JTC Engineering VPCR Response

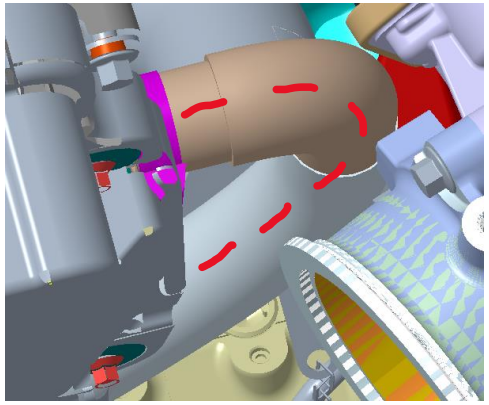
Odin Breather Hose Contacting Shutoff Valve on Intake Manifold

By: Jessica Nicholson

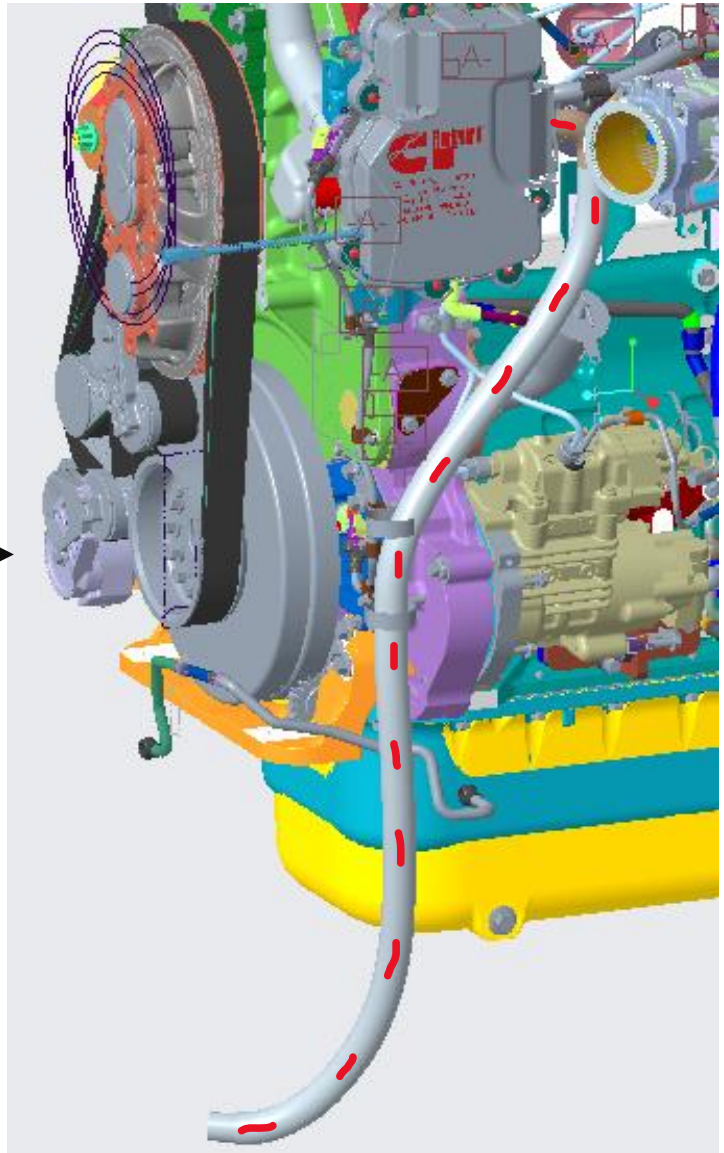
Date Opened: 7/14/2021

Date Closed: ____

System Background



- Odin breather hose: 5348266
- Installed in final parts mounting repair area
- Shown without insulation, however insulation covers full length of hose



(Obstructive parts hidden)

- Other engine configurations: 3688597
- Shorter breather hose model
- Insulation does not cover top section of hose

System Background

- Odin breather hose print:

