

## KBV Expansion Anchor

### Product Description

The KBV is a torque controlled expansion anchor, which provides consistent performance for a wide range of mechanical anchor applications. This anchor series is available in carbon steel with zinc electroplated coating. The KBV is available in diameters of 1/4 inch, 3/8 inch, 1/2 inch, 5/8 inch, and 3/4 inch. Applicable base materials include lightweight concrete, normal-weight concrete and grout-filled concrete masonry.

### Guide Specifications

Torque controlled expansion anchors shall be KBV supplied by Hilti meeting the description in Federal Specification A-A 1923A, Type 4. Anchors are manufactured to meet the following conditions:

1. The carbon steel anchor body, nut and washer have an electroplated zinc coating conforming to ASTM B633 to a minimum thickness of 5  $\mu\text{m}$ .
2. The carbon steel nut and washer have an electroplated zinc coating.

### Product Features

- Through fixture installation and variable lengths improve productivity and accommodate various base plate thicknesses.

- Anchor size is same as drill bit size for easy installation. For temporary applications anchors may be driven into drilled holes after usage.
- Mechanical expansion allows immediate load application.

### Material Properties

- Carbon Steel with Electroplated Zinc
- Carbon steel anchor components plated in accordance with ASTM B633 to a minimum thickness of 5  $\mu\text{m}$ .
- Nuts conform to the requirements of ASTM A563, Grade A, Hex.
- Washers meet the material requirements of ASTM F844.
- Expansion elements (wedges) are manufactured from carbon steel.

### Listings/Approvals

#### UL LLC

**UL 203 Pipe Hanger Equipment for Fire Protection Services (3/8 through 3/4)**



## KBV Expansion Anchor

Figure 1 – KBV Specifications

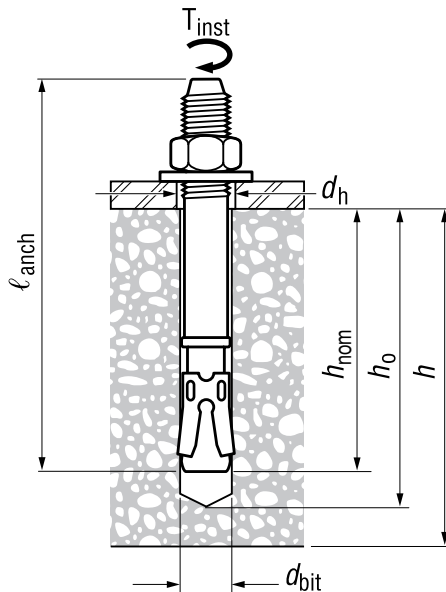


Table 1 – Installation Information

Setting Information	Symbol	Units	Nominal anchor diameter									
			1/4		3/8		1/2		5/8		3/4	
ANSI drill to nominal	$d_{bit}$	in.	1/4		3/8		1/2		5/8		3/4	
Minimum nominal embedment	$h_{nom}$	in. (mm)	1-1/8 (38)	2 (51)	1-5/8 (51)	2-1/2 (64)	2-1/4 (57)	3-1/2 (89)	2-3/4 (70)	4 (102)	3-1/4 (83)	4-3/4 (121)
Min hole depth	$h_o$	in. (mm)	1-3/8 (35)	2-1/4 (57)	2 (51)	2-7/8 (73)	2-3/4 (70)	4 (102)	3-3/8 (86)	4-5/8 (117)	4 (102)	5-1/2 (140)
Installation torque	$T_{inst}$	ft-b (Nm)	4 (5)		20 (27)		40 (54)		60 (81)		110 (149)	
Minimum fixture hole diameter	$d_n$	in. (mm)	5/16 (7.9)		7/6 (11.1)		9/16 (14.3)		11/16 (17.5)		13/16 (20.6)	
Minimum Base Material Thickness	$h_{min}$	in. (mm)	3-1/4 (83)	4 (102)	4 (102)	4 (102)	4-1/2 (114)	7 (178)	5-1/2 (140)	8 (203)	6 (152)	9-1/2 (241)
Minimum Edge Distance	$c_{min}$	in. (mm)	2-1/4 (57)		3-3/8 (86)		4-1/2 (114)		5-5/8 (143)		6 3/4 (171)	
Minimum Anchor Spacing	$s_{min}$	in. (mm)	2-1/4 (57)		3-3/8 (86)		4-1/2 (114)		5-5/8 (143)		6-3/4 (171)	

## Design Tables

The load values contained in this section are Hilti allowable loads calculated from the results of testing in accordance with ACI 355.2 and applying an ASD reduction factor. The recommended loads for an anchor group can be calculated according to the Allowable Stress Design (ASD) method outlined in Section 3.1.8 of the 2014 Hilti Anchor Fastening Technical Guide, Volume 2.

