

Effect of Heavy Horizontal Braces Upon Impact Resistance.

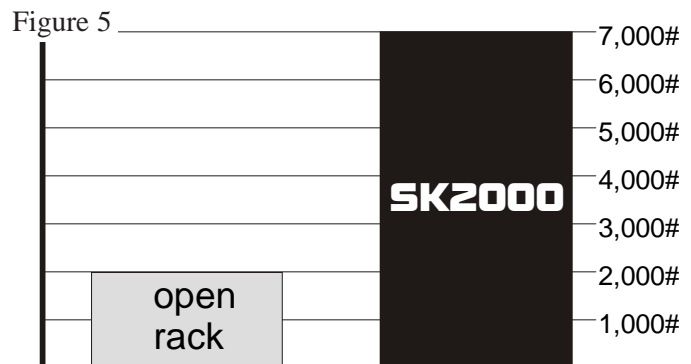
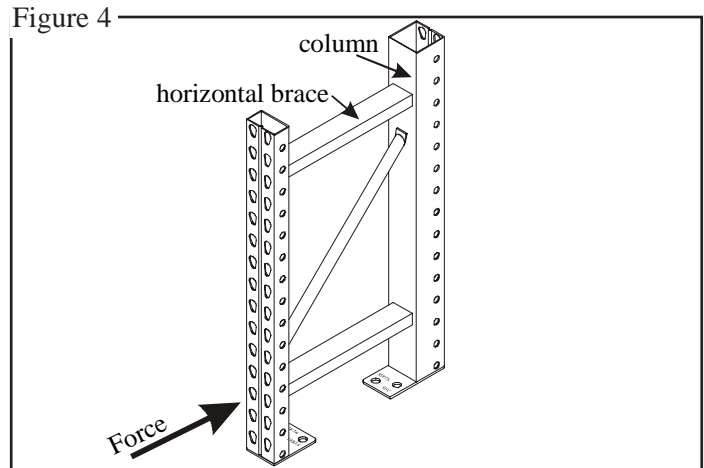
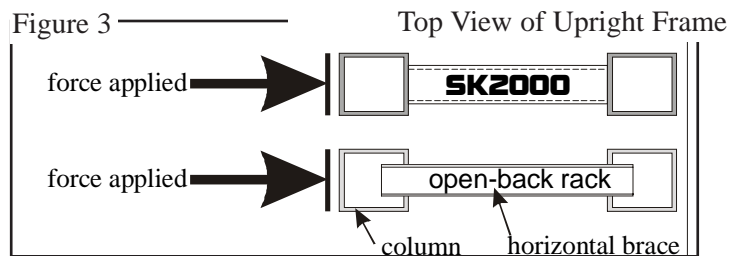
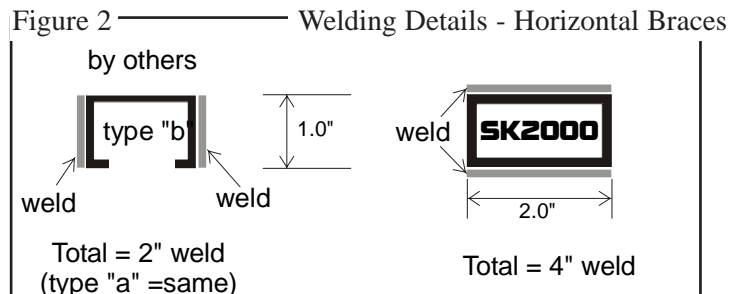
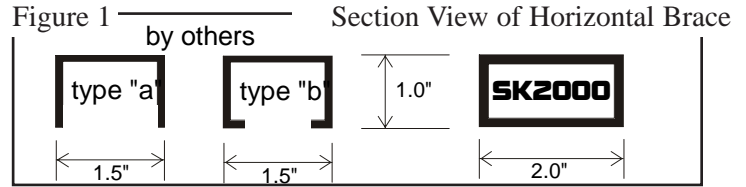
An independent engineering laboratory tested SK2000 racking for the purpose of quantifying several of the design advantages inherent in SK2000 pallet rack. The results of one such test is outlined below.

