

# Certificate of Compliance

No. 8115287908-100-01

Manufacturer **L&T Valves Ltd**  
**Tamil Nadu, INDIA**

Product Name **Globe Valves**

Application  
Categories

- Bolted Bonnet T Globe Valves Cast 001
- Bolted Bonnet T Globe Valves Forged 011,
- Screwed Bonnet T Globe Valves Forged 012,
- Bolted Bonnet Y Globe Valves Cast 006
- Bolted Bonnet Y Globe Valves Forged 013
- Pressure Seal T Globe Valves 009
- Pressure Seal Y Globe Valves 010
- Bellows Seal Globe Valves 004
- Cryogenic/ Extension Bonnet Globe Valves 002
- Extension Spindle 008
- Caged type 014

Globe valves are suitable for use in safety related systems in low demand and high/ continuous modes of operation as a single safety related subsystem according to IEC 61508/61511 up to and including SIL 3

SIL compatibility  
study results

For detailed results refer report

**No. 8115287908-100-01 Dated: 22 February 2018**

A short summary of the results is filled up on the reverse of this certificate


**The suitability for certain fields of application can only be assessed by additional evaluation of further components of the subsystem**

This certificate remains valid until 02/2021  
Subject to satisfactory Annual Surprise / Surveillance Audit

Date: 22 February 2018

  
**K. P. S. IYER**  
Team Leader



  
**V. Viswanathan**  
Head of Certifying Services

Manufacturer L&T Valves Ltd, Kanchipuram, TN

Type /series	<b>Globe valves</b> <ul style="list-style-type: none"> <li>• Bolted Bonnet T Globe Valves Cast 001</li> <li>• Bolted Bonnet T Globe Valves Forged 011,</li> <li>• Screwed Bonnet T Globe Valves Forged 012,</li> <li>• Bolted Bonnet Y Globe Valves Cast 006</li> <li>• Bolted Bonnet Y Globe Valves Forged 013</li> <li>• Pressure Seal T Globe Valves 009</li> <li>• Pressure Seal Y Globe Valves 010</li> <li>• Bellows Seal Globe Valves 004</li> <li>• Cryogenic/ Extension Bonnet Globe Valves 002</li> <li>• Extension Spindle 008</li> <li>• Caged type 014</li> </ul>
Systematic Capability:	<b>Low Demand SC 3 (SIL3 Capable)</b> <b>High/ Continuous Demand SC3 (SIL3 Capable)</b>

Appliance-specific values determined:		<b>Bare Valve</b>
Type of sub system	IEC 61508 -2 7.4.4.1.2	type A
Assumed Demand of operation		Low High/ Continuous
Confidence level		95 %
Hardware Fault Tolerance	HFT	Route 1 <sub>H</sub> SIL 3 = 1
		Route 2 <sub>H</sub> SIL 3 = 0

**Table 1 Failure Rate (Number of Failures/hour) distribution for Gate Valve (w/o PST)**

Application (Bare Valve w/o PST)	FAILURE RATE (Number of failures/hours)			
	$\lambda_{SD}$	$\lambda_{SU}$	$\lambda_{DD}$	$\lambda_{DU}$
<b>Case I: Tight Shutoff</b>				
1. Bolted Bonnet T Globe Valves Cast 001				
2. Bolted Bonnet T Globe Valves Forged 011	3.12E-08	1.83E-08	5.32E-08	4.03E-08
3. Screwed Bonnet T Globe Valves Forged 012				
4. Bolted Bonnet Y Globe Valves Cast 006	4.22E-08	2.27E-08	4.55E-08	3.25E-08
5. Bolted Bonnet Y Globe Valves Forged 013				
6. Pressure Seal T Globe Valves 009	3.39E-08	1.88E-08	5.46E-08	3.57E-08
7. Pressure Seal Y Globe Valves 010	3.39E-08	1.88E-08	5.46E-08	3.57E-08
8. Bellows Seal Globe Valves 004	4.77E-08	2.57E-08	6.05E-08	3.85E-08
9. Cryogenic/ Extension Bonnet Globe Valves 002	4.77E-08	2.57E-08	5.50E-08	3.67E-08
10. Extension Spindle 008	4.77E-08	2.57E-08	5.50E-08	3.67E-08
11. Caged type 014	3.12E-08	1.83E-08	5.32E-08	4.03E-08
<b>Case II: Failure to Close on Demand</b>				
1. Bolted Bonnet T Globe Valves Cast 001				
2. Bolted Bonnet T Globe Valves Forged 011	4.03E-08	1.83E-08	4.95E-08	3.48E-08
3. Screwed Bonnet T Globe Valves Forged 012				
4. Bolted Bonnet Y Globe Valves Cast 006	4.71E-08	2.27E-08	4.22E-08	3.09E-08
5. Bolted Bonnet Y Globe Valves Forged 013				
6. Pressure Seal T Globe Valves 009	3.95E-08	1.88E-08	5.08E-08	3.39E-08
7. Pressure Seal Y Globe Valves 010	3.85E-08	1.83E-08	4.95E-08	3.30E-08
8. Bellows Seal Globe Valves 004	5.32E-08	2.57E-08	5.68E-08	3.67E-08
9. Cryogenic/ Extension Bonnet Globe Valves 002	5.32E-08	2.57E-08	5.13E-08	3.48E-08
10. Extension Spindle 008	5.32E-08	2.57E-08	5.13E-08	3.48E-08
11. Caged type 014	4.03E-08	1.83E-08	4.95E-08	3.48E-08