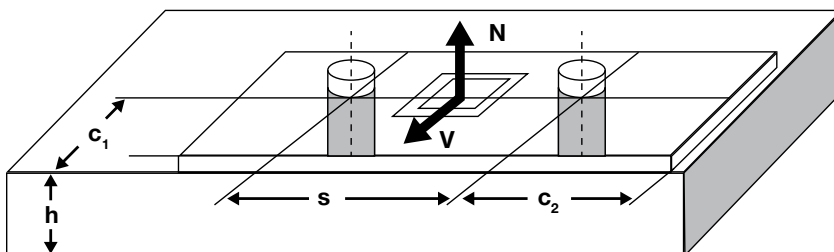
**Table 2 — Hilti KBV Carbon Steel Allowable Loads in Uncracked Concrete** <sup>1,2,3,4</sup>

Anchor Diameter in. (mm)	Nominal Embed. Depth in. (mm)	Tension - $N_{rec}$	Shear - $V_{rec}$
		$f'_c = 4000$ psi (27.6 MPa) lb (kN)	$f'_c = 4000$ psi (27.6 MPa) lb (kN)
1/4 (6.4)	1-1/8 (29)	405 (1.8)	450 (2.0)
	2 (51)	720 (3.2)	
3/8 (9.5)	1-5/8 (41)	940 (4.2)	1,130 (5.0)
	2-1/2 (64)	1,620 (7.2)	
1/2 (12.7)	2-1/4 (57)	1,680 (7.5)	1,900 (8.5)
	3-1/2 (89)	2,850 (12.7)	
5/8 (15.9)	2-3/4 (70)	2,105 (9.4)	2,355 (10.5)
	4 (102)	3,630 (16.1)	2,970 (13.2)
3/4 (19.1)	3-1/4 (83)	2,605 (11.6)	5,105 (22.7)
	4-3/4 (121)	4,985 (22.2)	

1 Anchors are tested in accordance with ACI 355.2 and failure mode is lesser of concrete, pullout, pryout, or steel failure.  
 2 Linear interpolation between embedment depths is not permitted.  
 3 Apply spacing and edge distance factors in Tables 3 to 7 as necessary.  
 4 Tabular values are for normal weight concrete only. For lightweight concrete multiply allowable loads by  $\lambda_a$  as follows:  
 For sand-lightweight,  $\lambda_a = 0.68$ . For all-lightweight,  $\lambda_a = 0.60$ .

**Figure 2 — Anchor Spacing and Edge Distance Guidelines**

1.  $s$  = on-center fastening spacing  
 $c$  = edge distance from center of bolt
2. Apply appropriate load reduction factors from tables 3 through 7 for tension and shear spacing and/or edge distance of the anchor or anchor group.
3. See Section 3.1.8 of the 2014 Hilti Anchor Fastening Technical Guide, Volume 2 for determining compounded spacing and edge distance reduction as well as intermediate load values for concrete strengths and embedment.



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### Table 5-9 Load Adjustment Factors

Table 3 — Load Adjustment Factors for 1/4-in. Diameter KBV Carbon Steel Anchor in Uncracked Concrete<sup>1</sup>

1/4 in. KBV Carbon Steel Uncracked Concrete		Spacing Factor in Tension $f_{AN}$		Edge Distance Factor in Tension $f_{RN}$		Spacing Factor in Shear <sup>2</sup> $f_{AV}$	Edge Distance in Shear	
							⊥ Toward Edge $f_{RV}$	∥ To Edge $f_{RV}$
Embedment $h_{nom}$ in (mm)		1-1/8 (29)	2 (51)	1-1/8 (29)	2 (51)	> 1-1/8 (29)	> 1-1/8 (29)	> 1-1/8 (29)
Spacing (s) / Edge Distance ( $c_a$ ) - in. (mm)	2-1/4 (57)	0.92	0.71	0.69	0.67	0.62	0.58	0.69
	2-1/2 (64)	0.97	0.74	0.77	0.72	0.63	0.67	0.77
	3 (76)	1.00	0.79	0.92	0.86	0.65	0.89	0.92
	3-1/2 (89)		0.83	1.00	1.00	0.68	1.00	1.00
	4 (102)		0.88			0.71		
	4-1/2 (114)		0.93			0.73		
	5 (127)		0.98			0.76		
	5-1/2 (140)		1.00			0.78		
	6 (152)					0.81		
	6-1/2 (165)					0.83		
	7 (178)					0.86		
	7-1/2 (191)					0.88		
	8 (203)					0.91		
	9 (229)					0.96		
10 (254)					1.00			

