

## LABORATORY TEST REPORT

Glass Guard Load Test, Side-mounted Concrete Substrate  
"12 mm thick tempered glass, 1850 mm x 1170 mm"

Report No. L24-1577-6999

Report Date: May 7, 2024

Prepared for:

**RF Transparent**  
67 Westmore Dr. Unit 19-20,  
Etobicoke, ON

**BC Transparent**  
1065 Rue Demers,  
Carignan, QC

Respectfully submitted by:  
**CANADIAN BUILDING ENVELOPE  
Science and Technology (CAN-BEST)**



Elie Alkhoury, M.Eng. (Building Science), P.Eng.  
*Director of Research & Testing*



- This report does not constitute certification of the test product. The reported test results refer only to the specimen tested. No representation is made that other samples of similar design will feature like performance.
- This report was prepared for the consideration of the addressee only. It shall not be used by any other party without the written consent of CAN-BEST.
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## 1. INTRODUCTION

Canadian Building Envelope Science and Technology (CAN-BEST) was retained by RF Transparent to carry out load testing on one 12 mm tempered glass guard system. Testing was carried out in accordance with the following Building Codes requirements:

- Ontario Building Code (OBC-2017), Section 9.8.8.2 "Loads on Guards"
- Code de construction du Québec, Section 4.1.5.14, Paragraph 1c).
- Code National du Bâtiment – Canada 2015, Tableau 9.8.8.2 "Autres garde-corps"

## 2. DISCLAIMERS

This report covers certain tests carried out on one glass guard specimen having specific properties, configuration and dimensions. Product performance is affected by variations in dimensions, assembly details and installation method. Consequently, the reader is advised to ensure product suitability for the intended application and conformity with all the details of the test sample described in the following section.

This report does not cover the guard's anticipated performance under service environmental conditions, nor the anchoring strength and stability of the substrate. No conclusions regarding anchor performance or glass performance may be drawn from the reported results.

## 3. SAMPLE DESCRIPTION

**Type:** One glass panel, side mounted to a concrete substrate using three bottom spigot supports/anchors.

**Glass Panel:** 12 mm thick tempered glass panel, 1850 mm wide by 1170 mm.

**Installation:** As shown in Figure (1), the test glass panel was side mounted to a concrete substrate using three nylon-lined stainless steel spigots. Two were positioned 277 mm from each end, and one at the center.

The glass panel was fixed at its base into the spigot using two M10 x 1.57 screws. The spigot were anchored to a concrete substrate using two KH-EZ 1/4" x 4" anchor screws each and four Kwik-Con+ 3/16"x3-1/4" anchor screws each.

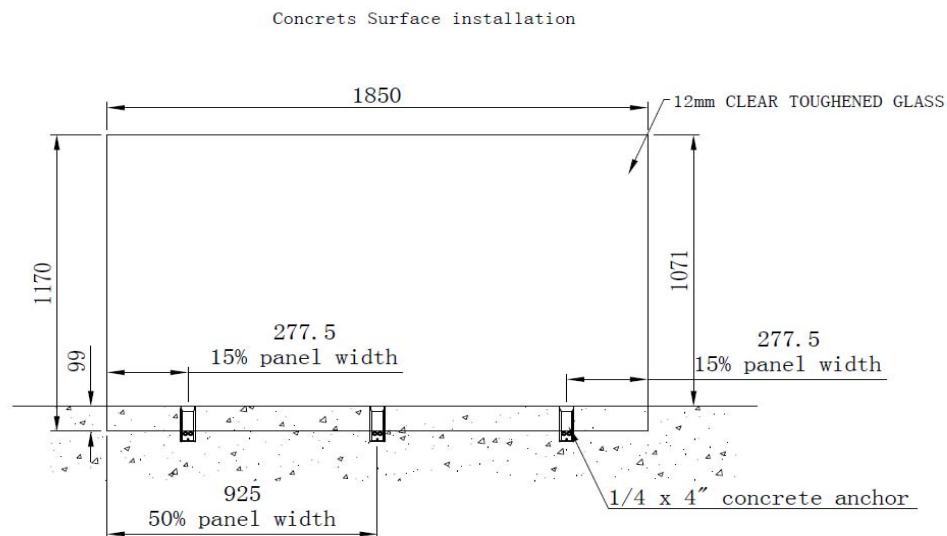


Figure (1): Test Guard Assembly

**Sampling:** The test guard system was selected and installed by the client.

**Drawings:** Detail drawings of the test sample, provided by the client, and stamped "Canadian Building Envelope Science and Technology", are attached to this report (6 pages).

