



CrashGard® Sand Barrel System Product Guide



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TESTS SUMMARY

WHO WE ARE

WE ARE PSS:

For over 30 years, PSS has crafted breakthrough solutions that can safeguard worksites and save lives. We are powered by dedicated, creative people and fueled by continuous innovation.

Our focus is on the right-of-way — that point in time and place where motorists, workers, and pedestrians intersect and interact. Our goal is to design products and services that provide safe travels so that everyone can return home safely at the end of the day.

We don't just talk about Innovations for Safety® — we live it. We believe that audacious ideas and hard work produce outstanding results.

Our important work on, around, and through the right-of-way will result in real solutions for real people. Through continuous innovation and with consultation, education, and training, we work to save lives today, tomorrow, and for decades to come.



PRODUCT FUNCTION

PSS CrashGard® Sand Barrel System is a non-redirective, gating sand barrel or crash cushion. Sand barrels are designed to protect fixed objects, whether permanent or temporary, and reduce the likelihood of a vehicle impacting the object.

FUNCTION OF A SAND BARREL:

As the AASHTO* Roadside Design Guide states, sand barrels absorb energy. AASHTO also states:

- » Sand barrels stop the impact vehicle in a short distance and at a controlled rate.
- » The controlled rate reduces the potential for injury to the occupants.
- » Sand barrels allow the vehicle to pass through the array but they do not redirect the vehicle.

**Association of American State Highway and Transportation Officials*



CrashGard Sand Barrel System consists of three components: Universal Sand Barrel, Lid, and Insert.

This product guide provides the information needed to specify and install CrashGard Sand Barrel System.

US Patent Nos. D542,685 and 8,282,309.

MASH TESTS & BARREL INVENTORY

FHWA LETTERS:

In March, 2007, the Federal Highway Administration (FHWA), issued PSS Acceptance Letter CC-97 for CrashGuard® Sand Barrel System. CC-97 acknowledges that CrashGuard passed NCHRP-350 Crash Tests. The letter confirms that CrashGuard meets the criteria of NCHRP-350 Test Level 3 for non-redirective, gating crash cushions.

In March 2009, FHWA issued CC-97-A, an amendment to the original letter. The amendment accepts the use of CrashGuard in “mixed array” configurations. See Page 20 for correct placement of CrashGuard in mixed arrays.

AASHTO Manual for Assessing Safety Hardware (MASH), test requirements supersede NCHRP-350 test requirements. Crash cushions are required to comply with MASH test guidelines by December 31, 2018.

PSS tested CrashGuard to MASH Test Level 3 in Spring 2018. FHWA issued Eligibility Letter CC-145 for CrashGuard in September 2018. In CC-145, FHWA agrees CrashGuard meets MASH test and evaluation requirements. CC-145 also states FHWA finds CrashGuard eligible “for reimbursement under the Federal-Aid Highway Program.” For a copy of CC-145, please visit pss-innovations.com.

See Page 21 for a summary of CrashGuard MASH tests.

USE OF EXISTING CRASHGARD® INVENTORY:

To meet MASH requirements PSS made a minor change to the sand-fill process for CrashGuard Sand Barrel System. We did not change the design or function of CrashGuard. Users can confidently install any CrashGuard Sand Barrel System purchased prior to CC-145 and still meet MASH requirements.

To meet MASH requirements, we made this change to the sand-fill process:

- » Under NCHRP-350 requirements, our 1,400 lbs barrel did not require use of CrashGuard Insert. Users simply filled barrels to the 1,400 lbs fill mark.
- » To meet MASH requirements, users must now install CrashGuard Inserts in 1,400 lbs barrels and then fill them with sand to a new fill mark.

As such, we changed the 1,400 lbs markings on the barrel effective with shipments beginning April 1, 2019.

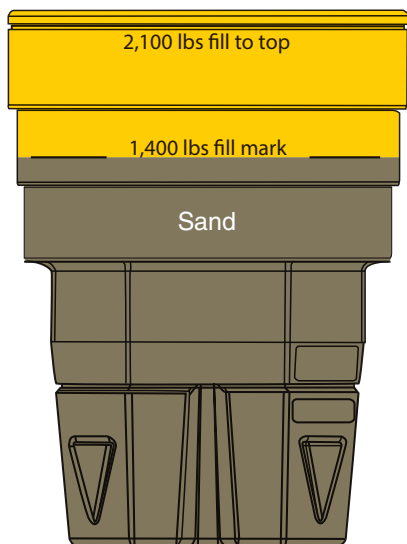
Please see pages 6-7 for more information and instructions.