<sup>1</sup> Linear interpolation not permitted.

<sup>2</sup> Spacing factor reduction in shear,  $f_{AV}$ , assumes an influence of a nearby edge. If no edge exists, then  $f_{AV} = f_{AN}$ .

Table 4 — Load Adjustment Factors for 3/8-in. Diameter KBV Carbon Steel Anchor in Uncracked Concrete<sup>1</sup>

3/8 in. KBV Carbon Steel Uncracked Concrete		Spacing Factor in Tension $f_{AN}$		Edge Distance Factor in Tension $f_{RN}$		Spacing Factor in Shear <sup>2</sup> $f_{AV}$	Edge Distance in Shear	
							⊥ Toward Edge $f_{RV}$	∥ To Edge $f_{RV}$
Embedment $h_{nom}$ in (mm)		1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	> 1-5/8 (41)	> 1-5/8 (41)	> 1-5/8 (41)
Spacing (s) / Edge Distance ( $c_a$ ) - in. (mm)	3-3/8 (86)	0.92	0.75	1.00	0.93	0.67	1.00	1.00
	3-1/2 (89)	0.94	0.76		0.97	0.67		
	4 (102)	1.00	0.80		1.00	0.70		
	4-1/2 (114)		0.84			0.72		
	5 (127)		0.88			0.75		
	5-1/2 (140)		0.91			0.77		
	6 (152)		0.95			0.80		
	6-1/2 (165)		0.99			0.82		
	7 (178)		1.00			0.85		
	7-1/2 (191)					0.87		
	8 (203)					0.89		
	9 (229)					0.94		
	10 (254)					0.99		
	11 (279)					1.00		

<sup>1</sup> Linear interpolation not permitted.

<sup>2</sup> Spacing factor reduction in shear,  $f_{AV}$ , assumes an influence of a nearby edge. If no edge exists, then  $f_{AV} = f_{AN}$ .

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**Table 5 — Load Adjustment Factors for 1/2-in. Diameter KBV Carbon Steel Anchor in Uncracked Concrete<sup>1</sup>**

1/2 in. KBV Carbon Steel Uncracked Concrete		Spacing Factor in Tension $f_{AN}$		Edge Distance Factor in Tension $f_{RN}$		Spacing Factor in Shear <sup>2</sup> $f_{AV}$	Edge Distance in Shear	
							⊥ Toward Edge $f_{RV}$	∥ To Edge $f_{RV}$
Embedment $h_{nom}$ in (mm)		2-1/4 (57)	3-1/2 (89)	2-1/4 (57)	3-1/2 (89)	> 2-1/4 (57)	> 2-1/4 (57)	> 2-1/4 (57)
Spacing (s) / Edge Distance ( $c_a$ ) - in. (mm)	4-1/2 (114)	0.89	0.74	1.00	0.76	0.67	1.00	1.00
	5 (127)	0.93	0.76		0.83	0.69		
	5-1/2 (140)	0.97	0.79		0.92	0.70		
	6 (152)	1.00	0.81		1.00	0.72		
	6-1/2 (165)		0.84			0.74		
	7 (178)		0.87			0.76		
	7-1/2 (191)		0.89			0.78		
	8 (203)		0.92			0.80		
	8-1/2 (216)		0.94			0.81		
	9 (229)		0.97			0.83		
	9-1/2 (241)		1.00			0.85		
	10 (254)					0.87		
	10-1/2 (267)					0.89		
	11 (279)					0.91		
12 (305)					0.94			
13 (330)					0.98			
14 (356)					1.00			

<sup>1</sup> Linear interpolation not permitted.

