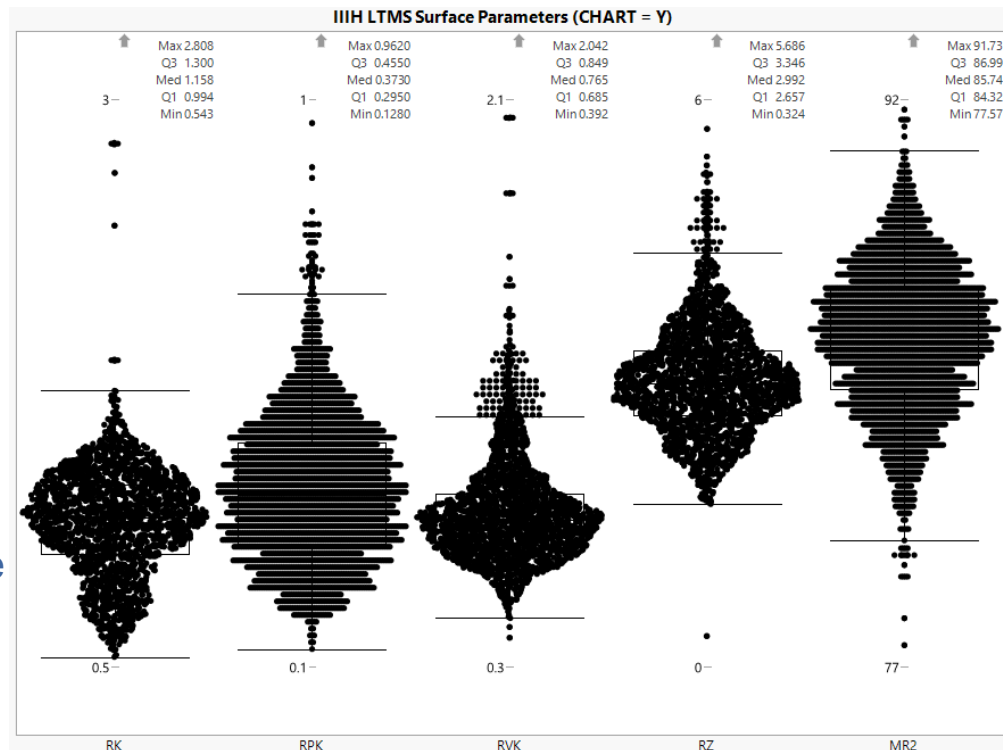
# Sequence VH Surface Finish

## IIIH build specification versus LTMS data

- ▲ All cylinders represented
- ▲ n = 2328 or 388 tests

Parameter	IIIH Specs (μm)		IIIH LTMS (μm)	
	Min	Max	Q1	Q3
Rpk	0.12	0.74	0.29	0.45
Rk	0.51	2.03	0.99	1.3
Rvk	0.43	1.34	0.68	0.85
Rz	1.71	5.17	2.65	3.35
MR2	70% min		84%	87%

