SIGNATURE PAGE

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Calculation Cover Sheet

1. Document Title:	Calculation of CH and RH Payload Container Waste Volumes		
2. Document Number:	PLD-CAL-0001	3. Document Revision: 1	4. Page: 1 of 42

5. Summary Description

This calculation determines the waste volumes for WIPP Type B package authorized payload containers and inner containers. The volume calculation is based on a solid model representation of the waste utilizing an assumption that the payload container internal body geometry is completely filled up to an elevation that precludes interference of the waste with the lid installation and closure process.

6. Software Usage

	Software Name	Version
1.	Creo Parametric	2.0
2.		
3.		
4.		
5.		

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TABLE OF REVISIONS

Revision Number	Pages Affected	Revision Description
0	All	New Issue
1	5, 6, 30, 31	Revised Section 2.0 and 3.0 software references from Pro/ENGINEER to Creo Parametric; revised Table 1 to incorporate the Criticality Control Overpack and to update drawing references to latest revision for 6-in. Standard, 12-in. Standard, S100, S200-A, S200-B, and S300 Pipe Overpacks, Standard Waste Box, Ten Drum Overpack, Removable Lid Canister, and Standard Large Box 2; and added Section 4.13 for the Criticality Control Overpack calculations.

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1.0 INTRODUCTION

This calculation determines the waste volumes for WIPP Type B package authorized payload containers and inner containers. The volume calculation is based on a solid model representation of the waste utilizing an assumption that the payload container internal body geometry is completely filled up to an elevation that precludes interference of the waste with the lid installation and closure process.

All calculations are based on the nominal payload container dimensions based on established production drawings. All payload containers other than drums are under WIPP design control, so no variation in container size beyond the drawing tolerances exists. Drums designs are controlled by individual drum manufacturers such that some minor size variation is inherent. Skolnik drums are used as the baseline from which to perform the drum waste volume calculations.

2.0 CALCULATION METHODOLOGY

The Creo Parametric solid models of the waste volume are utilized to calculate and establish a detailed and accurate waste volume value. However, simplified representations of the waste volume can be used to perform verification calculations using standard geometric relationships to confirm no gross errors in the automated solid model calculation.

3.0 SUMMARY OF RESULTS

A summary of the Creo Parametric waste volume calculations are provided in Table 1 as reported to 3 significant digits. The geometry of the payload containers utilized in the calculations was based on the referenced payload container production drawings. The waste volume is defined as the payload container body maximally filled up to the elevation that precludes interference of the contents (waste) with the operation and/or closure of the lid for direct load configurations. The waste volume for payload containers that are not directly loaded (i.e., that overpack other defined-size containers) can be established by summing the individual overpacked payload container volumes.

Table 1 – CH and RH Payload Container Waste Volumes

WIPP Type B Package Authorized Payload Containers	Waste Volume (m^3)	Note	Drawing Reference
55-gallon drum	0.216		Skolnik CQ5508, Rev. A4
6-in. Standard Pipe Overpack	0.0120		POC-DWG-0001, Rev. 1
12-in. Standard Pipe Overpack	0.0488		POC-DWG-0005, Rev. 1
S100 Pipe Overpack	0.00163		POC-DWG-0004, Rev. 1
S200-A Pipe Overpack	0.00691		POC-DWG-0008, Rev. 1
S200-B Pipe Overpack	0.0137		POC-DWG-0009, Rev. 1
S300 Pipe Overpack	0.00269		POC-DWG-0010, Rev. 1
85-gallon drum (short)	*0.324*	a.	
85-gallon drum (tall)	0.324		Skolnik HM8501, Rev. A
100-gallon drum	0.385	b.	Skolnik CQ11001-BNFL001, Rev. 11
Standard Waste Box	1.88		WTS 165-F-001, Rev. X
Ten Drum Overpack	4.37		WTS 165-F-010, Rev. F
Shielded Container	*0.117*	c.	
Criticality Control Overpack	0.0128		CCO-DWG-0001, Rev. 2
Removable Lid Canister	0.939		RLC-DWG-0001, Rev. 1
Welded Lid Canister	0.906		WTS 165-F-011, Rev. A
NS15 Neutron Shielded Canister	*0.195*	d.	
NS30 Neutron Shielded Canister	*0.351*	e.	
Standard Large Box 2	7.38		WTS 165-F-016, Rev. F
Inner Containers			
16-gallon drum	0.0649		Skolnik CQ1602, Rev. A2
30-gallon drum	0.117		Skolnik CQ3007, Rev. A2

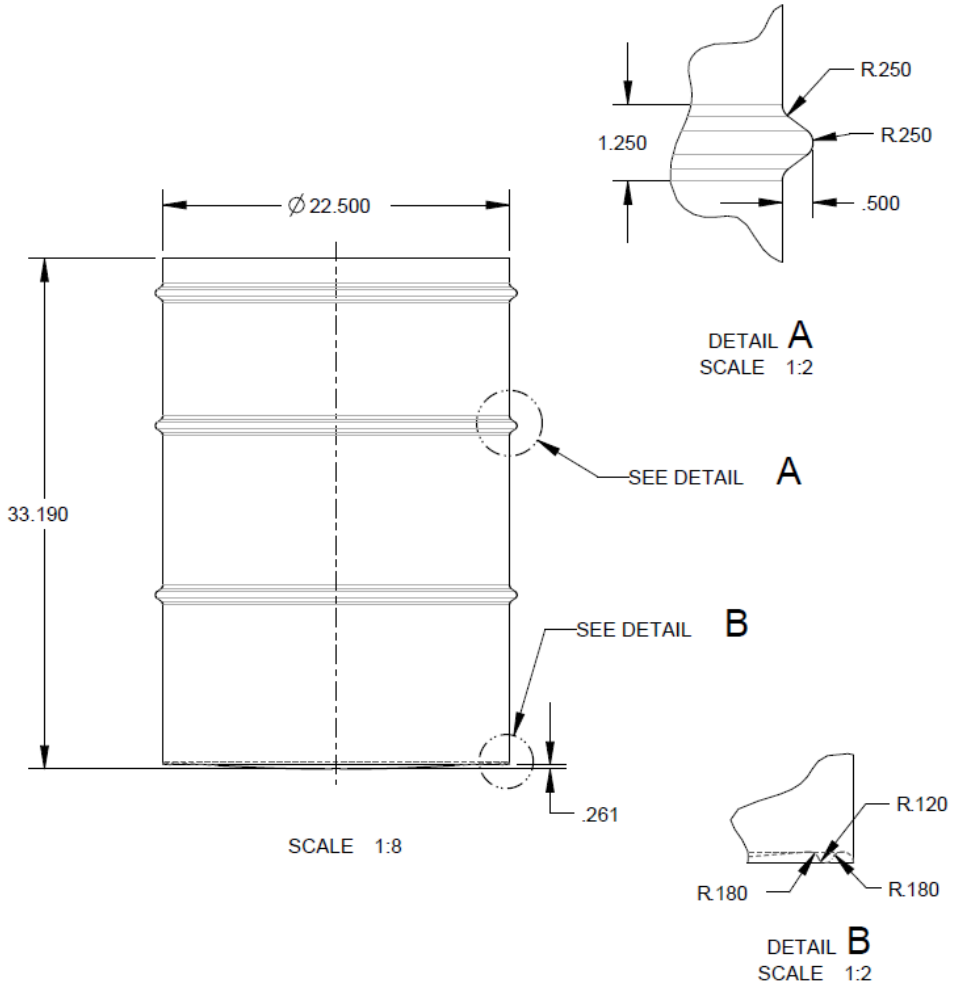
Notes:

a. The short version has not been utilized to date, so no reference drawing is available. Conservatively, the waste volume calculation utilizes the 85-gallon drum (tall).
b. The only 100-gallon drums utilized to date are for INL puck waste. The waste volume calculation disregards content type and determines the fill volume of the 100-gallon drum without considering internal spacers and/or internal lid components.
c. The only authorized content is a 30-gallon drum, so the waste volume is based on a 30-gallon drum.
d. The only authorized contents are three approximately 15-gallon drums. The commercially available standard size is a 16-gallon drum, so the waste volume is based on three 16-gallon drums.
e. The only authorized contents are three approximately 30-gallon drums. The commercially available standard size is a 30-gallon drum, so the waste volume is based on 30-gallon drums.

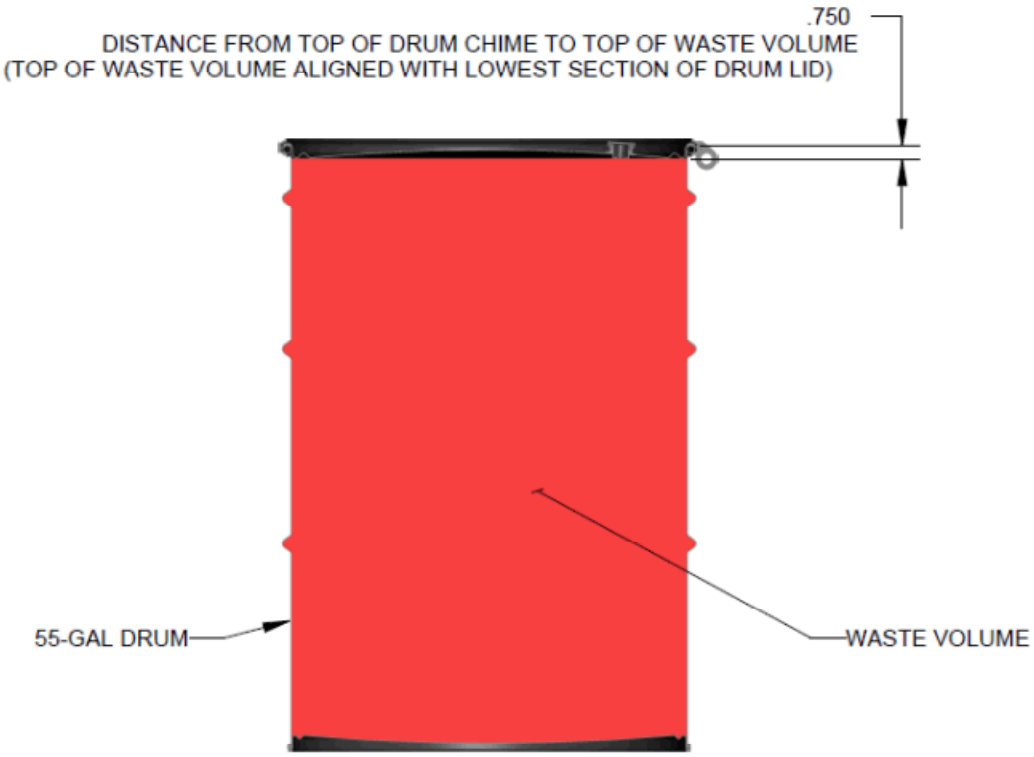
4.0 WASTE VOLUME GEOMETRY DETAILS

The waste volume geometry derived from the payload container fabrication drawings is illustrated in the following subsections, with dimensions shown in inches unless otherwise noted. To provide context, the waste volume is also illustrated inside the payload container to establish the geometric relationship between the top elevation of the waste volume and the payload container lid/closure features.