<sup>2</sup> Spacing factor reduction in shear,  $f_{AV}$ , assumes an influence of a nearby edge. If no edge exists, then  $f_{AV} = f_{AN}$ .

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**Table 6 — Load Adjustment Factors for 5/8-in. Diameter KBV Carbon Steel Anchor in Uncracked Concrete<sup>1</sup>**

5/8 in. KBV Carbon Steel Uncracked Concrete		Spacing Factor in Tension $f_{AN}$		Edge Distance Factor in Tension $f_{RN}$		Spacing Factor in Shear <sup>2</sup> $f_{AV}$	Edge Distance in Shear	
							⊥ Toward Edge $f_{RV}$	∥ To Edge $f_{RV}$
Embedment $h_{nom}$ in (mm)		2-3/4 (70)	4 (102)	2-3/4 (70)	4 (102)	> 2-3/4 (70)	> 2-3/4 (70)	> 2-3/4 (70)
Spacing (s) / Edge Distance ( $c_a$ ) - in. (mm)	5-5/8 (143)	0.93	0.77	1.00	0.82	0.67	1.00	1.00
	6 (152)	0.96	0.79		0.87	0.68		
	6-1/2 (165)	1.00	0.82		0.95	0.69		
	7 (178)	1.00	0.84		1.00	0.71		
	7-1/2 (191)		0.86			0.72		
	8 (203)		0.89			0.74		
	8-1/2 (216)		0.91			0.75		
	9 (229)		0.94			0.77		
	9-1/2 (241)		0.96			0.78		
	10 (254)		0.99			0.80		
	10-1/2 (267)		1.00			0.81		
	11 (279)					0.83		
	12 (305)					0.86		
	13 (330)					0.89		
	14 (356)					0.91		
16 (406)					0.97			
18 (457)					1.00			

1 Linear interpolation not permitted.

2 Spacing factor reduction in shear,  $f_{AV}$ , assumes an influence of a nearby edge. If no edge exists, then  $f_{AV} = f_{AN}$ .

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**Table 7 — Load Adjustment Factors for 3/4-in. Diameter KBV Carbon Steel Anchor in Uncracked Concrete<sup>1</sup>**

3/4 in. KBV Carbon Steel Uncracked Concrete		Spacing Factor in Tension $f_{AN}$		Edge Distance Factor in Tension $f_{RN}$		Spacing Factor in Shear <sup>2</sup> $f_{AV}$	Edge Distance in Shear	
							⊥ Toward Edge $f_{RV}$	∥ To Edge $f_{RV}$
Embedment $h_{nom}$ in (mm)		3-1/4 (83)	4-3/4 (121)	3-1/4 (83)	4-3/4 (121)	> 3-1/4 (83)	> 3-1/4 (83)	> 3-1/4 (83)
Spacing (s) / Edge Distance ( $c_a$ ) - in. (mm)	6-3/4 (171)	0.92	0.77	1.00	0.82	0.66	0.89	1.00
	7 (178)	0.93	0.78		0.85	0.66	0.92	
	7-1/2 (191)	0.96	0.80		0.91	0.67	0.98	
	8 (203)	1.00	0.82		0.97	0.69	1.00	
	8-1/2 (216)		0.84		1.00	0.70		
	9 (229)		0.86			0.71		
	9-1/2 (241)		0.88			0.72		
	10 (254)		0.90			0.73		
	11 (279)		0.94			0.75		
	12 (305)		0.98			0.78		
	13 (330)		1.00			0.80		
	14 (356)					0.82		
	15 (381)					0.85		
	16 (406)					0.87		
	18 (457)					0.92		
20 (508)					0.96			
24 (610)					1.00			

1 Linear interpolation not permitted.

2 Spacing factor reduction in shear,  $f_{AV}$ , assumes an influence of a nearby edge. If no edge exists, then  $f_{AV} = f_{AN}$ .

