

A NEW DECK SIDELAP CONNECTOR - WITH A PUNCH

By: Virgil R. Morton, P.E.

This, you will see, is a revolutionary development for the connection of the sidelap of steel roof and floor decks which will replace, in many cases, the top seam welds, the button punch or sheet metal screws currently in use.

What is this sidelap connection device? It is a puncture of the sidelaps of the interlocking roof or floor decks created by a tool that is mechanically driven. This puncture offers resistance to slippage longitudinally and resists the vertical separation which can occur when the deck is subjected to horizontal loading such as with wind, earthquake or construction loads such as concrete pours on composite decks. The punch creates a positive, identifiable interference between the male and the female lips of the sidelap of the interlocking deck. See Figure 1 for an illustration of the punch and Figure 2 for the PunchLok® tool.



Figure 1



Figure 2

A major advantage of steel roof decking is its ability to act as a horizontal diaphragm in building construction. For example, in the Western United States including Alaska, the deck is normally welded to steel supports. The deck serves to create the horizontal bracing necessary to eliminate the cross bracing used in the past. The diaphragm's strength and stiffness depend on the gage and span of the deck, how the deck units are fastened together, and how the deck is connected to the steel frame of the building. There is always some diaphragm action with any attachment, but in general, increasing or upgrading the connection system will increase the system's ability to resist the horizontal loads from seismic action or from wind. Developing an effective fastening system has been the goal of Verco Manufacturing Co. for many years.

Structural engineers have in the past questioned the effectiveness of any system of sidelap connection. This comes from the uncertainty of assurance that the connection is complete. Field inspectors have also expressed their concerns on how to assure themselves that a positive connection is real from observing either top seam welds or button punches from the topside of the steel deck. The question also arises when using screws at the sidelaps as the screws may create a larger hole that results in a more flexible connection than expected.

The engineering department of Verco Manufacturing Co. has sought to create an absolute sidelap connection which is easily inspected with total certainty from the topside of the deck, offers a positive connection, is easy to perform and results in a joint that resists slippage longitudinally and vertically when subjected to the forces of earthquakes and wind.

Verco's pursuit of improved steel deck diaphragm capabilities is an ongoing process. After the development of ShearTranz®II to attain maximum diaphragm shear capability, Verco's engineering staff began perhaps the most comprehensive and extensive research and testing program ever undertaken in the roof and floor deck industry, conducting over ninety full scale diaphragm tests. The tests were witnessed by an independent laboratory and a professional engineer. In conjunction with the test program, an improvement to ShearTranz®II was developed to enhance the installation process and the economy of the overall system.

The goals desired by Verco's engineering staff for the sidelap attachment were that the connection meet or exceed the following criteria. The attachment must:

- 1 Be 100% effective from the first attachment of the day to the last attachment.
- 2 Have 100% accuracy of inspection of the attachment from the topside of the deck.
- 3 Require no touch-up from either the topside or the bottomside of the deck.
- 4 Be able to be used either with or without the use of Verco's ShearTranz®II system.
- 5 Be stronger and more positive than conventional button punches.
- 6 Be stronger, more positive and more economical than screwed sidelaps.
- 7 Be virtually as strong, more positive and more economical than top seam welds.
- 8 Be effective on Verco's 1½", 2", and 3" roof and floor products.
- 9 Provide a competitive, completely weld-free system where shear requirements permit when used in conjunction with specified pins at supports.
- 10 Be free of toxic fumes such as may be encountered in the welding process.

In conjunction with Parker Manufacturing, Phoenix, Arizona, Verco has developed Verco's revolutionary PunchLok® system using the Parker patented PunchLok® pneumatic punch tool. The PunchLok® tool punctures the sidelap of the interlocking deck resulting in the connection that is described earlier in this article.

The advantages of this system also include economical aspects relating to field labor costs. When comparing field labor costs between PunchLok® deck systems and top seam welded systems, it must be noted that sidelap attachment for top seam welds is a two step operation. First, the sidelap of the deck must be crimped, usually by a hand operated crimping tool, and second, the operation of making the

weld. Sidelap attachments in the PunchLok® system are a one step operation which require less time to complete. Also, there are two other considerations which are plausible. One, the operator of the PunchLok® tool need not be a journeyman welder, thus reducing cost. Two, is the factor of fatigue. The operator of the PunchLok® tool would tend to tire less easily as the physical requirements to accomplish the task would be less than either the button punch or the weld connection.

In regard to the research and testing program, some of the typical tests conducted under auspices of S. B. Barnes Associates and Ramtech Laboratories, Inc. include the following examples of the range of testing that was performed:

- 1 Gages of 22, 20, 18 and 16.
- 2 Spans of 4'-0", 5'-0", 6'-8", 8'-0" and 10'-0".
- 3 With and without ShearTranz®II.
- 4 Sidelap attachment using top seam welds or PunchLok® tool.

The results of this test program were overwhelmingly positive. Every goal set forth by Verco's engineering staff was met or exceeded providing a completely new and revolutionary roof deck diaphragm system for the construction industry including an economical positive sidelap connection for floor decks prior to a concrete pour.

The Verco PunchLok® system solves the concerns for positive connections, accurate field inspection and ease in performing, thus resulting in a connection that offers resistance to longitudinal and vertical separation when the deck is subjected to horizontal loads. The Verco Punchlok® system, including the use of pins for support attachments, is included in ICBO ES Report ER-2078P. The Verco PunchLok® tool is patented under U.S. Patent #6,212,932. Formation of the Punchlok® deck system using the Punchlok® tool is patented under U.S. Patent #6,397,469.

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