#### 4. TEST RESULTS

Test results and observations are provided in Table (1).

**Table (1): Load Resistance Test Results**

Test Date: May 2, 2024

Test Requirement	Load Location	Results	Rating
<b>Horizontal Point Load</b> , top of panel at most critical location Test Load: 1.00 kN (225lb)  No maximum criteria provided for deflection under load or for permanent deflection after loading.	Top mid-span of panel	Measured deflections at top center of panel: <u>Load (kN)</u> <u>Deflection (mm)</u> 1.00              60 mm 0.00              10 mm (permanent)	PASS
	Top right corner	Measured deflections top corner of panel: <u>Load (kN)</u> <u>Deflection (mm)</u> 1.00              95 mm 0.00              10 mm (permanent)	PASS
<b>Horizontal Uniform load</b> , top of panel Test Load: 0.75 kN/m (51 lb/ft)  No maximum criteria provided for deflection under load, or for permanent deflection after loading.	Top mid-span of panel	Measured deflections at top center of panel <u>Load (kN/m)</u> <u>Deflection (mm)</u> 0.75              50 mm 0.00              8 mm (permanent)	PASS
<b>Elements within the guard</b> , Point Load Test Load: 0.50 kN (113 lb)	Glass panel at any location	<u>Load (kN)</u> <u>Observations</u> 0.50              No breakage	PASS
<b>Vertical Uniform load</b> , top of panel Test Load: 1.50 kN/m (100 lb/ft)  No maximum criteria provided for deflection under load, or for permanent deflection after loading.	Panel's top edge	<u>Load (kN/m)</u> <u>Observations</u> 1.50              No breakage	PASS
<b>Combination Load</b> , Point Load + Wind Load 0.5 kPa (10 psf) Test Load: 2.04 kN (459 lb)	Centre of panel + uniform wind load	<u>Load (kN)</u> <u>Observations</u> 2.04              No breakage	PASS

5. CONCLUSION

Based on the observations and obtained test results, the glass panel guard system described in this report **DID MEET** the load carrying capacity requirements specified in the following building codes:

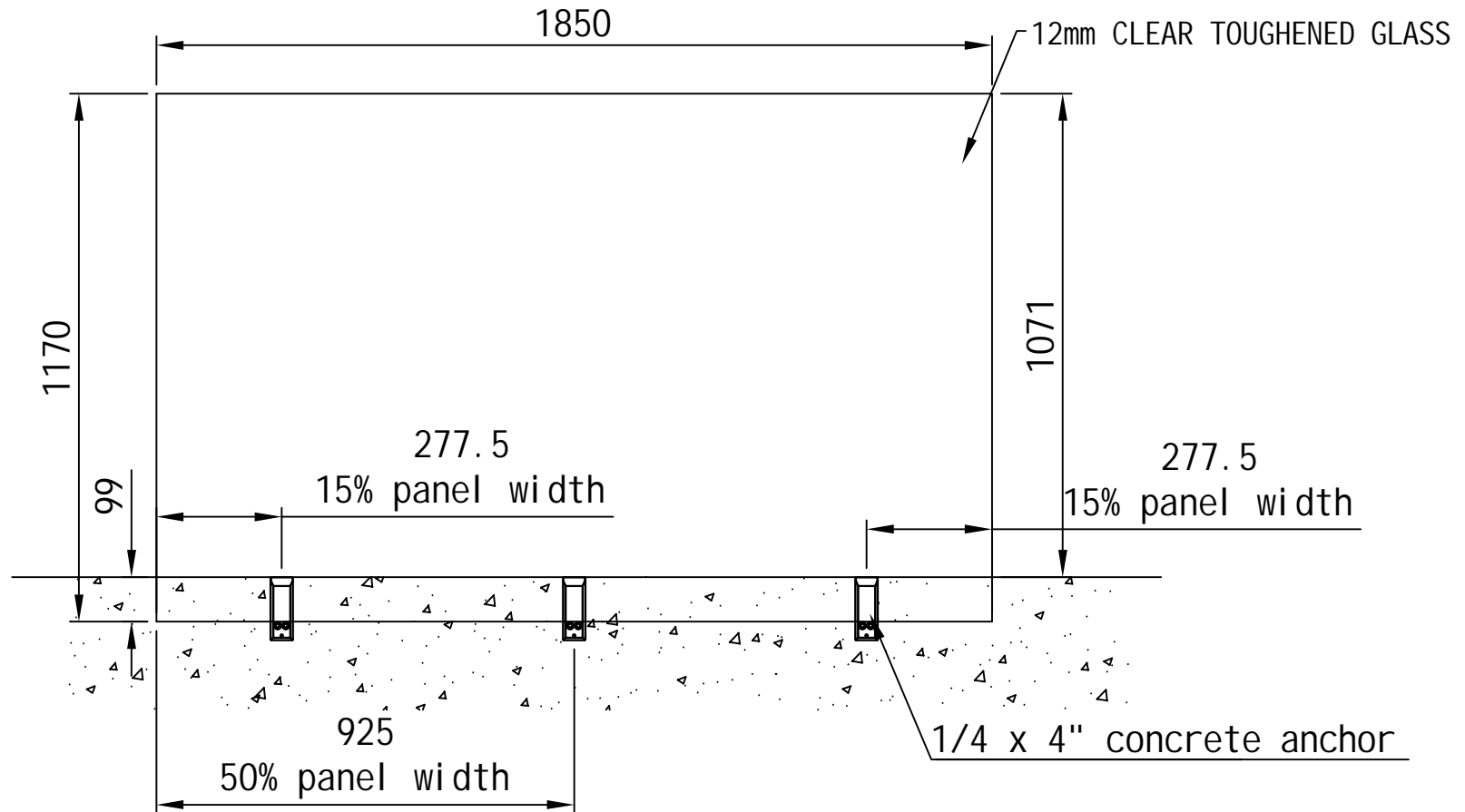
- Ontario Building Code (OBC-2017), Section 9.8.8.2 "Loads on Guards"
- Code de construction du Québec, Section 4.1.5.14, Paragraph 1c).
- Code National du Bâtiment – Canada 2015, Tableau 9.8.8.2 "Autres garde-corps"