4.1 55-gallon drum

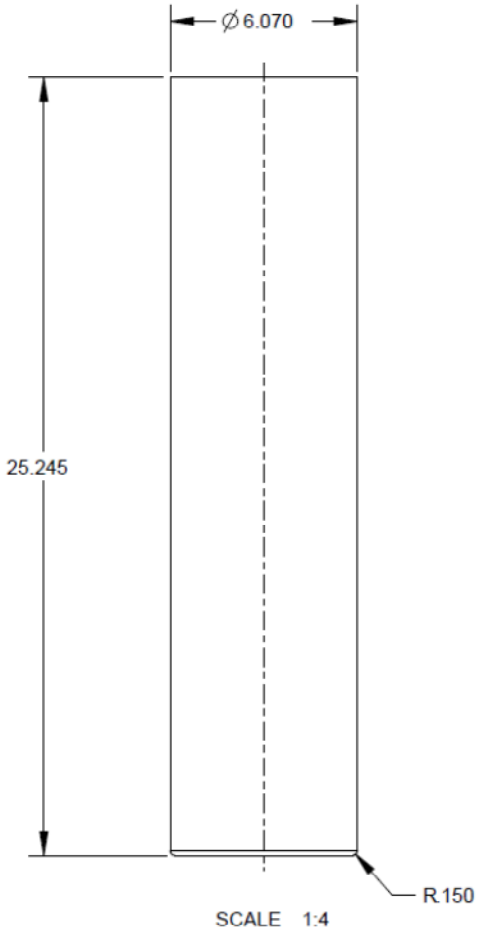


55-GALLON DRUM
WASTE VOLUME = .216 CUBIC METERS

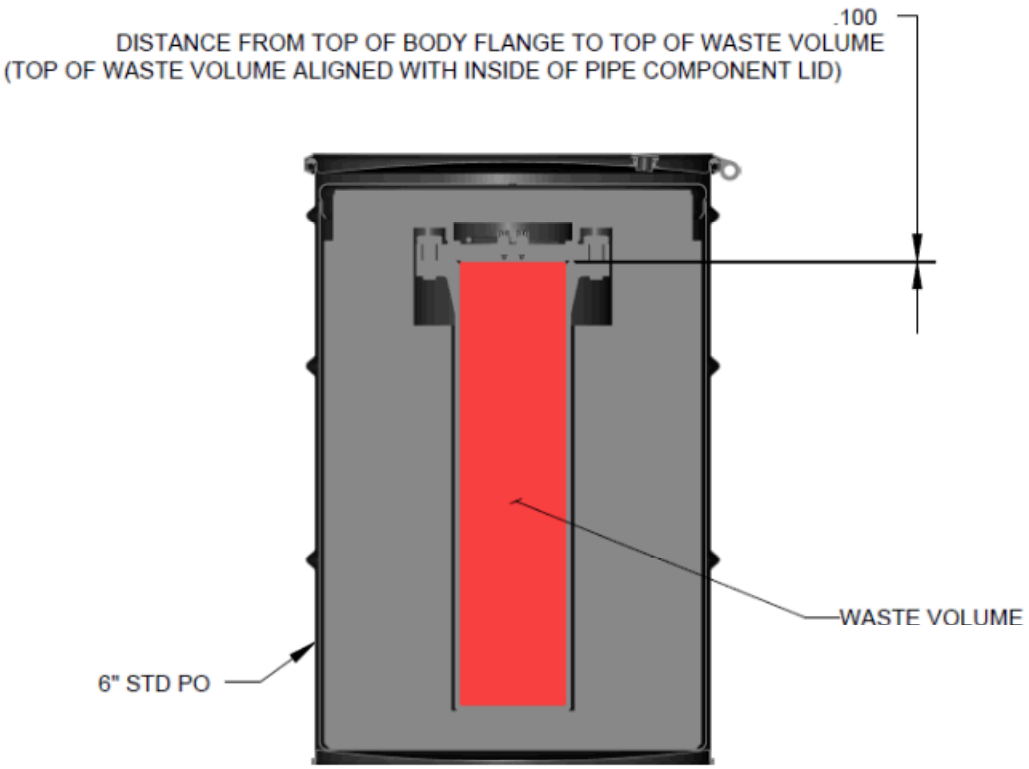


55-GALLON DRUM

4.2 6-in. Standard Pipe Overpack

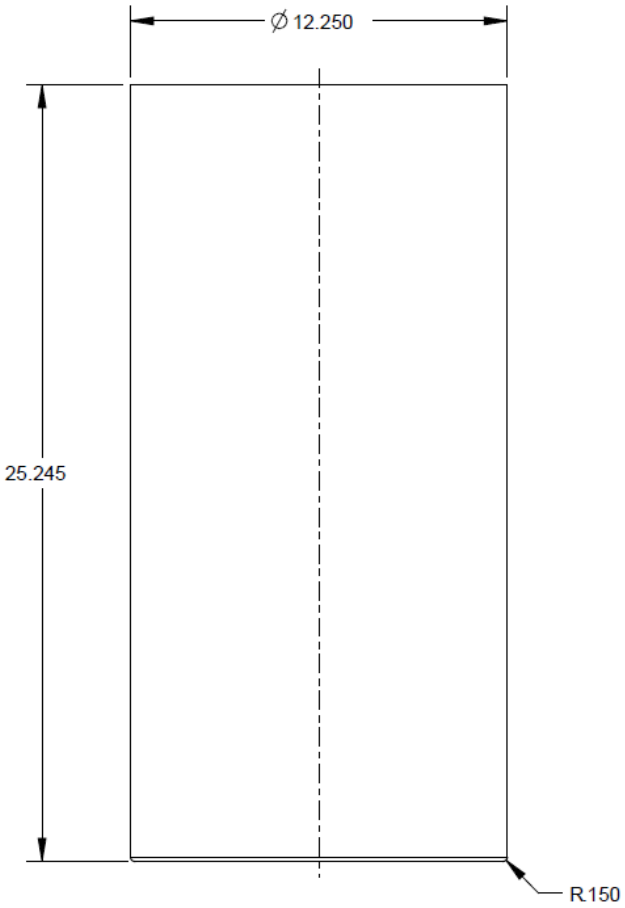


6 IN. STANDARD PIPE OVERPACK
WASTE VOLUME = .0120 CUBIC METERS



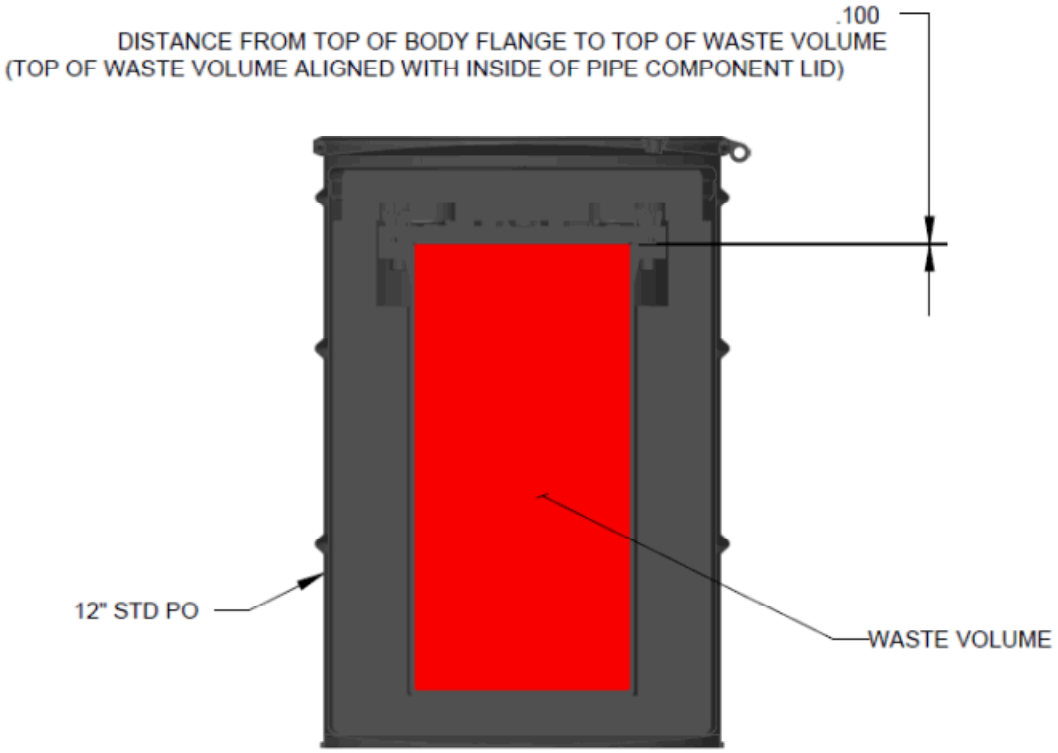
6 IN. STANDARD PIPE OVERPACK

4.3 12-in. Standard Pipe Overpack



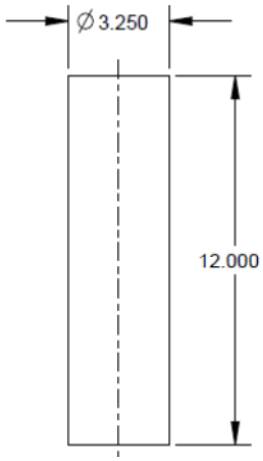
SCALE 1:4

12 IN. STANDARD PIPE OVERPACK
WASTE VOLUME = .0488 CUBIC METERS