At no extra charge to the consumer, Steel King's SK2000 series pallet rack frames feature "heavy horizontal braces". These braces are constructed of closed structural steel tubing, 1" high x 2" wide, as compared to the industry standard formed sheet metal sections, usually 1" high x 1.5" wide, with or without return flanges (**Figure 1**). The SK2000 brace is welded across both 2" surfaces, as compared to two 1" welds on most other racks (**Figure 2**). When these design features are combined with the SK2000 tubular column, resistance to damage from accidental impacts is greater. This test was performed to quantify that difference.

The SK2000 frame type, and the industry standard open-back frame type, were tested as detailed in **Figure 3**. The "industry standard" frame type included braces with return flanges (type "b"). A continually increasing force was applied to one column, through the horizontal brace, and into the rear column. This is in the same direction as one would expect fork truck impacts to occur (**Figure 4**).

The industry standard open section design failed at 2,000# of pressure. When subjected to a 2,000# load, the SK2000 design performed without any visually detectable damage, and continued to withstand increased pressure, until reaching it's own yield point at 7,000# (**Figure 5**).

CONCLUSION: Users of SK2000 rack systems can expect decreased maintenance costs, and improved safety, by taking advantage of the **250% greater strength** proven by this test. (An even greater advantage would exist between SK2000 racks, and racks manufactured with bracing type "a"). This is only one feature of the SK2000 system that gives users more value for their investment.



Force Applied, in pounds, to reach yield (failure) of frame assembly.

Effect of Number of Rivets Upon Beam Connection Strength

An independent engineering laboratory tested SK2000 racking for the purpose of quantifying several of the design advantages inherent in SK2000 pallet rack. The results of one such test is outlined below.

Steel King SK2000 series boltless pallet racks feature beam connectors with 3 rivets per end connector. Some brands of pallet rack have only two rivets per connector (**Figure 1**). Both designs were tested, to quantify the actual advantage realized by users of SK2000 pallet rack.

To eliminate any other influences upon the test (differing connector plate thickness, different rivet types, different welding patterns, etc.), identical connectors were tested, with the exception of the center (third) rivet, which was removed to create a comparable 2-rivet design.

A uniaxial compressive load was applied to the center of the beam, which in turn was connected to two fixed columns (**Figure 2**). The load beam was short in length, and heavily constructed, to insure that the connection, not the beam, would fail first. Increasing force was applied, until yielding was detected by the testing machine. The load weight required to achieve yielding (failure) was recorded. The identical procedure was implemented for beams with both two (2) 2-rivet and two (2) 3-rivet end connector designs.

The 2-rivet system failed at 16,100# of load weight. At this weight, the rivets were pulled through the end connector plates. The 3-rivet design was unaffected at this same load weight, and continued to perform, until reaching its yield weight of 20,300# (**Figure 3**).

CONCLUSION: The standard beam connection employed in Steel King SK2000 series pallet racks provide **26% greater strength** and safety, solely on the basis of the third rivet. Further gains are possible, based upon SK2000 connector thickness, the high strength steel used for SK2000 rivets, and the full vertical welding of the connection, as compared to other rack designs, and with the 4-rivet connectors that are standard on SK2000 6" high beams. This is only one feature of the SK2000 system that gives users more value for their investment.