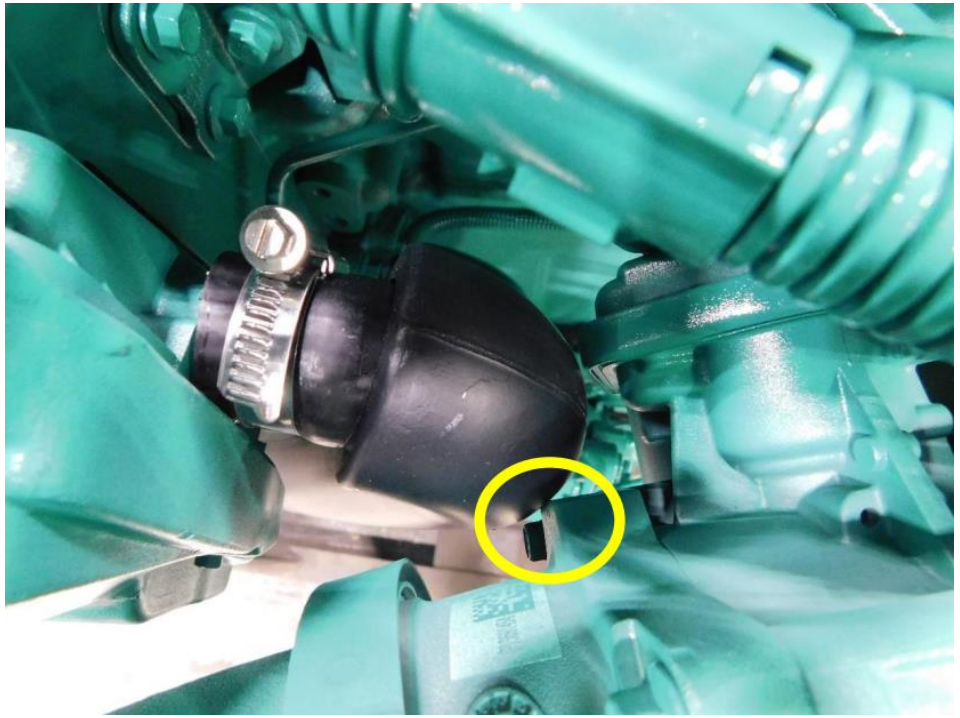
- Supplier for:
  - Odin breather hose: 5348266
  - Automotive configuration breather hose: 3688597

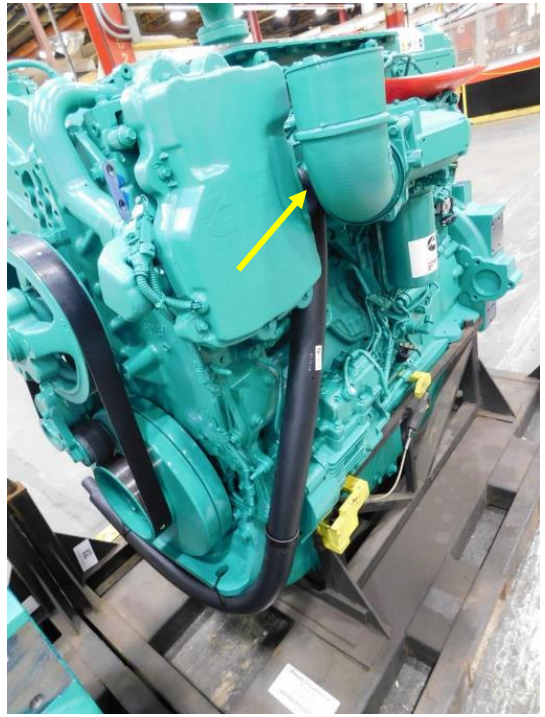
[redacted]

[redacted] = Censored for confidentiality

Failing Component and Potential Effects

- Odin breather hose is difficult to install due to size and tight fit
- Insulation covering hose makes contact with the shutoff valve
- May create long-term wear on insulation and shutoff valve during operation

