Preface

Every time we have a loading or discharge operation we prepare our job with care. We calculate up to 3 digits behind the comma. Preparation of the job is very important and we know a lot of preparation is based on experience from previous load-outs throughout the years. Still, we encounter a lot of professionals with different opinions about a lot of topics. What we hope to achieve with this software and of course with this manual is, that we all speak the same language, we all mean the same things and perform in the same way.

What is a Stopper?
Before we go any further, I should explain my naming convention. Over the years I have heard many different names for these tools, such as shear plates, H-Beams, clips/clamps, F1, S1 etc. All of you were right, these are names for stoppers, but more accurately for types of stoppers. The official name we use in the software and which is also known with the classification societies is stopper.

Very simple to remember, it stops the cargo from sliding.

Now what defines a stopper? A stopper is a steel construction which can consists of one steel plate or more, to an H-Beam (vertical or horizontal) with or without stiffeners, which is welded to the construction of the ship in order to prevent the cargo from sliding in any direction.

Unfortunately stoppers are nowhere mentioned in the IMO CSS Annex 13, but the shipping industry has been using them for decades. So we better learn to deal with them vs. to ignore them. Just learn how treat a stopper and it will save you lots of time, money and frustration. If we use them in a good, well thought way, we could all benefit for this magnificent tool.

We will first show you some of the stoppers used in our program, at least then we all see the same things whilst explaining them to you.
In VCC (Visual Cargo Care) we have 6 different type of stoppers in the toolbox.

We will discuss all of them and I will show you how they look and appear in your program.

**Plate stoppers**
Plate stoppers are used mainly for sliding prevention, if the strong edge of a cargo unit is low. A face plate, tack welded to the stopper plate, is recommended for sensitive cargo units.

Plate stoppers may also be used to additionally clip a cargo unit vertically against tipping / uplift. The welded seam must be fully passed around the plate, because there is a load concentration in the seam end under the clip.

*Plate stoppers with face plate (left) and with clip function (right)*

In VCC we use three (3) different types of these (shear) plate stoppers.
- F1  - consists of 1 Faceplate and 1 (shear)plate
- F2  - consists of 1 Faceplate and 2 (shear)plate
- F3  - consists of 1 Faceplate and 3 (shear)plate
The green part in front of the stopper is an indication in the program on to which side should be against the cargo.

So when we add an F2 or an F3 then we mean the same stopper as and F1, but only with 2 or 3 legs. In top view it would look like this:

**Low H-beam stoppers**

For heavy duty stoppers, pieces of H-beams should be used. They may be welded to the ground either on their face, fully welded around (left), or on the edges of the flanges (right in Figure). Again, a face plate should be tack welded to the flat stopper, if necessary.

**Low H-beam stoppers**

In VCC we use these H-Beams in two different types.
- Vertical H-Beam (On the left in picture)
- Horizontal H-Beam (On the right in picture)
High H-beam stoppers
If the strong edge of a cargo unit is higher, vertical H-beam stoppers must be used. It is then important, that the effective height $H$ of the stopper is not greater than the base length $L$, the whole construction is stabilised by an angle plate, the fillet weld is fully passed around the bottom line.

The predominant stress in this construction is the result of the bending moment $M_{SLxy} \cdot H$, which creates a critical vertical tensile stress in the welded seam at the end of the stopper towards the cargo unit.

The construction to the left in the figure below is easier to build, but less convenient to remove from the deck after use. It is comparably stronger than the construction to the right in the figure below, due to the greater seam density in the critical area of tensile forces. However, with greater height $H$ and length $L$ this construction may become weaker due to the risk of buckling of the long free edge of the triangle plate. Therefore, with figures of $(L - b) > 40$ cm the construction to the right in the figure below should be considered and/or the triangle plate edge strengthened.

Silly stoppers and others
Simple face plates or pieces of H-beams welded to the ground by a single fillet seam only, which are loaded transverse to the seam, are not trustworthy and therefore not allowed.

Silly stoppers
I have explained above what kind of stoppers are enclosed in our program. I will now explain some more about what is important in calculation with stoppers. In my examples I will use the F1 stopper, all of it also applies to the others.
What has an effect on the calculation of a stopper?
Actually a lot of things. I will list them and explain where to find them.
Length = the actual weld length.
Width = width of the plate
Height = height of the plate
Thickness support plate
Impact height = the height from the deck until first impact on the cargo
Height contact area = distance from impact height to full contact height
Weld throat thickness = thickness of the weld.

Welded stoppers
In certain situations welded stoppers are a useful option for protecting a cargo unit against sliding
and/or tipping/uplift. Although these fittings are generally of a temporary nature and will be removed after
completing the distinguished transport, they must be thoroughly positioned with regard to the ship structures
below the location and the welding itself must be carried out in a professional manner by an external welding
company, not by the crew of the vessel.