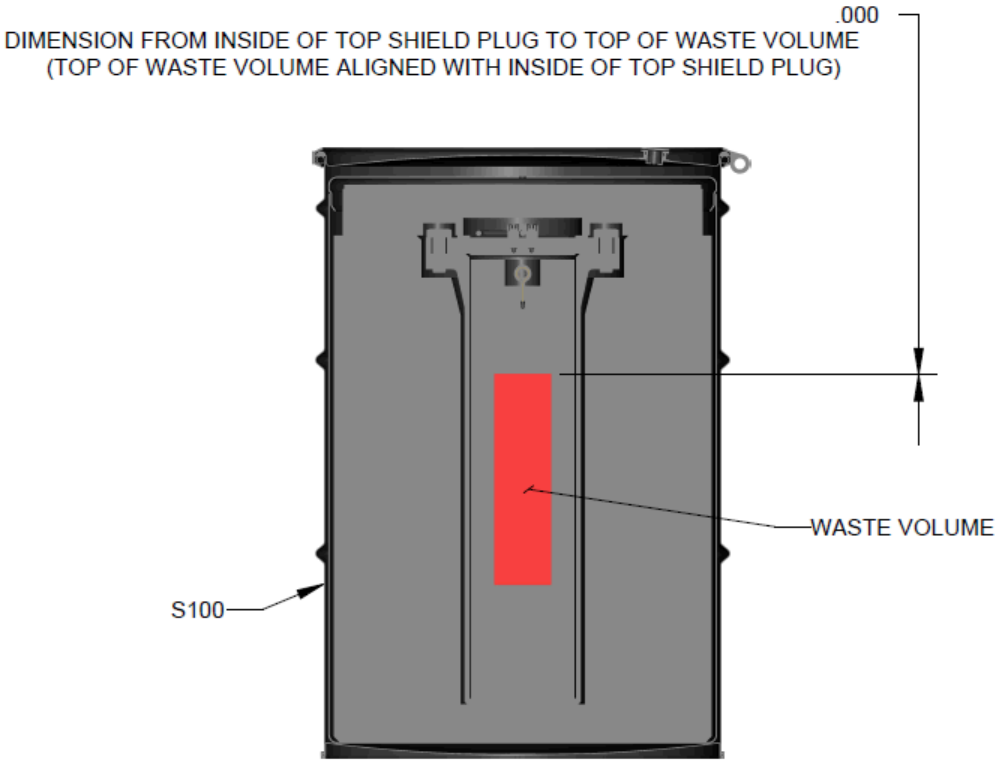
12 IN. STANDARD PIPE OVERPACK

4.4 S100 Pipe Overpack



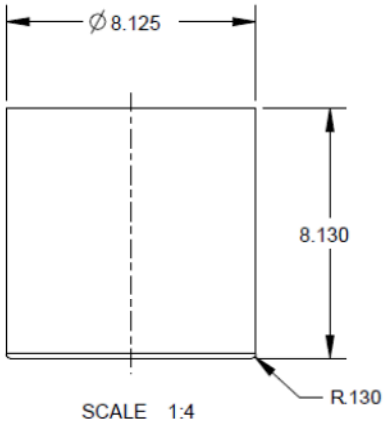
SCALE 1:4

S100 PIPE OVERPACK
WASTE VOLUME = .00163 CUBIC METERS

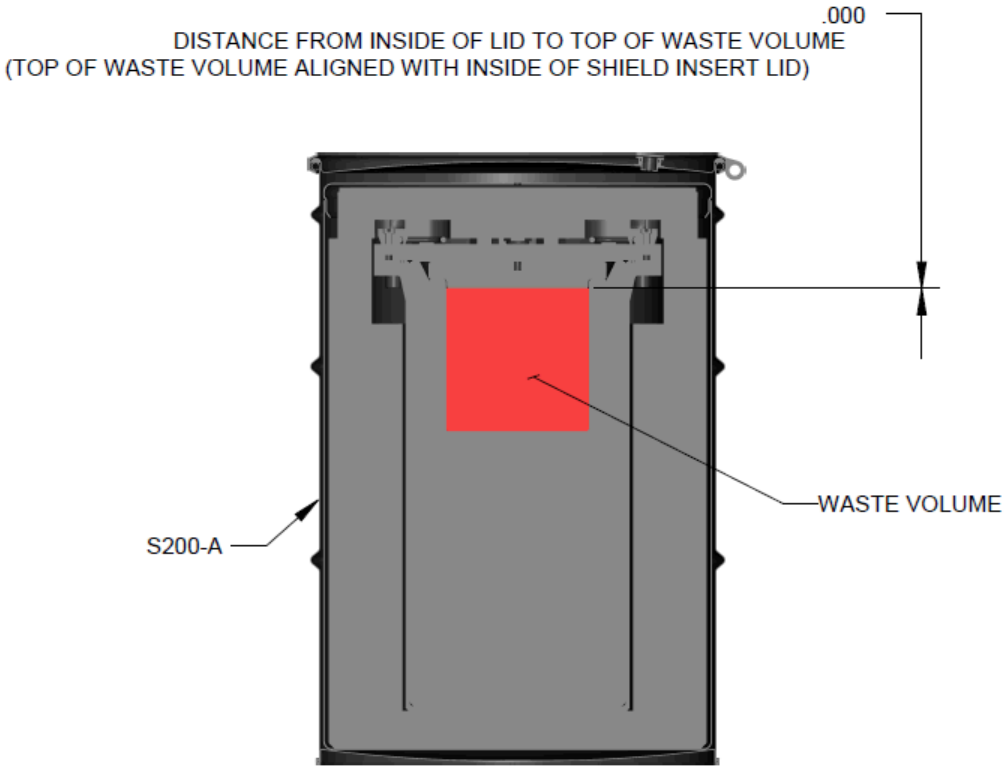


S100 PIPE OVERPACK

4.5 S200-A Pipe Overpack

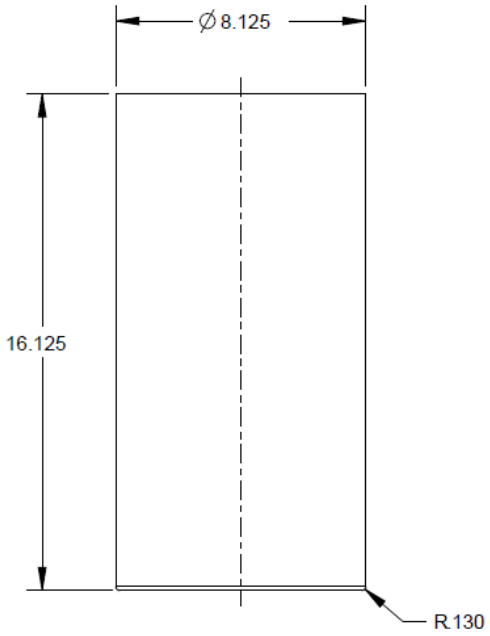


S200-A PIPE OVERPACK
WASTE VOLUME = .00691 CUBIC METERS



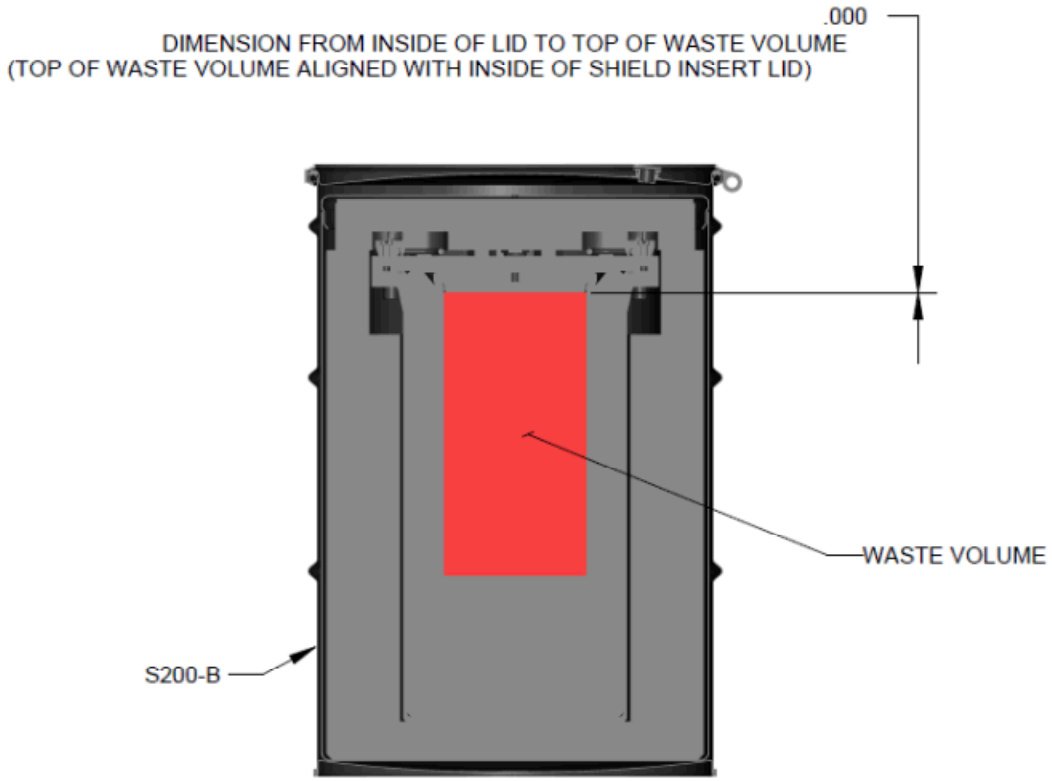
S200-A PIPE OVERPACK

4.6 S200-B Pipe Overpack



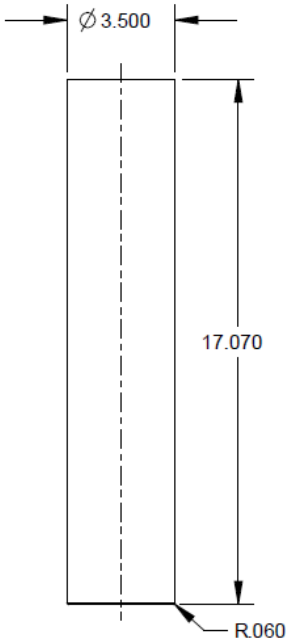
SCALE 1:4

S200-B PIPE OVERPACK