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**Table 8 — KBV Carbon Steel Anchor Allowable Loads in Grout-Filled Concrete Masonry Units**

Anchor Diameter in. (mm)	Anchor Depth in. (mm)	Min. Distance from Edge of Block		Tension lb (kN)		Shear lb (kN)	
		in.	(mm)	in.	(mm)	in.	(mm)
1/4 (6.4)	1-1/8 (29)	4	(102)	150	(0.7)	380	(1.7)
		12	(305)				
	2 (51)	4	(102)	540	(2.4)	445	(2.0)
		12	(305)				
3/8 (9.5)	1-5/8 (41)	4	(102)	320	(1.4)	735	(3.3)
		12	(305)	340	(1.5)	940	(4.2)
	2-1/2 (64)	4	(102)	780	(3.5)	950	(4.2)
		12	(305)				
1/2 (12.7)	2-1/4 (57)	4	(102)	630	(2.8)	830	(3.7)
		12	(305)	665	(3.0)	1465	(6.5)
	3-1/2 (89)	4	(102)	905	(4.0)	1065	(4.7)
		12	(305)			2100	(9.3)
5/8 (15.9)	2-3/4 (70)	4	(102)	815	(3.6)	890	(4.0)
		12	(305)	865	(3.8)	2165	(9.6)
	4 (102)	4	(102)	1165	(5.2)	970	(4.3)
		12	(305)			2770	(12.3)
3/4 (19.1)	3-1/4 (83)	4	(102)	930	(4.1)	785	(7.0)
		12	(305)			3135	(13.8)
	4-3/4 (121)	4	(102)	1365	(6.1)	825	(3.7)
		12	(305)			1710	(7.6)

1. Values are for anchor installed in Type 1 Grade N, lightweight, medium-weight, or normal-weight concrete masonry units conforming to UBC Standard 21-4. The masonry units must be fully grouted with coarse grout conforming to UBC Standard 21-15 Type S, N, or M. Masonry prism compressive strength must be at least 1500 psi at the time of installation when tested in accordance with UBC Standard 21-17.

2. Anchors must be installed a minimum of 1-3/8 inch from any vertical mortar joint (see figure).

3. Anchor locations are limited to one per masonry cell.

4. Embedment depth is measured from the outside face of the concrete masonry unit.

5. Linear interpolation to determine load values at intermediate edge distances is permitted.

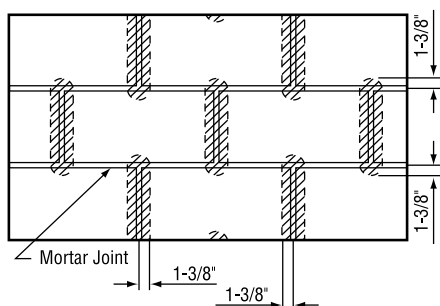
6. All allowable loads based on safety factor of 4.0.

## Combined Shear and Tension Loading for Grout-filled Masonry

$$\left( \frac{N_d}{N_{rec}} \right) + \left( \frac{V_d}{V_{rec}} \right) \leq 1.0$$

**Figure 3 — Installation in Grout-filled Concrete Masonry Unit**

1 Anchor installation is allowed in all non-shaded areas.





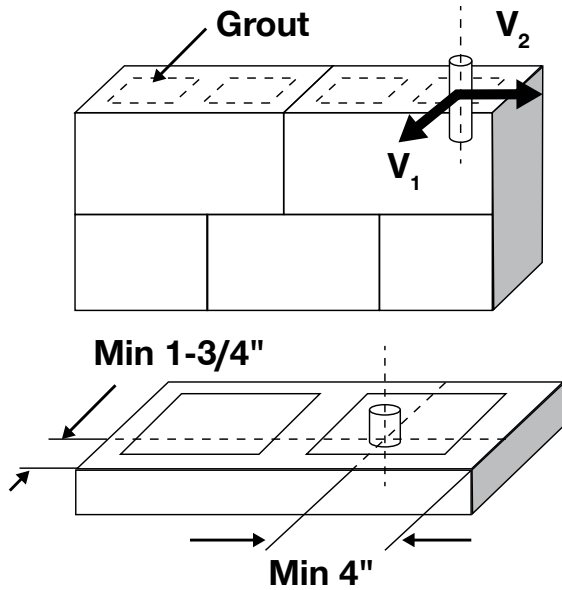
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**Table 9 – Carbon Steel KBV Anchor Allowable Loads in Top of Grout-filled Masonry Walls<sup>1</sup>**

Anchor Diameter in. (mm)	Minimum Embedment in. (mm)	Tension lb (kN)	Shear lb (kN)	
			V1	V2
1/2 (12.7)	3-1/2 (89)	645 (2.9)	310 (1.4)	615 (2.7)
5/8 (15.9)	4 (102)	850 (3.8)	310 (1.4)	615 (2.7)

<sup>1</sup> Values are for anchors installed in Type 1 Grade N, lightweight, medium-weight, or normal-weight concrete masonry units conforming to UBC Standard 21-4. The masonry units must be fully grouted with coarse grout conforming to UBC Standard 21-15, Type S, N, or M. Masonry prism compressive strength must be at least 1500 psi at the time of installation when tested in accordance with UBC Standard 21-17.