SAND-FILL MEASUREMENTS

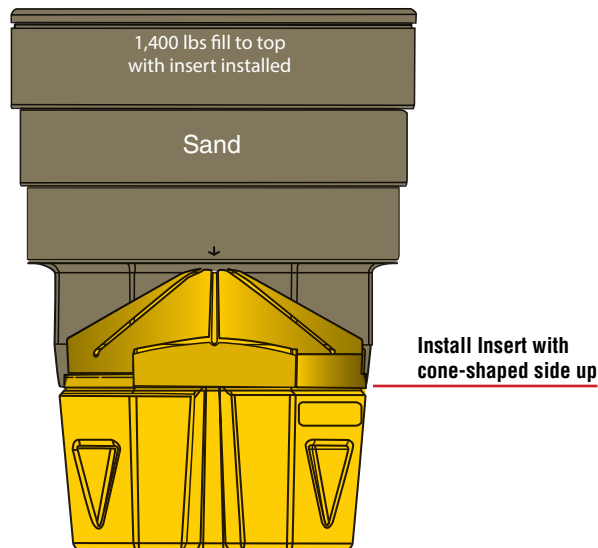
SHIPMENTS BEFORE APRIL, 2019:

Barrels shipped before April 1, 2019 show a “1,400 lbs fill mark” about 24" from the top of the barrel.



SHIPMENTS AFTER APRIL, 2019:

Barrels shipped after April 1, 2019 show a “1,400 lbs fill to top with insert installed” mark at the top of the barrel.



**NCHRP-350: Fill to 1,400 lbs mark.
MASH: Install Insert, fill to top of barrel.**

MASH: Install Insert, fill to top of barrel.

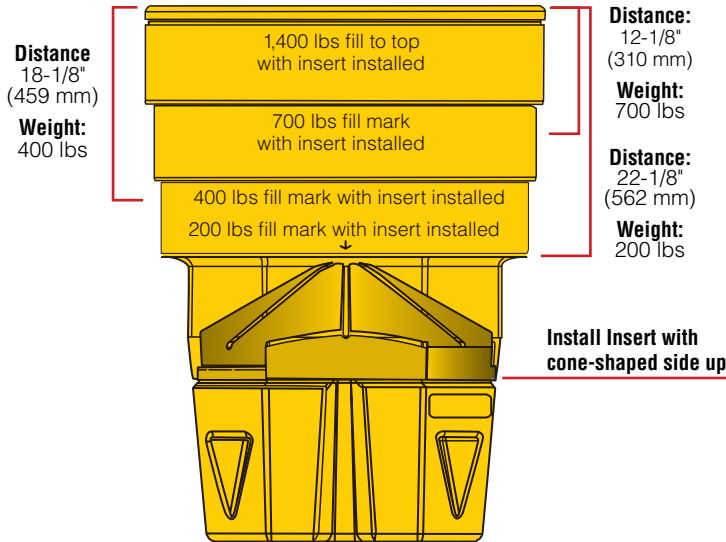
ARRAY RECOMMENDATIONS

See Page 17

MASH REQUIREMENTS:

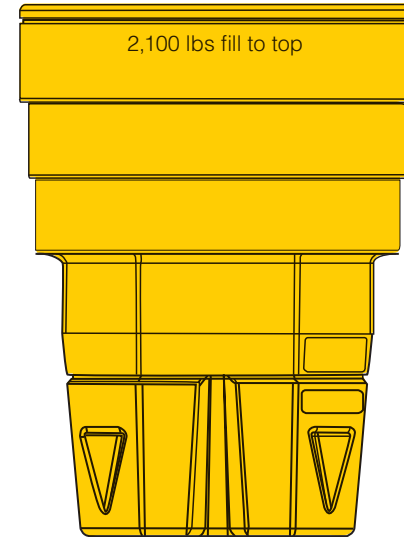
Barrels shipped after April 1, 2019 show a “1,400 lbs fill to top with insert installed” mark at the top of the barrel.

To Meet MASH requirements:



**MASH: Install Insert for 200, 400, 700, 1,400 lbs.
Fill to marks.**

The 2,100 lbs barrel does not require an Insert to meet MASH requirements. Fill with sand to the “2,100 lbs fill to top” mark.



MASH: No Insert for 2,100 lbs. Fill to top.

SPECIFICATIONS & WARRANTY

DESCRIPTION OF SYSTEM:

CrashGard® Sand Barrel System consists of three pieces.