Application (Bare Valve w/o PST)	FAILURE RATE (Number of failures/hours)			
	$\lambda_{SD}$	$\lambda_{SU}$	$\lambda_{DD}$	$\lambda_{DU}$
<b>Case III: Failure to Open on Demand</b>				
1. Bolted Bonnet T Globe Valves Cast 001				
2. Bolted Bonnet T Globe Valves Forged 011	4.03E-08	1.83E-08	4.95E-08	3.48E-08
3. Screwed Bonnet T Globe Valves Forged 012				
4. Bolted Bonnet Y Globe Valves Cast 006	4.71E-08	2.27E-08	4.22E-08	3.09E-08
5. Bolted Bonnet Y Globe Valves Forged 013				
6. Pressure Seal T Globe Valves 009	3.95E-08	1.88E-08	5.08E-08	3.39E-08
7. Pressure Seal Y Globe Valves 010	3.85E-08	1.83E-08	4.95E-08	3.30E-08
8. Bellows Seal Globe Valves 004	5.32E-08	2.57E-08	5.68E-08	3.67E-08
9. Cryogenic/ Extension Bonnet Globe Valves 002	5.32E-08	2.57E-08	5.13E-08	3.48E-08
10. Extension Spindle 008	5.32E-08	2.57E-08	5.13E-08	3.48E-08
11. Caged type 014	4.03E-08	1.83E-08	4.95E-08	3.48E-08