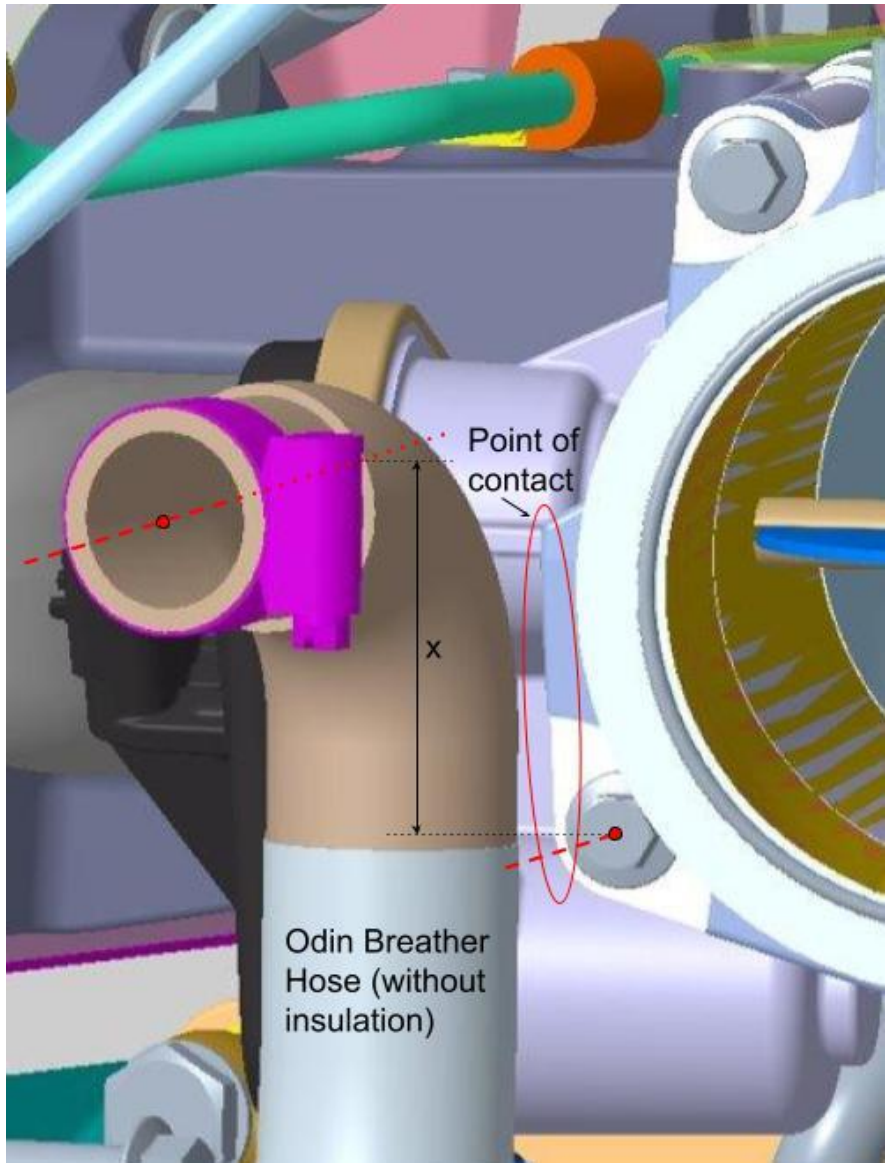




Proposed Solution and Justification

- Remove a section of insulation from top part of breather hose
  - Identify location where insulation makes contact with shutoff valve
  - Mark this location on hose
  - Mark how much insulation must be removed to prevent contact
- Engine heat is sufficient to prevent top section of breather hose from freezing without insulation
  - Insulation is unnecessary at the top of the breather hose, obsolete feature
  - Automotive hose demonstrates this
- Automotive breather hose (3688597) has no top insulation
  - Current insulated Odin hose (5348266) is longer than the automotive model
  - We cannot replace the Odin hose with the automotive model
- Must modify insulation for existing Odin breather hose

