ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Italia

COMPLIANCE

with IEC EN 61508 and IEC EN 61511

Certificate No.: C- IS-260811– 01

CERTIFICATE OWNER: **ORION S.p.A.**
VIA CABOTO, 8
I-34148 – TRIESTE (Italy)

WE HEREWITH CONFIRM THAT

THE ANALYSIS DEVELOPED BY ORION; REPORTED IN THE REPORT :

"ORION, Safety Analysis Report for Gate Valves – N° 010/2015 Rev.00 dated May, 05th 2015"

MEETS THE SIL REQUIREMENTS DETAILED IN THE ANNEXED TABLE

FOR THE SAFETY FUNCTIONS :

***"Switching on demand (open to closed/closed to open) and sealing in closed position* in low demand mode of operation"**

Examination result:	**The above described report was found to meet the standard defined requirements of the safety levels detailed in the following tables (T – IS – 260811 – 01 and T – IS – 260811 – 02) according to IEC EN 61508 and IEC EN 61511, under fulfillment of the conditions listed in the Report R-IS-260811-01 Rev.1 dated June, 19th 2015 in its currently valid version, on which this Certificate is based**
Examination parameters:	**Compliance of the operational approach adopted and followed in the aforementioned report by ORION: "*ORION, Safety Analysis Report for Gate Valves – N° 010/2015 Rev.00 dated May, 05th 2015*".**
Official Report No.:	**R-IS-260811-01 Rev. 1**
Expiry Date	**June, 18th 2018**

IT IS TO BE INTENDED THAT THE ABOVE OFFICIAL REPORT AND ITS ANNEXES ARE AN INTEGRAL PART OFTHIS DOCUMENT
THE PRESENT DOCUMENT SUBSITUTES AND REPEALS THE DOCUMENT C- IS 242784– 01

Reference Standard **IEC EN 61508:2010 Part 2, 4, 6, 7 - IEC EN 61511 Part 1, 2, 3**

Sesto San Giovanni, June, 19th 2015

TÜV ITALIA Srl

TÜV Italia Srl Industria Service Italia

TÜV ITALIA Srl
Industry Service Division
Director

Gennaro Oliva

SUMMARY TABLE

T – IS – 260811 – 01

E/EE/EP safety-related system (final element)	**GATE VALVES produced by ORION**			
System type	Type A			
***Environment / Application*(1)**	Temperature range HT (from -29 to +400°C) Service NON-NACE		Temperature range HT (from -29 to +400°C) Service NACE	
Safety Function Definition	*Complete switching on demand (open to closed / closed to open) and sealing in closed position*			
Max SIL	**SIL 2 with HFT = 0 (single valve configuration)**	**SIL3 with HFT = 1 (redundant configuration)**	**SIL 2 with HFT = 0 (single valve configuration)**	**SIL3 with HFT = 1 (redundant configuration)**
Additional requirements for the max SIL classification	*Execution of Partial Stroke Test with time interval not higher than 12 months and Full Proof Test with time interval not higher than 36 months*		*Execution of Partial Stroke Test with time interval not higher than 6 months and Full Proof Test with time interval not higher than 12 months*	
λ_{TOT}	1,56E-07		5,43E-07	
λ_{SD}	0,000E+00		0,000E+00	
λ_{SU}	1,09E-07		3,79E-07	
λ_{DD}	0,000E+00		0,000E+00	
λ_{DU}	4,74E-08		1,64E-07	
$\lambda_{DU,PST}$ (2)	3,65E-08		1,26E-07	
$\lambda_{DU,FPT}$ (2)	1,09E-08		3,79E-08	
***PFD*(3)**	3,03E-04		4,42E-04	
β and β_D factor	10%		10%	
MTTR	24 h		24 h	
Hardware Safety Integrity	Route 2_H		Route 2_H	
Systematic Safety Integrity	Route 2_S		Route 2_S	

Remarks

(1) *Category identified according to specific environment and application, in particular for fluid type and temperature range. Refer to product safety manual for detailed information on the categories*

(2) *Portion of the overall failure rate related to dangerous failure modes that can be detected by means of Partial Stroke Testing (DU,PST).*

(3) *Portion of the overall failure rate related to dangerous failure modes that can be detected by means of Full Proof Test (DU,FPT).*

(4) *PFD of reference calculated on the basis of a Full Proof Test and Partial Stroke test with time interval reported in the line Additional requirements for the max SIL classification. This time intervals are considered by TÜV as reasonably consistent with the implementation of the equipment for safety related-applications, with reference to the overall range of results shown in the report, where other possible combination of time intervals adequate for a classification up to SIL 2 or SIL3 are reported. Note that, concerning Full Proof Tests, time intervals for higher than 36 months are considered by TÜV as not adequate and consistent for equipment for safety related applications.*

SIL classification according to Standards IEC EN 61508:2010 (Chapters: 2, 4, 6, 7) and IEC EN 61511:2003 (Chapters: 1, 2, 3) for GATE VALVES produced by ORION S.p.A.