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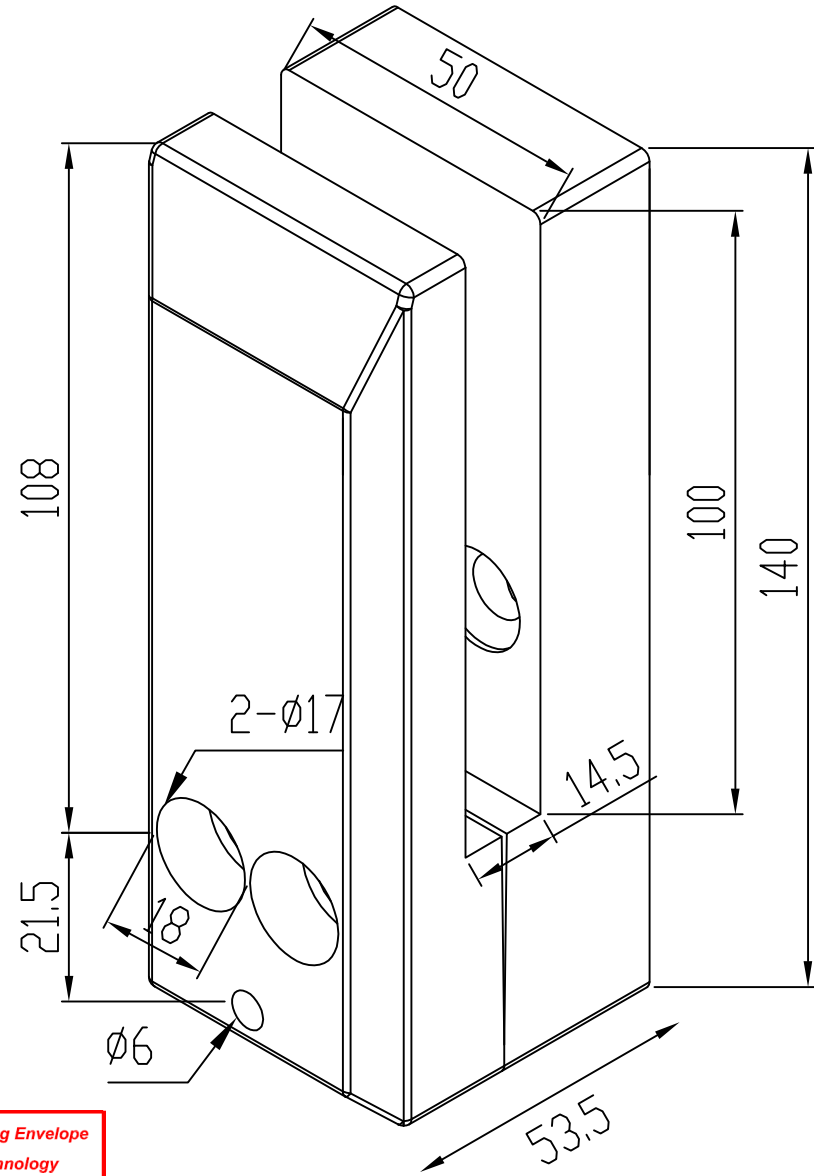
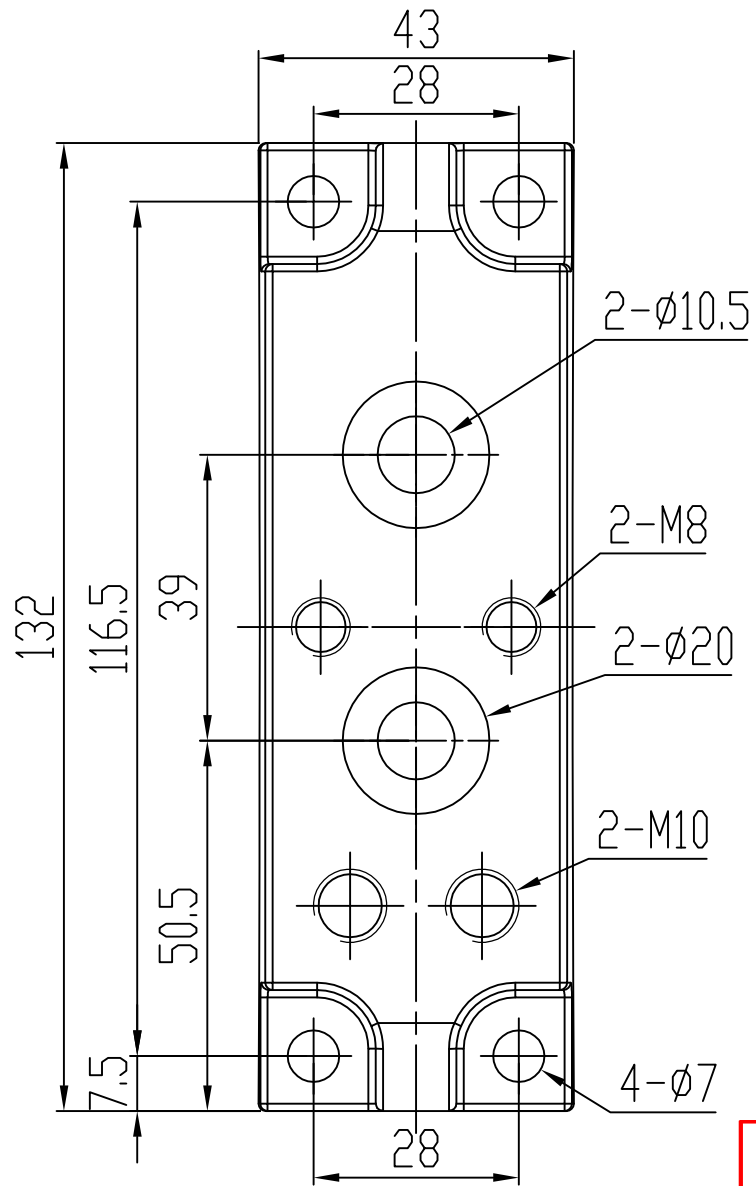
Report History