**Table 2 Failure Rate (Number of Failures/hour) distribution for Globe Valve (with PST)**

Application (Valve with PST)	FAILURE RATE (Number of failures/hours)			
	$\lambda_{SD}$	$\lambda_{SU}$	$\lambda_{DD}$	$\lambda_{DU}$
<b>Case I: Tight Shutoff</b>				
1. Bolted Bonnet T Globe Valves Cast 001				
2. Bolted Bonnet T Globe Valves Forged 011	3.12E-08	1.83E-08	5.32E-08	4.03E-08
3. Screwed Bonnet T Globe Valves Forged 012				
4. Bolted Bonnet Y Globe Valves Cast 006	4.22E-08	2.27E-08	4.55E-08	3.25E-08
5. Bolted Bonnet Y Globe Valves Forged 013				
6. Pressure Seal T Globe Valves 009	3.39E-08	1.88E-08	5.46E-08	3.57E-08
7. Pressure Seal Y Globe Valves 010	3.39E-08	1.88E-08	5.46E-08	3.57E-08
8. Bellows Seal Globe Valves 004	4.77E-08	2.57E-08	6.05E-08	3.85E-08
9. Cryogenic/ Extension Bonnet Globe Valves 002	4.77E-08	2.57E-08	5.50E-08	3.67E-08
10. Extension Spindle 008	4.77E-08	2.57E-08	5.50E-08	3.67E-08
11. Caged type 014	3.12E-08	1.83E-08	5.32E-08	4.03E-08
<b>Case II: Failure to Close on Demand</b>				
1. Bolted Bonnet T Globe Valves Cast 001				
2. Bolted Bonnet T Globe Valves Forged 011	4.03E-08	1.83E-08	4.95E-08	3.48E-08
3. Screwed Bonnet T Globe Valves Forged 012				
4. Bolted Bonnet Y Globe Valves Cast 006	4.71E-08	2.27E-08	4.22E-08	3.09E-08
5. Bolted Bonnet Y Globe Valves Forged 013				
6. Pressure Seal T Globe Valves 009	3.95E-08	1.88E-08	5.08E-08	3.39E-08
7. Pressure Seal Y Globe Valves 010	3.85E-08	1.83E-08	4.95E-08	3.30E-08
8. Bellows Seal Globe Valves 004	5.32E-08	2.57E-08	5.68E-08	3.67E-08
9. Cryogenic/ Extension Bonnet Globe Valves 002	5.32E-08	2.57E-08	5.13E-08	3.48E-08
10. Extension Spindle 008	5.32E-08	2.57E-08	5.13E-08	3.48E-08
11. Caged type 014	4.03E-08	1.83E-08	4.95E-08	3.48E-08
<b>Case III: Failure to Open on Demand</b>				
1. Bolted Bonnet T Globe Valves Cast 001				
2. Bolted Bonnet T Globe Valves Forged 011	4.03E-08	1.83E-08	4.95E-08	3.48E-08
3. Screwed Bonnet T Globe Valves Forged 012				
4. Bolted Bonnet Y Globe Valves Cast 006	4.71E-08	2.27E-08	4.22E-08	3.09E-08
5. Bolted Bonnet Y Globe Valves Forged 013				
6. Pressure Seal T Globe Valves 009	3.95E-08	1.88E-08	5.08E-08	3.39E-08
7. Pressure Seal Y Globe Valves 010	3.85E-08	1.83E-08	4.95E-08	3.30E-08
8. Bellows Seal Globe Valves 004	5.32E-08	2.57E-08	5.68E-08	3.67E-08
9. Cryogenic/ Extension Bonnet Globe Valves 002	5.32E-08	2.57E-08	5.13E-08	3.48E-08

Application (Valve with PST)	FAILURE RATE (Number of failures/hours)			
	$\lambda_{SD}$	$\lambda_{SU}$	$\lambda_{DD}$	$\lambda_{DU}$
10. Extension Spindle 008	5.32E-08	2.57E-08	5.13E-08	3.48E-08
11. Caged type 014	4.03E-08	1.83E-08	4.95E-08	3.48E-08

Globe Valves are suitable for use in safety related systems in low demand and high / continuous demand modes of operation as a single safety related subsystem according to IEC 61508 up to and including SIL 3 (according to table 2 of IEC 61508-1:  $10^{-4} \leq PFD < 10^{-3}$ ) subject to the installation conditions in the Safety manual.

The  $PFD_{avg}$  was calculated for different proof test periods and the results are shown below.

**Table 3  $PFD_{avg}$  for Different Proof Test Periods**

Application	Proof Test Period	PFDavg	Achieved SIL Rating
<b>Case I: Tight Shutoff</b>			
<b>1. Bolted Bonnet T Globe Valves Cast 001</b> <b>2. Bolted Bonnet T Globe Valves Forged 011</b> <b>3. Screwed Bonnet T Globe Valves Forged 012</b>	6 months	3.09E-04	SIL3
	1 year	3.93E-04	SIL3
	2 years	5.61E-04	SIL3
	3 years	7.29E-04	SIL3
	4 years	8.96E-04	SIL3
	5 years	1.06E-03	SIL2
<b>4. Bolted Bonnet Y Globe Valves Cast 006</b> <b>5. Bolted Bonnet Y Globe Valves Forged 013</b>	6 months	2.49E-04	SIL3
	1 year	3.17E-04	SIL3
	2 years	4.52E-04	SIL3
	3 years	5.87E-04	SIL3
	4 years	7.23E-04	SIL3
<b>6. Pressure Seal T Globe Valves 009</b>	5 years	8.58E-04	SIL3
	6 months	2.74E-04	SIL3
	1 year	3.49E-04	SIL3
	2 years	4.98E-04	SIL3
	3 years	6.46E-04	SIL3
<b>7. Pressure Seal Y Globe Valves 010</b>	4 years	7.95E-04	SIL3
	5 years	9.44E-04	SIL3
	6 months	2.74E-04	SIL3
	1 year	3.49E-04	SIL3
	2 years	4.98E-04	SIL3
<b>8. Bellows Seal Globe Valves 004</b>	3 years	6.46E-04	SIL3
	4 years	7.95E-04	SIL3
	5 years	9.44E-04	SIL3
	6 months	2.96E-04	SIL3
	1 year	3.76E-04	SIL3
<b>8. Bellows Seal Globe Valves 004</b>	2 years	5.36E-04	SIL3
	3 years	6.96E-04	SIL3
	4 years	8.56E-04	SIL3
	5 years	1.01E-03	SIL2