WASTE VOLUME = .0137 CUBIC METERS



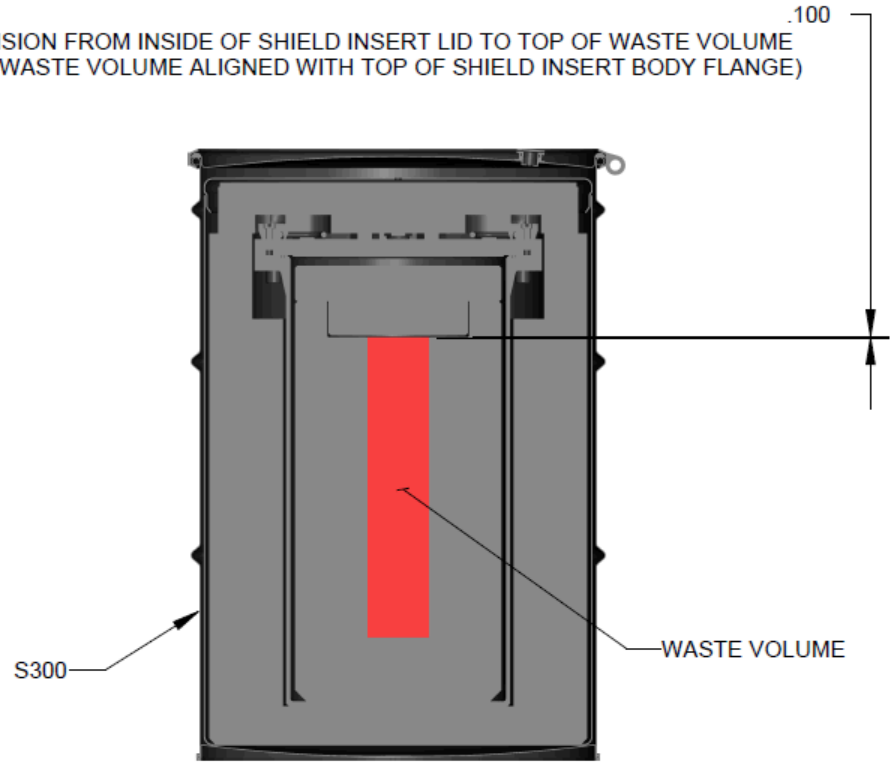
S200-B PIPE OVERPACK

4.7 S300 Pipe Overpack



SCALE 1:4

S300 PIPE OVERPACK
WASTE VOLUME = .00269 CUBIC METERS

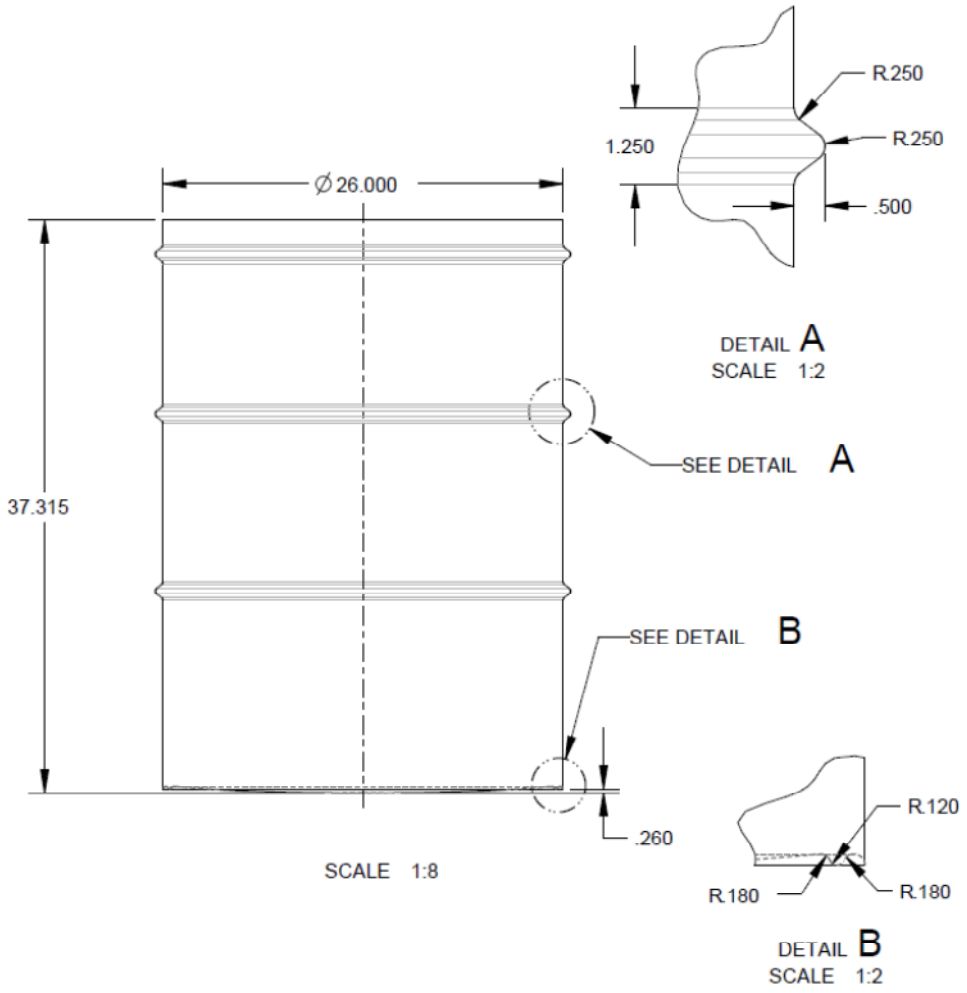


S300 PIPE OVERPACK

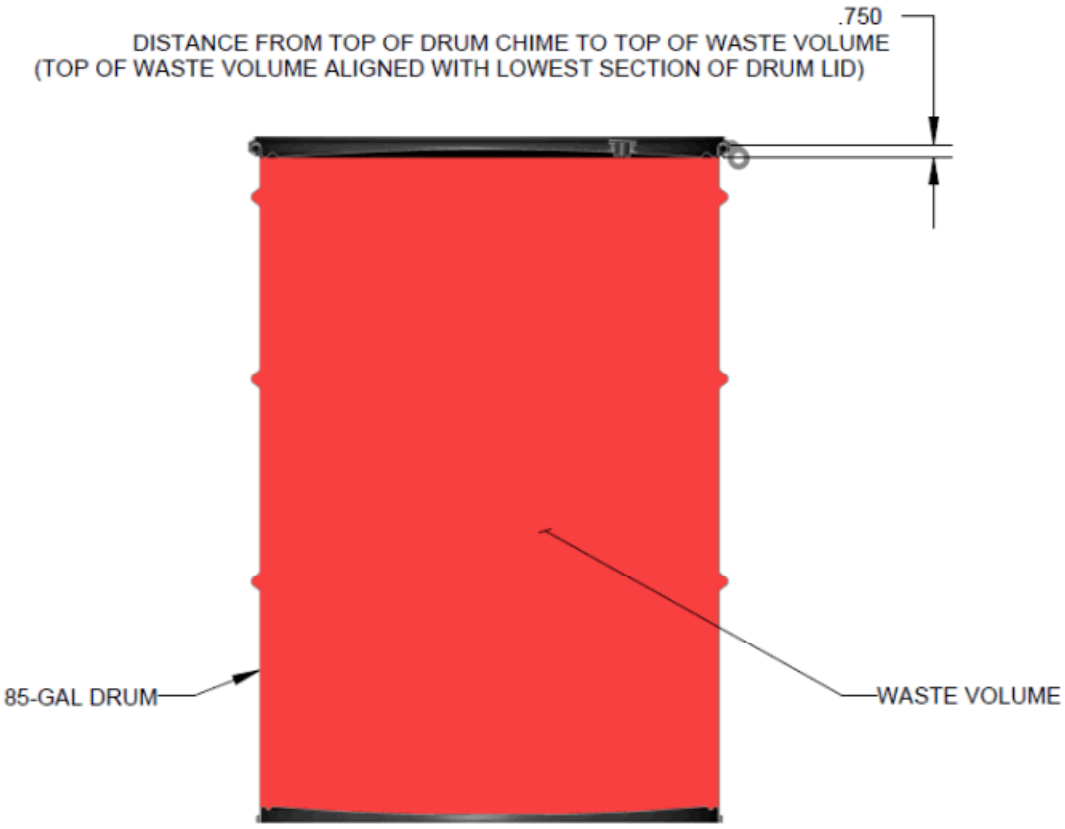
4.8 85-gallon drum (short)

See Table 1, note a.

4.9 85-gallon drum (tall)

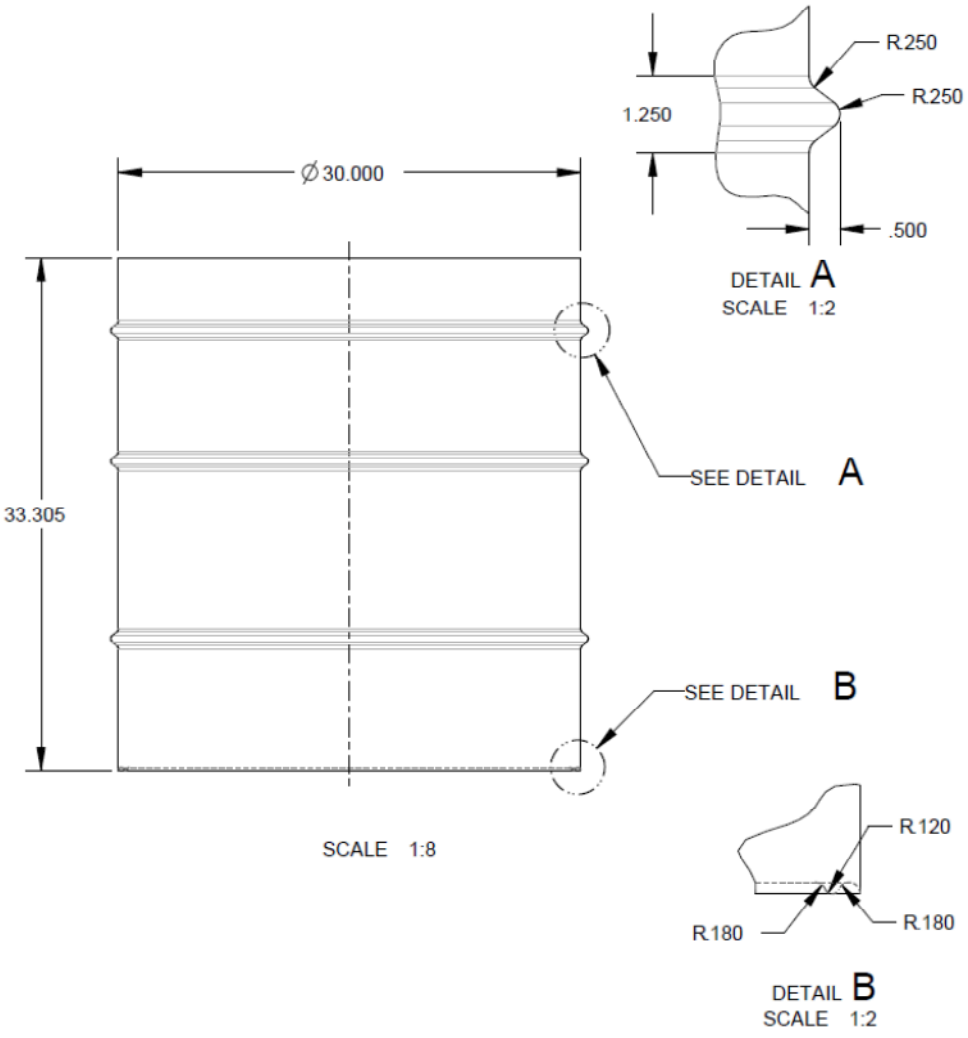


85-GALLON DRUM (TALL)
WASTE VOLUME = .324 CUBIC METERS

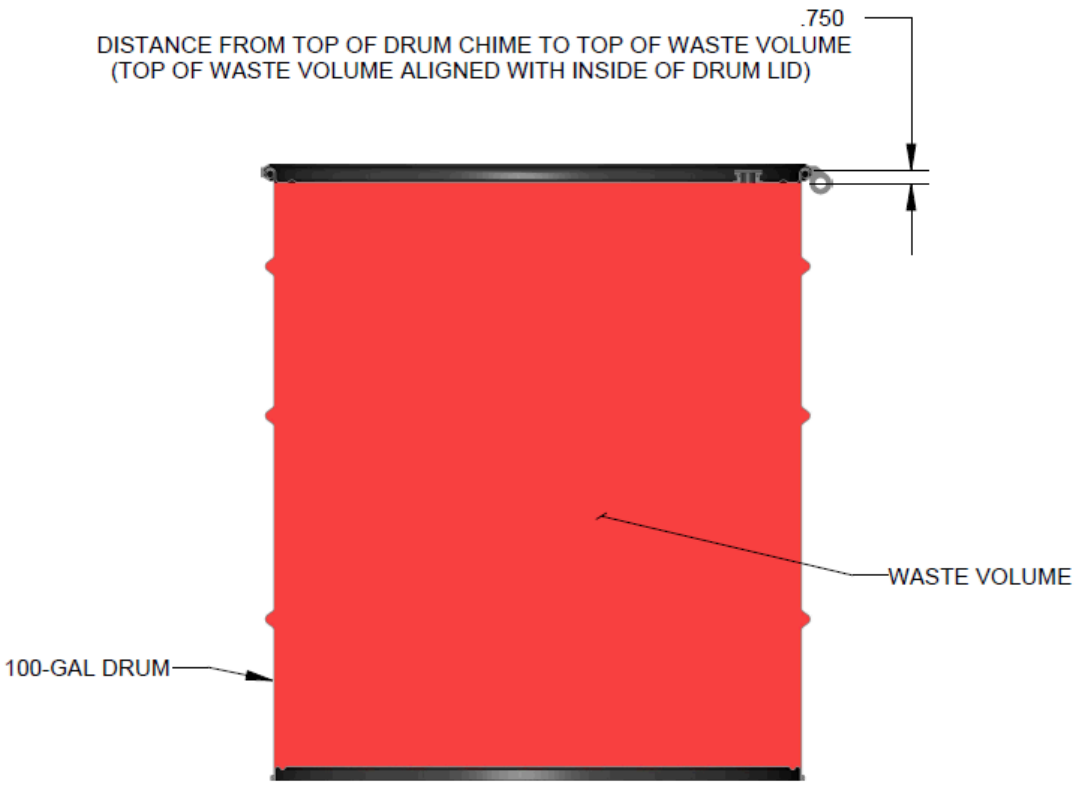


85-GALLON DRUM (TALL)