BARREL, P/N CC-48:

Overall dimensions: 36.0" diameter, 48.0" height, nominal.

Configuration of lower portion: Configured in a square profile, which creates lifting shelves at the intermediate section of the barrel.

Design function of lifting shelves: Provide support for forklift transportation.

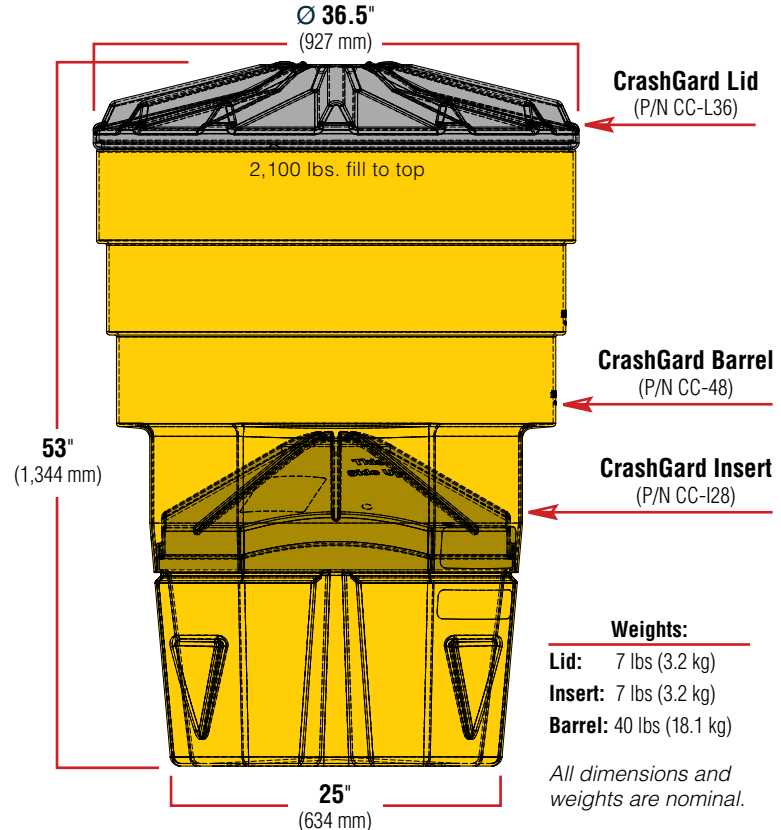
Configuration of upper portion: Configured in a straight wall. Groove in top of barrel allows for snap-on lid. Barrels will easily nest when empty of contents and with insert and lid removed from the barrel.

Design function of straight wall: Allows for easy application of retro-reflective sheeting and supports the CrashGard Hoist lift ring used for transport.

Maximum ballast: 2,100 lbs of sand.

The barrel is marked externally with following fill marks: 200, 400, 700, 1,400, and 2,100 lbs.

Molding process and material: Blow-molded from high-molecular, high-density polyethylene (HDMI-HDPE) safety yellow material which includes UV stabilizer agents.



INSERT, P/N CC-I28:

Overall dimensions: 27.0" square, 10.8" height.

Configuration: Conical in shape. Inserts will nest.

Design function: Allows for ballast of either 200, 400, 700, or 1,400 lbs of sand when installed on the ledge molded into the internal, lower portion of the barrel. Install conical side up as indicated.

Molding process and material: Rotationally molded from high-density polyethylene (HDPE) material.

LID, P/N CC-L36:

Overall dimensions: 36.5" diameter, 7" height.

Configuration: Round in shape. Lids will nest.

Design function: Tamper-resistant fit on top of barrel. Reduces vandalism and infiltration of water. Lip of lid snaps into a groove in the top of the barrel.