Application	Proof Test Period	PFDavg	Achieved SIL Rating
	5 years	1.02E-03	SIL2
9. Cryogenic/ Extension Bonnet Globe Valves 002	6 months	2.81E-04	SIL3
	1 year	3.58E-04	SIL3
	2 years	5.10E-04	SIL3
	3 years	6.63E-04	SIL3
	4 years	8.15E-04	SIL3
	5 years	9.68E-04	SIL3
	10. Extension Spindle 008	6 months	2.81E-04
1 year		3.58E-04	SIL3
2 years		5.10E-04	SIL3
3 years		6.63E-04	SIL3
4 years		8.15E-04	SIL3
5 years		9.68E-04	SIL3
11. Caged type 014		6 months	3.09E-04
	1 year	3.93E-04	SIL3
	2 years	5.61E-04	SIL3
	3 years	7.29E-04	SIL3
	4 years	8.96E-04	SIL3
	5 years	1.06E-03	SIL2
<b>Case II: Failure to Close on Demand</b>			
1. Bolted Bonnet T Globe Valves Cast 001 2. Bolted Bonnet T Globe Valves Forged 011 3. Screwed Bonnet T Globe Valves Forged 012	6 months	2.67E-04	SIL3
	1 year	3.40E-04	SIL3
	2 years	4.85E-04	SIL3
	3 years	6.29E-04	SIL3
	4 years	7.74E-04	SIL3
	5 years	9.19E-04	SIL3
4. Bolted Bonnet Y Globe Valves Cast 006 5. Bolted Bonnet Y Globe Valves Forged 013	6 months	2.37E-04	SIL3
	1 year	3.01E-04	SIL3
	2 years	4.29E-04	SIL3
	3 years	5.58E-04	SIL3
	4 years	6.86E-04	SIL3
	5 years	8.15E-04	SIL3
6. Pressure Seal T Globe Valves 009	6 months	2.60E-04	SIL3
	1 year	3.30E-04	SIL3
	2 years	4.71E-04	SIL3
	3 years	6.12E-04	SIL3
	4 years	7.53E-04	SIL3
	5 years	8.94E-04	SIL3
7. Pressure Seal Y Globe Valves 010	6 months	2.53E-04	SIL3
	1 year	3.22E-04	SIL3

Application	Proof Test Period	PFD <sub>avg</sub>	Achieved SIL Rating
	2 years	4.59E-04	SIL3
	3 years	5.96E-04	SIL3
	4 years	7.34E-04	SIL3
	5 years	8.71E-04	SIL3
8. Bellows Seal Globe Valves 004	6 months	2.81E-04	SIL3
	1 year	3.58E-04	SIL3
	2 years	5.10E-04	SIL3
	3 years	6.63E-04	SIL3
	4 years	8.15E-04	SIL3
	5 years	9.68E-04	SIL3
9. Cryogenic/ Extension Bonnet Globe Valves 002	6 months	2.67E-04	SIL3
	1 year	3.40E-04	SIL3
	2 years	4.85E-04	SIL3
	3 years	6.30E-04	SIL3
	4 years	7.75E-04	SIL3
	5 years	9.19E-04	SIL3
10. Extension Spindle 008	6 months	2.67E-04	SIL3
	1 year	3.40E-04	SIL3
	2 years	4.85E-04	SIL3
	3 years	6.30E-04	SIL3
	4 years	7.75E-04	SIL3
	5 years	9.19E-04	SIL3
11. Caged type 014	6 months	2.67E-04	SIL3
	1 year	3.40E-04	SIL3
	2 years	4.85E-04	SIL3
	3 years	6.29E-04	SIL3
	4 years	7.74E-04	SIL3
	5 years	9.19E-04	SIL3