4.10 100-gallon drum

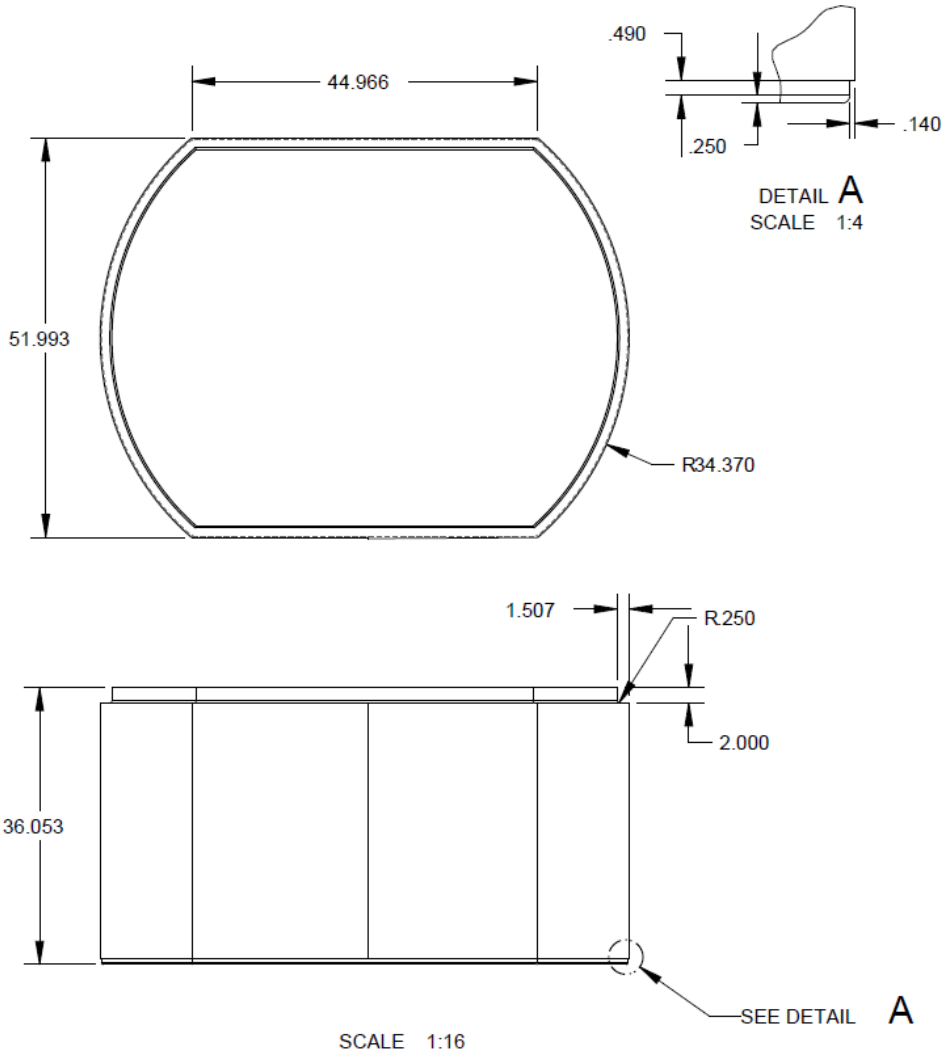


100-GALLON DRUM
WASTE VOLUME = .385 CUBIC METERS

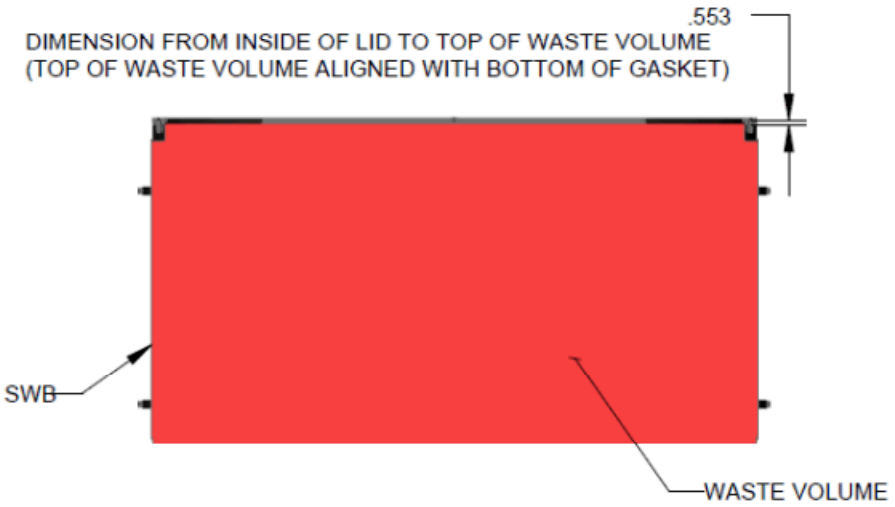


100-GALLON DRUM

4.11 Standard Waste Box

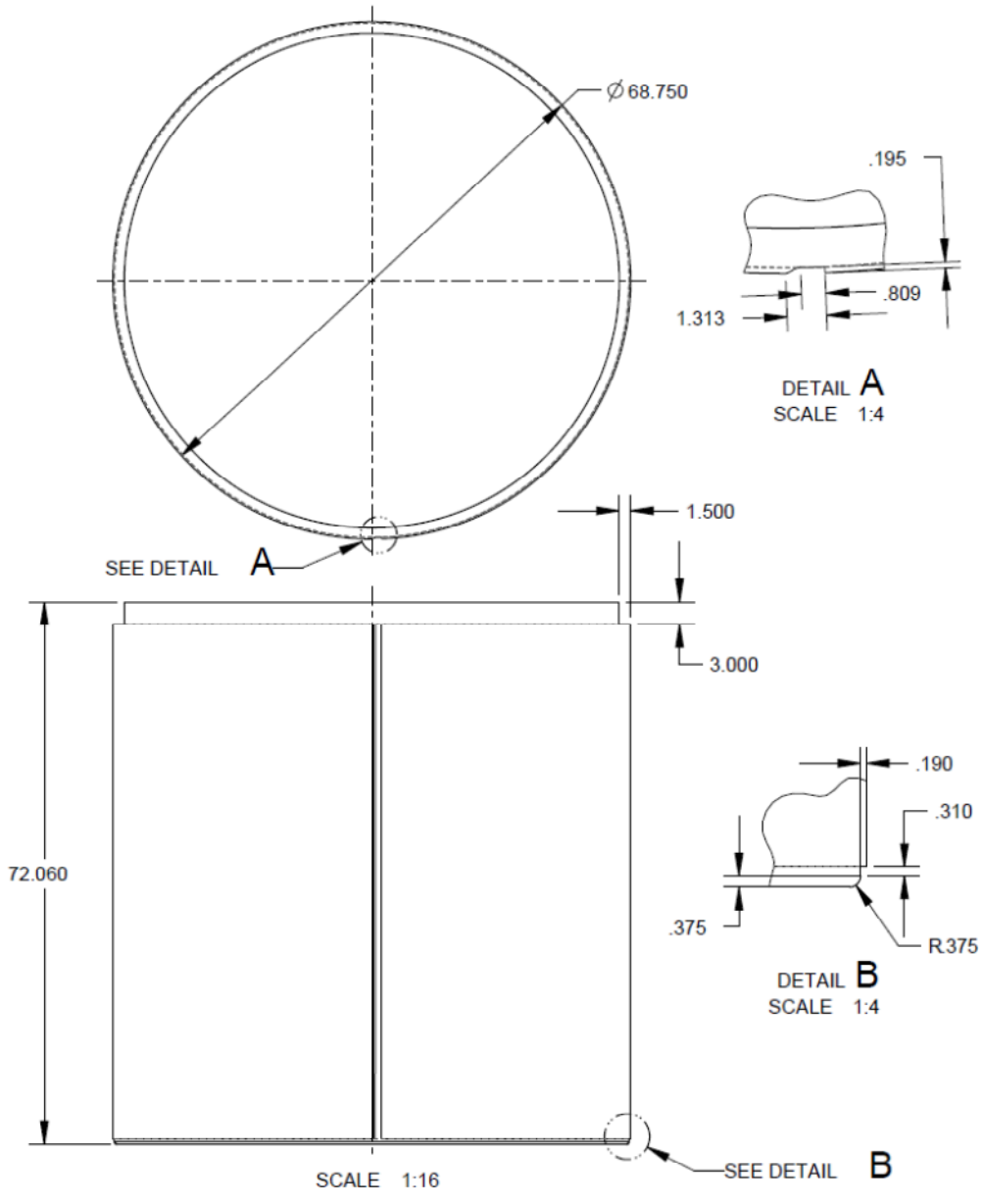


STANDARD WASTE BOX
WASTE VOLUME = 1.88 CUBIC METERS

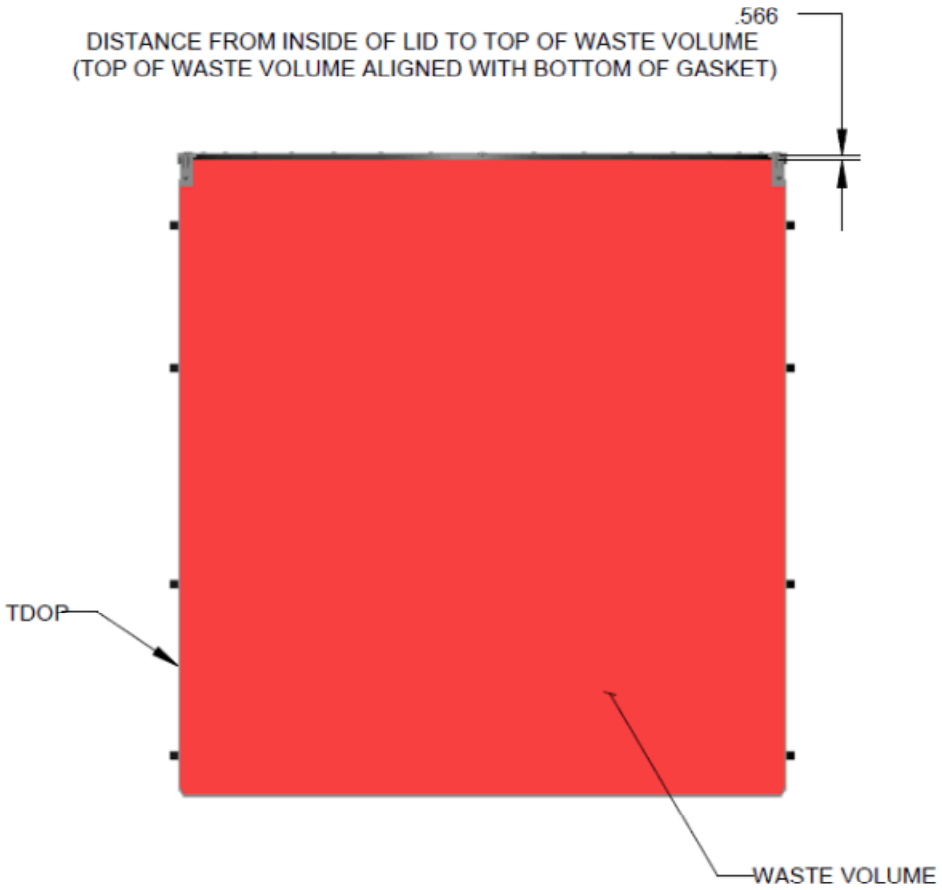


STANDARD WASTE BOX

4.12 Ten Drum Overpack

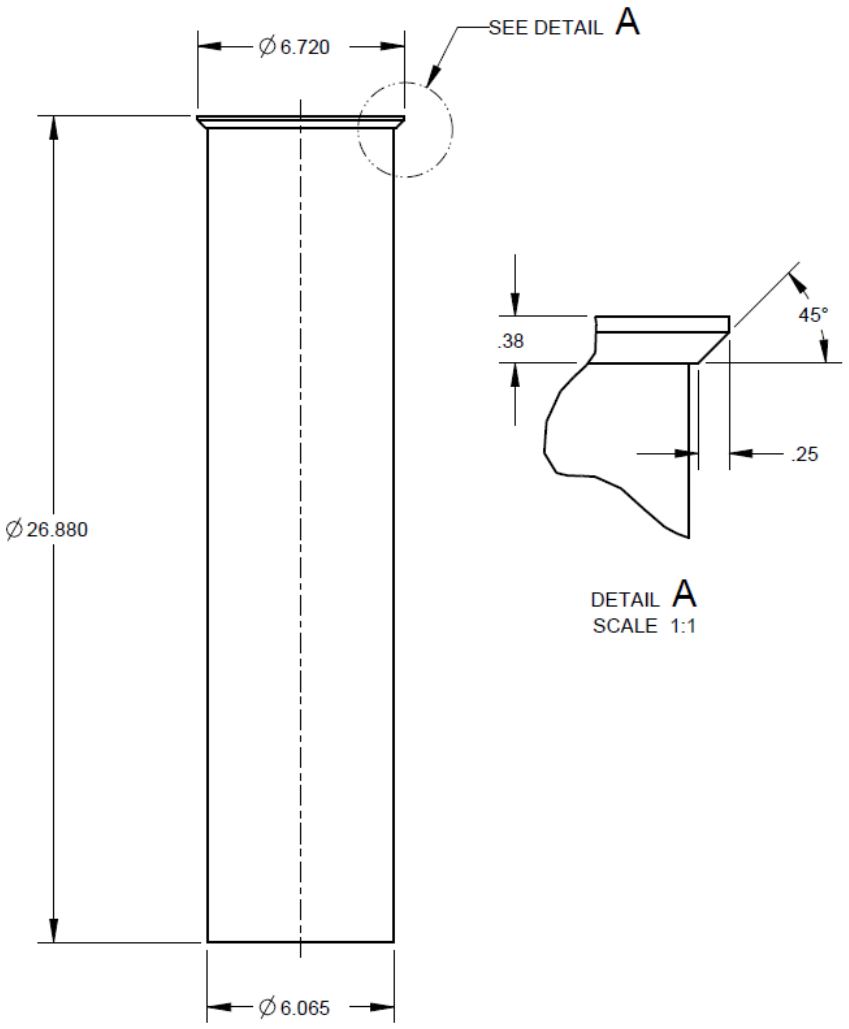