Welding principles
Apart from O-ring saddles, which are welded to the ground by a butt seam, all other types of stoppers and
plates are welded by a fillet seam. For assigning an appropriate MSL to such a stopper or lashing point the
following conditions are presumed:
• The yield tension (Sy) for any calculation applies to mild steel of strength class S355 for material
  thickness of up to 20 mm and is taken for the safety class “Normal” as 360 N/mm² or the
  equivalent 36.0 kN/cm².
• The permissible shear stress is 8.3 kN/cm²
• The permissible bending stress is 13.7 kN/cm²
• The permissible combines stress is 15.7 kN/cm²

Applicable types of welded seams
Quality of welding
Welded seams should be visually inspected after the slag has been removed. The inspection should include spot checking the A-measure and looking for seam faults. The A-measure may be quickly checked by a seam gauge, available for 90° fillet welds. Typical seam faults are described as follows:

- **Seam undercuts** may result from excessive current, wrong electrode angle and/or excessive welding speed.
- **Hot cracks** may result from excessively high current, insufficient preheat and/or high impurity level of base material.
- **Cold cracks** (hydrogen cracks) result mainly from wet electrodes or welding in rainy weather, occasionally from insufficient preheating.
- **Surface porosity** may result from wet electrodes, rusty or dirty base material and/or excessive welding speed.
- **Slag inclusion** may result from poor welding technique, wrong electrode size or wrong electrode type.

![Image](image1.png)

*Figure 3.12: Checking of fillet seams*

![Image](image2.png)

*Figure 3.13: Seam faults*

Crack detection may be enhanced by means of a crack detection kit, consisting of surface cleaning spray, dye penetration spray and dye developer spray.

If serious seam faults are detected, the responsible supercargo or port captain must be informed immediately and corrective steps taken as appropriate.

How to use it in the program
Now I have explained to you what kind of stoppers we have in the program, where to look for the quality of welding, and what we mean with the dimensions in the program.

Let’s find out how to apply them and what information you will get. Create a voyage under a vessel and add cargo onto your voyage, go to the lashing & securing section and select the tab ‘Stoppers’ from your toolbox.

Keep in mind stoppers can only be applied in the top view section of the viewport. Move your cursor over the stopper - F1, press your left mouse (keep it pressed) and drag it onto the top view and release it on the side of the cargo where you want to place it.

The stopper will rotate itself in the correct position, facing the cargo with the green strip. This goes automatically. You are still able to change the rotation of the stopper by double click on it (it will rotate every time 90 degrees) or select the rotation in the stopper property form.
Applying this stopper, with these dimensions, safety factor will end in a result of 207.5 kN.

When you go to your stopper property form and change the weld throat thickness from 5mm into 6mm, you will see the difference in result, suddenly the same stopper will hold a force of 249 kN.

A difference from 41.5kN, so quiet substantial.

When changing the impact height in the property form 20mm into 120mm, you will see that result of this stopper will change from 207.5 kN into 132.6 kN, again a difference from 74.9 kN.

Clips
Clips are used to prevent the movement of cargo in two (2) directions.
• Horizontal (shear force)
• Vertical (tipping / uplift)

The shear force capacity is easily calculated, they are calculated the same as normal plate stopper based on their dimensions and variables. But to calculate them for vertical force is different topic.
It should be noted that when a clip has a vertical force, the stress in the weld has different values in the beginning or at the end of the weld. Let me try to explain this with a small drawing.

When a vessel is rolling to starboard side the clip on the starboard side will prevent her from sliding of the ship. The clips then have the function for shear force, whilst the opposite cargo unit side has a vertical moment. If the vessel will roll to the other side, the clips change their functionality.

It should be mentioned that when a clip function has the shear force on it, it also can have a slight vertical force, but this is very minimum and can only be determined if the clips on the opposite side gives way. Taking all this into consideration you understand that we have to carefully calculate all the stresses in the weld
but also in the clip (buckling) is this can be critical in many occasions.

We show you know two (2) different kind of clips used currently on board.
• Wedged clip
• Normal clip

The use of the wedge is to transfer the force from the cargo base-plate into the nose of the clip. The distance to 0-line is from start of the clip to the centre of the wedge, if the base-plate touches the nose of the clip without any wedge, then the distance to 0-line is the distance from the start of the clip to centre of the contact area of the base-plate to the clip.

**Calculation force**

**Horizontal:**
- Length of the weld
- Width of the support plate
- Height of the shear plate
- Thickness support plate
- Impact height
- Contact area
- Weld throat thickness

**Vertical:**
- Weld length of the shear plate
- Distance to 0-line
- Height above wedge (or base-plate)
- Width of the contact area of wedge (or base-plate)
- Thickness of the shear plate

Play around with it and find out what influence, changes might have.
So how should we handle all these options, all these possibilities. All is depending, what is available or not. Some shipping lines have standard H-Beams on board, or steel plates. Then you go to Tools -> Options -> stoppers and change the settings and dimensions from your default stoppers.

Anyone who works as CSI or surveyor as freelancer have to adjust by what they find on board. Please look at Case studies which will be provided on the website.