Safety manual for Fisher™ VBL Volume Booster for Safety Instrumented System (SIS) Solutions

When the Fisher VBL volume booster is used in a Safety Instrumented System (SIS) the design process should follow a safety lifecycle as described in several international standards (IEC 61508, ANSI/ISA 84.01, etc.) The following check list must be thoroughly reviewed and implemented as part of the safety lifecycle. This is in addition to regular installation procedures and warnings listed in the latest version of the Fisher VBL Volume Booster Instruction Manual (D103317X012).

⚠ WARNING

This instruction manual supplement is not intended to be used as a stand-alone document. It must be used in conjunction with the following manual:
Fisher VBL Volume Booster Instruction Manual (D103317X012)

Failure to use this instruction manual supplement in conjunction with the above referenced manual could result in personal injury or property damage. If you have any questions regarding these instructions or need assistance in obtaining this document, contact your Emerson sales office or Local Business Partner.

CAUTION

Do not use sealing tape on pneumatic connections. This instrument contains small passages that may become obstructed by detached sealing tape. Thread sealant paste should be used to seal and lubricate pneumatic threaded connections.

Check List

A. Safety Instrumented System Design

1. The volume booster is suitable for use in applications up to a maximum Safety Integrity Level of 3 (SIL3).
2. The SIS application of the volume boosters is limited to low demand mode.
3. The safe state can be either Exhaust on Trip (0 psig input to the volume booster) or Supply on Trip (input pressure to the volume booster as required to fully stroke safety valve).
4. The volume booster is a 1:1 device with a designed deadband. Input pressure to the volume booster produces an identical output pressure within limits of the booster deadband.
5. The design must meet all interface requirements and environmental limits given in the VBL Volume Booster instruction manual (D103317X012). Temperature and humidity limits are class D1 per ANSI/ISA-S71.01-1985. Temperature limits may exceed the class D1 limits depending on elastomer selection (see instruction manual).
6. The volume booster configuration with 2.4 mm (0.094 inch) exhaust port is not approved for Exhaust on Trip applications.
7. Safety Instrumented Function (SIF) design verification must be done for all components in the SIF including the VBL volume booster. The SIF must fulfill the requirements according to the Safety Integrity Level (SIL). Failure rates for the volume booster appropriate for SIL verification calculations are given in the FMEDA Report (exida report no. FCI 10/06-083 R001), available from your Emerson sales office or Local Business Partner.

B. Volume Booster Installation

1. Maximum supply pressure is 40 psig or 150 psig depending on volume booster configuration (check the volume booster nameplate for maximum supply pressure). The supply medium must be a clean, dry, non-corrosive gas that meets the requirements of ISA standard 7.0.01.
2. After completion of pressure connections and prior to applying pressure, the bypass restriction must be properly adjusted.

   a. If the unit is used in a SIF without Partial Valve Stroke Testing (PVST), the bypass should be closed (turned fully clockwise). If the bypass is open, stroking time following a fail-safe command will be slowed.

   b. If the unit is used in a SIF with PVST that does not utilize valve stem position feedback, the bypass can likely be closed (turned fully clockwise). Test the PVST function to ensure that it operates properly with no resulting valve instability. If the bypass is open, stroking time following a fail-safe command will be slowed.

   c. If the unit is used in a SIF with PVST utilizing valve stem position feedback (e.g. a DVC6200 SIS digital valve controller) the bypass restriction must be tuned to both optimize valve stroking speed when a fail-safe command is received and maintain smooth operation and stable control during PVST. If the bypass is excessively open, the stroking time following a fail-safe command will be slowed. If the bypass is excessively restricted, the control loop response during PVST may be unstable, causing unacceptable process deviations and PVST failure. See the Operating Information section in the VBL Volume Booster instruction manual (D103317X012).

3. The safety function of the SIF must be tested after installation.

C. Volume Booster Operation and Maintenance

1. A conservative approach is taken in estimating the service interval for the volume booster in Safety Instrumented Systems. For SIS applications, replacement of the volume booster is required at ten year intervals from the date of shipment. Field maintenance is not possible due to factory calibration requirements for the valve plug assembly.
2. If air leakage from the volume booster is detected when at steady-state conditions, take immediate corrective action by replacing the volume booster. To ensure continuous improvement and accurate reliability prediction, the user must also work with their local Emerson service representative to see that all failures are reported.

D. Periodic Inspection, Test, and Repair

Periodic testing, consisting of proof tests and partial valve stroke testing (PVST), is an effective way to reduce the PFD_{avg} of the volume booster as well as the valve and actuator it is connected to. Results of periodic inspections and tests should be recorded.

⚠ WARNING

To avoid personal injury or property damage appropriate measures must be taken to ensure the safety of the process any time the SIF needs to be disabled, such as to perform a proof test or to take corrective actions.

1. Proof tests are full-stroke tests that are manually initiated. As part of the test, the capability of the SIF to achieve the defined safe state must be verified. The proof test interval must be established for the SIF based on the failure rates of all the elements within the function and the risk reduction requirements. This determination is a critical part of the design of the SIS. A proof test includes the following steps:

    d. Check air filters to ensure they are operating properly.

    e. Inspect the unit for any loose screws, contamination or other visible incorrect mechanical condition.

    f. Listen for air leaks when equipment is at steady-state.

    g. Apply the safe command input to the SIF to force the valve to the Fail-Safe state and verify that this is achieved within the required time.

    h. Restore the SIF to normal operation.

2. Repair consists of replacing a volume booster which demonstrates abnormal performance.

Note

To ensure continuous improvement and accurate reliability prediction, the user must also work with their local Emerson service representative to see that all failures are reported.

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