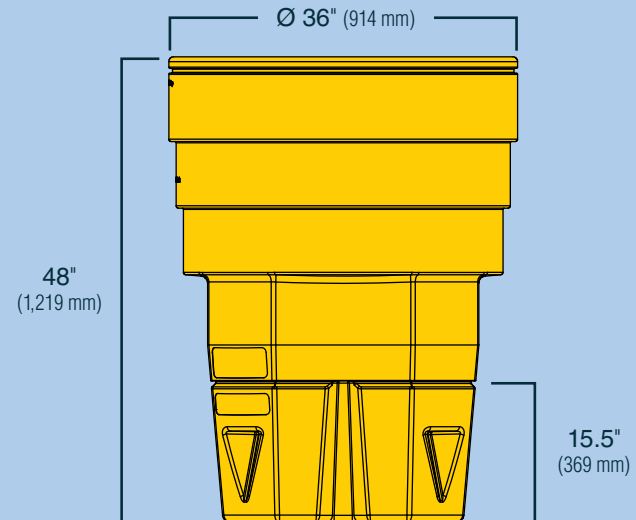
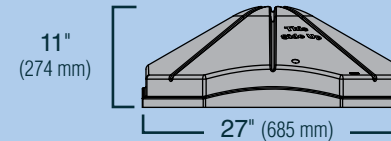
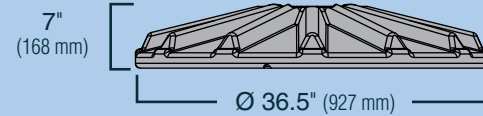
Molding process and material: Blow-molded from high-molecular, high-density polyethylene (HLMH-HDPE) material which includes UV stabilizer agents. The lids are black in color.

CRASHGARD® SAND BARREL SYSTEM LIMITS:

CrashGard Sand Barrel System meets MASH criteria, Test Level 3, for non-redirective gating crash cushions. It should not be used for any other function. Impacts that exceed design capabilities may not result in acceptable crash performances as described in MASH criteria, Test Level 3.

SPECIFICATIONS (in/mm)

All dimensions and weights are nominal.



SPECIFICATIONS & WARRANTY

DESIGN AND PLACEMENT OF ARRAYS:

Design and placement of arrays will adhere to guidelines established in:

- » AASHTO Roadside Design Guide
- » FHWA Report N5040.16, Crash Cushions, Selection Criteria and Design

Properly designed arrays (as described on Page 17) will decelerate the vehicle within the parameters described in MASH Certification.

PSS has tested the CrashGard® Sand Barrel System to the requirements set forth in MASH Certification, Test Level 3. See Page 5 for more information.

CRASHGARD® SAND BARREL SYSTEM WARRANTY:

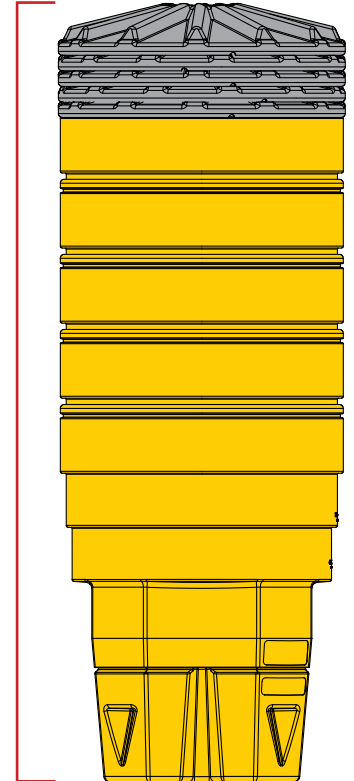
PSS warrants each CrashGard Sand Barrel System is free from manufacturing defects for one (1) year from date of purchase. (Subject to additional terms and conditions. Please contact PSS for complete warranty.)

PSS warrants each CrashGard Sand Barrel System against UV degradation for six (6) years from date of purchase on a pro-rated “repair or replace” basis.

SHIPPING CONFIGURATIONS:

A truckload stack consists of five CrashGard Barrels and five lids, both nested. The amount of CrashGard barrels per truckload depends upon the amount of inserts required. Call us with your array requirements and we will calculate shipping configurations for you.

99"
(2,515 mm)



RECOMMENDED INSTALLATION

PROPER INSTALLATION:

Review all engineering plans prior to installation for proper design array. Contact PSS at **800-662-6338** for questions about CrashGard® Sand Barrel System. PSS recommends the following installation procedure with dimensions as noted. State specifications may differ from our recommended dimensions. State specifications always supersede our recommendations.

For example, we recommend a minimum 12" space between the fixed object and the first row of barrels. However, some states specify a minimum of 18". In that case, installers should follow the state specification and place the barrels at least 18" from the fixed object.

In all installations, installers should adhere to state specifications or drawings.

A) PREPARE THE SITE:

1. Implement proper traffic control procedures to protect workers and the driving public.
2. Clear the site of any debris or snow.
3. Measure the grade of the installation site. The grade should not exceed 5% in either direction. The site requires grading if over 5%.

B) SET THE FIRST ROW:

The row of sand barrels closest to the fixed object and perpendicular to traffic is considered the first row. Start the installation at the first row. Set the rows in a straight line.