Revision No.	Change and Reason	Date	Approved by
---	Original report issued	May 7, 2024	EA

# Concrets Surface installation



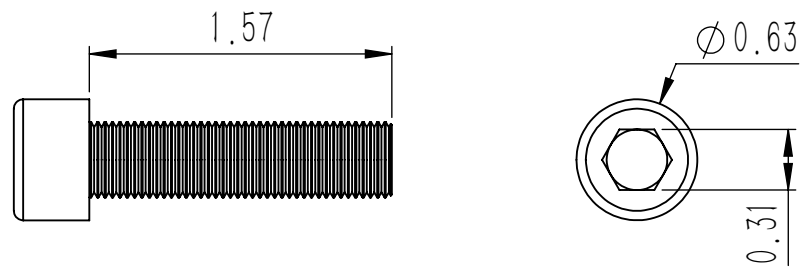
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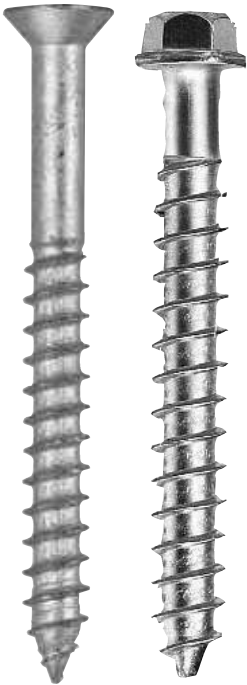

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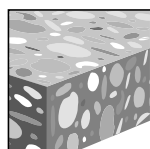
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### 3.3.20 KWIK-CON+ CONCRETE AND MASONRY SCREW

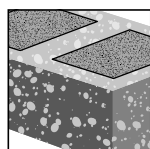
#### PRODUCT DESCRIPTION

##### KWIK-CON+ concrete and masonry screw anchors

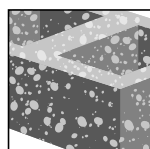
Anchor System	Features and Benefits
 <p data-bbox="582 728 798 761">KWIK-CON+ fastener</p>  <p data-bbox="582 1265 885 1321">KWIK-CON+ drive tool and installation accessories</p>	<ul style="list-style-type: none"> <li>• Zinc coating with proprietary finish that exceeds 1000 hours of protection from red rust per ASTM B117</li> <li>• Salt spray testing per ASTM G85</li> <li>• Coating is more durable than zinc plating alone</li> <li>• Base material specific carbide tipped bits optimize performance in concrete or masonry</li> <li>• Torx Hex washer head for fast secure installations into base material</li> <li>• Torx or Phillips flat head for countersunk applications</li> <li>• Load data available for installations in concrete, grout-filled and hollow concrete masonry units (CMU) and brick</li> <li>• Available in AISI Type 410 Stainless Steel</li> </ul>



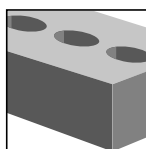
Uncracked concrete



Grout-filled concrete masonry



Ungrouted concrete masonry



Brick

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#### Approvals/Listings

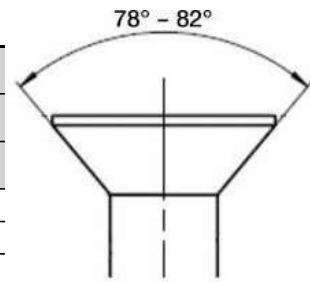
Metro-Dade County

NOA 19-1113.04



**Table 1 – Material Properties**

Property	Carbon Steel		Stainless Steel	
	Fastener Diameter (inches)		Fastener Diameter (inches)	
	3/16	1/4	3/16	1/4
Minimum Tensile Strength (ksi)	150		130	
Minimum Yield Strength (ksi)	120		105	
Coating	Zinc with organic top coat		N/A	