Case III: Failure to Open on Demand – same as for Case II

The PFD<sub>avg</sub> calculated for various partial stroke test intervals and Proof test periods are shown below



**Table 4 PFD<sub>avg</sub> for Different Proof Test Periods and Partial Stroke Test Frequency**

Application	PST Interval Proof Test Period	PFD <sub>avg</sub>					
		1 Month	2 Months	3 Months	6 Months	9 Months	12 Months
Case I: Tight Shutoff							

Case I: Tight Shutoff		PFDavg						
Application	Proof Test Period	PST Interval	1	2	3	6	9	12
		Month	Months	Months	Months	Months	Months	Months
<b>1. Bolted Bonnet T Globe Valves Cast 001</b> <b>2. Bolted Bonnet T Globe Valves Forged 011</b> <b>3. Screwed Bonnet T Globe Valves Forged 012</b>	6 months		2.36E-04	2.55E-04	2.75E-04			
	1 year		3.20E-04	3.39E-04	3.58E-04	4.17E-04		
	2 years		4.87E-04	5.07E-04	5.26E-04	5.85E-04		7.01E-04
	3 years		6.55E-04	6.75E-04	6.94E-04	7.52E-04	8.11E-04	8.69E-04
	4 years		8.23E-04	8.43E-04	8.62E-04	9.20E-04		1.04E-03
	5 years		9.91E-04	1.01E-03	1.03E-03	1.09E-03	1.15E-03	1.20E-03
<b>4. Bolted Bonnet Y Globe Valves Cast 006</b> <b>5. Bolted Bonnet Y Globe Valves Forged 013</b>	6 months		1.91E-04	2.08E-04	2.24E-04			
	1 year		2.59E-04	2.75E-04	2.92E-04	3.42E-04		
	2 years		3.94E-04	4.10E-04	4.27E-04	4.77E-04		5.76E-04
	3 years		5.29E-04	5.46E-04	5.62E-04	6.12E-04	6.62E-04	7.12E-04
	4 years		6.64E-04	6.81E-04	6.97E-04	7.47E-04	7.97E-04	8.47E-04
	5 years		7.99E-04	8.16E-04	8.33E-04	8.82E-04	9.32E-04	9.82E-04
<b>6. Pressure Seal T Globe Valves 009</b>	6 months		2.12E-04	2.32E-04	2.52E-04			
	1 year		2.86E-04	3.06E-04	3.26E-04	3.86E-04		
	2 years		4.35E-04	4.55E-04	4.75E-04	5.34E-04		6.54E-04
	3 years		5.84E-04	6.03E-04	6.23E-04	6.83E-04	7.43E-04	8.03E-04
	4 years		7.32E-04	7.52E-04	7.72E-04	8.32E-04	8.92E-04	9.51E-04
	5 years		8.81E-04	9.01E-04	9.21E-04	9.81E-04	1.04E-03	1.10E-03
<b>7. Pressure Seal Y Globe Valves 010</b>	6 months		2.06E-04	2.26E-04	2.45E-04			
	1 year		2.79E-04	2.98E-04	3.18E-04	3.76E-04		
	2 years		4.24E-04	4.43E-04	4.62E-04	5.21E-04		6.37E-04
	3 years		5.69E-04	5.88E-04	6.07E-04	6.66E-04	7.24E-04	7.82E-04
	4 years		7.14E-04	7.33E-04	7.52E-04	8.11E-04		9.27E-04
	5 years		8.58E-04	8.78E-04	8.97E-04	9.55E-04	1.01E-03	1.07E-03
<b>8. Bellows Seal Globe Valves 004</b>	6 months		2.29E-04	2.51E-04	2.73E-04			
	1 year		3.09E-04	3.31E-04	3.53E-04	4.19E-04		
	2 years		4.69E-04	4.91E-04	5.13E-04	5.79E-04		7.12E-04
	3 years		6.29E-04	6.51E-04	6.73E-04	7.39E-04	8.06E-04	8.72E-04
	4 years		7.89E-04	8.11E-04	8.33E-04	9.00E-04	9.66E-04	1.03E-03
	5 years		9.49E-04	9.71E-04	9.94E-04	1.06E-03	1.13E-03	1.19E-03
<b>9. Cryogenic/ Extension Bonnet Globe Valves 002</b>	6 months		2.17E-04	2.37E-04	2.57E-04			
	1 year		2.93E-04	3.13E-04	3.33E-04	3.93E-04		
	2 years		4.46E-04	4.66E-04	4.86E-04	5.46E-04		6.66E-04
	3 years		5.98E-04	6.18E-04	6.38E-04	6.99E-04	7.59E-04	8.19E-04
	4 years		7.51E-04	7.71E-04	7.91E-04	8.51E-04	9.11E-04	9.71E-04
	5 years		9.03E-04	9.23E-04	9.43E-04	1.00E-03	1.06E-03	1.12E-03
<b>10. Extension Spindle 008</b>	6 months		2.17E-04	2.37E-04	2.57E-04			
	1 year		2.93E-04	3.13E-04	3.33E-04	3.93E-04		
	2 years		4.46E-04	4.66E-04	4.86E-04	5.46E-04		6.66E-04