1. Laterally offset the first row on the side of traffic a minimum of 32".
2. Allow for a minimum 12" of space between the first row and the fixed object.

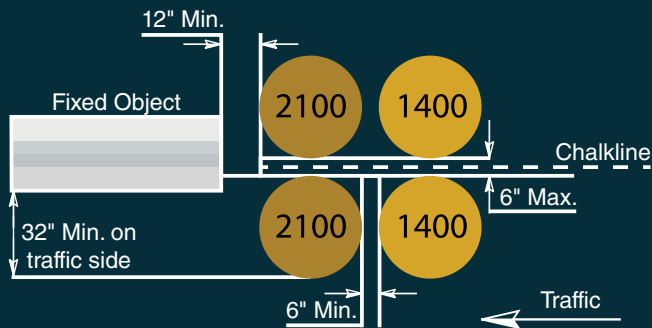


RECOMMENDED INSTALLATION

C) SET THE REST OF THE ARRAY:

1. Mark the centerline of the array with a chalk line or other marking device. (This works especially well for new installations.) (See Figure below.)
2. Adhering to the centerline, set each barrel in place:
 - a. Allow a minimum of 6" between barrels parallel to traffic. Measure from the top of the barrel.
 - b. Allow a maximum of 6" between other barrels perpendicular to traffic. Measure from the top of the barrel.

SETTING AN ARRAY:



D) FILL THE BARRELS:

To meet MASH requirements, please see new sand-fill measurements for 1,400 lb barrels on Pages 6 and 7.

1. Filling the barrels offsite: follow the directions below for filling barrels on site, but also make sure to mark the barrels with their respective weights to avoid incorrect placement in the array.
2. Filling the barrels on site:
 - a. Review the array plans or drawings to determine the appropriate weight for each barrel.
 - b. Install CrashGard Insert for weights of 200, 400, 700, and 1,400 lbs.
 - c. Weights of 2,100 lbs do not require Inserts.
3. Compact the sand to achieve proper fill.
4. Fill the barrels with the appropriate weight of sand using the fill level marks on the side of the barrel. See Page 7 of this guide to measure sand-fill levels from inside the barrel if retroreflective sheeting obscures the fill level marks.

D) FILL THE BARRELS (CONT'D):

5. Use only sand that meets ASTM C-33, washed concrete sand or equivalent. Use only sand that contains less than 3% moisture. In freezing conditions, add a minimum of 5% rock salt. In all cases, sand must meet state specifications.

CAUTION: If the sand has been heated recently, make sure it is cool before filling any barrels. Hot sand could distort and misshape the barrel or insert and cause leaks.

6. Press a lid on each barrel. Check that each has completely snapped into the lid groove on the barrel. Compare the array to the specifications in this guide for a final check. Clean up area.

INSERT INSTRUCTIONS:

1. Determine which barrels in the array require Inserts. Only those barrels with weights of 200, 400, 700, and 1,400 lbs require Inserts. Barrels of 2,100 lbs do not require Inserts.
2. Always install CrashGuard® Insert with the cone-shaped side face up. See images 1 & 2 for further Insert installation instructions.



1. Lean the barrel inward. Hold the Insert, cone-shaped side face up, with both hands.



2. CrashGuard Insert is a square-sided piece. Make sure the configuration of the Insert matches the configuration of the barrel shelf upon which it rests. Drop the Insert into position.

LIFTING INSTRUCTIONS

CRASHGARD HOIST INSTRUCTIONS:

CrashGard Hoist operates in a scissor-like mode to engage and disengage with CrashGard barrel using the barrel itself to do so. With CrashGard Hoist, loading or unloading a truck is at most a two-person operation and often only a one-person operation.

CAUTION: Never stand or walk under a sand barrel or the Hoist while it is being transported.

1. Using a boom, simply hook the Hoist's lifting ring. Raise the Hoist.
2. Align the Hoist over a CrashGard barrel, and slowly lower it. The lid of the barrel will open the Hoist.
3. Continue to lower the Hoist.



CRASHGARD HOIST INSTRUCTIONS (CONT'D):

4. Let the Hoist rest upon the barrel top.
5. Raise the Hoist. The tension on the steel cables will cause the Hoist to clamp tightly, directly underneath the middle round tier.
6. Once engaged, continue to raise the Hoist and carry it to its destination. Place the barrel where appropriate.

TO DISENGAGE CRASHGARD HOIST:

1. Lower the Hoist to fully rest on the lid of the barrel.
2. While the Hoist is in the open position, simply slide it off either side of the barrel.
3. Once off, raise the Hoist clear of the barrel and other objects to pick up another.