**Figure 1 – Flathead KWIK CON+ Head Angle**

**Table 2 – Physical Dimensions**

Characteristic	Nominal anchor diameter (inches)					
	3/16			1/4		
Head Style	Tapered Flat Head	Tapered Flat Head	5/16-in. Hex Washer	Tapered Flat Head	Tapered Flat Head	5/16-in. Hex Washer
Internal recess	#3 Phillips	T-25 TORX	T-25 TORX	#3 Phillips	T-27 TORX	T-25 TORX
Maximum Head Diameter (inches)	0.507	0.385	0.433	0.507	0.507	0.433
Major Thread Diameter (inches)	0.217			0.283		
Minor Diameter (inches)	0.145			0.190		
Shank Diameter (inches)	0.170			0.224		

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**INSTALLATION**

**Table 3 – KWIK CON+ Installation Specifications**

Setting information	Symbol	Nominal anchor diameter (inches)			
		3/16		1/4	
Embedment (inches)	$h_{nom}$	1	1-3/4	1	1-3/4
Nominal drill bit diameter (inches) <sup>1</sup>	$d_{bit}$	3/16		1/4	
Minimum fixture hole diameter (inches)	$d_h$	1/4		5/16	
Minimum hole depth (inches)	$h_o$	1-1/4	2	1-1/4	2
Minimum member thickness (inches)	$h_{min}$	2-1/2	3-1/4	2-1/2	3-1/4
Minimum anchor spacing (inches)	$s_{min}$	2-1/4		2-1/2	
Critical anchor spacing (inches)	$s_{cr}$	3	4	3	4
Minimum edge distance (inches)	$c_{min}$	1-1/8		1-1/2	
Critical edge distance (inches)	$c_{cr}$	2-1/2	3-1/2	2-1/2	3-1/2

<sup>1</sup> Requires matched tolerance drill bit from Hilti, TKC drill bits for concrete, TKB drill bits for other materials.

**Table 4 – Load adjustment factors for Hilti KWIK CON+ screw anchors in concrete**

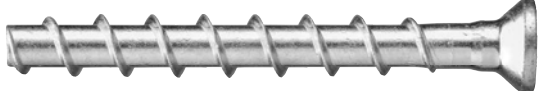
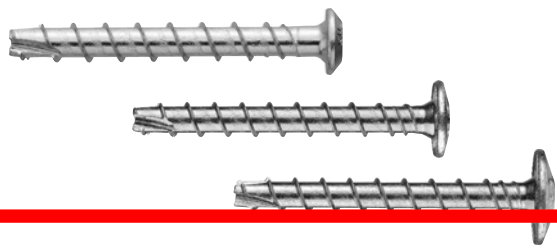

