



ENG-033 - CRR - CHIT RESOLUTION REPORT

BES SHUTTER UPGRADE CHIT RESOLUTION REPORT

NSTXU_1-4-1-7-1_CRR_100

Rev. 1

Work Planning #:
Effective Date: **02/28/2020**
Prepared By: **Yusi Cao**

Reviewed By	Brentley C. Stratton, Responsible Engineer	02/24/2020 16:40:31 PM
Approved By	Yuhu Zhai, Project Engineer	02/26/2020 09:50:49 AM
Approved By	Timothy N. Stevenson, Chief Engineer	02/28/2020 11:32:24 AM



Chit Resolution Report for BES Shutter Upgrade

NSTXU_1-4-1-7-1_CRR_100, Rev 1

Prepared By:

Cognizant Individual – A. Cao

Reviewed By:

Responsible Engineer – B. Stratton

Approved By:

NSTX-U Project Engineer – Y. Zhai

Approved By:

Alt. Chief Engineer – T. Stevenson



Table of Contents

1	CLOSED: DIAGWS03 – Review BES Shutters	6
2	CLOSED: D1AGWS05 – Ensure Air Hoses Are Correctly Connected	6
3	CLOSED: D1AGWS06 – Assess Need to Replace Boron Nitride	6
4	CLOSED: BESUCDR01 – Changing Solenoid Connections	7
5	CLOSED: BESUCDR02 - Consider Drive Mechanism Improvements.....	7
6	CLOSED: BESUCDR03 – Account for Ceramics Margin of Safety	7
7	CLOSED: BESUCDR04 – Ensure Correct Drawing Labels	8
8	CLOSED: BESUCDR05 - Fully Signed DRP	8
9	CLOSED: BESUCDR06 - Throttle Flow to Low Pressure Side	8
10	CLOSED: BESUFDR01 – Fully Signed Documents.....	9

Summary of Chits

Review	ID	Chit	Review Board Comment	Status
Diagnostics DVVR	DIAGWS03	Re-review BES shutters. Assess the need for design changes to prevent another failure.	N/A	Closed
Diagnostics DVVR	DIAGWS05	The BES shutters should have some positive mechanism to ensure that the air hoses are corrected correctly	N/A	Closed
Diagnostics DVVR	DIAGWS06	I believe we still have the cracked BN pieces on the BES shutters...we need a positive considered decision to leave as is or replace them (or is there one and I missed it).	N/A	Closed
BES Upgrade CDR	BESUCDR01	Changing only the connections at the valve only corrects half the problem. Consider changing the connection at the solenoids also.	Concur.	Closed
BES Upgrade CDR	BESUCDR02	Consider improving the drive to allow a lower operating pressure.	Consider.	Closed
BES Upgrade CDR	BESUCDR03	Where 3100 psi allowable, make sure you account for the margin required by the SDC. For brittle materials, I think this is a safety factor of 2.	Concur.	Closed
BES Upgrade CDR	BESUCDR04	Please assess how to ensure that the drawings of the parts include labels like "air to open" and "air to close" (or whatever is the correct way to express it).	Concur.	Closed
BES Upgrade CDR	BESUCDR05	The Design Review Plan which is posted is not fully signed. However, it was mentioned that it has been revised. Please ensure that an up to date, fully signed DRP is available. If it is being revised, consider including FMECA in the FDR requirements.	Concur.	Closed
BES Upgrade CDR	BESUCDR06	Consider throttling flow on the low pressure side so that if the connection is reversed it will preclude slamming the shutter shut	Consider.	Closed
BES Upgrade FDR	BESUFDR01	Please ensure that the DRP is fully signed and posted in DocMan. Also, please ensure that the 1.4.1.7.1_CALC_100 receives the cog signature and is uploaded to DocMan	Concur.	Closed



Introduction

This report provides resolution of BES Shutter Upgrade (Recovery WBS 1.04.01.07) chits and recommendations originating from the BES Shutter Upgrade CDR and from the Diagnostics DVVR.

The chits in the NSTX-U Recovery chit log can cite the sections in this report as evidence of closure. The chit resolution described herein is aligned with the chit tables in the Diagnostics DVVR and BES Shutter Upgrade CDR dashboards.

1 CLOSED: DIAGWS03 – Review BES Shutters

Review	ID	Chit	Review Board Comment
Diagnostics DVVR	DIAGWS03	Re-review BES shutters. Assess the need for design changes to prevent another failure.	N/A

A standalone job, work planning #3060, has been created to address the need for design changes and upgrades to the BES shutter assembly. The chits and design reviews described herein directly address design changes to prevent future failure.