LIFTING INSTRUCTIONS

CRASHGARD HOIST & FORKLIFT

We designed CrashGard Sand Barrel System for both safe and easy transport with CrashGard Hoist or a forklift.

CRASHGARD HOIST:

- » Operates with a simple scissor action.
- » Transport of barrels can be a one-person operation.
- » Made of welded steel. Weighs 140 lbs.
- » Powder-coated paint helps deter corrosion.

Some lifting devices made by other barrel manufacturers are adjustable by size. If one is being used, we recommend setting the device to “large”.

FORKLIFT INSTRUCTIONS

To accommodate forklift trucks, we designed four flat sides located just below the bottom round tier at the 200 lb. fill level. We also designed the bottom tier to act as a “shelf” for the forklift blades.

- 1. CAUTION:** never stand or walk under a sand barrel during transport.
- 2.** Measure the distance between forklift blades from inside to inside. The distance should not exceed 28". See images 1 & 2 for further instruction.



Align the blade with the flat sides of the barrel. If the barrel contains any significant weight, use the center of the blades for balance.



Many forklift blades become loose after years of use. To ensure the blades maintain consistent distance, use a chain binder or a similar type of binder.

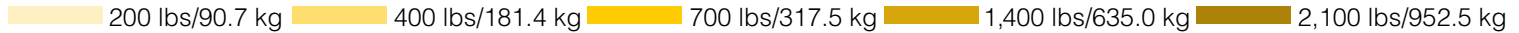
DESIGN ARRAY RECOMMENDATIONS

CrashGard Sand Barrel System is designed to progressively decelerate vehicle impact to reduce injury to vehicle occupants and damage to property. The controlled rate of deceleration varies as it depends upon the speed at which impacting vehicles are traveling.

As such, users must install the appropriate array for the posted speed limit in the work zone.

The design array recommendations below are shown in ascending speed limit.

For speed limits above 75 mph / 121 kph, please contact PSS Technical Support at **800.662.6338** for custom array recommendations.