Labs build within ~20% of spec range

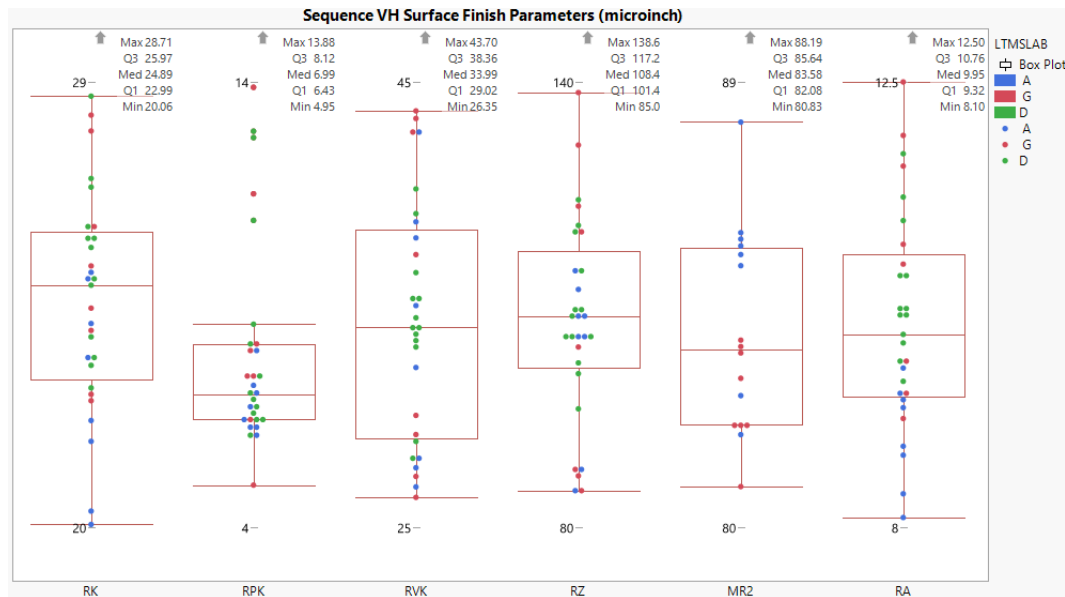


# Sequence VH Surface Finish

- Convert the IIH spec range into microinch
- Calculate the actual range usage observed in IIH
- Apply that range to the median in Seq VH

Sequence IIH			
Parameter	Spec Range (μin)	Range Use %	LTMS Range (μin)
Rpk	24	26%	6
Rk	60	20%	12
Rvk	36	19%	7
Rz	136	20%	28
MR2	70% min		

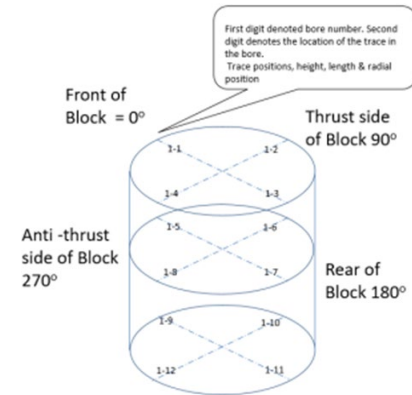
Sequence VH			
Parameter	Nominal Observed	Proposed Range	
		Min	Max
Rpk	7	4	10
Rk	25	19	31
Rvk	34	31	37
Rz	108	94	122



# Sequence VH Surface Finish

## Ford's Guidance:

- ▶ Cross-hatched honing pattern shall be uniformly cut in two directions having an included angle of  $30 \pm 10$  degrees to a plane perpendicular to the bore axis
- ▶ Surface Finish measurement locations at 4 angles inline with the bore (12 total)
  - 25mm down from top of bore
  - 75mm down from bottom of bore
  - 10mm up from the bottom of the bore
- ▶  $R_a = 0.15 - 0.50 \mu\text{m}$  (5.9 to 19.7  $\mu\text{in}$ )
- ▶  $CV = 0.10 \mu\text{m}^3/\mu\text{m}^2$  max (each individual reading)
- ▶  $CV = 0.010 - 0.060 \mu\text{m}^3/\mu\text{m}^2$ , average for each bore.
- ▶  $CV = 3.94 \mu\text{in}^3/\mu\text{in}^2$  max (each individual reading)
- ▶  $CV = 0.39 - 2.36 \mu\text{in}^3/\mu\text{in}^2$ , average for each bore
- ▶ Crevice Volume (CV) =  $(100\% - MR2) \times Rvk / 200 (\mu\text{m}^3/\mu\text{m}^2)$





# Sequence VH Surface Finish

📌 Proposal: Labs target the proposed range without validity implications (except for Ra)

Parameter	Sequence VH		
	Nominal Observed	Proposed Range	
		Min	Max
Rpk	7	4	10
Rk	25	19	31
Rvk	34	31	37
Rz	108	94	122
MR2	84	70% min	
Ra	10	9	11
Crevice Volume (100-MR2)xRvk/200	2.72	0.39	2.36

VH median with IIIH range

Tightened current spec

Ford spec

📌 Set new targets into the procedure following the fuel approval matrix dataset

# Sequence VH Surface Finish – Additional slide not covered in meeting

- As requested with Lab B's additional data
- Dashed lines represent Ford's production limits

