



DIRECTIVE NO.	540-xx-xxx	APPROVED BY Signature:	_____
EFFECTIVE DATE:	March 21, 2012	NAME:	_____
EXPIRATION DATE:	March 21, 2017	TITLE:	Pressure Regulated Systems

Responsible Office: 540 / RECERT / Certification and Recertification of Lifting Devices and Equipment, Pressure Vessels, and Pressurized Systems

Title: Pressure Regulated Systems

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1.0 PURPOSE

The purpose of this document is to define the best practices for a Pressure Regulated System (PRS) that will ensure safety and uniformity across center. This practice will assist in simplifying the design requirements for a PRS and increase efficiency during the certification process.

2.0 APPLICABILITY

This document is only applicable to PRS type systems as determined by the PSM of RECERT. The system must also be ≤ 150 psig in maximum allowable working pressure (MAWP). PRS with MAWPs greater than 150 psig may use concepts from this document, but does not guarantee certification by the RECERT program without further analysis.

3.0 REFERENCES

NASA-STD-8719.17, Revision A: Requirements for Ground-Based Pressure Vessels and Pressure Systems (PVS)

4.0 CANCELLATION

None



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5.0 SAFETY

NPD 8710.5 NASA Safety Policy for Pressure Vessels and Pressurized Systems
 NPR 8715.3 NASA General Safety Program Requirements

6.0 TRAINING

Training will be made available upon request.

7.0 PROCEDURE

Owner should follow the following steps when designing a PRS. Details of the steps are outlined throughout the rest of this section.

- Identify process conditions using Table 1
- Identify configuration options using Table 2
- Select appropriate configuration from Table 3
- Refer to appendices for example designs

7.1 Step One

The PRS designs have been reduced to 3 different configurations with multiple versions of each configuration to achieve the final requirements of the system as specified by the system Owner. The 3 configurations are based on process condition limitations of the system; the Owner is responsible for identifying the correct configuration for the applicable process conditions.

Table 1 assigns the process conditions of various systems under the RECERT program. The Owner is to identify which process condition best describes the PRS. Should the applicable system fall outside of the scope of these conditions, RECERT should be consulted to check applicability of this document for the respective PRS.

Process Conditions		Pressure (psig)		
		$0 \leq P < 14.7$	$14.7 \leq P < 100$	$100 \leq P \leq 150$
Flow (SCFM)	< 10	Condition 1	Condition 2	Condition 3
	$10 \leq F < 50$	Condition 4	Condition 5	Condition 6
	≥ 50	Condition 7	Condition 8	Condition 9

Table 1: Process condition description of PRS



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7.2 Step Two

Once the condition is identified, the Owner must identify between the various versions within each configuration, identified as options. The options are based on the overall purpose of the PRS while taking into account specific requirements for safe practice/use of various types of fluids. Table 2 outlines these options, and is applicable for each condition identified in Table 1.

Option 1	Option 2	Option 3	Option 4
<ul style="list-style-type: none"> Relief device venting to atmosphere Ability to depressurize line to atmosphere 	<ul style="list-style-type: none"> Relief device venting to controlled exhaust required Ability to depressurize line to a controlled exhaust 	<ul style="list-style-type: none"> Clean system compatible components Components must be free of oxygen and or hydrocarbons 	<ul style="list-style-type: none"> Stainless steel components required for corrosion/material compatibility issues

Table 2: Options for different configurations of PRS

7.3 Step Three

The final step is for the Owner to identify the appropriate configuration/option combination for their PRS based on the process conditions and system type. The Owner should select the correct combination from Table 3 that most aptly describes the system that they require. Should the requirements not fall into any of the below listed conditions, the Owner should consult RECERT for recommendations to modifying the combinations below.

Process Conditions	Inert Gases	Hazardous/Flammable Gases	Lethal Gases	Clean Systems	S.S. Systems
Conditions 8 or 9	Config. 1; Option 1	Config. 1; Option 2	Config. 1; Option 2	Config. 1; Option 3	Config. 1; Option 4
Conditions 1/2/5/6	Config. 2; Option 1	Config. 2; Option 2	Config. 2; Option 2	Config. 2; Option 3	Config. 2; Option 4
Conditions 1/4/7	Config. 3; Option 1	Config. 3; Option 2	Config. 3; Option 2	Config. 3; Option 3	Config. 3; Option 4

Table 3: PRS configuration selector

A pictorial description of each configuration type can be found in Appendix A. The components shown in each description are required unless stated as an option. All relief valves shown may be swapped with a burst/rupture disc with equal set point and equal or greater flow capacity.