DESIGN ARRAY RECOMMENDATIONS

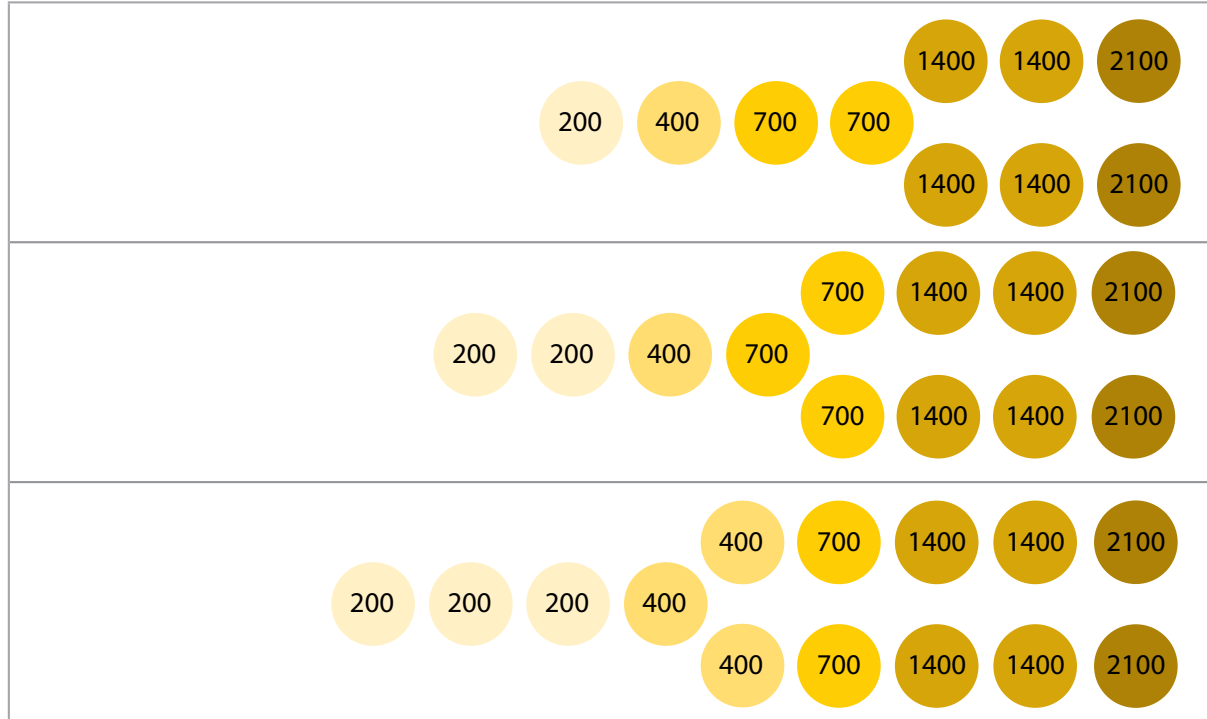
200 lbs/90.7 kg

400 lbs/181.4 kg

700 lbs/317.5 kg

1,400 lbs/635.0 kg

2,100 lbs/952.5 kg



**DESIGN SPEED:
50 MPH / 80 KPH**

Recommended
10 barrel array

**DESIGN SPEED:
55 MPH / 89 KPH**

Recommended
12 barrel array

**DESIGN SPEED:
60 MPH / 97 KPH**

Recommended
14 barrel array

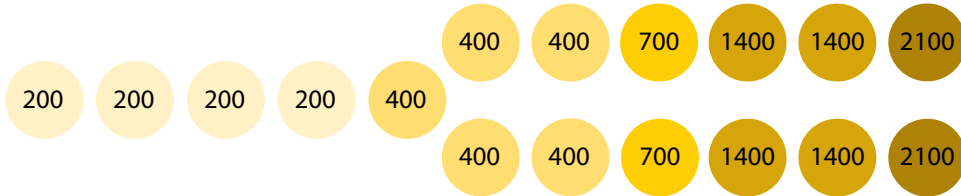
200 lbs/90.7 kg

400 lbs/181.4 kg

700 lbs/317.5 kg

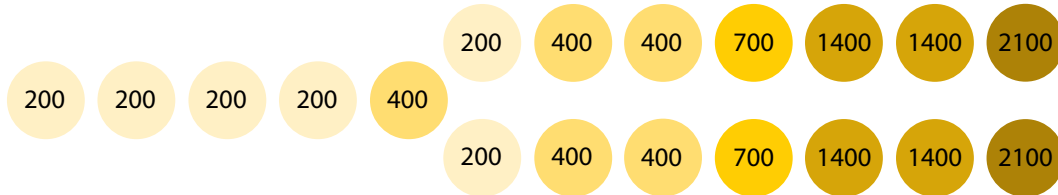
1,400 lbs/635.0 kg

2,100 lbs/952.5 kg



DESIGN SPEED:
65 MPH / 105 KPH

Recommended
17 barrel array



DESIGN SPEED:
70 MPH / 113 KPH

Recommended
19 barrel array



DESIGN SPEED:
75 MPH / 121 KPH

Recommended
21 barrel array

DESIGN ARRAY RECOMMENDATIONS

FHWA LETTER CC-97-A:

In March 2009, FHWA (Federal Highway Administration) issued Acceptance Letter CC-97-A, an amendment to the original letter, CC-97. In CC-97-A, FHWA accepts the use of our CrashGuard Sand Barrel in “mixed arrays”. A mixed array is defined as an array that contains barrels from different manufacturers. A mixed array usually evolves over time as portions of the original array are destroyed in crashes. Installers may replace the destroyed barrels with new ones from another manufacturer, thus creating the mixed array.

PSS recommends installers follow the manufacturer’s recommendation, design, or plan that utilizes the highest number of barrels. If placed incorrectly within an array,

CrashGuard may not perform as designed or intended.
PSS ADVISES AND RECOMMENDS THAT:

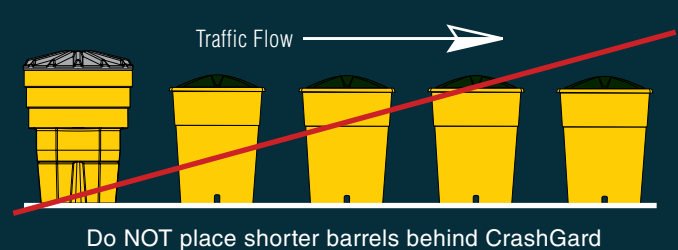
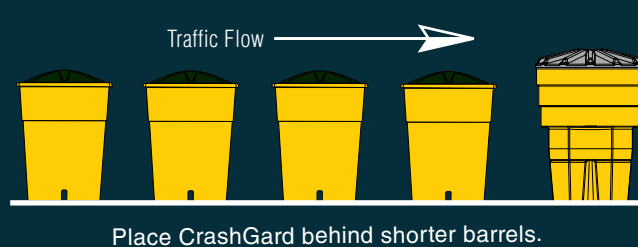
- » Installers should **ALWAYS** place CrashGuard **BEHIND** shorter barrels.
- » Installers should **NEVER** place CrashGuard **IN FRONT OF** shorter barrels.