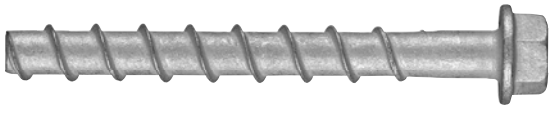
Load adjustment factors for anchor spacing $f_A$					Load adjustment factors for edge distance $f_R$									
Tension/Shear loads					Tension				Shear					
Embedment (inches)	1	1-3/4	1	1-3/4	Embedment (inches)	1	1-3/4	1	1-3/4	1	1-3/4	1	1-3/4	
Spacing (s)		Anchor diameter			Edge Distance		Anchor Diameter		Anchor Diameter					
in.	(mm)	3/16		1/4	in.	(mm)	3/16		1/4	3/16		1/4		
2-1/4	(57)	0.80	0.80		1-1/8	(29)	0.80	0.80			0.30	0.30		
2-1/2	(64)	0.87	0.83	0.80	1-1/4	(32)	0.82	0.81			0.36	0.34		
2-3/4	(70)	0.93	0.86	0.90	1-1/2	(38)	0.85	0.83	0.80	0.80	0.49	0.41	0.30	0.30
3	(76)	1.00	0.89	1.00	1-3/4	(44)	0.89	0.85	0.85	0.83	0.62	0.48	0.48	0.39
3-1/4	(83)		0.91		2	(51)	0.93	0.87	0.90	0.85	0.75	0.56	0.65	0.48
3-1/2	(89)		0.94		2-1/4	(57)	0.96	0.89	0.95	0.88	0.87	0.63	0.83	0.56
3-3/4	(95)		0.97		2-1/2	(64)	1.00	0.92	1.00	0.90	1.00	0.71	1.00	0.65
4	(102)		1.00		3	(76)		0.96		0.95		0.85		0.83
					3-1/2	(89)		1.00	1.00		1.00	1.00		1.00

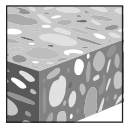
<sup>1</sup> Reduction factors are multiplicative and linear interpolation between  $s_{cr}$  and  $s_{min}$ ,  $c_{cr}$  and  $c_{min}$  is permitted.

### 3.3.6 KWIK HUS-EZ SCREW ANCHOR

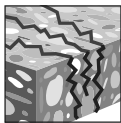
#### PRODUCT DESCRIPTION

##### KWIK HUS EZ carbon steel anchors

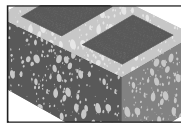
Anchor System		Features and Benefits
	Carbon Steel KH-EZ C 1/4" and 3/8"	<ul style="list-style-type: none"> <li>• OSHA Table 1926.1153 Table 1 complaint installation when installed with Hilti vacuum and DRS system or Hilti SafeSet™ hollow drill bit technology</li> <li>• Easy installation using impact tool or torque wrench</li> </ul>
	Carbon Steel 1/4" KH-EZ P, PM, PL	<ul style="list-style-type: none"> <li>• Product and length identification marks helps facilitate quality control after installation</li> <li>• Through fixture installation improves productivity and more accurate installation.</li> <li>• Thread design helps enable quality setting and exceptional load values in wide variety of base material strengths</li> </ul>
	Carbon Steel KH-EZ 1/4"-3/4"	<ul style="list-style-type: none"> <li>• 1/4" diameter available in hex head countersunk head and pan head styles.</li> <li>• Anchor is fully removable.</li> <li>• Anchor diameter is same as drill bit diameter. No special diameter bit required.</li> <li>• Suitable for reduced edge distances and spacing.</li> </ul>
	Carbon Steel KH-EZ CRC 3/8"-3/4"	<ul style="list-style-type: none"> <li>• Corrosion resistant coating allows for use in outdoor moderate corrosive environments (KH-EZ CRC only).</li> <li>• Installation process allows for adjustability.</li> </ul>



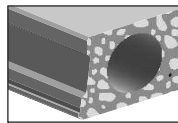
Uncracked concrete



Cracked concrete



Grout-filled concrete masonry



Hollowcore concrete



Seismic Design Categories A-F



SafeSet™ System with Hollow Drill Bit



Profis Anchor design software

Approvals/Listings	
<b>ICC-ES (International Code Council)</b>	ESR-3027 in concrete per ACI 318 Ch. 17 / ACI 355.2/ ICC-ES AC193 ESR-3056 in grout-filled CMU per ICC-ES AC106
<b>City of Los Angeles</b>	City of Los Angeles 2020 LABC Supplement (within ESR-3027 and ESR-3056)
<b>Florida Building Code</b>	2020 FBC w/ HVHZ (within ESR-3027 and ESR-3056)
<b>FM (Factory Mutual)</b>	Pipe hanger components for automatic sprinkler systems for KH-EZ I and KH-EZ E
<b>ANSI/MSS SP-58-2018</b>	Anchors conform to ANSI/MSSP-58-2018. Contact Hilti for more information.



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