Case I: Tight Shutoff		PFDavg						
Application	Proof Test Period	PST Interval	1	2	3	6	9	12
			Month	Months	Months	Months	Months	Months
11. Caged type 014	3 years		5.98E-04	6.18E-04	6.38E-04	6.99E-04	7.59E-04	8.19E-04
	4 years		7.51E-04	7.71E-04	7.91E-04	8.51E-04	9.11E-04	9.71E-04
	5 years		9.03E-04	9.23E-04	9.43E-04	1.00E-03	1.06E-03	1.12E-03
	6 months		2.36E-04	2.55E-04	2.75E-04			
	1 year		3.20E-04	3.39E-04	3.58E-04	4.17E-04		
	2 years		4.87E-04	5.07E-04	5.26E-04	5.85E-04		7.01E-04
	3 years		6.55E-04	6.75E-04	6.94E-04	7.52E-04	8.11E-04	8.69E-04
	4 years		8.23E-04	8.43E-04	8.62E-04	9.20E-04	9.78E-04	1.04E-03
	5 years		9.91E-04	1.01E-03	1.03E-03	1.09E-03	1.15E-03	1.20E-03

Case II: Failure to Close on Demand		PFDavg						
Application	Proof Test Period	PST Interval	1	2	3	6	9	12
			Month	Months	Months	Months	Months	Months
1. Bolted Bonnet T Globe Valves Cast 001 2. Bolted Bonnet T Globe Valves Forged 011 3. Screwed Bonnet T Globe Valves Forged 012	6 months		2.05E-04	2.23E-04	2.41E-04			
	1 year		2.77E-04	2.95E-04	3.14E-04	3.68E-04		
	2 years		4.22E-04	4.40E-04	4.58E-04	5.13E-04		6.21E-04
	3 years		5.67E-04	5.85E-04	6.03E-04	6.58E-04	7.12E-04	7.66E-04
	4 years		7.12E-04	7.30E-04	7.48E-04	8.02E-04	8.57E-04	9.11E-04
	5 years		8.57E-04	8.75E-04	8.93E-04	9.47E-04	1.00E-03	1.06E-03
4. Bolted Bonnet Y Globe Valves Cast 006 5. Bolted Bonnet Y Globe Valves Forged 013	6 months		1.81E-04	1.96E-04	2.12E-04			
	1 year		2.45E-04	2.61E-04	2.76E-04	3.22E-04		
	2 years		3.74E-04	3.89E-04	4.05E-04	4.51E-04		5.43E-04
	3 years		5.02E-04	5.18E-04	5.33E-04	5.79E-04	6.26E-04	6.72E-04
	4 years		6.31E-04	6.46E-04	6.61E-04	7.08E-04	7.54E-04	8.00E-04
	5 years		7.59E-04	7.75E-04	7.90E-04	8.36E-04	8.82E-04	9.29E-04
6. Pressure Seal T Globe Valves 009	6 months		2.00E-04	2.19E-04	2.37E-04			
	1 year		2.71E-04	2.89E-04	3.08E-04	3.63E-04		
	2 years		4.12E-04	4.30E-04	4.49E-04	5.04E-04		6.16E-04
	3 years		5.53E-04	5.71E-04	5.90E-04	6.45E-04	7.01E-04	7.56E-04
	4 years		6.93E-04	7.12E-04	7.30E-04	7.86E-04	8.42E-04	8.97E-04
	5 years		8.34E-04	8.53E-04	8.71E-04	9.27E-04	9.83E-04	1.04E-03
7. Pressure Seal Y Globe Valves 010	6 months		1.95E-04	2.13E-04	2.31E-04			
	1 year		2.64E-04	2.82E-04	3.00E-04	3.54E-04		
	2 years		4.01E-04	4.19E-04	4.37E-04	4.91E-04		6.00E-04
	3 years		5.38E-04	5.56E-04	5.74E-04	6.29E-04	6.83E-04	7.37E-04
	4 years		6.76E-04	6.94E-04	7.12E-04	7.66E-04	8.20E-04	8.74E-04
	5 years		8.13E-04	8.31E-04	8.49E-04	9.03E-04	9.57E-04	1.01E-03
8. Bellows Seal Globe Valves 004	6 months		2.17E-04	2.38E-04	2.59E-04			



