

**TECHNICAL APPENDIX FORM (TA5031) FOR PRESSURE VESSELS
PRESSURE VESSEL ENGINEERING NOTE PER CHAPTER 5031**

Prepared by: Ron Williams
Preparation date: 6/18/2012

1. Description and Identification
Fill in the label information below:

THIS VESSEL CONFORMS TO FERMILAB ES&H MANUAL CHAPTER 5031	
Vessel Title	<u>Vacuum lifter 4 tank one</u>
Vessel Number	<u>4-1</u>
Vessel Drawing No.	<u>Not Applicable</u>
Maximum Allowable Working Pressure (MAWP)	
Internal Pressure	<u>175</u>
External Pressure	<u>Not rated for external pressure</u>
Working Temperature Range	<u>-20</u> °F <u>400</u> °F
Contents	<u>Compressed Air</u>
Designer / Manufacturer	<u>Speedair</u>
Test Pressure (if tested at Fermilab)	Acceptance Date <u>N/A</u>
_____ PSIG, Hydraulic _____	Pneumatic _____
Accepted as conforming to standard by _____	
Of Division / Section _____	Date: _____

← Obtain from Division/Section Safety Officer

← Document per Chapter 5034 of the Fermilab ES&H Manual

← Actual signature required

NOTE: Any subsequent changes in contents, pressures, temperatures, valving, etc., which affect the safety of this vessel shall require another review.

Reviewed by: DAVE PUSHICA
(Print Name)

Signature: [Signature] Date: 7-2-2012

Director's signature (or designee) if the vessel is for manned areas but doesn't conform to the requirements of the chapter.

Signature: _____ Date: _____
Amendment No.: _____ Reviewed by: _____ Date: _____

Lab Property Number(s): _____
 Lab Location Code: _____ (obtain from safety officer)
 Purpose of Vessel(s): One of two tanks supplying compressed air to the lifting fixture

Vessel Capacity/Size: 6 Gallons Diameter: 10 inches Length: 20 inches
 Normal Operating Pressure (OP) 95
 MAWP-OP = 175 PSI

List the numbers of all pertinent drawings and the location of the originals.

<u>Drawing #</u>	<u>Location of Original</u>
<u>None; vessel is commercially made</u>	_____
_____	_____
_____	_____
_____	_____

2. Design Verification

Is this vessel designed and built to meet the ASME BPVC or "Experiment Vessel" requirements?
 Yes X No _____.

If "No" state the standard that was used _____.
 Demonstrate that design calculations of that standard have been made and that other requirements of that standard have been satisfied.
 Skip to part 3 "system venting verification."

Does the vessel(s) have a U stamp? Yes X No _____. If "Yes", complete section 2A; if "No", complete section 2B.
 Staple photo of U stamp plate below.

Copy "U" label details to the side



Copy data here:
 U Stamp
 NB
 1688417
 Certified by
 Campbell Hausfeld
 MAWP 175
 PSI at
 400 F
 MDMT 200
 PSI at -
 20 F
 CRN
 OH10108.
 5C
 SH .094
 HD .094

Provide ASME design calculations in an appendix. On the sketch below, circle all applicable sections of the ASME code per Section VIII, Division I. (Only for non-coded vessels)

