

## Calculation of Effective Hydraulic Diameter of MKI Dynapore® Wire Mesh Laminates

Let  $p$  = open area % of a square weave wire mesh. ( $0 < p < 1$ )  
Then  $1-p$  = closed area % in 2-d projection.

However, the true “effective closed area” in 3-d structure is  $c(1-p)$ , where  $c$  is some constant such that  $0 < c < 1$ . Because the wires are contoured, allowing ample gas flow in what would otherwise be “closed” areas in the 2-d projection,  $c$  must be  $< 1$ . Based on the geometry, we estimate a value for  $c$  in the range  $.50 < c < .66$ .

If two layers of cloth are placed adjacent to one another, the pores of the first layer will be partially occluded by the wires in the second layer. If the pores in the first layer are of diameter (or square size)  $d$ , then the pore size  $d$  will be effectively reduced by the “effective closed area” of the second layer as defined above. I.e. the pore size  $d$  is reduced by the quantity  $d * c(1-p)$ , resulting in an effective pore size for the two-layer structure of

$$d - [d * c(1-p)] = d * (1-c(1-p))$$

This factor,  $(1-c(1-p))$ , may be called the occlusion factor of the second layer.  
Let  $k$  = the occlusion factor =  $(1-c(1-p))$ . Notice that  $k$  is dependent not only on our estimated constant  $c$ , but also on the open area percentage  $p$  of the occluding layer.

$k$  may be used as a correction factor in converting hydraulic diameters for straight flow-path media to pore sizes for multiple-layer wire mesh structures. For example, if a structure with hydraulic diameter  $h$  is to be replaced by a wire mesh laminate, then the finest mesh in the laminate should have a pore size of approximately  $h/k$ . When the effective pore size is calculated after occlusion by an adjacent layer of mesh, the result will be  $(h/k) * k = h$ .

The calculation of  $k$  in determining the corrected equivalent mesh pore size  $h/k$  depends on our estimate of  $c$ , as well as the open area  $p$  of the meshes. Therefore, for coarser structures, for which the meshes typically have a higher open area percentage  $p$ ,  $k$  will be larger, as  $k = (1-c(1-p)) = 1-c+pc$ .

Using values of  $c$  in the range of  $.50 - .66$ , we find that throughout this range the recommended equivalent meshes for each hydraulic diameter size of crimped ribbon structure do not vary. We can therefore offer recommended replacement structures with some degree of confidence, subject of course to empirical testing to be performed by the customer.

Based on the above calculations, we can select Dynapore® structures for each value of  $h$ . We can select two or more types of laminate for each hydraulic diameter; for example, one comprising alternating layers of two different plain square weave meshes, and a second comprising layers of one square weave mesh at alternating  $0^\circ$  and  $45^\circ$  orientations. It is our recommendation that a variety of structures be tested to establish baseline performance characteristics for Dynapore® in comparison with crimped ribbon or other structures.