Case II: Failure to Close on Demand

Application	PST Interval	PFDavg					
		1 Month	2 Months	3 Months	6 Months	9 Months	12 Months
Proof Test Period							
	1 year	2.94E-04	3.14E-04	3.35E-04	3.97E-04		
	2 years	4.46E-04	4.67E-04	4.88E-04	5.50E-04		6.74E-04
	3 years	5.99E-04	6.20E-04	6.40E-04	7.03E-04	7.65E-04	8.27E-04
	4 years	7.51E-04	7.72E-04	7.93E-04	8.55E-04	9.17E-04	9.80E-04
	5 years	9.04E-04	9.25E-04	9.45E-04	1.01E-03	1.07E-03	1.13E-03
9. Cryogenic/ Extension Bonnet Globe Valves 002	6 months	2.06E-04	2.24E-04	2.43E-04			
	1 year	2.78E-04	2.97E-04	3.16E-04	3.72E-04		
	2 years	4.23E-04	4.42E-04	4.60E-04	5.17E-04		6.29E-04
	3 years	5.68E-04	5.87E-04	6.05E-04	6.62E-04	7.18E-04	7.74E-04
	4 years	7.13E-04	7.32E-04	7.50E-04	8.07E-04	8.63E-04	9.19E-04
	5 years	8.58E-04	8.76E-04	8.95E-04	9.51E-04	1.01E-03	1.06E-03
10. Extension Spindle 008	6 months	2.06E-04	2.24E-04	2.43E-04			
	1 year	2.78E-04	2.97E-04	3.16E-04	3.72E-04		
	2 years	4.23E-04	4.42E-04	4.60E-04	5.17E-04		6.29E-04
	3 years	5.68E-04	5.87E-04	6.05E-04	6.62E-04	7.18E-04	7.74E-04
	4 years	7.13E-04	7.32E-04	7.50E-04	8.07E-04	8.63E-04	9.19E-04
	5 years	8.58E-04	8.76E-04	8.95E-04	9.51E-04	1.01E-03	1.06E-03
11. Caged type 014	6 months	2.05E-04	2.23E-04	2.41E-04			
	1 year	2.77E-04	2.95E-04	3.14E-04	3.68E-04		
	2 years	4.22E-04	4.40E-04	4.58E-04	5.13E-04		6.21E-04
	3 years	5.67E-04	5.85E-04	6.03E-04	6.58E-04	7.12E-04	7.66E-04
	4 years	7.12E-04	7.30E-04	7.48E-04	8.02E-04	8.57E-04	9.11E-04
	5 years	8.57E-04	8.75E-04	8.93E-04	9.47E-04	1.00E-03	1.06E-03

Case III: Failure to Open on Demand – same as for Case II

Conditions for Application:

- i. The valve is only to be used within its specified design and operating conditions.
- ii. The valve is not to be used for a Safety function other than its designed purpose.
- iii. The valve is not to be used under a high demand or continuous process unless due measures are taken.
- iv. The valves can be applied as a final element for any SIS system equal to/ less than its own SIL compatibility level. However, the final SIL must be established independently on the basis of the entire SIS/SIF Loop.
- v. The valve is not to be modified or tampered with in any way.
- vi. The proof test period should be followed for the valves to maintain SIL 3 compatibility
- vii. The prescribed HFT requirement should be maintained to ensure SIL class 3 compatibility of the final element in the SIS

Reference Documentation:

FMEDA report: <8115287908-100-01 Dated: 22 February 2018.>

Functional Safety Manual: <L&T Safety Manual of the Product>