Figure 1

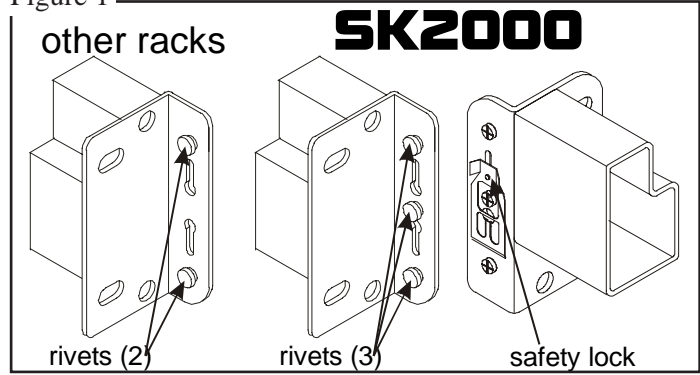


Figure 2

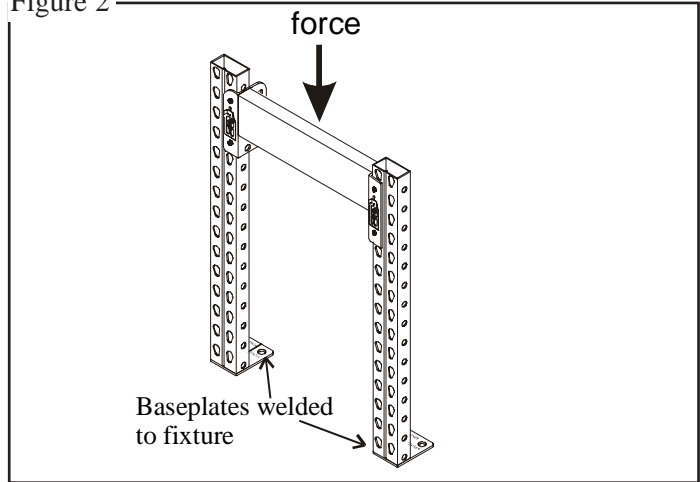
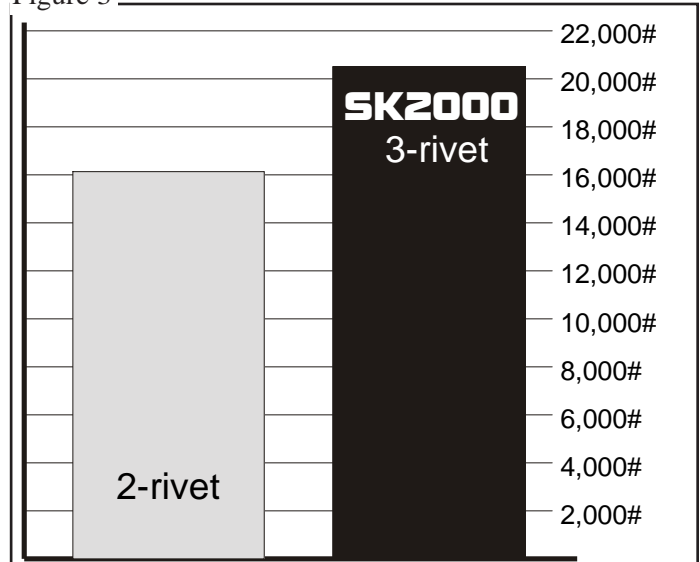


Figure 3



Force, applied in pounds, to reach yield (failure) of beam connections.

Effect of Column Shape Upon Frontal Damage Resistance

An independent engineering laboratory tested SK2000 racking for the purpose of quantifying several of the design advantages inherent in SK2000 pallet rack. The results of one such test is outlined below.

Steel King's SK2000 series pallet rack frame columns are constructed of closed tubular steel sections. Other rack manufacturers offer open-back, roll-formed columns (**Figure 1**). A test was performed to quantify the difference in the ability of these designs to resist a direct frontal impact.

The SK2000 frame type, and the industry standard frame type, were tested as shown in **Figure 2**. The load was evenly distributed across the face of the column, but was concentrated midway between horizontal braces (this imitates the manner in which many accidental fork lift truck impacts occur). The testing machine applied a continually increasing load weight, and the point at which each assembly yielded (failed) was recorded. The identical procedure was employed in testing both rack frame types.