NOTE : The present table is integral part of the Document: C – IS – 260811 -01
Date : June, 19th 2015

SUMMARY TABLE

T – IS – 260811 – 02

E/EE/EP safety-related system (final element)	**GATE VALVES produced by ORION**			
System type	Type A			
Environment / Application [1]	Temperature range LT (from -196°C to 200°C) Service NACE		Temperature range LT (from -196°C to 200°C) Service NON-NACE	
Safety Function Definition	*Complete switching on demand (open to closed / closed to open) and sealing in closed position*			
Max SIL	**SIL 2 with HFT = 0 (single valve configuration)**	**SIL3 with HFT = 1 (redundant configuration)**	**SIL 2 with HFT = 0 (single valve configuration)**	**SIL3 with HFT = 1 (redundant configuration)**
Additional requirements for the max SIL classification	*Execution of Partial Stroke Test with time interval not higher than 12 months and Full Proof Test with time interval not higher than 36 months*		*Execution of Partial Stroke Test with time interval not higher than 12 months and Full Proof Test with time interval not higher than 36 months*	
λ_{TOT}	1,29E-07		1,40E-09	
λ_{SD}	0,000E+00		0,000E+00	
λ_{SU}	8,99E-08		9,76E-10	
λ_{DD}	0,000E+00		0,000E+00	
λ_{DU}	3,90E-08		4,23E-10	
$\lambda_{DU,PST}$ [2]	3,01E-08		3,25E-10	
$\lambda_{DU,FPT}$ [2]	8,99E-09		9,75E-11	
PFD [3]	2,50E-04		2,70E-06	
β and β_D factor	10%		10%	
MTTR	24 h		24 h	
Hardware Safety Integrity	Route 2_H		Route 2_H	
Systematic Safety Integrity	Route 2_S		Route 2_S	

Remarks

(1) *Category identified according to specific environment and application, in particular for fluid type and temperature range. Refer to product safety manual for detailed information on the categories*

(2) *Portion of the overall failure rate related to dangerous failure modes that can be detected by means of Partial Stroke Testing (DU,PST).*

(3) *Portion of the overall failure rate related to dangerous failure modes that can be detected by means of Full Proof Test (DU,FPT).*

(4) *PFD of reference calculated on the basis of a Full Proof Test and Partial Stroke test with time interval reported in the line Additional requirements for the max SIL classification. This time intervals are considered by TÜV as reasonably consistent with the implementation of the equipment for safety related-applications, with reference to the overall range of results shown in the report, where other possible combination of time intervals adequate for a classification up to SIL 2 or SIL3 are reported. Note that, concerning Full Proof Tests, time intervals for higher than 36 months are considered by TÜV as not adequate and consistent for equipment for safety related applications.*

SIL classification according to Standards IEC EN 61508:2010 (Chapters: 2, 4, 6, 7) and IEC EN 61511:2003 (Chapters: 1, 2, 3) for GATE VALVES produced by ORION S.p.A.

NOTE : The present table is integral part of the Document: C – IS – 260811 -01
Date : June, 19th 2015

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Italia

COMPLIANCE

with IEC EN 61508 and IEC EN 61511

Certificate No.: C- IS-722118481

CERTIFICATE OWNER: **ORION S.p.A.**
VIA CABOTO, 8
I-34148 – TRIESTE (Italy)

WE HEREWITH CONFIRM THAT

THE ANALYSIS DEVELOPED BY ORION; REPORTED IN THE REPORT :

"ORION, Safety Analysis Report for Actuated Globe Valves – N° 009/2015 Rev.02 dated October, 06th 2016"

MEETS THE SIL REQUIREMENTS DETAILED IN THE ANNEXED TABLE

FOR THE SAFETY FUNCTIONS :

***"Switching on demand (open to closed/closed to open) and sealing in closed position* in low demand mode of operation"**

Examination result:	**The above described report was found to meet the standard defined requirements of the safety levels detailed in the following tables (T – IS – 722118481 – 01 and T – IS – 722118481 – 02) according to IEC EN 61508 and IEC EN 61511, under fulfillment of the conditions listed in the Report R-IS-722118481-01 Rev.1 dated November, 08th 2016 in its currently valid version, on which this Certificate is based**
Examination parameters:	**Compliance of the operational approach adopted and followed in the aforementioned report by ORION: *"ORION, Safety Analysis Report for Globe Valves – N° 009/2015 Rev.02 dated October, 06th 2016"*.**
Official Report No.:	**R-IS- 722118481-01 Rev. 1**
Expiry Date	**November, 07th 2019**