Installers may place CrashGuard in front of, next to, or behind other manufacturers’ barrels when those barrels are the same height as CrashGuard.

CrashGuard is completely interchangeable with other manufacturers’ barrels of the same height.

Please call PSS Technical Support at **800-662-6338** for more information.

PLACEMENT OF CRASHGUARD® SAND BARRELS IN MIXED ARRAYS



CRASHGARD MASH TESTS SUMMARY

FHWA LETTER CC-145:

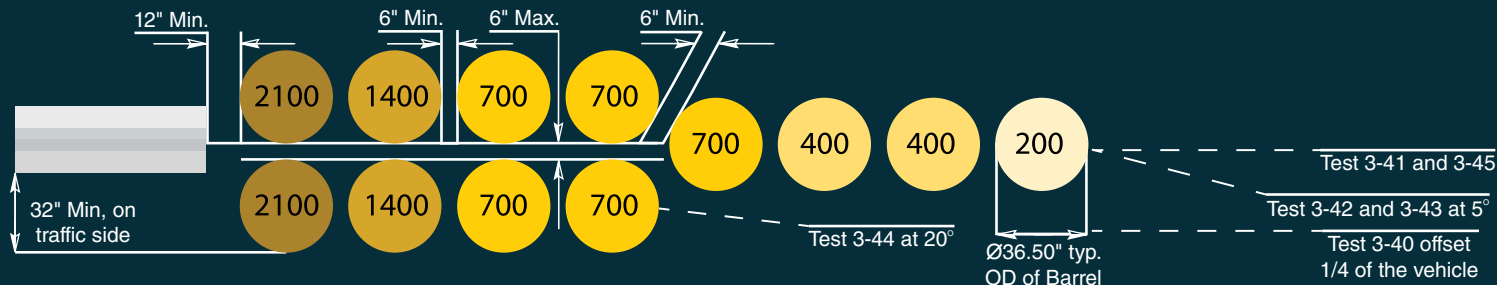
MASH (Manual for Assessing Safety Hardware) Crash Test Guidelines supersede NCHRP-350 Test Guidelines. PSS crash-tested CrashGard Sand Barrel System to MASH Test Level 3 Guidelines in Spring 2018. CrashGard passed all MASH Tests.

FHWA issued Eligibility Letter CC-145 for CrashGard in September 2018.

In CC-145, FHWA agrees CrashGard meets MASH test and evaluation requirements. CC-145 also states FHWA finds CrashGard eligible “for reimbursement under the Federal-Aid Highway Program.” For a copy of CC-145 please visit pss-innovations.com.

Please call PSS Technical Support at **800-662-6338** for more information.

CRASHGARD® SAND BARREL SYSTEM CRASH TESTING: MASH TEST 3-40 - 3-45



All lengths in inches. All weights in pounds.

CRASHGARD MASH

1. MASH TEST 3-40:

Vehicle: Passenger Car
Weight: 1,100 kg / 2,425 lbs
Impact Speed: 100 kph / 62 mph
Impact Angle: 0° (Head-On)
Offset 1/4 width of vehicle

1.



2. MASH TEST 3-41:

Vehicle: Pickup Truck
Weight: 2,270 kg / 5,004 lbs
Impact Speed: 100 kph / 62 mph
Impact Angle: 0° (Head-On)

2.



3. MASH TEST 3-42:

Vehicle: Passenger Car
Weight: 1,100 kg / 2,425 lbs
Impact Speed: 100 kph / 62 mph
Impact Angle: 5°

3.



H TESTS SUMMARY



4. MASH TEST 3-43:

Vehicle: Pickup Truck
Weight: 2,270 kg / 5,004 lbs
Impact Speed: 100 kph / 62 mph
Impact Angle: 5°



5. MASH TEST 3-44:

Vehicle: Pickup Truck
Weight: 2,270 kg / 5,004 lbs
Impact Speed: 100 kph / 62 mph
Impact Angle: 20°



6. MASH TEST 3-45:

Vehicle: Intermediate Vehicle
Weight: 1,500 kg / 3,307 lbs
Impact Speed: 100 kph / 62 mph
Impact Angle: 0°

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