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An example of each recommended component can be found in Appendix B. The examples provided are to be used as a baseline approach for designing the PRS, the Owner is able to substitute the recommended components with different manufacturers, however the components shall contain the same properties as outlined in Appendix B and the research shall be done at the Owner's expense. All relevant documents must be provided if the Owner chooses to deviate from the RECERT recommended components.

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8.0 APPENDIX A

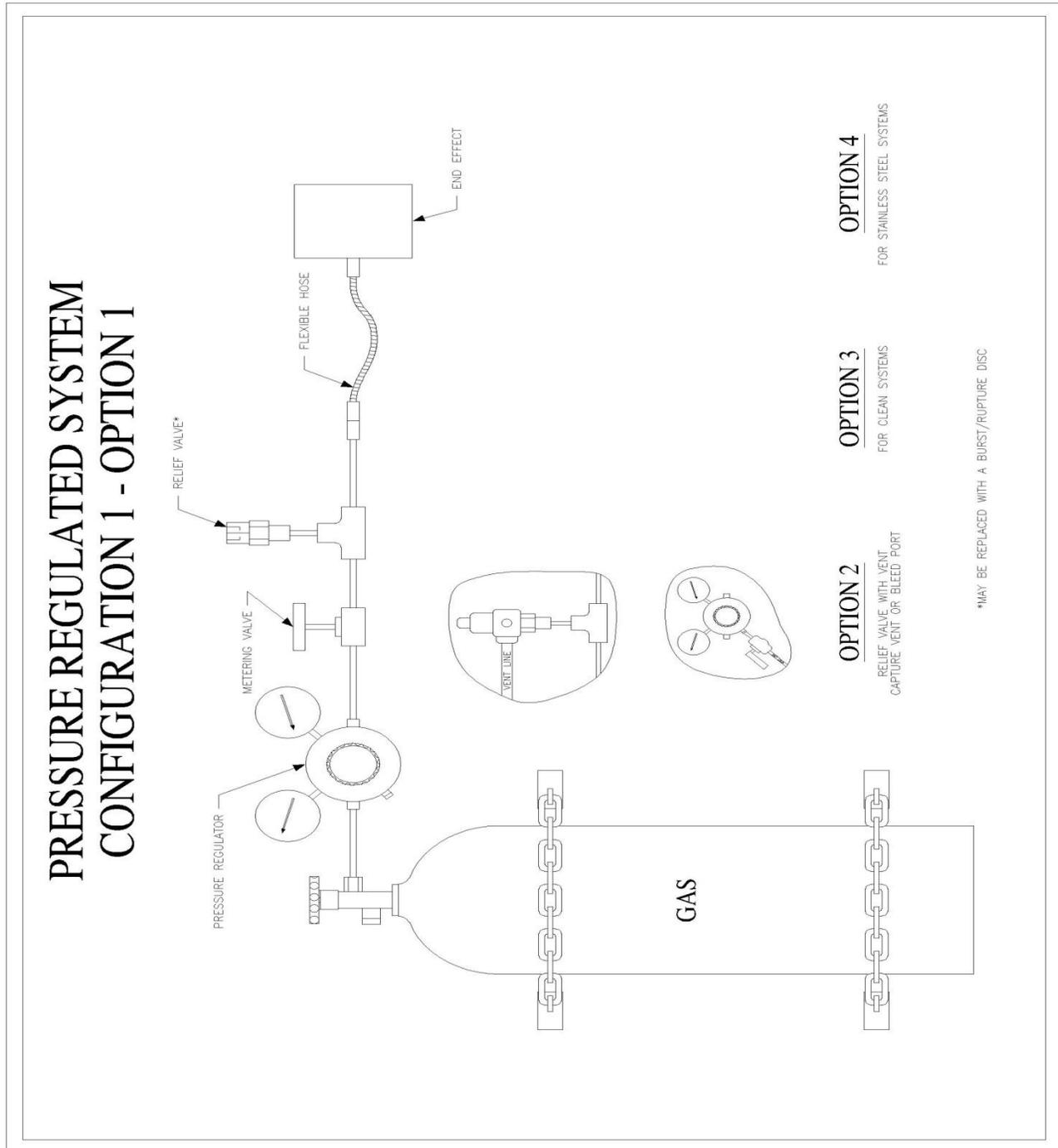


Figure 1: Configuration 1 schematic

*A by-pass vent maybe installed branching off main piping instead of via the regulator to accomplish Option 2 requirements



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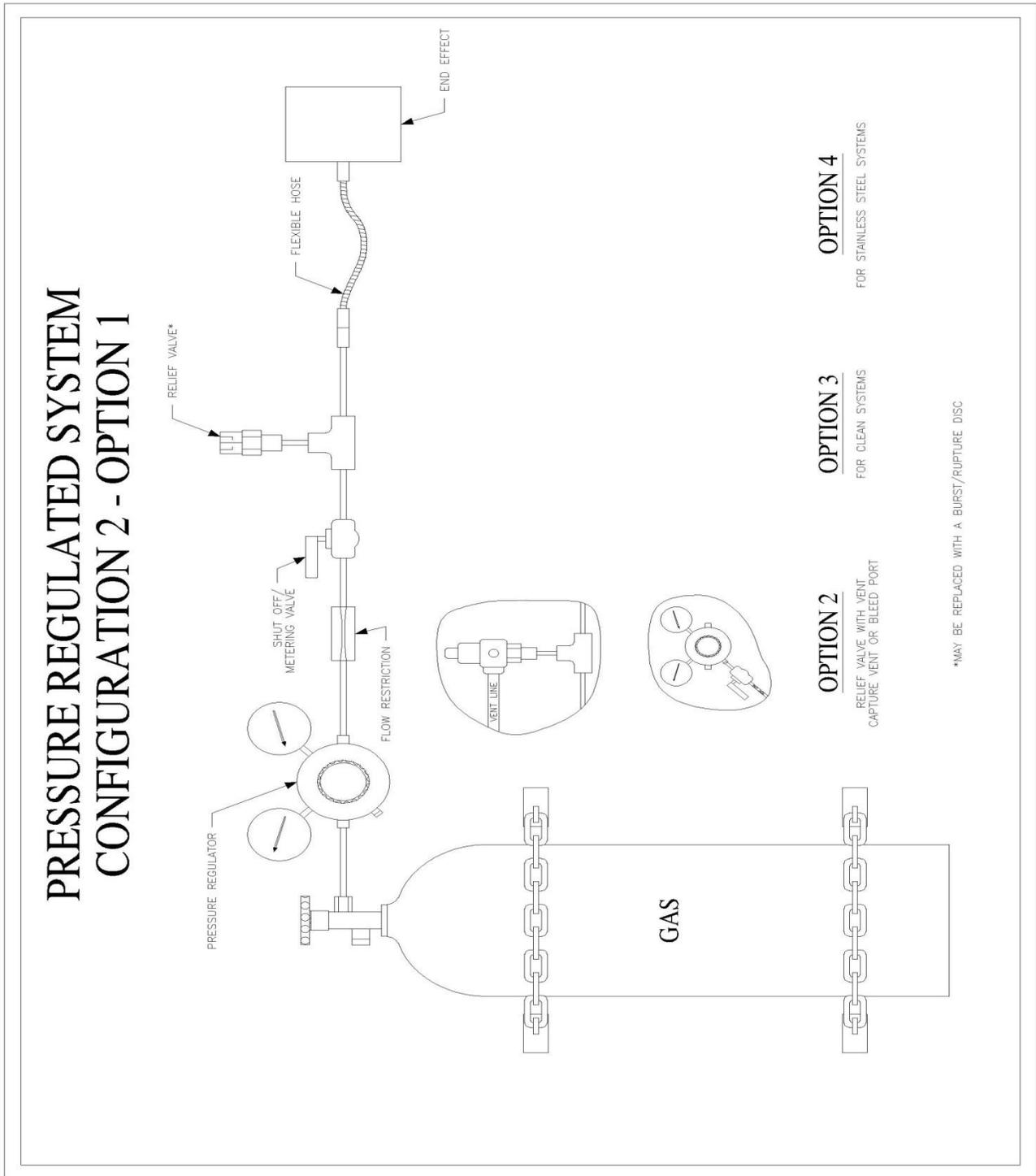