The industry standard, open-back (roll-formed) frame assembly failed at 3,200# of pressure. When subjected to a similar 3,200# load, the SK2000 assembly exhibited no deflection, nor any visually detectable damage. The SK2000 frame assembly continued to withstand increasingly heavy amounts of pressure, until reaching it's own yield point of 4,700# (**Figure 3**).

CONCLUSION: Users of SK2000 rack systems can expect decreased maintenance costs, and improved safety, by taking advantage of the **47% greater strength** proven by this test. This is only one feature of the SK2000 system that gives users more value for their investment.

Figure 1 ————— Cross Section of Frame Column



Figure 2 —————

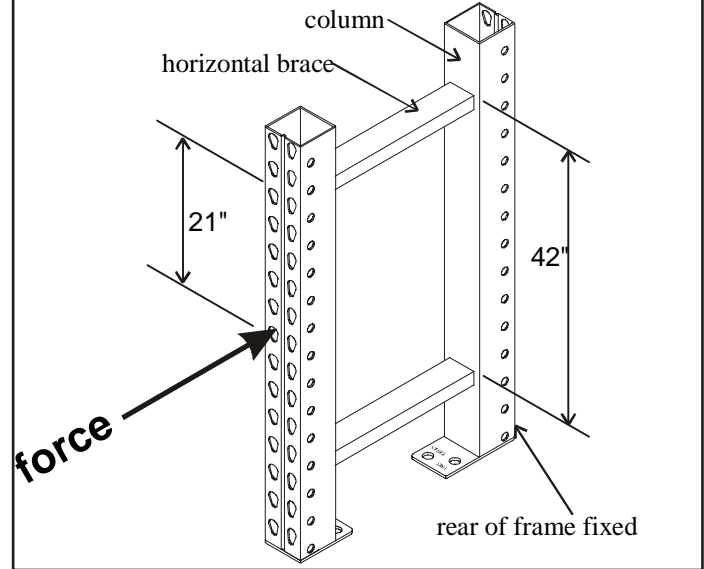
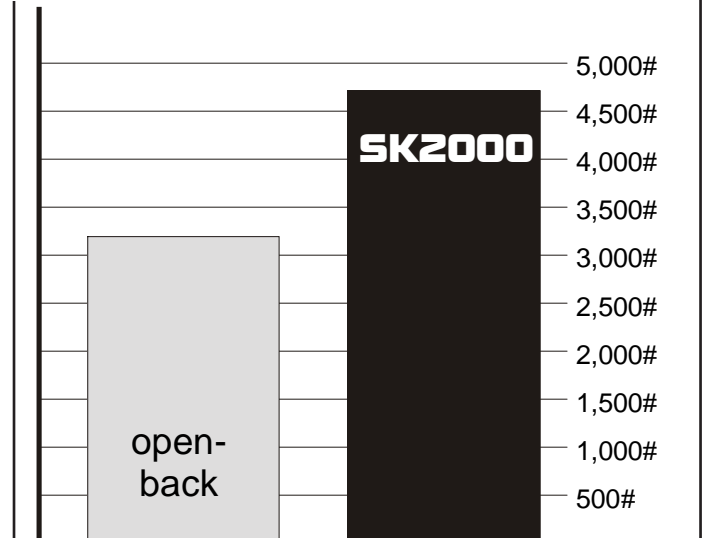


Figure 3 —————



Force Applied, in pounds, to reach yield (failure) of column.