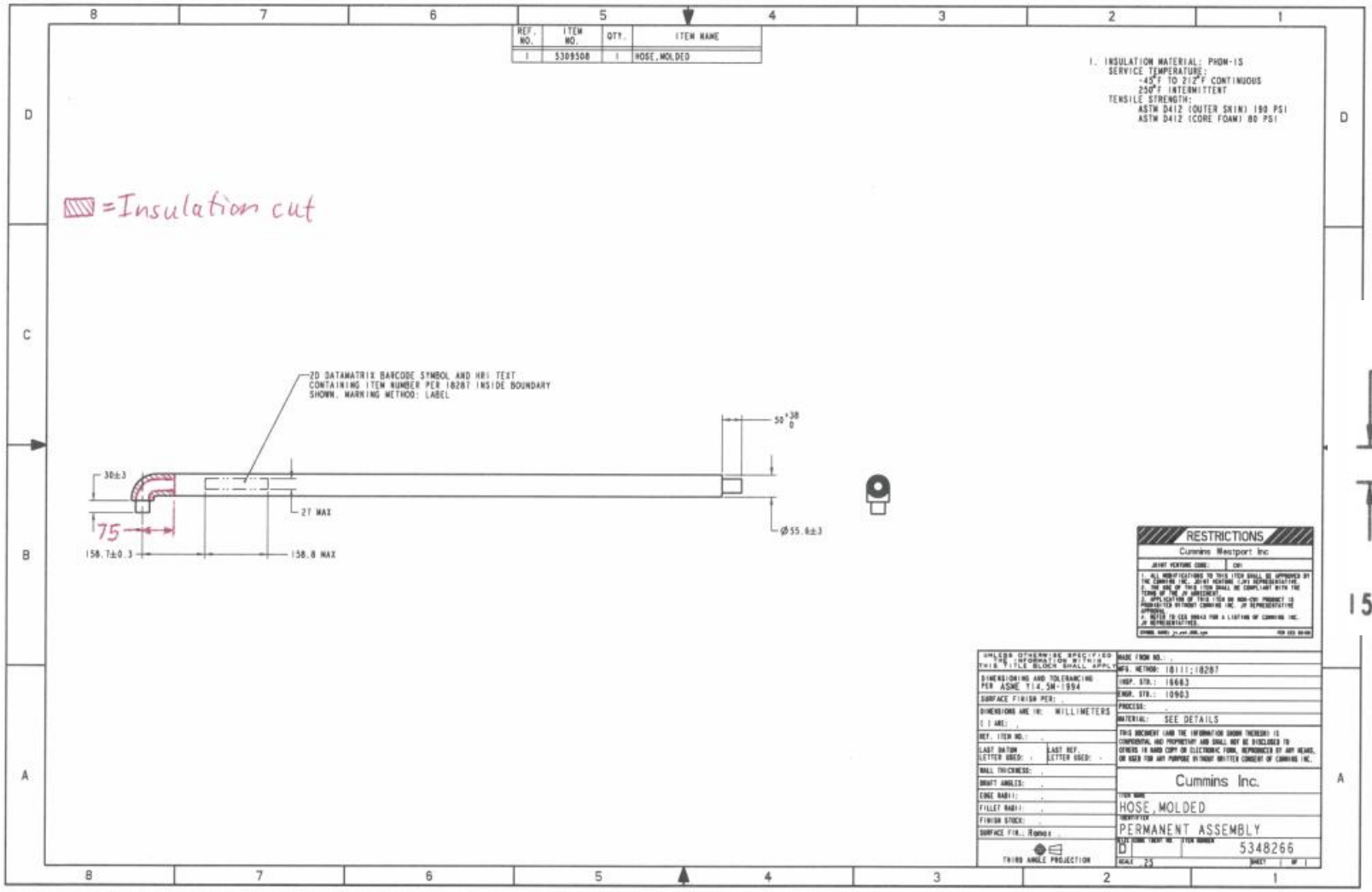
Redesign Process – Identify Location of Contact

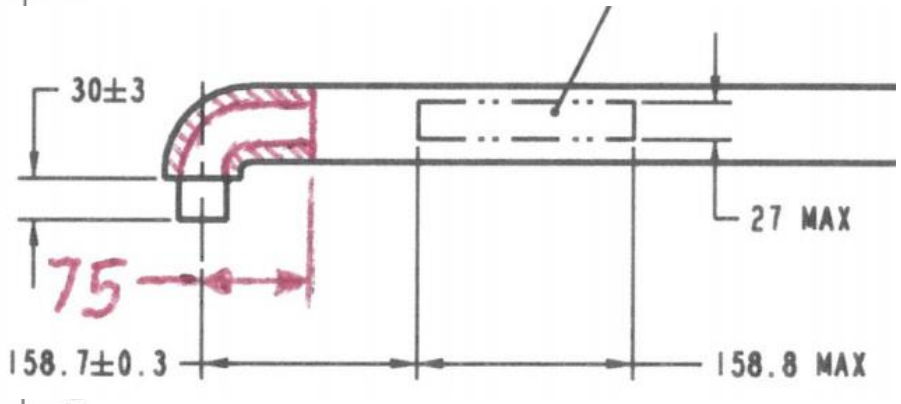


(Obstructive parts hidden)

