

Chit Resolution Report for Interspace Vacuum Pumping System

NSTX-U-REC-107-01

Prepared By: _____
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List of Chits closed in this report on the cover, details inside the report
Attach total log of Chits, including all those previously closed and those not yet closed.

(*) For CDR and PDR the DRC, for FDR and after FDR the Main Approver (A-1: Chief Engineer, A-2 and A-3: DRC)
DRC =Design Review Chairperson

Record of Changes

Rev.	Date	Description of Changes
0	02/13/2019	Initial Release
1	03/28/2019	Include chits from FDR

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Disposition Key:

A	=	Actionable
NA	=	Not Actionable
NB	=	Not Actionable due to budget constraints
O	=	Out of Scope
R	=	Redundant

IVPS-VACS-01– Evaluate Interlock Reliability

Disposition	Review	ID	Chit
A	NSTX-U IVPS - PDR	ISPS PDR01	Evaluate reliability of interlocking that prevents machine operation via clock system in case of low pressure (Paschen) conditions, versus consequence of failure (since clock system/EPICs generally not relied on for protection purposes). If failure consequence is severe, consider alternate means to prevent pulse (e.g. block the FCPC power supply permissive).

Venting the pumpout lines with air should not be required since no arcing across the ceramic breaks will take place if a voltage is impressed on the vacuum vessel during a shot (see resolution to chit IVPS-VACS-02). But if venting should be required, then if the air backfill valve fails, the interlock will abort the shot by stopping the shot clock. The likelihood of the air backfill valve failing and the interlock failing and a voltage being impressed on the vacuum vessel during the same discharge are incredibly minimal. However, if it does happen, since we have two ceramic breaks in series and have grounding for the section between the two ceramic breaks and after the second ceramic break, there will be no damage to the transducers-in case of a Paschen condition. There may be a ticking sound and we will need to screen the system in this case.

IVPS-VACS-02– Breakdown Voltage for Ceramic Break at 50 mtorr

Disposition	Review	ID	Chit
A	NSTX-U IVPS - PDR	ISPS PDR02	Please assess the standoff capability of the insulators at pressures of ~50 mtorr. Ideally, there would be no breakdown or glow at the 2 kV AC RMS hipot requirement in the GRD. If possible, please identify the voltage limit for the system.

At 50 millitorr the torrcm number for the IVPS pumping line ceramic break is about 0.05, which corresponds to a breakdown voltage much higher than 2 KV (see figure below).