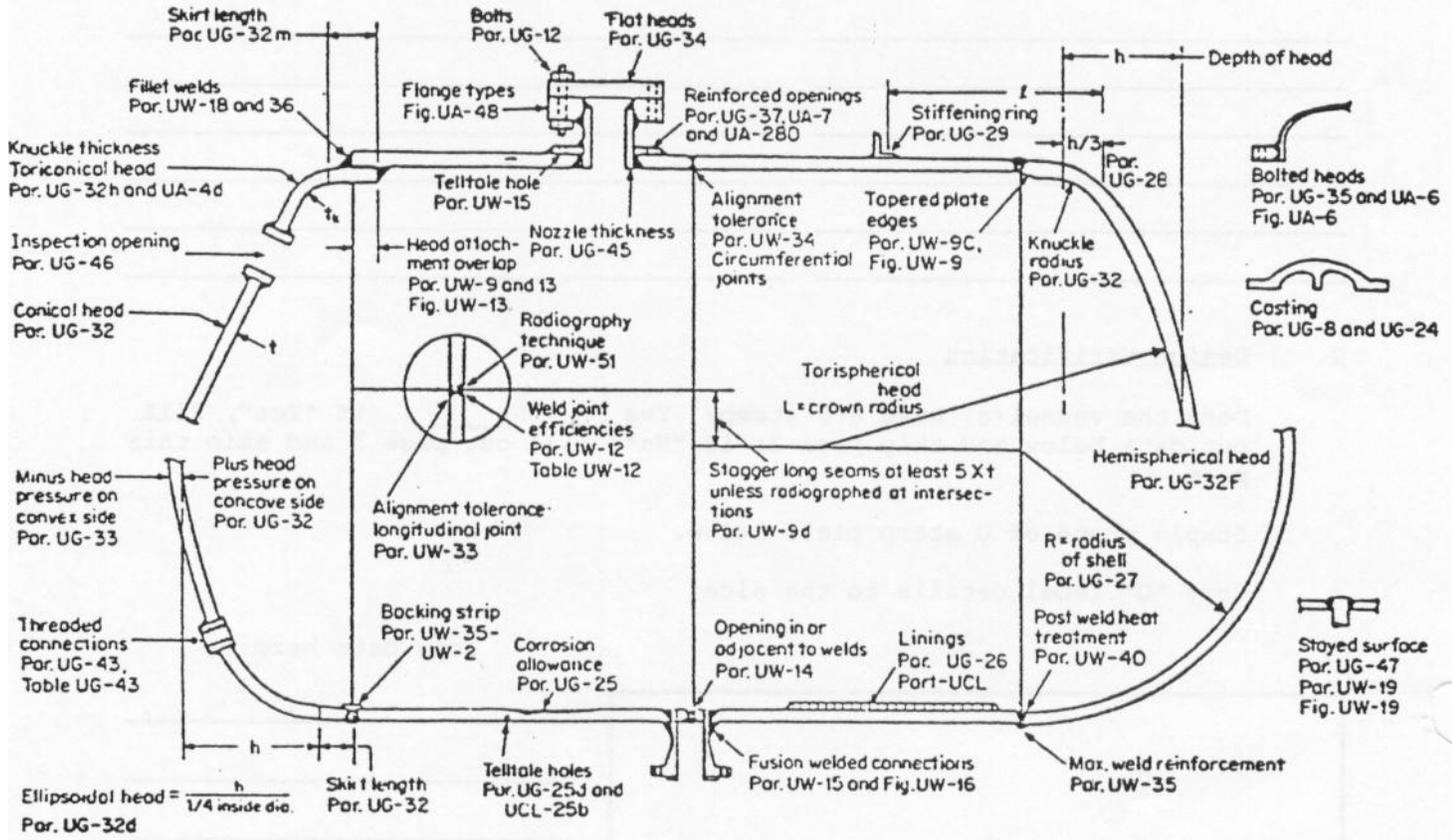


Figure 1. ASME Code: Applicable Sections

2B.

Summary of ASME Code

Item	Reference ASME Code Section	CALCULATION RESULT	
		(Required thickness or stress level vs. actual thickness calculated stress level)	
_____	_____	_____	VS _____
_____	_____	_____	VS _____
_____	_____	_____	VS _____
_____	_____	_____	VS _____
_____	_____	_____	VS _____

3. System Venting Verification Provide the vent system schematic.

Does the venting system follow the Code UG-125 through UG-137?
 Yes No

Does the venting system also follow the Compressed Gas Association Standards S-1.1 and S-1.3?
 Yes No (S-1.1 applies to DOT cylinders S-1.3 calculations appended at the end of this document)

A "no" response to both of the two proceeding questions requires a justification and statement regarding what standards were applied to verify system venting is adequate.

List of reliefs and settings:

Manufacturer	Model #	Set Pressure	Flow Rate	Size
F.C. Kingston	CRNOG3144.1C	105 PSI	<u>102 SCFM</u>	<u>½ inch</u>

4. Operating Procedure

Is an operating procedure necessary for the safe operation of this vessel?
 Yes No (If "Yes", it must be appended)

5. Welding Information

Has the vessel been fabricated in a non-code shop? Yes No
 If "Yes", append a copy of the welding shop statement of welder qualification (Procedure Qualification Record, PQR) which references the Welding Procedure Specification (WPS) used to weld this vessel.

6. Existing and Unmanned Area Vessels

Is this vessel or any part thereof in the above categories?
 Yes No

If "Yes", follow the requirements for an Extended Engineering Note for Existing and Unmanned Area Vessels.

7. Exceptional Vessels

Is this vessel or any part thereof in the above category?
 Yes No

If "Yes", follow the requirements for an Extended Engineering Note for Exceptional Vessels.

ASME-Code Brass Pop-Safety Valves



A

- Meet ASME Code Section VIII for Air and Inert Gas
- Temp. Range:
 Styles A&C: -40° to +400° F
 Style B: -15° to +250° F

Protect against damage in air lines and air-powered equipment, such as air receivers and compressor tanks. Valves meet ASME standards for compressed air.