Effect of Column Shape Upon Side-Damage Resistance

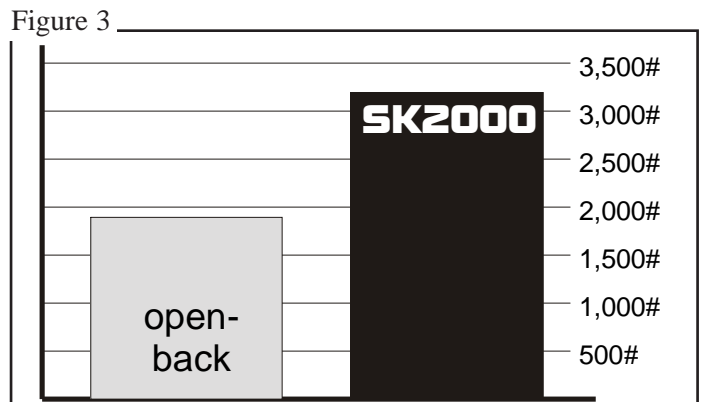
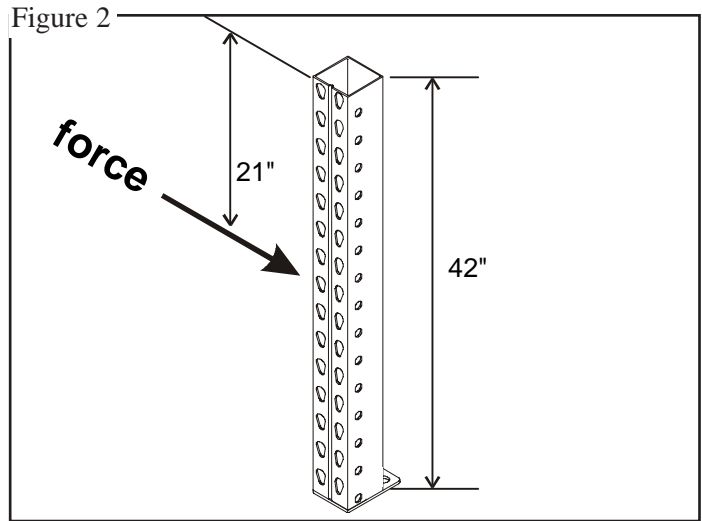
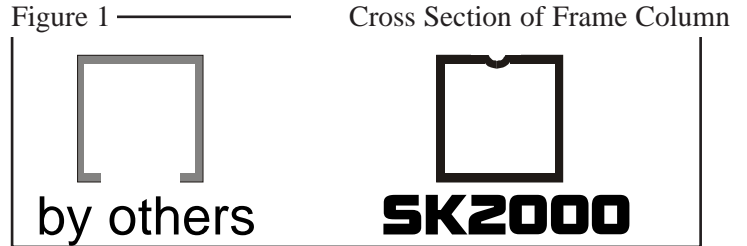
An independent engineering laboratory tested SK2000 racking for the purpose of quantifying several of the design advantages inherent in SK2000 pallet rack. The results of one such test is outlined below.

Steel King's SK2000 series pallet rack frame columns are constructed of closed tubular steel sections. Other rack manufacturers offer open-back, roll-formed sections (**Figure 1**). A test was performed to quantify the difference in the ability of these two designs to withstand side impacts.

The SK2000 column type, and the industry standard column type, were tested as shown in **Figure 2**. All columns tested were of an equivalent steel thickness and column size. The test load was evenly distributed across the side of the column, but was concentrated midway along its height (this imitates the manner in which many accidental fork lift truck impacts occur, especially in drive-in configurations, or at ends of rack rows). The testing machine applied a continually increasing load weight, and the point at which each column yielded (failed) was recorded. The identical procedure was employed in testing both column types.

The industry standard, open-back (roll-formed) column failed at 1,900# of pressure. When subjected to a similar 1,900# load, the SK2000 closed tubular column exhibited no visually detectable damage. The SK2000 column continued to withstand increasingly heavy amounts of pressure, until reaching its own yield point of 3,200# (**Figure 3**).

CONCLUSION: Users of SK2000 rack systems can expect decreased maintenance costs, and improved safety, by taking advantage of the **68% greater strength** proven by this test. This is only one feature of the SK2000 system that gives users more value for their investment.



Force, applied in pounds, to reach yield (failure) of column.