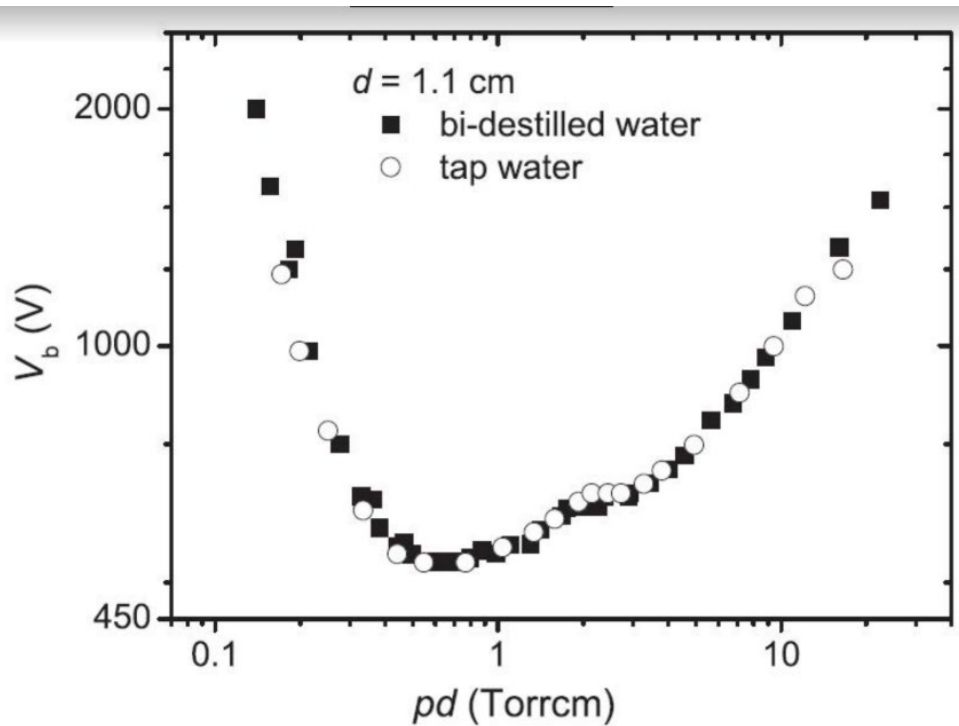


FIG. 2. Breakdown voltage vs pd in water vapor from bidistilled, de-ionized water (solid squares) and tap water (open circles) for $d = 1.1$ cm.

(N. Škoro, Electrical Breakdown in Water Vapor, Phys. Rev. E 84, 055401(R))

IVPS-VACS-03– Cost for Extra Control Work Scope

Disposition	Review	ID	Chit
A	NSTX-U IVPS - PDR	ISPS PDR03	Please assess whether expansion of the air control cabinets, and all EPICS and PLC work, is included in the WAF

The cost of the work scope listed in this chit is now included in the latest version of the WAF

IVPS-VACS-04– Spare Vacuum Pump

Disposition	Review	ID	Chit
A	NSTX-U IVPS - PDR	ISPS PDR04	Please consider adding a spare pump to the WAF; this can support both the interspace system and the gas delivery system

A spare pump is now included in the IVPS WAF

IVPS-VACS-05– SAD Update

Disposition	Review	ID	Chit
A	NSTX-U IVPS - PDR	ISPS PDR05	Please assess if the SAD needs updated (Section 3.4.1 I guess). Talk to Jerry or Tim about process of doing this.

See chit ID ISPS-FDR01.

IVPS-VACS-06– USI and SAD Update

Disposition	Review	ID	Chit
A	NSTX-U IVPS - FDR	IVP FDR01	<p>The chit resolution result that the SAD has been updated seems likely incorrect, as there have been no official SAD revisions during the Recovery outage.</p> <p>Please correct; probably the right answer is that the USI screening is done, and that it will be in the updated SAD that Malo/Levine/Stevenson are working on.</p>

The USI screening of IVPS has been done. The SAD update for IVPS will be included in the version that Malo/Levine/Stevenson are working on.

IVPS-VACS-07– MECH-15 Compliance

Disposition	Review	ID	Chit
A	NSTX-U IVPS - FDR	IVP FDR02	Please do some formal documentation activity to validate that the systems is MECH-15 compliant. This may simply be a statement that it is too small a volume, and therefore under the thresholds in the standard.

ES-MECH-015, Rev3 considers vacuum systems as pressure systems mainly due to “their potential for catastrophic failure due to backfill pressurization” (Section 4 on page 3). For IVPS system, we only back fill the system by opening a valve to atmosphere. So the pumping piping will not see a pressure higher than 14.7 PSIA, i.e. the stored energy inside pumping pipe is zero as the pressure difference between inside and outside piping will be zero. In this case, ES-MECH-015 requirement is excluded according to 5.1.1 on page 4.

IVPS-VACS-08– Interconnection Tube Compliance

Disposition	Review	ID	Chit
A	NSTX-U IVPS - FDR	IVP FDR03	Is there compliance between the hard connection on the umbrella and the connection (tubing) to the Pf1C ports? Note, during bake out the VV / pf1C will grow thermally. Umbrella is on slides allows VV radial thermal growth. Is there compliance to absorb relative thermal growth between umbrella and pf1C?

The 3/8" SS316 inter connection tubes will have bends and one coiled loop to accommodate the radial and vertical growth difference between umbrella and pumping ports on double o-ring flanges.