Body is brass. Valves exhaust to the atmosphere. Pipe connection is NPT male. **High-flow valves** have twice the flow capacity of medium-flow valves.



B

(A) Valves with Test Ring—Seal is brass. Vent is on the side.

(B) Extended-Life Valves with Test Ring—Seal is silicone for a longer service life in applications that operate close to the set pressure. Vent is on the side.

To Order: For **Styles A and B**, please specify set pressure: from 25 to 150 psi in 5 psi increments or from 175 to 300 psi in 25 psi increments, unless noted.



C

(C) Valves with Test Lever—Seal is brass. Vent is on the top.

To Order: For **Style C**, please specify set pressure: 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100, 110, 125, 130, 140, 150, 175, or 200 psi.

[View flow capacities for these valves.](#)

Pipe Size	Ht.		Each
(A) Valves with Test Ring			
Medium Flow			
1/8	2 1/8"	9889K15*	\$9.19
1/4	3 1/8"	9889K19	18.98
3/8	3 1/8"	9889K29	20.98
1/2	3 3/4"	9889K39	36.34

[Catalog Page](#) | [Bookmark](#) ✕

ASME-Code Brass Pop-Safety Valve w/ Test Ring Medium Flow, 1/2 NPT Male Each

ADD TO ORDER

[Air Flow Capacities for Brass ASME Pop-Safety Valves](#)

Set Pressure:
 ▼



SPEEDAIRE Air Tank, Stationary, 175 PSI, 6 Gal, Horiz

Pneumatics > [Air Compressor Accessories](#) > Stationary Air Tanks

☆☆☆☆☆

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Air Tank, Stationary, Steel, Capacity 6 Gal, Working Pressure 175 PSI, Tank Type Horizontal, Dia 10 In, Length 20 In, Height 12 In, Standards ASME U Code

Grainger Item #	1TZY8
Price (ea.)	\$298.50
Brand	SPEEDAIRE
Mfr. Model #	1TZY8
Ship Qty. <input type="text"/>	1
Sell Qty. (Will-Call) <input type="text"/>	1
Ship Weight (lbs.)	32.5
Availability	Ready to Ship <input type="text"/>
Catalog Page No.	3728 <input type="text"/>
Country of Origin (Country of Origin is subject to change.)	USA



[Enlarge Image](#)

Qty:

Add Grainger TripleGuard® repair & replacement coverage for \$55.95 each.

[Add to Order](#) [Add to Personal List](#) [Compare Alternates](#)

Price shown may not reflect your price. [Sign in](#) or [register](#).

When can I get it? Use your ZIP code to estimate availability.

Qty: ZIP code: [Go](#)

Tech Specs	Additional Information	Compliance & Restrictions	MSDS	Required Accessories	Optional Accessories	Alternate Products	Repair Parts
Item	Air Tank						
Type	Stationary						
Material	Steel						
Capacity (Gal.)	6						
Working Pressure (PSI)	175						
Tank Type	Horizontal						
Dia. (In.)	10						
Length (In.)	20						
Height (In.)	12						
Standards	ASME U Code						

Kingston Safety & Relief Valves

Kingston Model 112CSS

ASME Code Safety Valve
Brass, Stainless Steel Ball



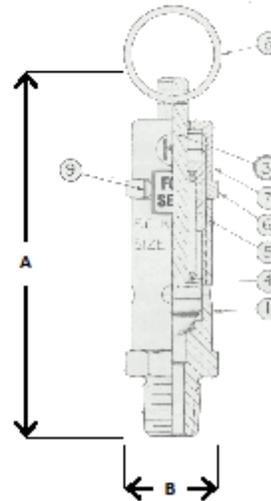
Features:

- Precision Machined Hard Seat
- Brass Construction
- Stainless Steel Ball & Spring
- Pull Ring for Manual Testing
- Three Sizes: 1/4 NPT, 3/8 NPT & 1/2 NPT
- ASME Certified - Stamped UV + NB
- Registered in All Canadian Provinces & Territories
- Maximum Temperature 400°F
- Set Pressure Range 25-300 PSIG
- Every Safety Valve Factory Set and Tested

Model	Available Sizes	Orifice	Figure/Part No	Dimensions (Inches)		Set Pressure Range PSIG	Approximate Ship Weight	Max Temp
				Height (A)	Hex (B)			
112CSS	1/4 NPT	.250	112CSS-2-000	3 1/8	3/4	25-300	4 oz	400°F
	3/8 NPT	.250	112CSS-3-000	3 1/8	3/4		4 oz.	
	1/2 NPT	.375	112CSS-4-000	3 3/4	7/8		7 oz.	