Figure 2: Configuration 2 schematic

*A by-pass vent maybe installed branching off main piping instead of via the regulator to accomplish Option 2 requirements



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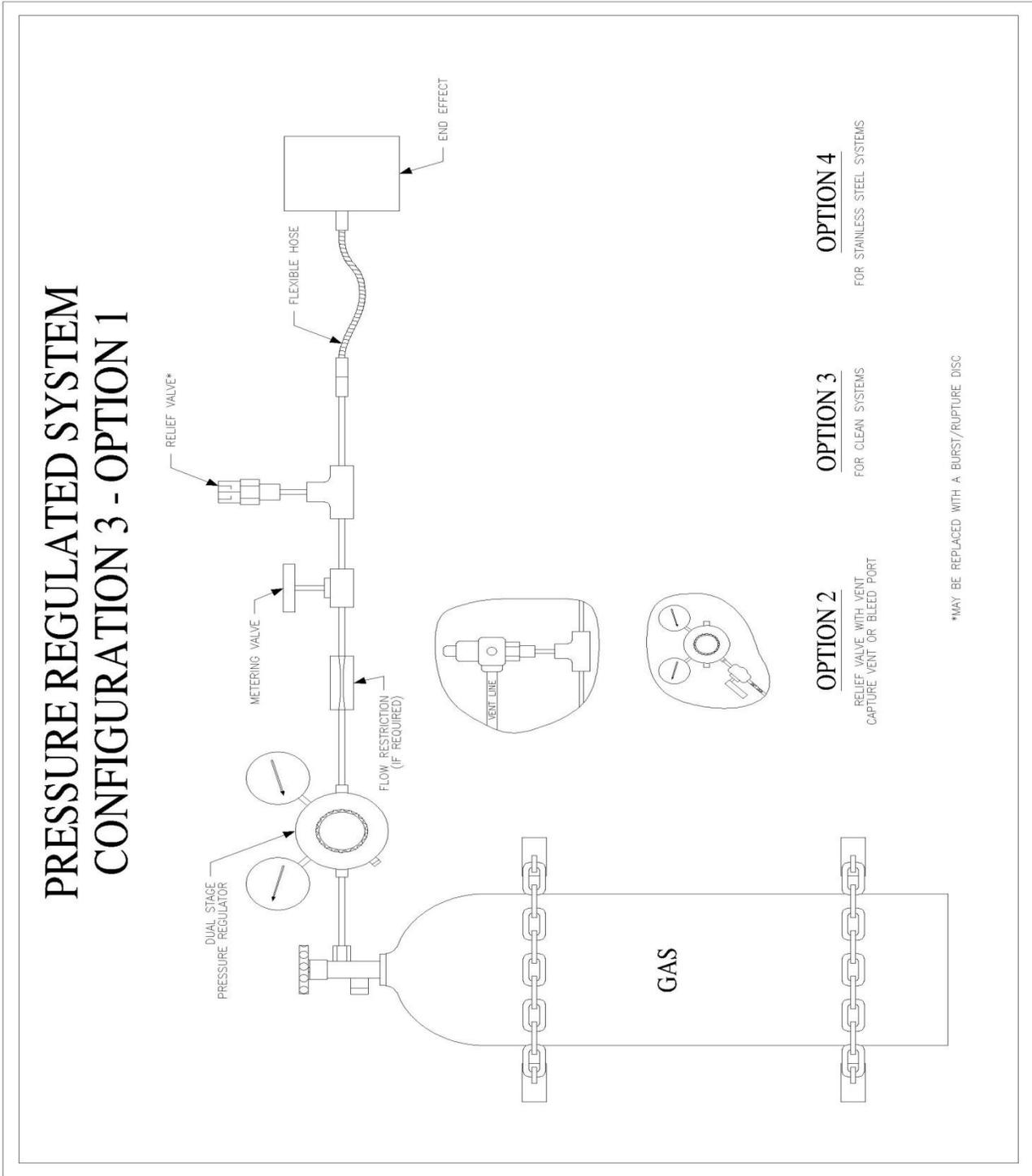