2 CLOSED: D1AGWS05 – Ensure Air Hoses Are Correctly Connected

Review	ID	Chit	Review Board Comment
Diagnostics DVVR	DIAGWS05	The BES shutters should have some positive mechanism to ensure that the air hoses are corrected correctly	N/A

A multi- step approach detailed in sections 7 and 9 of this report ensures that the air hoses are correctly connected. The drawings will be correctly labeled and different size threads on the inlet and outlet ports of the actuator will mitigate this issue.

3 CLOSED: D1AGWS06 – Assess Need to Replace Boron Nitride

Review	ID	Chit	Review Board Comment
Diagnostics DVVR	DIAGWS06	I believe we still have the cracked BN pieces on the BES shutters...we need a positive considered decision to leave as is or replace them (or is there one and I missed it).	N/A

The BN pieces are essential for BES shutter operation. The BES shutter cover plates will be remade with the proposed upgrades and will meet diagnostics and disruption requirements.

4 CLOSED: BESUCDR01 – Changing Solenoid Connections

Review	ID	Chit	Review Board Comment
BES Upgrade CDR	BESUCDR01	Changing only the connections at the valve only corrects half the problem. Consider changing the connection at the solenoids also.	Concur.

Errors can occur in soldering pins and assembling connectors. Systematic issues must be addressed in procedures and testing prior to mechanism installation or operation on a lab-wide basis. For the BES shutter upgrade job, the combination of solutions described in the BES shutter FDR will mitigate the risk of breakage with high confidence. Additional changes add scope and complexity beyond what is necessary for successful operation.

5 CLOSED: BESUCDR02 - Consider Drive Mechanism Improvements

Review	ID	Chit	Review Board Comment
BES Upgrade CDR	BESUCDR02	Consider improving the drive to allow a lower operating pressure.	Consider.

The improvement of the drive involves reducing the torque needed to actuate the shutter. We have identified a simple improvement: slightly modifying the existing shutter components to accommodate the mounting of a torsion spring. The torsion spring will resist the gravitational forces experienced by the shutter cover during actuation, which will have the effect of lowering the required operating pressure.

6 CLOSED: BESUCDR03 – Account for Ceramics Margin of Safety

Review	ID	Chit	Review Board Comment
BES Upgrade CDR	BESUCDR03	Where 3100 psi allowable, make sure you account for the margin required by the SDC. For brittle materials, I think this is a safety factor of 2.	Concur.

Analysis performed for the CDR demonstrates a variety of extreme load cases. The selected strongback radius (1.125”) is sufficient for 80 g-force at a safety factor of 2. This is well beyond the expected loading for this shutter and three times better at 25 g-force than a strongback with the washer radius used on the existing assembly.

7 CLOSED: BESUCDR04 – Ensure Correct Drawing Labels

Review	ID	Chit	Review Board Comment
BES Upgrade CDR	BESUCDR04	Please assess how to ensure that the drawings of the parts include labels like "air to open" and "air to close" (or whatever is the correct way to express it).	Concur.

The labelling of air lines and input/output ports has historically not been an issue. The drawing group will include a detail or drawing note on the assembly drawing that shows the drive actuator orientation and correct inlet/outlet labels.

8 CLOSED: BESUCDR05 - Fully Signed DRP

Review	ID	Chit	Review Board Comment
BES Upgrade CDR	BESUCDR05	The Design Review Plan which is posted is not fully signed. However, it was mentioned that it has been revised. Please ensure that an up to date, fully signed DRP is available. If it is being revised, consider including FMECA in the FDR requirements.	Concur.

The up-to-date DRP is available on the BES Shutter Upgrade FDR dashboard. FMECA is now included in the FDR requirements. The DRP will be signed before the FDR.

9 CLOSED: BESUCDR06 - Throttle Flow to Low Pressure Side

Review	ID	Chit	Review Board Comment
BES Upgrade CDR	BESUCDR06	Consider throttling flow on the low pressure side so that if the connection is reversed it will preclude slamming the shutter shut	Consider.

Skinner valves already exist on both the inlet and outlet. The use of different size thread adapters for inlet/outlet ports mitigates the problem of mechanically reversing the connection.



10 CLOSED: BESUFDR01 – Fully Signed Documents

Review	ID	Chit	Review Board Comment
BES Upgrade FDR	BESUFDR01	Please ensure that the DRP is fully signed and posted in DocMan. Also, please ensure that the 1.4.1.7.1_CALC_100 receives the cog signature and is uploaded to DocMan	Concur.

The DRP, updated for the FDR, has been fully signed, uploaded to the FDR dashboard, and uploaded to DocMan. The DRP has been assigned an official document number, NSTXU_1-4-1-7_DRP_101, R0 BES Shutter DRP.

1.4.1.7.1_CALC_100 has received the COG signature from R. Ellis and has been uploaded to the FDR dashboard and uploaded to DocMan.