IT IS TO BE INTENDED THAT THE ABOVE OFFICIAL REPORT AND ITS ANNEXES ARE AN INTEGRAL PART OFTHIS DOCUMENT
THE PRESENT DOCUMENT SUBSITUTES AND REPEALS THE DOCUMENTS C- IS-251538– 01

Reference Standard **IEC EN 61508:2010 Part 2, 4, 6, 7 - IEC EN 61511 Part 2**

Sesto San Giovanni, November, 08th 2016

TÜV ITALIA Srl

TÜV Italia S.r.l. Industrie Service — TÜV SÜD — Italia

TÜV ITALIA Srl
Industry Service Division
Director

Paolo Marcone

SUMMARY TABLE

T – IS – 722118481 – 01

E/EE/EP safety-related system (final element)	**GLOBE VALVES produced by ORION**	
System type	Type A	
Systematic Capability	SC2	
Environment / Application[1]	Temperature range HT (from -29 to +400°C) Service NON-NACE	Temperature range HT (from -29 to +400°C) Service NACE
Safety Function Definition	*Complete switching on demand (open to closed / closed to open) and sealing in closed position*	
Max SIL[2]	**SIL3**	**SIL3**
λ_{TOT}	1,67E-08	2,57E-07
λ_{SD}	0,000E+00	0,000E+00
λ_{SU}	1,30E-08	2,00E-07
$\lambda_{DD,PST}$[3]	3,10E-09	4,80E-08
$\lambda_{DU,FPT}$	6,20E-10	9,50E-09
β and β_D factor	10%	10%
MTTR	24 h	24 h
Hardware Safety Integrity	Route 2_H	Route 2_H
Systematic Safety Integrity	Route 2_S	Route 2_S

Remarks

(1) Category identified according to specific environment and application, in particular for fluid type and temperature range. Refer to product safety manual for detailed information on the categories

(2) The Safety Integrity Level (SIL) of the entire Safety Instrumented Function (SIF) must be verified via a calculation of PFD_{AVG} considering the redundant architectures, proof test interval, proof test effectiveness, any automatic diagnostics, average repair time and the specific failure rates of all products included in the SIF. Each subsystem must be checked to assure compliance with the minimum hardware fault tolerance (HFT) requirements.

(3) Portion of the overall failure rate related to dangerous failure modes that can be detected by means of Partial Stroke Testing (DD,PST).

SIL classification according to Standards IEC EN 61508:2010 (Chapters: 2, 4, 6, 7) and IEC EN 61511:2003 (Chapters: 1, 2, 3) for GLOBE VALVES produced by ORION S.p.A.

NOTE : The present table is integral part of the Document: C – IS – 722118481
Date : November, 08th 2016

SUMMARY TABLE

T – IS – 722118481 – 02

E/EE/EP safety-related system (final element)	**GLOBE VALVES produced by ORION**	
System type	Type A	
Systematic Capability	SC2	
Environment / Application[1]	Temperature range LT (from -196°C to 200°C) Service NACE	Temperature range LT (from -196°C to 200°C) Service NON-NACE
Safety Function Definition	*Complete switching on demand (open to closed / closed to open) and sealing in closed position*	
Max SIL[2]	**SIL3**	**SIL3**
λ_{TOT}	1,22E-07	1,16E-07
λ_{SD}	0,000E+00	0,000E+00
λ_{SU}	9,50E-08	9,50E-08
$\lambda_{DD,PST}$[3]	2,30E-08	2,10E-08
$\lambda_{DU,FPT}$	4,50E-09	4,30E-09
β and β_D factor	10%	10%
MTTR	24 h	24 h
Hardware Safety Integrity	Route 2_H	Route 2_H
Systematic Safety Integrity	Route 2_S	Route 2_S

Remarks

(1) Category identified according to specific environment and application, in particular for fluid type and temperature range. Refer to product safety manual for detailed information on the categories.

(2) The Safety Integrity Level (SIL) of the entire Safety Instrumented Function (SIF) must be verified via a calculation of PFD_{AVG} considering the redundant architectures, proof test interval, proof test effectiveness, any automatic diagnostics, average repair time and the specific failure rates of all products included in the SIF. Each subsystem must be checked to assure compliance with the minimum hardware fault tolerance (HFT) requirements.

(3) Portion of the overall failure rate related to dangerous failure modes that can be detected by means of Partial Stroke Testing (DD,PST).

SIL classification according to Standards IEC EN 61508:2010 (Chapters: 2, 4, 6, 7) and IEC EN 61511:2003 (Chapters: 1, 2, 3) for GLOBE VALVES produced by ORION S.p.A.

NOTE : The present table is integral part of the Document: C – IS – 722118481
Date : November, 08th 2016