TEN DRUM OVERPACK
WASTE VOLUME = 4.37 CUBIC METERS



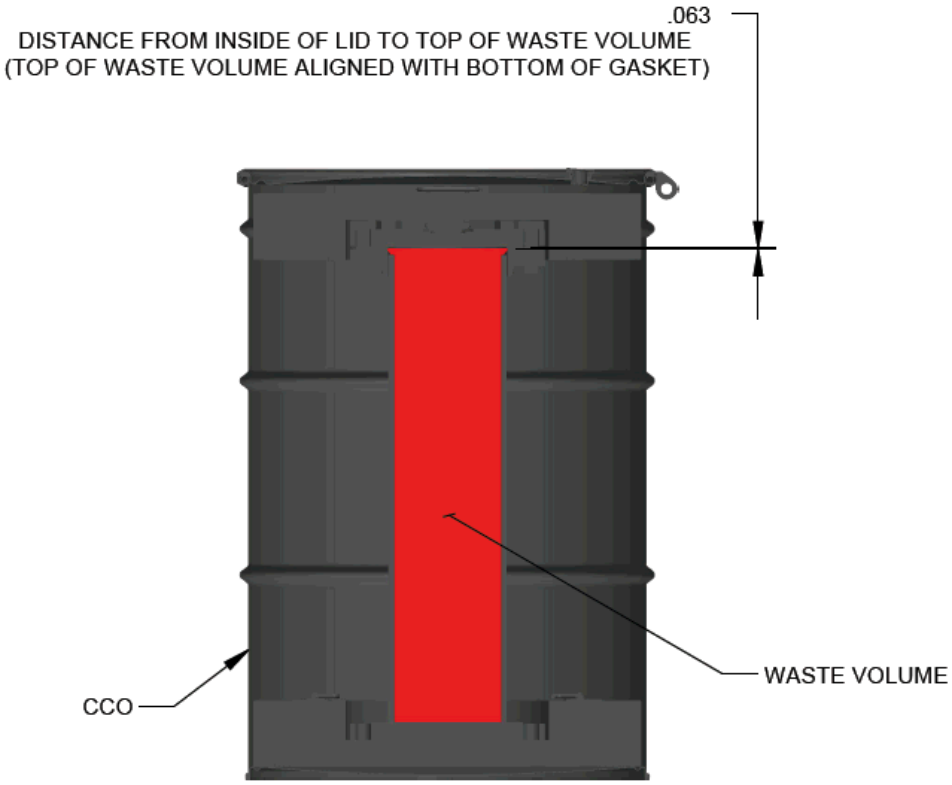
TEN DRUM OVERPACK

4.13 Criticality Control Overpack



SCALE 1:4

CRITICALITY CONTROL OVERPACK
WASTE VOLUME = .0128 CUBIC METERS

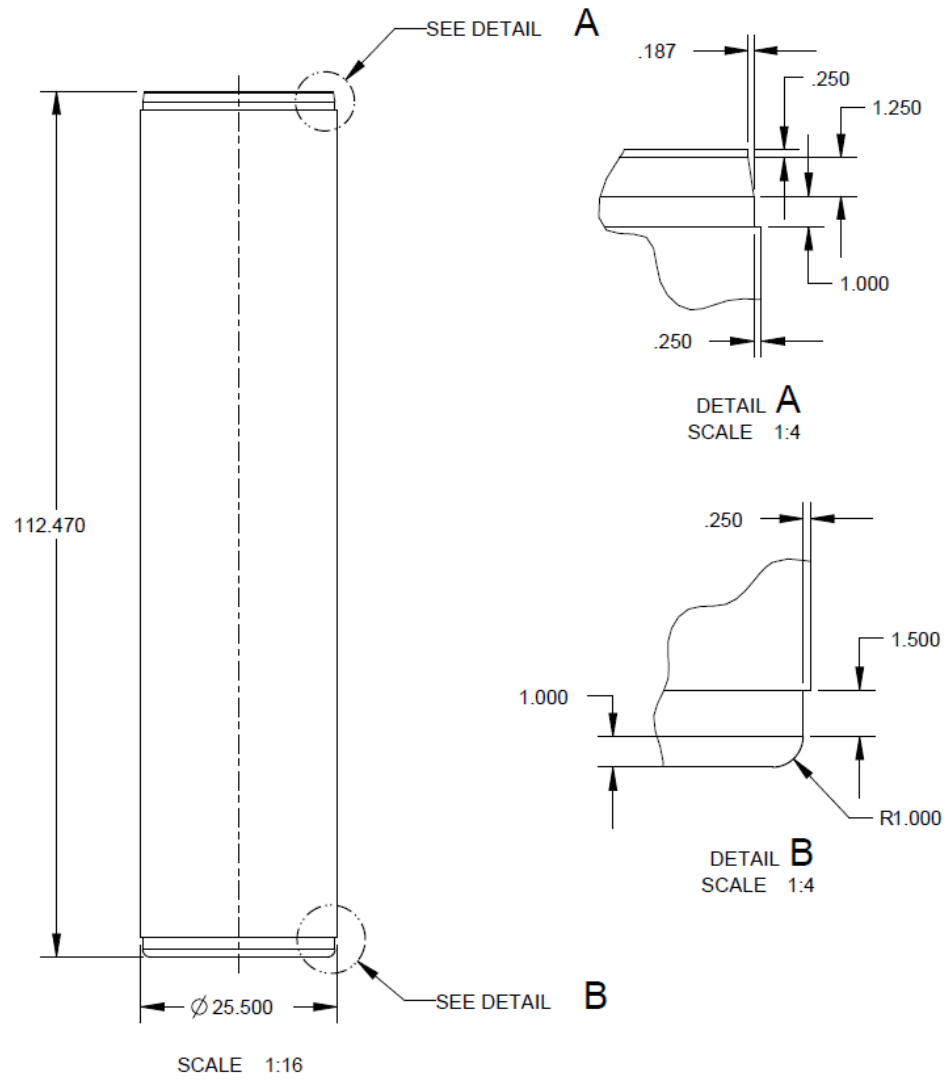


CRITICALITY CONTROL OVERPACK

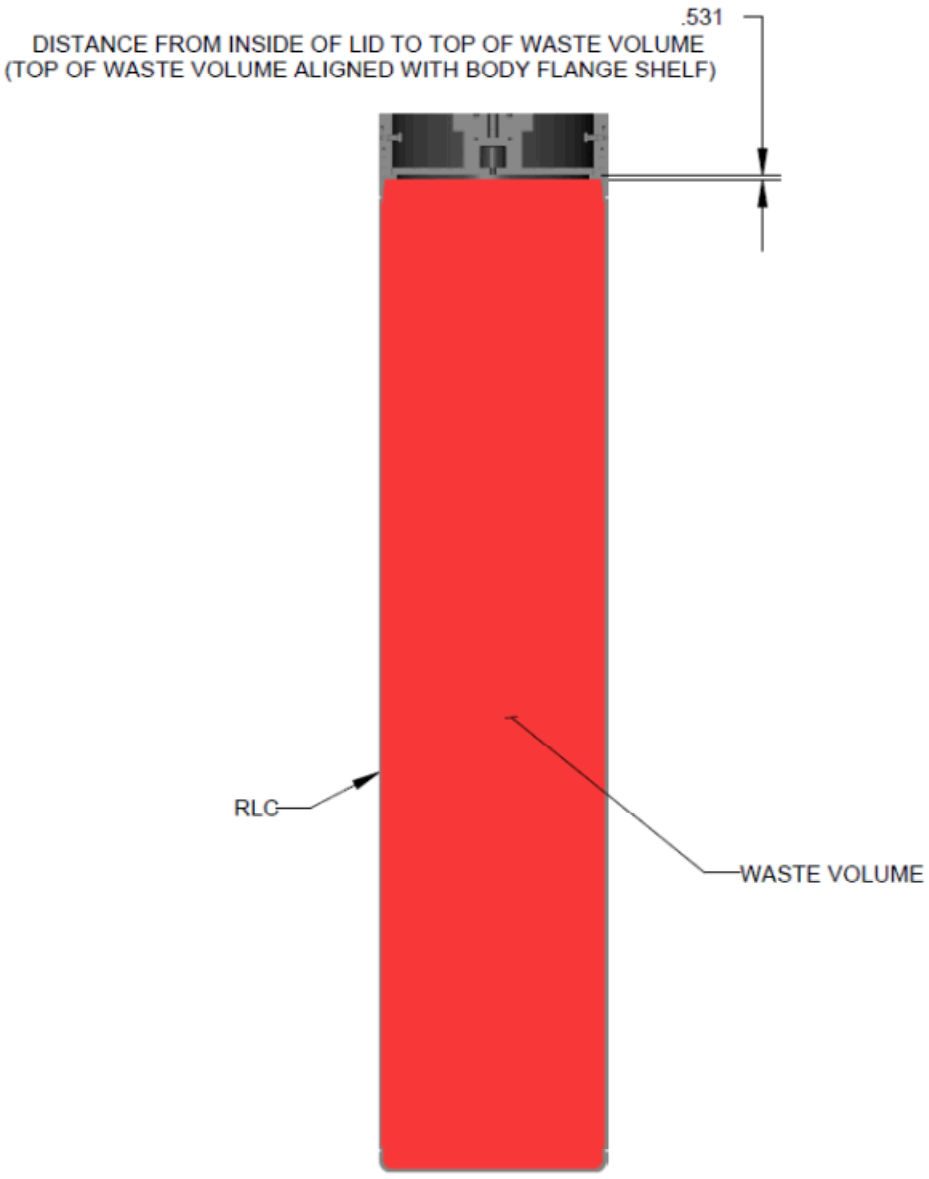
4.14 Shielded Container

See Table 1, note c.

