

# Impact of Removal of Housing on Structural Analysis of DN30 Package

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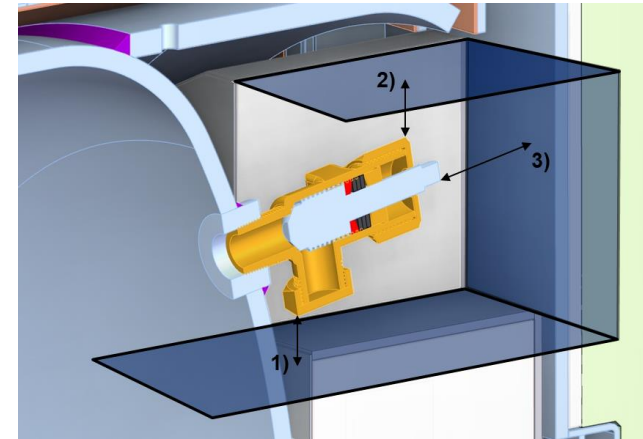
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# Impact of Housing in Simulations

- **Housing of valve protecting device (VPD) was added to the DN30 design to improve its thermal safety after the experimental drop test program was already completed**
- **Validation of the structural calculation model based on the experimental drop tests was therefore performed without consideration of the housing as well**
- **In fact, none of the simulations performed for the structural analysis of the DN30 package consider the housing explicitly as it has no function regarding structural protection**
- **Structural analysis of DN30 package only includes a dimensional check of remaining distances between valve and VPD**
- **Lateral movement of 30B cylinder inside DN30 PSP is not an issue in any test**
- **Accordingly, only the remaining vertical and longitudinal distances between valve and VPD need to be checked (shown on the next slide)**

# Impact of Housing in Simulations

- **Measured vertical and longitudinal distances between valve and VPD are shown on the right**
  - **As proven by results on next slide...**
  - taking into account corrected valve dimensions only has an impact on distances 2) and 3)
  - margins for distance 3) are very large though so that no issue arises in this regard
  - corrected valve dimensions reduce margins for distance 2) by ~12 mm, especially important for SQ8 (flat drop onto top of DN30 PSP)
  - taking into account impact of detailed cavity shape further reduces margins for distance 2) [as well as distance 1)]
  - combining all penalizing assumptions regarding temperature, package mass, and manufacturing tolerances at the same time consumes the remaining margins
- **Removal of housing would drastically reduce any risk of contact between the valve and any other part of the DN30 package**



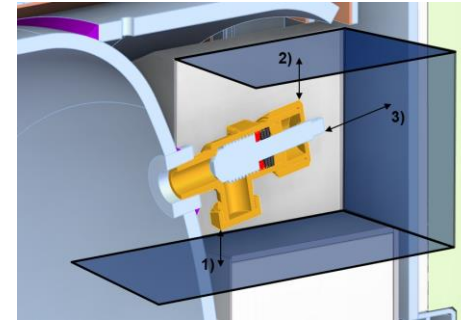
1) Port cap, 2) Packing nut, 3) Valve stem

# Valve Margins with/without Housing

Measurement Point	Current SAR results in mm	Corrected for valve dimensions and DN30 PSP cavity height in mm	Without housing in mm
<b>Sequence 1 at 20 °C</b>			
1) Port cap	26	20 <sup>a)</sup>	24
2) Packing nut	32	15 <sup>a)</sup>	59 <sup>b)</sup>
3) Valve stem	72	37	51
<b>Sequence 1 at 60 °C</b>			
1) Port cap	26	20 <sup>a)</sup>	24
2) Packing nut	34	17 <sup>a)</sup>	59 <sup>b)</sup>
3) Valve stem	57	21	35
<b>Sequence 5 at 60 °C</b>			
1) Port cap	14	8 <sup>a)</sup>	12
2) Packing nut	19	3 <sup>a)</sup>	59 <sup>b)</sup>
<b>Sequence 8 at 20 °C</b>			
1) Port cap	14	8 <sup>a)</sup>	12
2) Packing nut	22	4 <sup>a)</sup>	59 <sup>b)</sup>
<b>Sequence 10 at 20 °C</b>			
1) Port cap	22	16 <sup>a)</sup>	20
2) Packing nut	25	12 <sup>a)</sup>	59 <sup>b)</sup>

a) Impact of incorrect DN30 PSP cavity is estimated to reduce the distance between valve and housing by 8 mm, which corresponds to increase of cavity for top/bottom half of DN30 PSP

b) Not an actual restriction because this distance is only affected by deformation of cylinder skirt



1) Port cap, 2) Packing nut, 3) Valve stem

- Distances correspond to minimal values during whole simulation time
- Since gravity is not modelled explicitly, decelerating the upwards movement of the 30B cylinder, unrealistically small distances can result opposite to drop direction (highlighted in gray for sequence 5 and 8)

# Impact of Removal of Housing

- **Removal of housing increases the similarity between series and prototype design of DN30 PSP used for experimental drop tests**
- **Since prototypes for drop test program had no housing, series design becomes closer to prototype design and validity of experimental tests improves**
- **Removes necessity to evaluate the impact of the housing on structural analysis by complex and time intensive numerical analyses**
- **Structural analysis of DN30 package remains valid entirely since housing was not explicitly considered in any simulation**
- **Correct valve dimensions for distance 3) are considered by spreadsheet calculations**
- **No changes to calculation models are required**
- **No simulation needs to be redone**
- **No additional simulations are required**

# Summary

- **Housing has no function with regard to structural safety of DN30 package**
- **In fact, any risk of contact between valve and any other part of the package is decreased by removing the housing**
- **Removal of housing from the DN30 package design does not affect any of the performed simulations and no new simulations are required**
- **Solely to the documentation of the structural analysis small changes are necessary to remove the housing from the design**
- **Removal of housing only increases the structural safety of the DN30 package**



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