Materials

No.	Part Name	Materials
1	Body	Brass
3	Stem Assembly	Brass Stem, Stainless Steel Ball
4	Spring	Stainless Steel
5	Adjusting Screw	Brass
6	Lock Nut	Brass
7	Cap	Brass
8	Pull Ring	Stainless Steel
9	Seal	Vinyl



Storm Manufacturing Group
23201 Normandie Ave., Torrance CA 90501-5050
Toll Free: 866-628-8287 Fax: 800-997-0300 Direct: 310-326-8287

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Relief Valve Sizing Calculations:

Source of pressure in the vessel is only the house air compressor.

Lifting fixture (and therefore this pressure vessel) is in a building with fire detector and fire suppressions systems. Engulfment in fire is not a credible source of vessel pressurization. This addresses paragraph UG-125 (2).

House Air Compressor has a capacity of 34.8 cfm at 175 psig according to the name plate data read by Ron Williams at the Far Detector Building in Ash River

House Air Receiver has a Relief valve information capacity of 178 cfm at 200 psig.

The lifting fixture compressed air tank has a relief valve capacity of 102 scfm.

Therefore, the relief valve capacity exceeds the capacity of the air source and this satisfies UG-133

Relief valve set point (105 psig) is less than the vessel MAWP (175 psig). This is acceptable per ASME B&PV code paragraph UG-125 (3) (b) and UG-134.

Relief valve is mounted directly on the vessel as required by UG-135. Relief valve discharges directly to the room air, no discharge piping is used.

UG-127 does not apply as a rupture disk is not used.

UG-128 does not apply as the vessel is not filled with liquid.

UG-129 has been satisfied by the relief valve manufacture with the data stamped on the relief valve.

UG-130 has been satisfied by the relief valve manufacture with the data stamped on the relief valve.

UG-131 has been satisfied by the relief valve manufacture.

UG-132 does not apply as a non-reclosing pressure relief is not used.

UG-133 has been satisfied as described above.

UG-134 has been satisfied as the relief valve set point does not exceed the vessel MAWP

UG-135 has been satisfied as the relief in on the top of the vessel.

UG-136 has been satisfied by the relief valve manufacture.

UG-137 does not apply as a rupture disk is not used.

CGA S-1.1 and S-1.3: CGA S-1.1 applies to compressed gas cylinders. This vessel is not a compressed gas cylinder. CGA S-1.3 has two paragraphs applicable to the relief valve sizing for this vessel. Installed relief has more capacity than required by this calculation.

CGA 1.3 paragraph 6.2.1 Minimum Required flow capacity for an uninsulated container of non-liquefied compressed gas

Symbol	description	Units	Value	Comments
Qa	Required Flow capacity	cfm	0.01957	
P	MAWP in absolute units	psia	189.4	
V	Receiver Volume	ft3	0.802083	
C	Gas Constant	n/a	356	for air and k = 1.4
M	molecular weight	n/a	29	for air
Z	Compressibility factor	n/a	0.9958	for air at 200 psi and 68 F

CGA 1.3 paragraph 6.3.1 Minimum Required flow capacity for an uninsulated container of non-liquefied compressed gas under fire conditions

Symbol	description	Units	Value	Comments
A prd	Required relief device flow area	in ²	0.001221	must be larger than 0.003 0.3 for vessels in water fire protection, 1
S	Safeguarding Factor	n/a	0.3	otherwise
A	Container exterior area	ft ²	5.5	
k	ratio of specific heats	n/a	1.4	for air
M	molecular weight	n/a	29	for air
C	Gas Constant	n/a	356	for air and k = 1.4
Kd	Discharge Coefficient	n/a	0.975	for gas
P	MAWP in absolute units	psia	189.4	
D	Diameter	0.833333	ft	
H	Height	1.666667	ft	
A shell	Shell Area	4.4	ft ²	
A End	End Area	0.5	ft ²	
A total	Total area	5.5	ft ²	

Relief Orifice Area

Inlet Hole diameter	inches	0.375
Inlet Orifice area	in ²	0.110447
Plunger displacement	inches	0.0625
Seat area at above displacement	in ²	0.073631
Number of outlet holes		4
Outlet hole diameter	inches	0.25
Outlet Hole area	in ²	0.785398

See FC Kingston data sheet for orifice dimensions

The outlet area on the same valve is four holes, each 0.25 inches in diameter.

The area across the valve seat depends on the amount of displacement on the valve.

The seat displacement is measured to be at least 1/16th of an inch