4.15 Removable Lid Canister

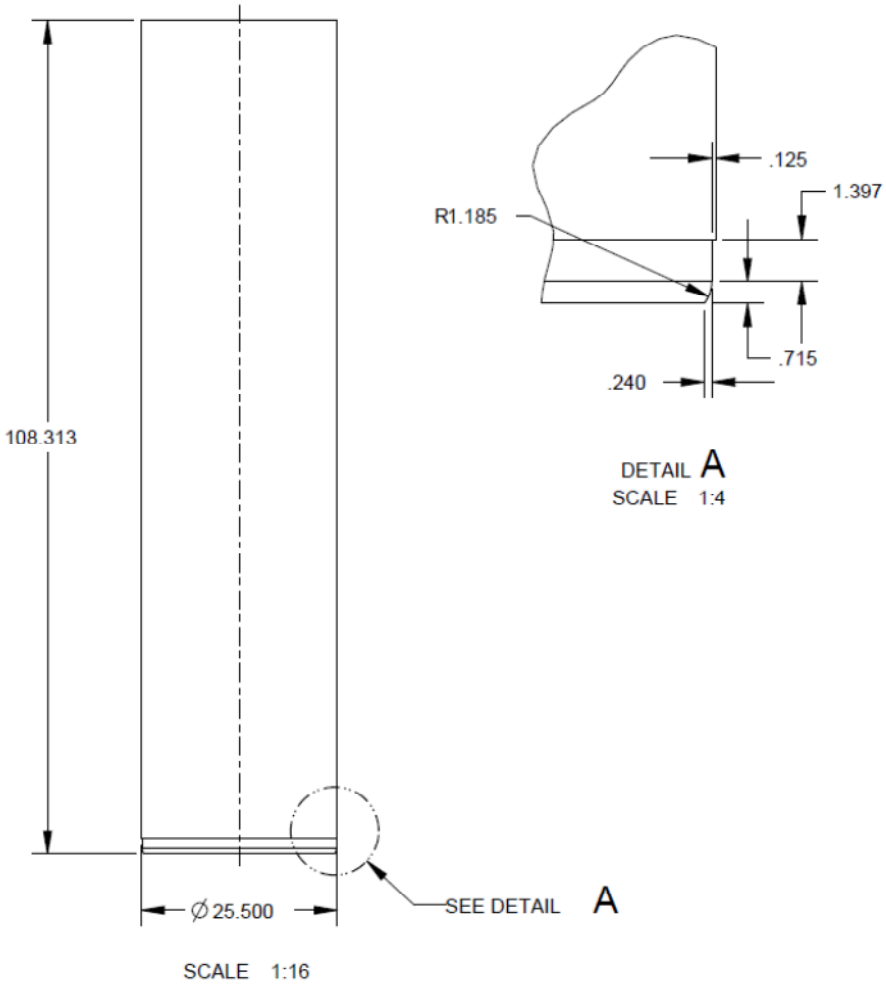


REMOVABLE LID CANISTER
WASTE VOLUME = .939 CUBIC METERS

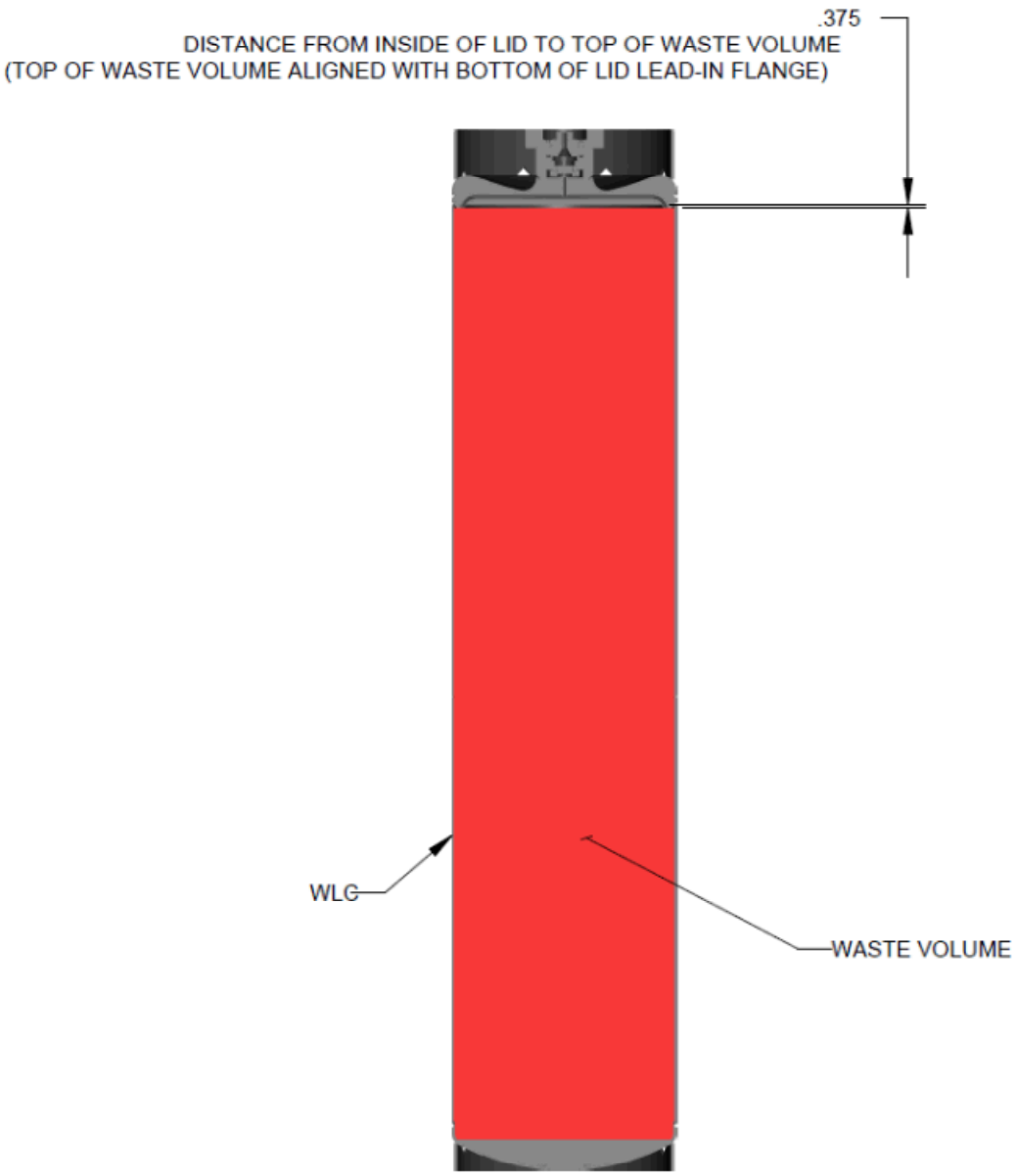


REMOVABLE LID CANISTER

4.16 Welded Lid Canister



WELDED LID CANISTER
WASTE VOLUME = .906 CUBIC METERS



WELDED LID CANISTER

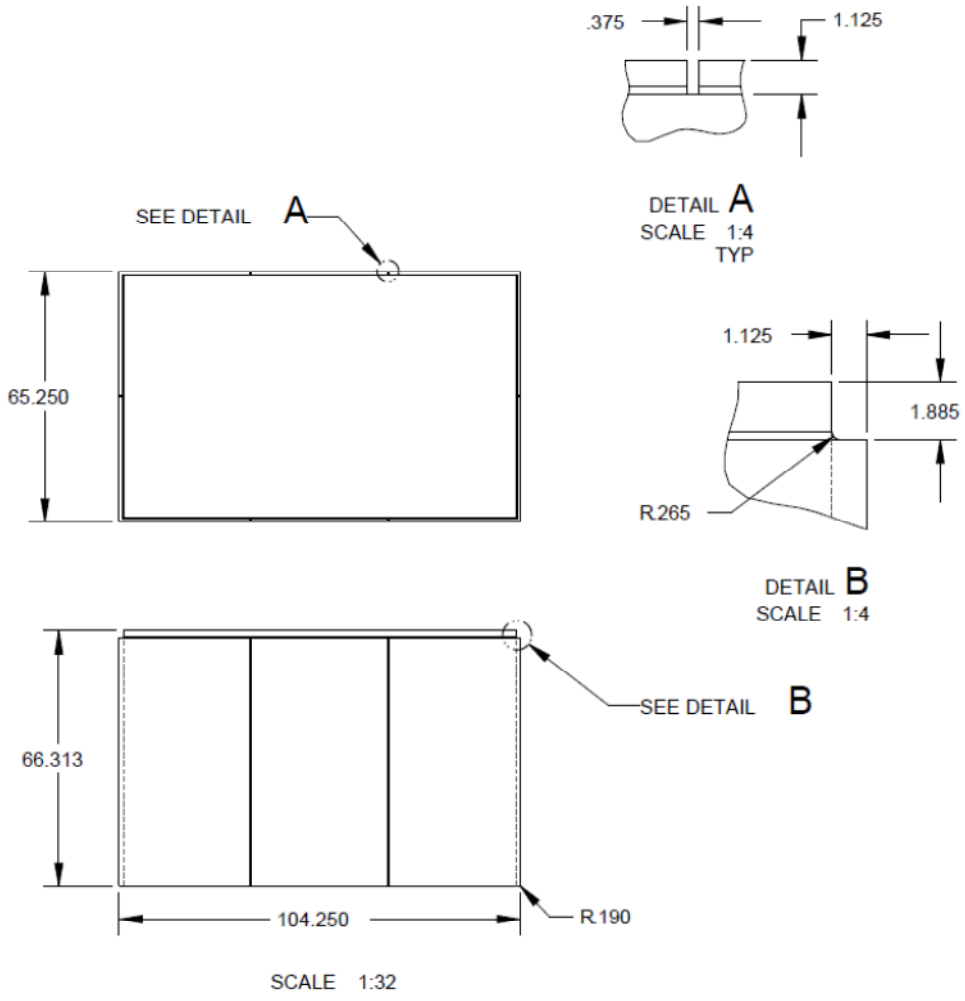
4.17 NS15 Neutron Shielded Canister

See Table 1, note d.