- Distance from top of hose centerline to lowest possible insulation contact point x = 47.7 mm
- Insulating tube from the top of the hose must be removed so that there is no insulation above 47.7 mm from this centerline
- To allow for plenty of clearance, we should remove at least **75 mm** of insulation from the top hose centerline

Redesign Process – Remove Section of Insulation





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Approver: **Yuchen Hua** Date: **14DEC2015**

Revision: **1** State: **Released**
Change: **154829-166**

Potential Failure Modes

- Top of Odin breather hose without insulation freezes
  - Breather hose 3688597 has no top insulation
  - Top of this hose does not freeze, similar design precedent
  - Find level of failure of this part in coldest regions from claims data
- Insulation tube not secure, slips out of place
  - Insulation tightly fitted to breather hose
  - Securing mechanism is adequate, slipping is not a concern

- Failure modes are unlikely in this new insulation design
- Evaluate design changes in Odin breather hose

Potential Failure Modes – Top of Odin Hose Freezes

- Coldest regions we supply to: North America, Europe, Korea
- Engine configurations with breather hose 3688597, no top insulation
  - D103021GX03 – Power Gen
  - D103020CX03 – Tier 2
  - D103015CX03 – Tier 3, Atlantic Red, Hulk
  - D103014GX03 – Vulcan Green
  - D103012BX03 – Pacific Red
  - D103010CX03 – Vulcan Red
  - D103009BX03 – Monarch Red

Potential Failure Modes – Top of Odin Hose Freezes

- Similar Design Precedent (3688597)
  - Odin engine used 3688597 before current hose
  - Both breather hoses have the same thickness

If a large portion of engines with this breather hose are sent to our coldest regions and have an insignificant rate of failure due to freezing, we can conclude that the Odin breather hose (5348266) without top insulation will also not experience this failure at a significant level.

- Conduct claims research to verify failure rate for 3688597

Claims Research

- Claims data summary
  - Breather hose fail code: BBTU
  - Build range: 01/2018 - 07/2021
  - Regions: North America, Europe, Korea

Engine Configuration	Number of Engines Sent	Number of Failures	RPH
D103021GX03	1125	[redacted]	[redacted]
D103020CX03	14		
D103015CX03	7971		
D103014GX03	11		
D103012BX03	466		
D103010CX03	139		
D103009BX03	9		
Total:	**9735**		
Total (all configs):	296160		

- Sample size sufficient for accurate data
- Insignificant level of failure among engine configurations with the 3688597 breather hose
- We can reasonably assume that **the modified Odin breather hose will not freeze or experience failure**

CTR Research

- Odin engine transitioned from 3688597 to 5348266 breather hose
  - Purpose was to provide a longer breather hose
  - No documented need for included insulation at top of hose
    - Supplier feature
- CTR Research Summary for Odin hose (5348266):

Engineering Release Number	Release Date	CTR Number	Part Changes	Relevant to Freezing Issues and Odin Breather Hose Insulation?
[redacted]	6/24/2015	[redacted]	Additional crankcase breather plumbing arrangements created, assembly revised for valve cover, oil level gauge, and auxillary cooling plumbing. Insulation cut from components other than breather hose.	No
	12/15/2015		Revised prints, released new hose clamp, restructured assemblies with new hose clamp.	No
	1/14/2016		Created new assembly to solve various freezing issues. Applied to Cheetah engine, not Odin, and this engine has a different layout.	Yes
	2/23/2016		Evaluated and performed design validation on the heated breather	No
	1/15/2020		Manufacturing data release, no information available yet	Unknown
	2/6/2020		Final design review	No

CTR Research

- No CTR changes relevant to insulation on the Odin hose
- One CTR is unavailable, but is recent and unlikely to indicate issues with insulation or freezing
- One CTR ([redacted]) mentions freezing issues, however
  - These issues were present in the Cheetah engine, not Odin
  - This applied to breather hoses other than 5348266
  - Has been resolved with a change in part assembly layout

My Recommendation

- Implement design change to Odin breather hose insulation
  - Top of breather hose will not make contact with shutoff valve
  - Eliminates potential issues due to contact with shutoff valve
  - Easier to install in tight space
- Order new insulation tube design for production use
  - Supplier modification tooling cost = [redacted]
  - Cost per part remains the same: [redacted]
- No changes necessary to Odin breather hose itself


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