**Figure 4 – Installation in Top of Grout-filled Masonry Walls**



**Installation Instructions**

Installation instructions for use (IFU) are included with each product package. They can also be viewed or downloaded online at [www.us.hilti.com](http://www.us.hilti.com) (US) and [www.hilti.ca](http://www.hilti.ca) (Canada). Because of the possibility of changes, always verify that downloaded IFU are current when used. Proper installation is critical to achieve full performance. Training is available on request. Contact Hilti Technical Services for applications and conditions not addressed in the IFU.

## KBV Expansion Anchor

### Installation Instructions

For installation instructions and parameters refer to Tables of this document and the Instructions for use contained in each box of anchors.

### Ordering Information

Item No.	Description	Thread Length (inches)	Qty	Packaging
02078657	KBV 1/4 x 2-1/4	1	100	Box
02078658	KBV 1/4 x 3-1/4	2	100	Box
02078659	KBV 3/8 x 3	1-1/2	50	Box
02078800	KBV 3/8 x 3-3/4	2-1/4	50	Box
02078801	KBV 3/8 x 5"	3-1/2	50	Box
02078802	KBV 1/2 x 3-3/4	2	25	Box
02078803	KBV 1/2 x 4-1/2	2-3/4	25	Box
02078804	KBV 1/2 x 5-1/2	3-3/4	25	Box
02078805	KBV 5/8 x 4-3/4	2-3/4	15	Box
02078806	KBV 5/8 x 6	4	15	Box
02078807	KBV 3/4 x 4-3/4	2-7/16	10	Box
02078808	KBV 3/4 x 5-1/2	3-1/4	10	Box
02078809	KBV 3/4 x 7	4-5/8	10	Box
03512163	KBV 1/4 x 2-1/4 MC	1	1200	MC
03512164	KBV 1/4 x 3-1/4 MC	2	1200	MC
03512165	KBV 3/8 x 3 MC	1-1/2	600	MC
03512166	KBV 3/8 x 3-3/4 MC	2-1/4	400	MC
03512167	KBV 3/8 x 5" MC	3-1/2	400	MC
03512168	KBV 1/2 x 3-3/4 MC	2	200	MC
03512169	KBV 1/2 x 4-1/2 MC	2-3/4	200	MC
03512170	KBV 1/2 x 5-1/2 MC	3-3/4	200	MC
03512171	KBV 5/8 x 4-3/4 MC	2-3/4	120	MC
03512172	KBV 5/8 x 6 MC	4	120	MC
03512173	KBV 3/4 x 4-3/4 MC	2-7/16	80	MC
03512174	KBV 3/4 x 5-1/2 MC	3-1/4	80	MC
03512175	KBV 3/4 x 7 MC	4-5/8	60	MC
03512176	KBV 1/4 x 2-1/4 8 MC	1	9600	8 MC
03512177	KBV 1/4 x 3-1/4 8 MC	2	9600	8 MC
03512178	KBV 3/8 x 3 8 MC	1-1/2	4800	8 MC
03512179	KBV 3/8 x 3-3/4 8 MC	2-1/4	3200	8 MC
03512180	KBV 3/8 x 5" 8 MC	3-1/2	3200	8 MC
03512181	KBV 1/2 x 3-3/4 8 MC	2	1600	8 MC
03512182	KBV 1/2 x 4-1/2 8 MC	2-3/4	1600	8 MC
03512183	KBV 1/2 x 5-1/2 8 MC	3-3/4	1600	8 MC
03512184	KBV 5/8 x 4-3/4 8 MC	2-3/4	960	8 MC
03512185	KBV 5/8 x 6 8 MC	4	960	8 MC
03512186	KBV 3/4 x 4-3/4 8 MC	2-7/16	640	8 MC
03512187	KBV 3/4 x 5-1/2 8 MC	3-1/4	640	8 MC
03512188	KBV 3/4 x 7 8 MC	4-5/8	480	8 MC

Note: All dimensions in inches