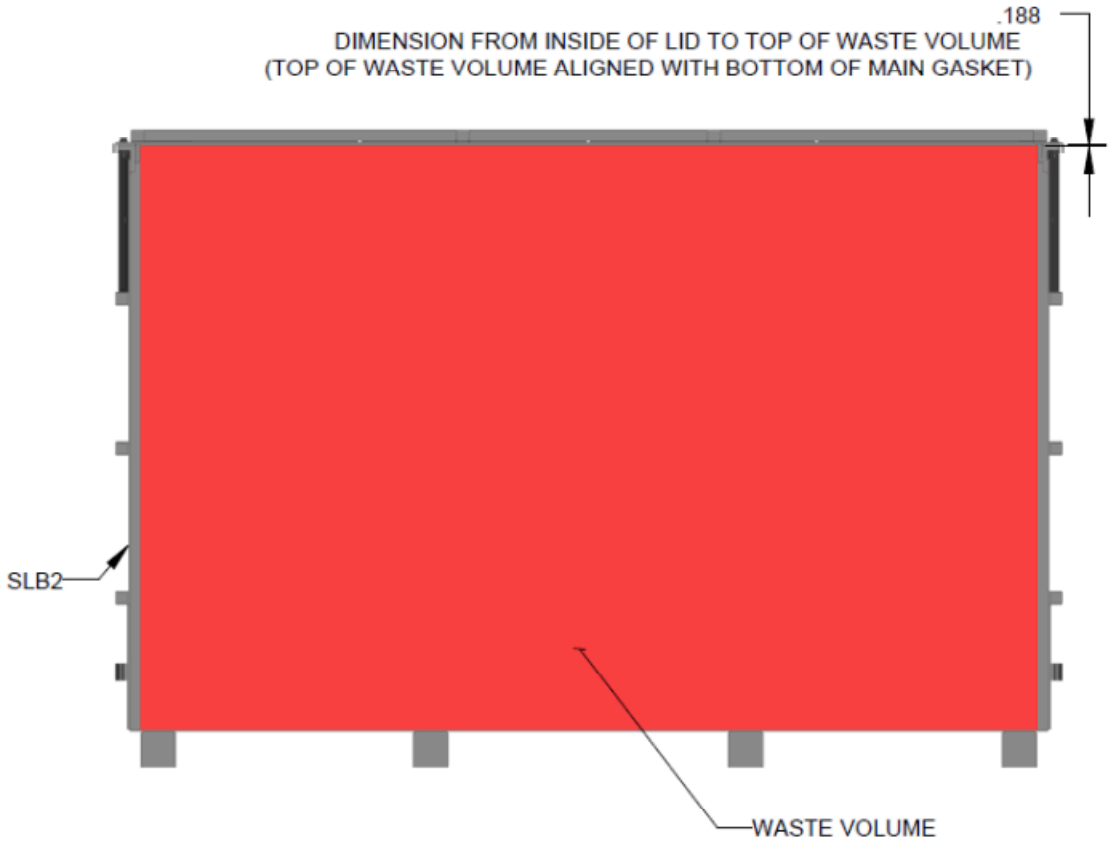
4.18 NS30 Neutron Shielded Canister

See Table 1, note e.

4.19 Standard Large Box 2

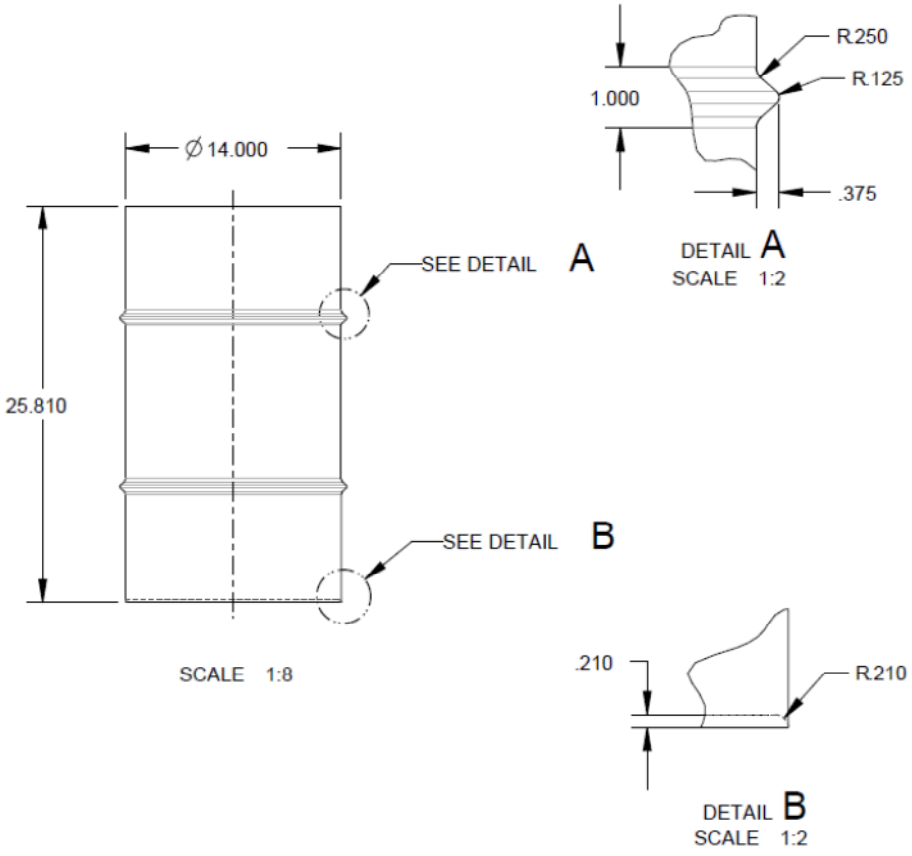


STANDARD LARGE BOX 2
WASTE VOLUME = 7.38 CUBIC METERS

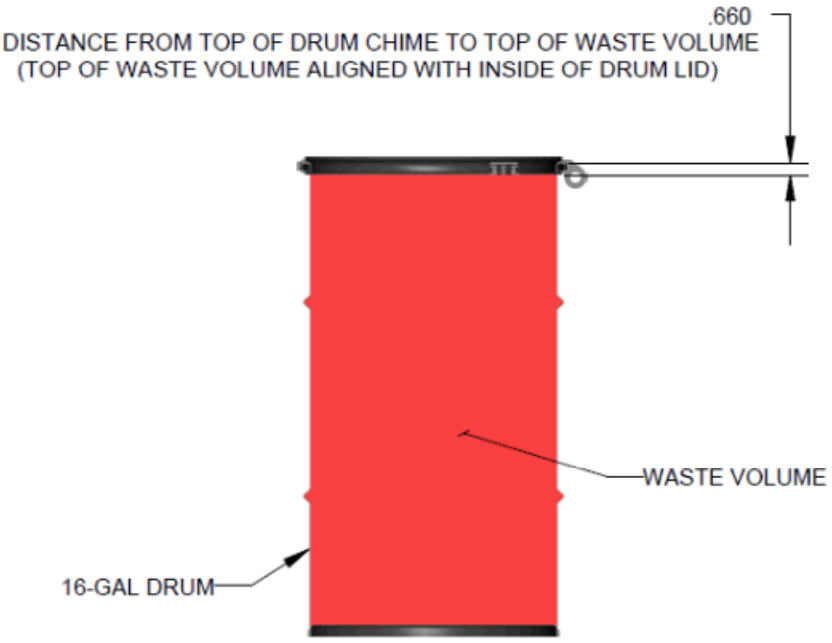


STANDARD LARGE BOX 2

4.20 16-gallon drum

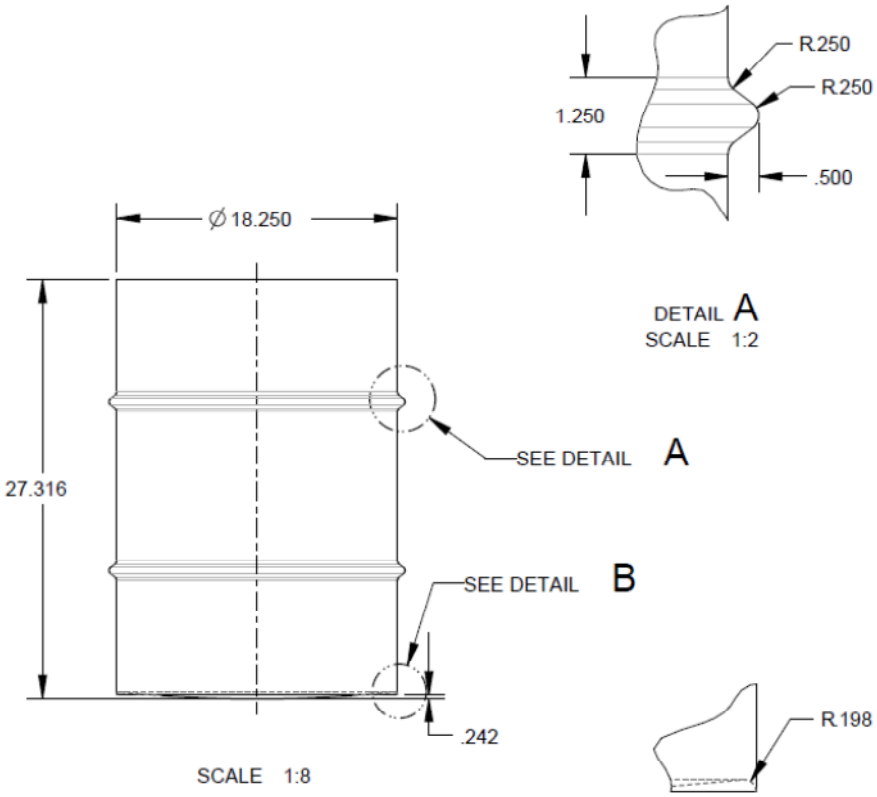


16-GALLON DRUM
WASTE VOLUME = .0649 CUBIC METERS

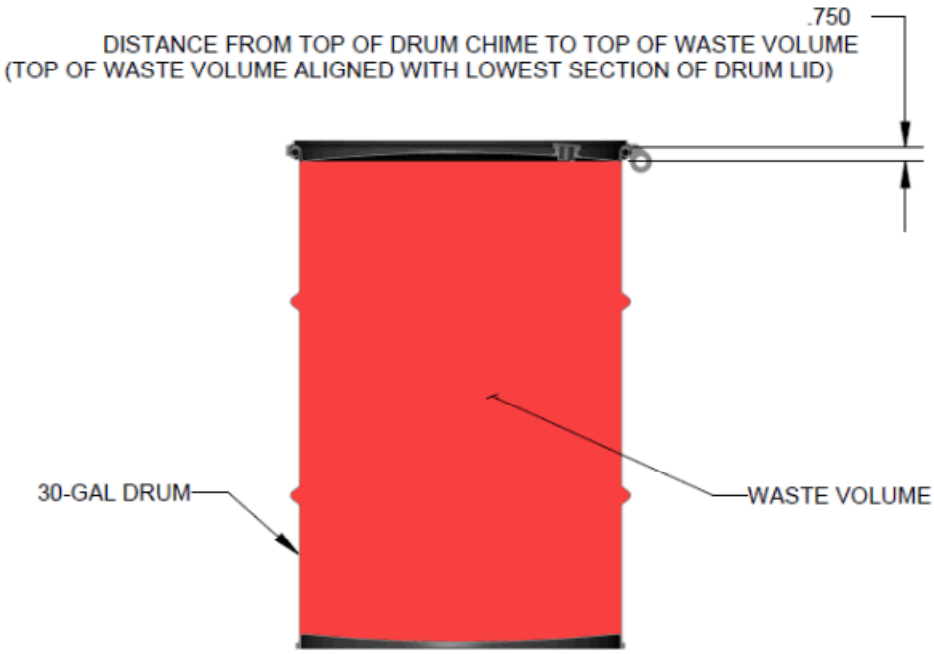


16-GALLON DRUM

4.21 30-gallon drum



30-GALLON DRUM
WASTE VOLUME = .117 CUBIC METERS



30-GALLON DRUM