Figure 3: Configuration 3 schematic

*A by-pass vent maybe installed branching off main piping instead of via the regulator to accomplish Option 2 requirements



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9.0 APPENDIX B

	Configuration 1	Configuration 2	Configuration 3
Option 1	<ul style="list-style-type: none"> • Pressure Regulator – Airgas / Y11-244D • Valve – Swagelok / B-1R Series • Relief Device – Kunkle Valve / 540 Series 	<ul style="list-style-type: none"> • Pressure Regulator – Airgas / Y11-244B • Flow Restrictor – Swagelok / SS-XS Series • Valve – Swagelok SS-AFS Series • Relief Device – CDI / SA Model 	<ul style="list-style-type: none"> • Pressure Regulator – Airgas / Y12-244A • Flow Restrictor – Swagelok / SS-XS Series • Valve – Swagelok / B-1R Series • Relief Device – Kunkle Valve / 540 Series
Option 2	<ul style="list-style-type: none"> • Pressure Regulator – Airgas / Y11-244D • Valve – Swagelok / B-1R Series • Relief Device – Kunkle Valve / 918 	<ul style="list-style-type: none"> • Pressure Regulator – Airgas / Y11-244B • Flow Restrictor – Swagelok / SS-XS Series • Valve – Swagelok SS-AFS Series • Relief Device – Kunkle Valve / 918 	<ul style="list-style-type: none"> • Pressure Regulator – Airgas / Y12-244A • Flow Restrictor – Swagelok / SS-XS Series • Valve – Swagelok / B-1R Series • Relief Device – Kunkle Valve / 918
Option 3	<ul style="list-style-type: none"> • Pressure Regulator – Matheson Tri Gas / 9310 Series • Valve – Swagelok / SS-1R Series • Relief Device – Kunkle Valve / 540 Series 	<ul style="list-style-type: none"> • Pressure Regulator – Matheson Tri Gas / 9330 Series • Flow Restrictor – Swagelok / SS-XS Series • Valve – Swagelok SS-AFS Series • Relief Device – Relief Device – CDI / SA Model 	<ul style="list-style-type: none"> • Pressure Regulator – Matheson Tri Gas / 9460 Series • Flow Restrictor – Swagelok / SS-XS Series • Valve – Swagelok / SS-1R Series • Relief Device – Kunkle Valve / 540 Series
Option 4	<ul style="list-style-type: none"> • Pressure Regulator – Swagelok / KPR Series • Valve – Swagelok / SS-1R Series • Relief Device – REGO PRV 29 Series 	<ul style="list-style-type: none"> • Pressure Regulator – Swagelok / KPR Series • Flow Restrictor – Swagelok / SS-XS Series • Valve – Swagelok SS-AFS Series • Relief Device – REGO PRV 29 Series 	<ul style="list-style-type: none"> • Pressure Regulator – Swagelok / KCY Series • Flow Restrictor – Swagelok / SS-XS Series • Valve – Swagelok / SS-1R Series • Relief Device – Crosby 900 Series

Table 4: Example components for various configurations

*Process conditions for the required system should be compared against the examples provided in Table 4. The examples given are not applicable across the full range of conditions this document represents. RECERT should be consulted if there are any questions.



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10.0 APPENDIX C

Recommended Vendors: Relief Valves

- Anderson Greenwood
- Control Devices Inc.
- Crosby
- Dresser
- Farris
- Kingston
- Kunkle
- Leser
- Rego

Recommended Vendors: Rupture Discs

- BS&B Safety Systems
- Continental Disc Corp.
- Donadson SDD
- Fike Corp.
- Oseco
- Zook

*The Owner should check all relief devices for applicability of material and suitable capacity of relief device prior to use. The list above is just a sample of approved vendors; Owner has the ability to venture outside of this list, provided the manufacturer has provided similar data to prove adequate design.